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SCIENTIFIC FELLOWSHIP IN A SWISS COMMUNITY ENLIGHTENMENT:
A HISTORY OF ZURICH'S PHYSICAL SOCIETY, 1746-1798

DISSERTATION

Presented in Partial Fulfillment of the Requirements for
the Degree Doctor of Philosophy in the Graduate
School of The Ohio State University

By

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* * * * *

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1981

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1981
It is a pleasure to record my obligations to the people who have aided me in this work. Above all others, I wish to express my gratitude to June Z. Fullmer. The dissertation has gained as much from her gentle guidance and critical rigor as its author has from her kindness and friendship. Her example of scholarly integrity and personal concern will never be forgotten. I also owe special thanks to Marilyn Robinson Waldmann and John C. Rule; they provided me with an inestimable amount of aid and advice during my years at Ohio State and offered incisive criticism of this manuscript. I am grateful to Paul Fullmer for improving my writing style.

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### TABLE OF CONTENTS

<table>
<thead>
<tr>
<th>Section</th>
<th>Page</th>
</tr>
</thead>
<tbody>
<tr>
<td>ACKNOWLEDGEMENTS</td>
<td>ii</td>
</tr>
<tr>
<td>VITA</td>
<td>iv</td>
</tr>
<tr>
<td>LIST OF TABLES</td>
<td>vii</td>
</tr>
<tr>
<td>LIST OF FIGURES</td>
<td>viii</td>
</tr>
</tbody>
</table>

### Chapter

<table>
<thead>
<tr>
<th>Chapter</th>
<th>Page</th>
</tr>
</thead>
<tbody>
<tr>
<td>I. INTRODUCTION</td>
<td>1</td>
</tr>
<tr>
<td>II. WHICH ENLIGHTENMENT?</td>
<td>16</td>
</tr>
<tr>
<td>Zurich and the European Enlightenment</td>
<td>19</td>
</tr>
<tr>
<td>Aufklärung</td>
<td>24</td>
</tr>
<tr>
<td>The Swiss Enlightenment</td>
<td>31</td>
</tr>
<tr>
<td>III. THE SOCIAL OUTLOOK OF THE CANTONAL ENLIGHTENMENT</td>
<td>43</td>
</tr>
<tr>
<td>Zunftregiment</td>
<td>45</td>
</tr>
<tr>
<td>Enlightened Middle Citizens</td>
<td>60</td>
</tr>
<tr>
<td>Consensus and Socialibility</td>
<td>66</td>
</tr>
<tr>
<td>IV. JOHANNES GESSNER AND THE BIRTH OF CIVIC SCIENCE</td>
<td>74</td>
</tr>
<tr>
<td>Time for Fellowship</td>
<td>77</td>
</tr>
<tr>
<td>The Social Cast</td>
<td>87</td>
</tr>
<tr>
<td>Gessner's Agenda</td>
<td>95</td>
</tr>
<tr>
<td>V. SCIENTIFIC ENTERPRISE IN PATRICIAN SOCIETY, 1747-1759</td>
<td>110</td>
</tr>
<tr>
<td>Urban Wealth</td>
<td>111</td>
</tr>
<tr>
<td>Meetings in the Zunfthaus zur Meise</td>
<td>115</td>
</tr>
<tr>
<td>Performers: Professional and Patrician</td>
<td>123</td>
</tr>
<tr>
<td>VI. THE SOCIAL PROGRAM OF THE ECONOMIC COMMISSION, 1760-1779</td>
<td>140</td>
</tr>
<tr>
<td>Agricultural Enthusiasm</td>
<td>140</td>
</tr>
<tr>
<td>The Rural Socrates</td>
<td>146</td>
</tr>
<tr>
<td>Preisfragen</td>
<td>155</td>
</tr>
<tr>
<td>Bauerngespräche</td>
<td>162</td>
</tr>
<tr>
<td>VII. TWILIGHT OF FELLOWSHIP, 1780-1798</td>
<td>171</td>
</tr>
<tr>
<td>Scientific Performance</td>
<td>171</td>
</tr>
<tr>
<td>The Waser Affair</td>
<td>182</td>
</tr>
<tr>
<td>Postscript to Enlightenment</td>
<td>189</td>
</tr>
</tbody>
</table>
### VIII. EPILOGUE .................................................. 197

### NOTES ........................................................................ 200

### APPENDIXES

<table>
<thead>
<tr>
<th>Section</th>
<th>Page</th>
</tr>
</thead>
<tbody>
<tr>
<td>A. Chronology of Major Events in Physical Society History ...............</td>
<td>229</td>
</tr>
<tr>
<td>B. Performing Members <em>(Ordinarii)</em> of the Physical Society, 1746-1798</td>
<td>233</td>
</tr>
<tr>
<td>C. Swiss Ehrenmitglieder of the Physical Society ............................</td>
<td>237</td>
</tr>
<tr>
<td>D. Contributors to Essay Competitions of the Economic Commission from 1762-1798</td>
<td>240</td>
</tr>
<tr>
<td>E. Budgetary Account of the Physical Society, 1747-1798 ..................</td>
<td>244</td>
</tr>
<tr>
<td>F. <em>Abhandlungen der Naturforschenden Gesellschaft in Zürich</em> ..........</td>
<td>246</td>
</tr>
<tr>
<td>1. Title page of the first volume of <em>Abhandlungen</em> published in 1761 by &quot;Heidegger und Compagnie&quot;..</td>
<td>247</td>
</tr>
<tr>
<td>2. Table of Contents. Volume I (1761). ....................................</td>
<td>248</td>
</tr>
<tr>
<td>3. Table of Contents. Volume II (1764) ....................................</td>
<td>250</td>
</tr>
<tr>
<td>4. Table of Contents. Volume III (1766) .................................</td>
<td>251</td>
</tr>
<tr>
<td>G. The &quot;Sigilum Soc. Phys. Turicensis&quot; over a Photograph of the Zunfthaus zur Meise .................................</td>
<td>252</td>
</tr>
<tr>
<td>BIBLIOGRAPHY ...................................................................</td>
<td>253</td>
</tr>
</tbody>
</table>
**LIST OF TABLES**

<table>
<thead>
<tr>
<th>Table</th>
<th>Description</th>
<th>Page</th>
</tr>
</thead>
<tbody>
<tr>
<td>1.</td>
<td>Foreign Membership in the Physical Society</td>
<td>21</td>
</tr>
<tr>
<td>3.</td>
<td>Number and Percentage of Craftsmen in Zurich's 12 Guilds in 1780</td>
<td>55</td>
</tr>
<tr>
<td>4.</td>
<td>Social Occupation of the 24 Guildmasters of Zurich in 1762</td>
<td>56</td>
</tr>
<tr>
<td>6.</td>
<td>Number and Percentage of Merchants and the Number and Percentage of Merchant Guildmasters and Councillors in the 12 Guilds and the Constabulary in 1780</td>
<td>59</td>
</tr>
<tr>
<td>7.</td>
<td>Middle Citizens: (A) Their Number and Percentage of Citizenship, 1599-1790, and (B) Number and Percentage of Clerics and Medical Doctors in the 13 Urban Corporations in 1780</td>
<td>63</td>
</tr>
<tr>
<td>8.</td>
<td>Changing Density of Guild Families from 1599 to 1790</td>
<td>69</td>
</tr>
<tr>
<td>9.</td>
<td>List of 23 Zurich Societies of Enlightenment, Founded Between 1679 and 1788</td>
<td>71</td>
</tr>
<tr>
<td>10.</td>
<td>Charter Members Holding Political Office on (A) 31 August 1746 and (B) at the High-Point of their Careers, Arranged by Urban Class</td>
<td>89</td>
</tr>
<tr>
<td>11.</td>
<td>Officers of the Physical Society and Their Terms in Office, 1746-1798</td>
<td>126</td>
</tr>
<tr>
<td>12.</td>
<td>Year of Death and Age at Death of 12 Founding and 10 Early Ordinary Members</td>
<td>128</td>
</tr>
<tr>
<td>13.</td>
<td>Division of Physical Society Papers, Presented between 1747-1761, into Five Principal Fields of Study</td>
<td>132</td>
</tr>
<tr>
<td>14.</td>
<td>Number and Percentage of Physical Society Members Who Joined the Fellowship between 1746-59, 1760-79, or 1780-98, Arranged by Social Status</td>
<td>172</td>
</tr>
<tr>
<td>15.</td>
<td>Number of Scientific Papers Read to the Physical Society by Leading Middle Citizen Performers, 1766-1783</td>
<td>177</td>
</tr>
<tr>
<td>16.</td>
<td>Division of Physical Society Papers Presented in 1762 and 1778, Into Five Principal Fields of Study and Their Sub-Fields</td>
<td>178</td>
</tr>
</tbody>
</table>
# LIST OF FIGURES

<table>
<thead>
<tr>
<th>Figure</th>
<th>Page</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. Dr. Johannes Gessner as a Young Man</td>
<td>74</td>
</tr>
<tr>
<td>2. Comparison of Johannes Gessner's Division of the Physical Sciences with the Division of the Sciences by Christian Wolff</td>
<td>98</td>
</tr>
</tbody>
</table>
I. INTRODUCTION

Historians customarily consider science to have had a primarily cosmopolitan past. Perhaps this is true because they understand the more lasting scientific achievements as those which transcend geography and society. In recent historical literature, however, one senses that there is greater sensitivity for the sociological structure of scientific ideas. R.A. Dolby argued in his 1977 article "The Transmission of Science" that the history of a scientific idea is regulated by local and regional barriers. In all time periods, and particularly in cultural environments where there is difficulty of communication over a distance or across language groups, a considerable proportion of scientists identify chiefly with a home community. Stevin Shapin and Arnold Thackray confirmed this in their prosopographical survey of the membership of British provincial academies. Only a rare individual in one of these societies attempted to manipulate the resources of the local scientific organization into a vehicle for international reputation. Most members were interested in science as it related to local issues.

There are few spots in the world better suited for an investigation of this distinction between the cosmopolitan and localistic arenas of science than Switzerland. There, in the heart of Europe, along a broad central plateau, in foothills, and in remote mountain valleys, cultures converged to produce a heterogeneous country full of local and regional idiosyncrasy where "your voice, your identity..."
your politics will vary if you come from Schwändi or Sarnen separated by all of three kilometres. The polarities which characterize the Swiss way of life — harmony in diversity, community overriding jealously guarded sectionalism, a worldly outlook amidst provincialism — rest in the historical interplay of human attitudes with an imposing natural environment.

The Alps are the heartland of the Swiss paradox. As the central European barrier with vital transit corridors, the Alps involve the Swiss in a cosmopolitan life. Those "magic mountains where nothing ever seems impossible" were never the barrier one might imagine. Seventeen of the 23 major Alpine passes were already in use at the time of Christ. Ancient Graeco-Etruscan roads led traders, Roman legionaries, and Christian missionaries through Helvetia into northern Europe. Wheels made by the master cartwrights of La Tene on Lake Neuchâtel kept Italian traffic rolling on to the Seine and Upper Danube into the Middle Ages. Waggoners' and carriers' villages in the Valais, the Bernese Oberland, Uri, and the Grisons, existed principally to organize mountain crossings. Around 1225 A.D. Europe's first suspension bridge, built over the Schöllenen gorge by Urseren Valley engineers working for Milanese merchants, made the Gotthard Road a principal route from the Rhine to Genoa and Venice. In the early 1800's Bonaparte ordered the completion of the road through the Simplon Pass from Brig to Domodossola. Today, trains disappear above the eastern outskirts of Brig into the darkness of the Simplon's twin railway tunnel — the longest in the
world—and emerge some 12 miles later with their international travellers on the sunny southern slope of the Alps.

While the trans-Alpine routes made Switzerland a natural crossroads, the mountain landscape also compartmentalized much of Swiss life. Karl Schmid, a modern Swiss professor of literature, in a widely-read 1972 newspaper article of "Swiss Self-Awareness" for the Neue Zürcher Zeitung, wrote that a preference for a conception of local physical space over any conception of time has been a deep source of resistance to change in Swiss societies:

The spirit of our nation has disliked time as something open, uncertain, and renovating. It tends to see in the future only attacks on the existing order. The little state which never expects anything good from the great winds of world history outside tends to understand its politics as a defense against the force of time itself. It can be ventured that much of historical "Swissness" rests in awareness of the rock-ribbed compartments into which communities fell. Steep slopes, secluded valleys, and walled towns encouraged feelings of isolation and self-sufficiency. As the medieval song of William Tell succinctly put it: "The land is well enclosed therein, for God himself has walled it in". Such an environment surely did little to unify scientific life.

One of the first and still most important accounts of Swiss science came in an 1873 book Histoires des sciences et des savants depuis deux siècles (Geneva, Basel, Lyon; H. Georg) by Alphonse de Candolle, a Genevan botanist. Moved by the social statistical school of Quesnay and by opposition to Francis Galton's theory of hereditary
genius, Candolle attempted to determine the natural and social conditions which favored or handicapped the growth of scientific talents in European countries by examining national representation among the foreign membership of the English Royal Society, the French Institut, and the Prussian Academy of Sciences. Though he did not consider his pioneer sociological method perfect, he did believe that his data, to date, offered the most neutral and objective picture of scientific development and "its dependence upon social, political, and economic conditions, upon social-psychological attitudes of the environment, upon the situation of a given country on a geographical and cultural scale, upon all the factors creating public opinion and a personality with all its interests and education." 

Candolle's numbers exhibited his belief in the brilliant position of Swiss scholars in the world of international science. For example, he showed that in 1750 six of the 35 associés étrangers (17%) of the Paris Academy, and nine of the 74 foreign members (12%) of the Royal Society of London were Swiss. In 1789 seven of the 36 "Abwesende" (19%) of the Berlin Academy were Swiss. In fact, Switzerland ranked first among all countries in the number of its members in the three great academies, relative to population size, for the years 1750, 1789, 1829, and 1869. In his table "Valeur Scientifique d'un million d'Habitants de Chaque Pays", Swiss
Today we remember Candolle along with Max Weber and Robert Merton for their sociological treatment of the association of Calvinism with scientific interest and accomplishment.\textsuperscript{10} Candolle's statistical comparison of foreign membership from the allied populations of Switzerland in the great academies supplied the most significant data on the influence of religion over scientific life. In Switzerland, where Protestants and Catholics were differentiated by canton, or mixed in a few cantons, and where Protestants outnumbered Catholics by only three to two, all fourteen Swiss associates of the Paris Academy were Protestants.

How could this be true, Candolle wondered:

Nous respirons pourtant tous, en Suisse, le même air. Nous avons pourtant tous les cantons le régime républicain, excepté dans celui de Neuchâtel, qui s'étaient donné volontairement, un Prince, dépourvu du reste de toute autorité sérieuse. Les cantons catholiques étaient aussi libres dans leur administration intérieure.... Donc la diversité dans le nombre des savants qui ont fait le plus progresser les sciences, doit être, en grande partie, l'effet de la religion, soit sur l'éducation dans les familles et dans les écoles, soit sur l'ensemble des moeurs et des idées.\textsuperscript{11}

But, Candolle did not account for the lustre of Swiss science by pointing to a "non-authoritarian church" and to a non- celibate clergy alone. He compiled 20 causes favorables to European scientific achievement, including the presence of sufficient wealthy families favorable to science; well-organized schools; the ability to communicate in the three principal languages (French, German, and English); the custom of extensive foreign travel; public curiosity in things "true" and "real" rather than
in things "imaginary" or "ideal"; freedom to express opinions and to choose occupations; residence of educated immigrants; a small, politically-independent country situated adjacent to civilized countries. While Candolle felt that all of these factors stimulated the production of quality scientific work, his method could not suggest further relationships between them and national scientific characters.\(^{12}\)

In 1959 Emil J. Walter, a Dozent in sociology at St. Gallen's Handelshochschule, offered an innovative historical comparison of the degree and kind of scientific activity in the major Swiss towns from the Reformation to the Helvetic Revolution which confirmed many of the conclusions of Candolle's book. In his little-known Soziale Grundlagen der Entwicklung der Naturwissenschaften in der alten Schweiz, Walter used a quantitative technique (often reminiscent of fellow Swiss Candolle's statistical method) which sought out the influence of economic, social, political, and religious forces on Swiss scientific life. He offered a special justification for such a study:

Old Switzerland, between 1539 and 1798, presents itself as a particularly suitable subject for such a study, since from the Reformation until the Helvetic Revolution it suffered no severe externally-inflicted shocks and did not change significantly internally.\(^{13}\)

Walter believed that his statistical survey of "significant" Old Swiss scientists showed that scientific activity within the Confederation grew at different rates depending upon such factors as a town's (1) educational facilities (Basel had the only
university and an uncommonly high number of important scientists); (2) religion (Geneva, "the Protestant Rome", advanced in science far ahead of French Catholic Freiburg, German Catholic Lucerne, or Italian Catholic Lugano); socio-economic make-up (merchants and industrialists in Basel, Geneva, Zurich, and Schaffhausen, stimulated science, especially after gaining political status; and (3) citizen-to-subject ratio (Bernese were too busy governing a huge subject countryside to bother with much scientific research). 14

Although Walter uncovered differences in the rate of scientific development in Old Swiss communities, he nonetheless felt that the Old Regime produced a science of common brand and quality. He argued that the socio-political conservatism and insecurity of the Swiss ruling classes crippled the land's creative energies, rendered individuals and institutions apathetic toward science, and forced what little scientific interest there was into non-distinguished pre-occupation with a narrow range of problems. With the exception of the Basel mathematicians and Albrecht von Haller in "intellectually stagnant" Berne, Walter claimed that Old Switzerland produced no scholars of genuine European character and too few of any estimable importance — 19 in the fifteenth and sixteenth centuries together, 35 in the seventeenth century, and 134 in the Enlightened eighteenth century. 15 Local pressures for conformity restricted the choice of "safe" scientific subjects to botany, medicine, mineralogy, and zoology. Scholars avoided such "dangerous" fields as astronomy, mathematics, and physics, which embraced Copernicanism. Walter concluded that early Swiss science was locally-descriptive rather
than theoretically exact and of deficient international validity. Old Regime society had "put a heavy mortgage on Swiss science".  

Though even today the work of Candolle and Walter suggests the most satisfactory range of research problems to be found in the historical literature by which to examine the cultural meanings of Swiss science in the Early Modern period, it is necessary to free oneself from some of their basic concepts and appraisals. Obvious bias exists in Candolle. Consider again his list of causes favorables. How many of them result directly from his own identity: a Swiss citizen of Geneva, a descendant of a refugee Huguenot family full of internationally-known thinkers which enjoyed the smiles of fortune in a Swiss Protestant haven? A curious Whiggishness troubles Walter's work. He understood science in its sociological context but criticized the science which the social environment produced (as if it could have produced another). He accepted the questionable notion that the story of scientific progress was essentially a contest between an alienated minority of progress-minded, cosmopolitan intellectuals and reactionary, oppressive ruling establishments. In his histories of Zurich science, for instance, he underscored such dramatic events as the banishment of mathematician Michael Zingg from the city in the 1660's and the execution of pastor-naturalist Johann Waser in 1780. Abiding by such a dialectic, Walter investigated the Swiss scientific environment in order to determine the local factors which inhibited the development of "significant" scientists.
Here, however, Walter sheds more heat than light upon the subject of Swiss science. By "significant scientists" he meant scholars who, like Candolle's foreign members of the great academies, actively sought out and developed contacts within an international community. Both men dismissed from their consideration "localites" whose research interests may have been regulated by regional barriers (such as difficulty of communication over a distance or across language groups), by differing community commitments, or by differing institutional imperatives. Both Candolle and Walter followed the popular inclination to view all scientists as "cosmopolites". This is clearly true for Candolle. For him, only the presence of the "internationale hugusnote" in the Swiss Confederation explains the exceptional number of Swiss scientists among the foreign members of London, Paris, and Berlin. He pointed to a curious note relative to Switzerland:

Nous avons vu, que huit de ses associés étrangers, étaient des descendants de Belges ou de Français protestants, expulsés de leurs pays pour cause de religion. Par conséquent, la population véritablement suisse, antérieure au XVIème siècle, n'a fourni par ses descendants que quatre Associés étrangers, chiffre encore élevé pour un pays de 2 million d'âmes, mais qui placerait la Suisse au rang d'autres petits pays et non dans une position exceptionnelle.18

Candolle's method, therefore, highlighted scientists with cosmopolitan outlook and international connections. It was "les idées cosmopolites des Suisses" which gave the tiny country its brilliant position in the world of science.
Today, historians and sociologists of science realize that all scientific activity is not cosmopolitan. Much science, especially in such a diverse cultural environment as Switzerland, takes place within regional or local community structures where international connection is not necessarily the crucial factor in the career of a scholar. R.B.A. Dolby argues that in all historical periods, a considerable proportion of (scientists) identify primarily with their local community. Although the members of local scientific organizations have sought out others with similar interests, many of them have less interest in people outside their immediate circle. No doubt there is some tension between being a localite and pursuing an interest in science. But individuals who are primarily interested in science as it relates to local issues are often an important part of the membership of local scientific academies. It is also possible for members or even the elite of a major scientific centre, such as nineteenth century Paris, to have little or no interest outside that centre.19

The team of Stevin Shapin and Arnold Thackray add:

For every recognizable name of a publishing man of science which we may detect in the records of these scientific societies we will notice possibly 50 or more individuals to whom no scientific article or book may be attributed. These latter were largely local medical men, clergy, merchants, manufacturers, lawyers, gentry and skilled artisans. They were not, it should be emphasized, failed scientists; they participated in an, sustained the local scientific enterprise as medical men, artisans, clergy, etc. Only the exceptional individual in a typical provincial society regarded himself primarily as a man of science and attempted to manipulate the resources and interests of the local organization into a vehicle for his own career interests.20

Localites did in fact organize Swiss science in the eighteenth century. On 18 October 1746 twenty-two Zurich citizens attended the first meeting of a scientific society in Switzerland at the meeting
house of the Black Garden Society, an urban association of barbers and surgeons affiliated with the smithy guild. Though Zurich had had learned associations previous to this "Physikalische Gesellschaft", the meeting in the house of the Black Garden and those which later occasioned in the Limmatburg (1747-1756) and in the "Zunfthaus zur Heise" (1757-1840) were the first gatherings of Swiss designed to nurture the body of natural knowledge in any systematic way and to stimulate the growth and public utility of scientific activity in a canton. Physical Society meetings became the chief rallying-point for the institutionalization of science in eastern Switzerland until the middle of the nineteenth century when the two "Hochschule" (the University of Zurich and the Swiss Polytechnical Institute) were established, with many of their programs modeled after the experience of the Physical Society.21

Scientific organizations proliferated in the other leading Swiss Protestant towns during the last half-century of the Old Regime. Burgers of Berne in 1759 created the Economic Society, forerunner of the town's Natural Science Society (founded in 1786); Lausanne citizens established the Society of the Physical Sciences in 1780; and Genevois founded the Physical and Natural Science Society in 1790 organized out of the larger Society of Arts (which had come to life in 1776). These local societies accomplished things which were then impossible to have done at the Confederation level. In the eighteenth century there developed neither a national scientific academy nor an occasional congress which brought together the separate academies. The first inter-cantonal scientific body,
the Swiss Natural Science Society ("Die Schweizerische Naturforschende Gesellschaft", or SNG), arose in Geneva only in October 1815. It eventually became the medium through which the Swiss federal government first began to support science.22

The focus of this dissertation is Zurich's Physical Society, the oldest and longest lasting of eighteenth century Swiss scientific organizations. Founded in 1746 and flourishing still as the Natural Science Society in Zurich ("Die Naturforschende Gesellschaft in Zurich", or NGZ), this Society is well worth studying. Zurich at a European cross-roads proved sensitive to the intellectual environment of the Enlightenment; before and during the French Revolution, the city and its scientific fellowship occupied a pivotal place for the transmission of scientific and other kinds of knowledge. Yet, the Society was essentially a local affair, established by Zurich citizens for their own benefit. Thus, its records permit evaluation in microcosm of the distinction between "cosmopolites" and "localites" during the Enlightenment.

In Chapter 2 of this study, we shall consider the meaning of eighteenth century Zurich scientific activity within the cosmopolitan movement known as the European Enlightenment. At present there is a good deal of historiographical concern over our commitment to the Enlightenment as a single category. Historians now see many Enlightenments, arising for subtly different reasons, behaving according to different generational patterns, and functioning within independent social and ideological contexts. The chapter
will examine Zurich's participation in the worlds of the European, German, and Swiss Enlightenments. The purpose is not to deplore a poverty of scholarship generated by the noble aspiration to design comprehensible labels and definitions with which to promote a synthetic understanding of the age's varied historical experience. Rather, it is to illustrate some of the deficiencies in our present Enlightenment constructs by testing their suitability for explaining eighteenth century Zurich. To concede that "The Enlightenment" has a rightful existence as a valuable model by which to study certain manifestations of the century is neither to say that it is always the most appropriate model, nor to say that it is even an always applicable model.

Chapter 3 will offer a social reconstruction and interpretation of the Zurich Enlightenment by setting its efflorescence of organized scientific activity, together with the cultural meanings it came to possess, against several salient features of the old cantonal regime. Here the analysis will depend greatly upon social statistics collected and organized by the Economic Commission of the Physical Society between 1760 and 1798. The objective is to situate the Zurich Enlightenment within the most real social context possible to recreate.

Chapters 4 through 7 will be devoted to an examination of the factors which stimulated the birth and development of a civic program of science in eighteenth century Zurich. Each in part is based on a social, biographical, and generational account of the 303 identifiable men who joined the Physical Society between its beginning
in 1746 and the discontinuity in the organization's history 52 years later caused by the Helvetic Revolution. Research into the prosopography of the Zurich scientific community should tie the Society down to the bedrock. The original and evolving aims of the Society entrepreneurs, the nature of scientific work undertaken by the group's performers and received by their audience, and the social function of natural knowledge in the city-state will be reviewed at length.

This history of Zurich's eighteenth century Physical Society has been written primarily from the records of the Staatsarchiv des Kantons Zürich. This archive harbors nearly all of the NGZ manuscript material, both official and personal. It also houses much personal material, not within the NGZ accession, relating to this history of Society members and their families, and contains published material, both primary and secondary, relevant to Zurich history. Dr. Ulrich Helfenstein and his staff maintain the archive in marvelous order and condition.

Some research was done in a small NGZ accession within the Zentralbibliothek Zürich and in the library's manuscript collection. Dr. Marco Schnitter, a subject librarian for the natural sciences and their history, preserves a few documents of the early Physical Society which have escaped transference to the cantonal archive. Here rests a complete set of financial reports. Dr. Jean-Pierre Bodmer, head of the manuscripts department, guards a wealth of personal and family papers (e.g. Carl Linnaeus' letters to Physical Society president Johannes Gessner, published by Gavin de Beer) and a
few official papers of the Society, mostly relating to the Economic
Commission.

Time and circumstance kept me from seeing worthwhile materials
in other Swiss archives, libraries, and museums. In particular, I
believe that my research may have profited from a look at the
records of rival scientific societies in Berne, Basel, Lausanne,
and Geneva. Though such additional investigation certainly would
have refined my study, it would but confirm the major conclusions
reached here.

Finally, may I remind readers that my work is basically a
social history of an Old Regime scientific institution. Those
interested in the internal history or technical accomplishments
of Old Zurich scientists may find it in the work of Hans Fischer,
Edgar Frenck, Eduard Fuster, Erich Hintzsche, Bernhard Milt,
Bernhard Peyer, Rudolf Steiger, Rudolf Wolf, and in the Physical
Society "Festschriften" of Ferdinand Rudio (1896) and Eduard
Rübel (1946). 24
II. WHICH ENLIGHTENMENT?

Geography gave to Zurich a cosmopolitan yet localistic life history. The town developed at the northern tip of a long, crescent-shaped lake which gave access to Alpine passes and on a swift if shallow river flowing out of the lake which facilitated movement towards the Rhine and the north. Cosmopolitan, empire-minded Romans helped to create it. In 58 B.C. a Roman army interested in putting an end to tribal migrations, and in the conquest of Gaul, laid out a military encampment on a knoll of a moraine at the end of the lake. Under Rome's "Civitas Helvetiorum" the place became a free trade village, or vicus, with a customs station on a narrow stretch of the Limmat River. Another empire-builder, Charlemagne, also influenced its development in the early Middle Ages. According to tradition, the Emperor founded the Grossmunster cathedral on the river's east bank (its school was known as the "Carolinum" into the eighteenth century). In 853 his grandson Ludwig the German established the Fraumunster abbey on the west bank. By 1218 a faubourg settlement of merchants and artisans around these two institutions had grown into a free imperial city.

Yet, Zurich's history contains long episodes of tribal and Germanic actors. Neolithic lake dwellers built huts at the future site of the town as long ago as 3000 B.C. Its first recognizable
residents were Celts and their tribal relatives, the Helvetii. Romans knew the place as Turicum, the Latin version of the Celtic word for water. At best, Romanization of the area proved to be patchwork and superficial. Already in the third century A.D. Alemanni infiltrated the lines and by the fifth century they had totally ousted the Romans from the northeastern Swiss plateau. The fragile centralizing influence of the Carolingians, working in Zurich from an unfortified palace upon the Lindenhof Hill, soon surrendered the village to the Germanic chaos of particularized authority. Bailiffs, barons, lords, and overlords vied for power and wealth. Though legally incorporated into the German Empire in the eleventh century, Zurich was in fact controlled by a series of local strongmen like the dukes of Zähringen and their innumerable petty lords temporal. By the end of the thirteenth century, another magnate rose from his seat at the Habsburg in Aargau to become Rudolf IV, Emperor of Germany and successor to the Duchy of Austria. Imperial control over this increasingly prosperous medieval town of craftsmen, commercial factors, and manufacturers soon waned, however. Artisans took the upper hand away from the local nobility, changed the urban constitution into a democratic form of government, and quickly recognized that their best interests lay in joining confederates fighting the Habsburgs in central Switzerland. From that day in 1351, in poetry, in song, on every solemn occasion, men of Zurich called their country Helvetia and considered themselves as Swiss.
Zurich's history, therefore, is mixed with ingredients international yet parochial, imperial yet tribal, Germanic yet Swiss. To this day the city's personality is ambiguous. It is a major metropolis, Switzerland's most populous city and the citadel of world finance; yet, it strikes most of its visitors as an overgrown village. Its restaurants offer dishes from around the world, anything from Angus beef to bouillabaisse, from chop suey to piccata Milanese; but, its residents and smart tourists prefer the local specialties of roast sausages, minced veal, and liver on the spit.

Eighteenth century Zurich was perhaps a bit less cosmopolitan and a bit more localistic than the modern city. Yet, the Zurich Enlightenment can still be studied in the context of at least three other Enlightenments: the European Enlightenment, the German Enlightenment, and the Swiss Enlightenment. In the European context, Zurich's movement toward Enlightenment can be seen as part of a great pedagogical effort which united leading thinkers from Madrid to Upsala and from Edinburgh to Vienna into an international family. Then, too, within the distinctive German wing of the international movement, Zurich's branch can be perceived as a southwestern flowering of "Aufklärung". Finally, as a reflection of traditions, tendencies, and problems peculiar to the Confederation of the Thirteen Cantons, its Enlightened achievements can be understood as products of the Swiss Enlightenment.
Zurich and the European Enlightenment

The contexts of the cosmopolitan family, the Aufklärung, and the Swiss Enlightenment are very different. The historian dealing with the Zurich cultural unit connectible to all three of these conceptualizations faces major difficulties. If an historian seeking "delicious lungfuls of pure reason" on the lofty peaks of the international Enlightenment sometimes disappears into "clouds of vaporous generalization", as Robert Darnton suggests, then one working to re-experience the Enlightened cultural ecology of the Swiss plateau suffers from all of the psychic uneasiness and physical discomfort brought on by an Alpine Föhn. Swiss courts have in the past acquitted criminals in cases where the defense has proved that the distressful wind was blowing when the foul deed was committed. Surely students of the eighteenth century should show no lesser degree of tolerance for the impaired analytical abilities of the historian drifting amidst the fitful, imprecisely mixing currents of the Zurich Enlightenment.

Using the analogy of a cosmopolitan family may help in analyzing Zurich's connection to certain internationally-active ideas, individuals, institutions, or issues, but it may not be the most suitable concept to understand the state of knowledge in the cantonal regime. While Zurich was a vital link in Europe's trans-Alpine traffic and a major publishing center sensitive to wide-ranging issues, it was also a self-contained
parochial, German-speaking city-state of the Swiss Confederation. Zurichers like Bodmer, Breitinger, Johannes and Salomon Gessner, and Pestalozzi qualify for status within a republic of letters. But, purely intellectual profiles directs attention away from the more immediate local and regional life dimensions. Once these Zurichers are removed from the canton, excised of community meaning, manipulated into proper categories and glorified with the forms of thought proper to the philosophes, what remains are agents in mankind's dialectical struggle against the so-called "archaic forms of thought".3

How can we locate Zurich's position in the cosmopolitan world of the European Enlightenment? One method is to survey à la de Candolle the foreign membership of the Physical Society. Between the Society's first election of a "Fremdemitglieder" in 1771 and its last election of one during the Old Regime period in 1798, fellows chose 58 non-Swiss correspondents. They came from as nearby as Memmingen, Stuttgart, and Strassbourg, and as far away as Prague, Moscow, and London. Table I shows their origins from five geo-cultural units: (1) major scientific centers, excluding Berlin; (2) major scientific centers, including Berlin; (3) Germany; (4) northern Italy, and; (5) the Rhineland and Low Countries, including Strassbourg.

This procedure shows that Zurich's scientific gathering was not just another soiree for a cosmopolitan "party of humanity". It had unique geographical characteristics. The Physical Society regularly transmitted news to and received news
Table 1

Foreign Membership in the Physical Society, 1771–98

Arranged According to Place of Residence into 5 Geo-Cultural Units

<table>
<thead>
<tr>
<th>A.</th>
<th>Major Scientific Centers, excluding Berlin</th>
</tr>
</thead>
<tbody>
<tr>
<td>1.</td>
<td>Artur Young</td>
</tr>
<tr>
<td>2.</td>
<td>Abbé Jean Rozier</td>
</tr>
<tr>
<td>3.</td>
<td>Comte d'Alban</td>
</tr>
<tr>
<td>4.</td>
<td>Count Maximilian von Lemberg</td>
</tr>
<tr>
<td>5.</td>
<td>Count von Razumovsky</td>
</tr>
<tr>
<td>6.</td>
<td>De Planazu</td>
</tr>
<tr>
<td>7.</td>
<td>Professor Ritter</td>
</tr>
<tr>
<td>8.</td>
<td>Franz W. Schmidt</td>
</tr>
<tr>
<td>10.</td>
<td>Professor Mikan</td>
</tr>
<tr>
<td>11.</td>
<td>Guy-Lussac</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>B.</th>
<th>Major Scientific Center: Berlin</th>
</tr>
</thead>
<tbody>
<tr>
<td>1.</td>
<td>Dr. Mark E. Bloch</td>
</tr>
<tr>
<td>2.</td>
<td>Dr. Carl von Wildenov</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>C.</th>
<th>Germany</th>
</tr>
</thead>
<tbody>
<tr>
<td>1.</td>
<td>Balthasar Sprenger</td>
</tr>
<tr>
<td>2.</td>
<td>Johann Adam Bernhard Grafschaft Mark</td>
</tr>
<tr>
<td>3.</td>
<td>Professor Gmelin</td>
</tr>
<tr>
<td>4.</td>
<td>Ludwig Timotheus, Freiherr von Spitheler</td>
</tr>
<tr>
<td>5.</td>
<td>Prince Carl Eugen von Wurttemberg</td>
</tr>
<tr>
<td>6.</td>
<td>Minister von Kniestadt</td>
</tr>
<tr>
<td>7.</td>
<td>Johann G. Hartmann</td>
</tr>
<tr>
<td>8.</td>
<td>Franz Seraph Kohlbrunner</td>
</tr>
<tr>
<td>9.</td>
<td>Dr. Christian Reuss</td>
</tr>
<tr>
<td>10.</td>
<td>Pastor Johann Meier</td>
</tr>
<tr>
<td>11.</td>
<td>Dr. Matthias Merck</td>
</tr>
<tr>
<td>12.</td>
<td>Johann C. Stark</td>
</tr>
<tr>
<td>13.</td>
<td>Professor Leske</td>
</tr>
<tr>
<td>14.</td>
<td>Provost Pralln</td>
</tr>
<tr>
<td>15.</td>
<td>Christian Daniel Erhard</td>
</tr>
<tr>
<td>17.</td>
<td>Bernhard Neu</td>
</tr>
<tr>
<td>18.</td>
<td>Dr. Johann Christoph Billhuber</td>
</tr>
<tr>
<td>Number</td>
<td>Name</td>
</tr>
<tr>
<td>--------</td>
<td>-------------------------------</td>
</tr>
<tr>
<td>22</td>
<td>Dr. Christian Ludwig</td>
</tr>
<tr>
<td>20</td>
<td>Franz von Paula-Schrack</td>
</tr>
<tr>
<td>21</td>
<td>Hofrat von Göhl</td>
</tr>
<tr>
<td>22</td>
<td>Professor Hoffmann</td>
</tr>
<tr>
<td>23</td>
<td>August Hartmann</td>
</tr>
<tr>
<td>24</td>
<td>Ingmar Scheyer</td>
</tr>
<tr>
<td>25</td>
<td>Dr. Persoon</td>
</tr>
<tr>
<td>26</td>
<td>Gottfried C. Reich</td>
</tr>
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</table>

**D. Northern Italy**

<table>
<thead>
<tr>
<th>Number</th>
<th>Name</th>
<th>Location</th>
<th>Year</th>
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</thead>
<tbody>
<tr>
<td>1</td>
<td>Antonio de Turra</td>
<td>Vicenza</td>
<td>1772</td>
</tr>
<tr>
<td>2</td>
<td>Petrus Harduini</td>
<td>Padua</td>
<td>1772</td>
</tr>
<tr>
<td>3</td>
<td>Johannes Harduini</td>
<td>Venice</td>
<td>1772</td>
</tr>
<tr>
<td>4</td>
<td>Robert Strange</td>
<td>Venice</td>
<td>1773</td>
</tr>
<tr>
<td>5</td>
<td>Alessandro Volta</td>
<td>Como</td>
<td>1776</td>
</tr>
<tr>
<td>6</td>
<td>Baron von Kreitmayer</td>
<td>Milan</td>
<td>1780</td>
</tr>
<tr>
<td>7</td>
<td>Senator Quirini</td>
<td>Venice</td>
<td>1782</td>
</tr>
<tr>
<td>8</td>
<td>Marsiglio Landriani</td>
<td>Milan</td>
<td>1782</td>
</tr>
<tr>
<td>9</td>
<td>Professor Figaro</td>
<td>Genoa</td>
<td>1787</td>
</tr>
<tr>
<td>10</td>
<td>'Abbe Joseph Olivi</td>
<td>Padua</td>
<td>1793</td>
</tr>
<tr>
<td>11</td>
<td>Professor Nocca</td>
<td>Mantua</td>
<td>1794</td>
</tr>
<tr>
<td>12</td>
<td>Professor Zucconi</td>
<td>Florence</td>
<td>1797</td>
</tr>
</tbody>
</table>

**E. Rhineland/Low Countries**

<table>
<thead>
<tr>
<th>Number</th>
<th>Name</th>
<th>Location</th>
<th>Year</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Dr Van Noodt</td>
<td>Amsterdam</td>
<td>1774</td>
</tr>
<tr>
<td>2</td>
<td>Abbé Philippe-Andre</td>
<td>Strasbourg</td>
<td>1777</td>
</tr>
<tr>
<td>3</td>
<td>David van Royens</td>
<td>Leyden</td>
<td>1779</td>
</tr>
<tr>
<td>4</td>
<td>Dr. Wilhelm Muniks</td>
<td>Groningen</td>
<td>1780</td>
</tr>
<tr>
<td>5</td>
<td>Philippe-Frederic, Baron de</td>
<td>Strasbourg</td>
<td>1792</td>
</tr>
<tr>
<td></td>
<td>Strasbourg</td>
<td></td>
<td></td>
</tr>
<tr>
<td>6</td>
<td>Professor Marten</td>
<td>Louvain</td>
<td>1798</td>
</tr>
</tbody>
</table>

From Zurich Staatsarchiv B IX 206: "Verzeichnis samtlicher so wol von Anfang incorporiert gewesenen als demzahlen bey lbbl. Phys. Soc. in Zch. annoch anwesenden Ehren und Mitgliedern".

A number of these men corresponded principally with the Society's botanical garden. See B IX 220: "Originalbriefe von Naturforschern aus dem In- u. Ausland an Dr. med. Johann Georg Locher (1739-1787), Dr. John. Scheuchzer (1738-1815), Dr. med. Salomon Schinz (1734-1784), und Dr. med. Hans Caspar Hirzel (1725-1803)"; also B IX 255-256: "Tauschverkehr des Botanischen Gartens, 1779-1794".
from foreign correspondents along an avenue which followed the traditional northern Italy — trans-Alpine — Rhine to Flanders/ or Rhine to Germany trade routes. Zurich, too, belonged to this commercial path-way. Twenty-eight of the 58 correspondents (48%) resided in German states, and 13 (22%) in northern Italy. Six of them (10%) lived in either Strassbourg or in the Low Countries. Only 13 of the correspondents (22%) belonged to major scientific centers, including Berlin. It can be ventured safely that only a specialist in eighteenth century European studies can recognize more than a dozen of the Society's foreign members. For Zurich the correspondents acquired their scientific identity from factors peculiar to a regional community, not from their contributions to the positivistic annals of international science.

A survey of the Physical Society library for the year 1777 also confirms the importance of regional structures in the outlook of Zurich intellectuals. Table 2 identifies the sites of publication for 429 books listed in the "Index Topicus Bibliothecae Societatis Physico. Oeconomica" now stored in the Zurich Staatsarchiv. These books deal with two subjects integral to Physical Society activity — economics and natural history — and with two subjects of lesser Society concern — higher mathematics and philosophy. Clearly German editions predominated in the library. Only 149 of the 429 books (35%) came from outside of Germany or German-speaking Switzerland. Leipzig contributed 94 volumes, 15 more than did Paris. Nearly half of the books on mathematics and philosophy
(80 of 163) arrived from Paris, Venice, Amsterdam, Leyden, or Geneva, but their subject matter was less fundamental to the scientific interests of the majority of the Physical Society members. Seventy-nine of the 98 books on economics (81%) and 121 of the 179 natural histories (71%) were sent by German publishers.

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Table 2

Major Publishers Represented in the Physical Society Library - 1777*

<table>
<thead>
<tr>
<th>Publisher</th>
<th>Economics Number of vols.</th>
<th>Natural history Publisher number of vols.</th>
<th>Math &amp; Philosophy Publisher number of vols.</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. Leipzig</td>
<td>27</td>
<td>Leipzig 40</td>
<td>Paris 41</td>
</tr>
<tr>
<td>2. Paris</td>
<td>16</td>
<td>Paris 22</td>
<td>Leipzig 27</td>
</tr>
<tr>
<td>3. Berlin</td>
<td>11</td>
<td>Frankfurt 21</td>
<td>Berlin 22</td>
</tr>
<tr>
<td>4. Hamburg</td>
<td>9</td>
<td>Leyden 15</td>
<td>Zurich 17</td>
</tr>
<tr>
<td>5. Zurich</td>
<td>8</td>
<td>Zurich 13</td>
<td>Venice 11</td>
</tr>
<tr>
<td>6. Stuttgart</td>
<td>6</td>
<td>Basel 13</td>
<td>Amsterdam 10</td>
</tr>
<tr>
<td>7. Frankfurt</td>
<td>6</td>
<td>Stockholm 13</td>
<td>Leyden 9</td>
</tr>
<tr>
<td>8. Halle</td>
<td>5</td>
<td>Berlin 12</td>
<td>Göttingen 9</td>
</tr>
<tr>
<td>10. Lausanne</td>
<td>3</td>
<td>Nuremberg 10</td>
<td>Wittenberg 8</td>
</tr>
</tbody>
</table>

* From "Index Topicus Bibliothecae Societatis Physico-Oeconomica, 1777". Zurich Staatsarchiv, B IX 152

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Aufklärung

Though the "German Enlightenment" has some of the same deficiencies as a defining context as has the analogy of the cosmopolitan family, clearly it represents better the broad cultural environment of eighteenth century Zurich. This is especially true as Peter Reill has recently described it in The German Enlightenment and the Rise of Historicism (1975).
In this work, Reill investigated the ideas of German figures usually labelled "secondary" and excluded from discussion by great men-oriented historians of the European Enlightenment. This focus enabled him to differentiate between dynamics operating in Germany and those operating elsewhere and to fashion special categories, definitions, and interpretations of the German phase of the total movement.

Reill found the Aufklärung formed by (1) the legacy of the philosophy of Leibniz, based in the concept of "contextual harmony"; (2) a "Ständestaat" political tradition interpreted by reform-, not revolution-, minded "burgerlich" social types; and (3) Pietist revival of Protestant spirituality. These three elements encouraged discussion of German Swiss as part of Aufklärung's distinctive set of philosophical issues, political solutions, social and religious forms, and generational patterns. They rescued "Naturforschung" and "Naturphilosophie" from positivistic critics who saw the interests as aberrant mystical studies of God.

According to Reill, the German idea of "change" strongly differentiated Aufklärer from philosophes: the Aufklärer thought of healthy conservation, the philosophes of modernization. Leibniz's followers opposed the discontinuous or catastrophic theories that made Nature little more than the sum of mechanically-changing parts. They emphasized the continuous and symbiotic aspect of change which tied parts organically to their past nature.

Reill saw the German organic language of change reflecting Aufklärer commitment to established social and political traditions.
Aufklärer felt no alienation from the controlling elite; their French counterparts were more or less excluded from power by the revived presence of a strong nobility. Aufklärer believed that positive change could occur within the constituted regime. Their future-directed programs focused on repairing and polishing the existing system.

Because these Aufklärung characteristics match the aspirations of the German-speaking cantons, Swiss played a more prominent role in the German Enlightenment than they did in the cosmopolitan Enlightenment. Reill referred to 19 Swiss scholars and made at least a dozen independent points concerning their intellectual significance. Five Swiss played a critical role in Reill's thesis: Johann Jakob Bodmer, 1698–1783; Isaak Iselin, 1728–1782; Johannes von Müller, 1752–1809; Johann Georg Sulzer, 1720–1779; and Jakob Wegelin, 1721–1791. In particular, Zurich's Bodmer burst forth to illuminate Reill's argument that the birth of the modern historical consciousness occurred during the German Enlightenment and that the achievements of the Sturm und Drang and Romanticism flowed directly from the Enlightenment.

Peter Gay ranks as one of the greatest historians of the European Enlightenment. But he identified Bodmer in his award-winning The Enlightenment: An Interpretation as only the chief advocate of the "Swiss school" in the "noisy", "marginal, often confused, and wholly inconclusive" aesthetic debate with Leipzig's Johann Cristoph Gottsched over the value of imagination in literary apprehension. For Gay, the debate (and perhaps also the imagination)
resulted only in confusing the German literary community into producing the "pathetic, sentimental, mystical poetry" of Klopstock and others. Reill, however, saw Bodmer as a crucial thinker involved in positive development and appreciation of the historically unique. His work led to the triumph of an historicist outlook.

Alphonse de Candolle in his late nineteenth century sociological study of the foreign membership in the three great early modern scientific academies (Berlin, London, and Paris) and Adolf Harnack in his early twentieth century history of the Prussian Academy also noted the vigorous Swiss presence in eighteenth century German life. Candolle found that in 1789 nearly 20% of the foreign correspondents of Frederick II's academy were Swiss, a figure highly disproportionate to the population of the Confederation. Harnack, who examined the influence of resident Swiss in Berlin, suggested Swiss members, including Alexandre de Catt, Leonhard Euler, Johann III (Jean) Bernoulli, Nicolas Beguelin, Johann Heinrich Lambert, Johann Bernhard Merian, Daniel Passavant, Johann Georg Sulzer and Jakob Wegelin, dominated the Prussian group for decades.

Why had Swiss thinkers moved to Germany? They obviously chafed at the lack of educational and professional opportunities in their country. They were enticed by the most dynamic "reform, expansion, and re-invigoration" of the German university system since the Reformation. Once settled in German states, their influence increased. They formed an essential part of both the
student body and faculty of the University of Göttingen, a new institution founded in 1737. Berne's Von Haller presided over Göttingen's Royal Academy of Sciences until he resigned in 1753 (to assume a post on the sovereign council of his home town). During his tenure, Haller attracted Swiss medical students to Göttingen, notably Brugg's Johann Georg Zimmermann (1728-1795). So famed did Zimmermann become in Germany, he acquired a clientele of important princes; in 1786 attended the dying Frederick II in Potsdam. Basel's Johann Jakob Huber (1707-1778) succeeded Haller as professor of anatomy at Göttingen. His patients included the Landgrave of Hesse-Cassel, the Margrave of Baden and Gustavus III, King of Sweden. Other Swiss were energized by their study in Germany: Schaffhausen's Johannes von Müller and Basel's Isaak Iselin while at Göttingen studied history. Müller began his famous (only partially completed) history of the Swiss Confederation at the suggestion of Göttingen's August Ludwig von Schlozer. Iselin was able to resolve his own intellectual tension between his growing historical interests and his earlier attachment to Christian Wolff's rationalism when he "fell under the sway" of Göttingen's political historian Johann Jakob Schauuss. Certainly, Göttingen drew Swiss to "the most important center of Aufklärung". Other Swiss crossed the Rhine to promote academic careers. Three of Bodmer's students expatriated. Johann Sulzer of Winterthur (Canton Zurich) became the mathematics professor at the Joachimstal gymnasium in 1747; in 1750 the Berlin Academy elected him a member. Johannes von Müller, besides becoming secretary to the Berlin
academy, held a number of important advisory and diplomatic posts for the Prussian government lasting into the Napoleonic era. Jakob Wegelin of Vevey taught history at the Ritterakademie; later he became the Berlin academy's chief archivist. Through students, Bodmer's influence spread far beyond Zurich. 18

Bodmer's gifted teaching of Swiss native sons shaped the thought of six other Zurichers mentioned in Reill's study: Bodmer's friend and editorial collaborator Johann Breitinger (1701-1776) worked with him on two journals, the Discours der Maler and the Helvetische Bibliothek; the pre-Romantic, mannerist Heinrich Füssli (1741-1825) gained his painting fame in London as 'Fuseli'; idyllic poet and landscapist Salomon Gessner (1730-1788) directed a publishing firm which later became the famous "Orell, Gessner, Füssli und Co."; pastor Johann Caspar Lavater (1741-1801) finished his "Physiognomische Fragmente" in 1778; educational theorist and social reformer Heinrich Pestalozzi (1746-1827) established a model rural school "Der Neuhof" near Birr in the canton of Aargau before he was 25 years old; and Physical Society member Johann Heinrich Waser (1742-1780) contributed some of the most innovative social and economic analyses found anywhere in eighteenth century Europe. When he was executed by the city oligarchs for high treason, Göttingen's Schlozer saw it as an injustice comparable to the murder of Jean Calas. 19

With Bodmer standing supreme over an active intellectual community, Zurich grew into a major Enlightenment location in its own right. In the middle decades of the century Klopstock and
and Wieland became Bodmer proteges. Kleist, Heinse, and Goethe visited him. Kleist had come to Zurich as a Prussian officer recruiting mercenaries; he left believing the Limmatstadt to be incomparable, far outshining Berlin in men of genius. The more factually inclined Heinse noted that 800 Zurich citizens had published something (his figure was far too high). Goethe, escorted to an aged Bodmer by Lavater in 1779, told his host that he was fortunate to live in "the most highly cultivated city" where life takes place in "a truly idyllic setting".

The impressive number of Swiss energized by German institutions and intellectuals and the depth of enthusiasm for Zurich shown by important eighteenth century Germans supports a use of "Aufklärung" as a meaningful synoptic term for certain developments of the Zurich Enlightenment. Certainly the relationship of Zurich to the German Enlightenment rested on far more than Bodmer's quarrel with Gottsched over the merits of Milton's Paradise Lost, as Peter Gay seems to have claimed. Yet, one still wonders whether Zurich's Enlightened thinkers are best understood as Aufklärer. Despite exodons of some to Germany, most Zurich citizens rarely left Switzerland; for that matter, they seldomly travelled beyond the canton. Of the seven Zurichers important to Reill's study, only Füssli immigrated (though perhaps Waser should have) and he moved to England, not to Germany. Salomon Gessner had found his contacts with Berlin's "Montagsklub" invigorating. His study with Anacreontic and Rococo artists Karl Wilhelm Ramler in Berlin, court painter G. Hempel in Magdeburg, J.W.L. Gleim in Halberstadt, and Friedrich von Hagedorn in Hamburg
decided much of his taste and style. Yet, he returned to Zurich
to handle his father's publishing business, to marry into the
influential Heidegger family, and to pioneer Zurich's first
porcelain factory. Like Bodmer before him, Gessner was elected
a "Rathsherr", a member of the city's "Grosser Rat", or sovereign
council. Bodmer and Breitinger both held treasured teaching posts.
Lavater and Waser were pastors. Pestalozzi, though hardly the
typical conforming citizen, left the city only a short distance
to reside in the rural canton.

... ... ... ... ...

The Swiss Enlightenment

Zurich citizens lived out their lives in a land which, like
Germany, enjoyed little unity or national tradition. Old Regime
Switzerland amalgamated essentially independent states. Its
13 loosely connected cantons (Stände) or districts (Orte) were
sovereign in all important matters. The cantons varied greatly
in size, in demographic concentration, in citizen-to-subject
ratio, in their degree of industrialization, in educational
and professional opportunities, in constitutional outlook,
and in the social and ideological basis of their ruling class.

To this cantonal union belonged certain subject territories
governed by different cantons in their turn as "common lordships"
(Gemeine Herrschaften). Finally, there were several "associated
districts" (Zugewandte Orte) connected to the cantons only by a
treaty of protection. Religious beliefs worsened the split. The
Reformation had divided these lands nearly in two between
Catholics and Protestants, and time cemented the divisions.
Linguistically, Switzerland offered (and still offers) an Alpine Babel. German, French, Italian, and Romansch speakers used countless mixtures and dialects.\(^2\) (This was perhaps more true in German Swiss areas. French Swiss traditionally insist that their speech is purer French than that spoken in Paris, an over-stated claim that nonetheless signals a greater homogeneity of tongues in "la suisse romande".\(^2\)) Add to this the persistently annoying problem of properly naming cities, cantons, lakes, territorial areas and the like; many have two or three designations, a clue to the fascinating, if perplexing, Swiss pluralism.\(^2\)

Usually native Swiss historians judge their Enlightenment to have arisen from forces working to understand and to unify the incomparably differentiated country.\(^2\) They define it as a cross-cantonal movement aimed at the creation and clarification of Swiss national character. They see it as pre-nationalistic rather than cosmopolitan. They center it in the German Protestant towns of the central Swiss plateau, particularly in Basel, Berne, and Zurich, and in Geneva.

Consciousness of being Swiss, they say, originated from attachment to the land. Perhaps the Volkscharakter of the Confederation was too polymorphous or the aesthetic presence of the Alps too imposing for it to have happened otherwise. Whatever the cause, Swiss patriotism developed hand-in-hand with Landeskunde and with Naturforschung. Men of the late seventeenth century and early eighteenth century who collected and classified flora in Zug, Glarus, and the Grisons
and who searched for paleontological relics on the tops of Rigi, Pilatus, and the Crispalt shaped awareness of the special nature of the Swiss environment. So too did the naturalists who took barometrical readings and examined ice crystals at the hospice of the St. Gotthard. Map-makers and landscapists promoted a physical sense of Swiss-ness. Nature poets searched for the proper literary images by which to convey the breath-taking magnificence of the Lauterbrunnen valley waterfalls; travelling scholars and merchants commented on regional customs. Poetic or matter of fact in their accounts, they all contributed to a Swiss awareness of their physical space.

Residents of the Confederated lands shared an ecology. All these Alpine regions could claim a common Nature. Some areas were ruled as subject lordships or as associated districts; some spoke French, others German; some were Catholic, some Reformed; some were ruled by a large aristocratically-constituted canton (Berne); some were dominated by a small rural community ruled by popular assembly (Appenzell). If Swiss could not travel to the world of barren rock, to rushing water, to glaciers, gorges, and eternal whiteness, they could look to a horizon to see the land's Alpine grandeur. God, they sensed, had given them a special world and a special fate.28

Environmental reverence unified the forces of the early Swiss Enlightenment. Alpine aesthetics stimulated Naturforscher to bring forth a correspondingly heroic vision of the land's peoples. Scheuchzer's “Beschreibung des Naturgeschichten des
Schweizerlandes" (1706) and Haller's poem "Die Alpen" (1729) presented Switzerland as a divinely ordained land of free human beings destined to be a politically neutral and culturally mediating force in European affairs. Other Swiss went further. Sulzer observed that God had made the Swiss Alps to be "the greatest and most admirable work of Nature". Christoph Trümpl of Glarus (1739-1781) asserted that the Swiss Confederates held the God-given rank of the world's most marvelous people. 29 Montesquieu's writings on the effects of climate on society found a delighted audience. Swiss thinkers carefully examined his notion that environment determined national character.

Early in Fernand Braudel's monumental study of the Mediterranean world of the sixteenth century, he reminded his reader of Raoul Blanchard's warning that "it is well nigh impossible even to provide a definition of the mountains which is both clear and comprehensible". 30 Earlier writers experienced a similar defeat. In an 1847 address to Zurich's Naturforschende Gesellschaft on the occasion of its centenary anniversary, Oswald Heer recognized the uncertain human boundaries mountains impose which cannot be drawn onto a map:

We shall find the correct relationship of man to the mountain only if we recognize that man experiences the mountain both objectively and subjectively.... The intensity of the experience is to an extent dependent upon the objective beauty of the landscape, but it depends also to a high degree upon the spectator's imagination. The sense of content and achievement which a mountain expedition gives comes from our inner excitement over the anticipated view which will present itself at the summit.
Thus, the longer the time one takes on making plans and preparations, assembling equipment and completing the approach, the more supreme is the climbing experience.

It has been said that foreign visitors to Switzerland, particularly the British, prompted the enthusiasm for mountains. Non-Swiss supplanted "mountain gloom" with "mountain glory". Marjorie Hope Nicholson argued that English scientists and literary persons alike developed a new attitude toward the mountains producing a pre-Romantic reflection on the "infinite" and the "sublime". True, the people living in the High Alpine regions, or perhaps even in the foothills, had little reason to romanticize their existence in this rugged environment. The people of the central Swiss plateau felt otherwise. They were not mountain people. Yet the Alpine horizon enduringly scribed their world. When the conditions were right, burgers in Zurich, Aarau, Berne, and Biel could look south or southwest and enjoy a crystal-clear view of snow-covered peaks. They seemed near enough to touch. The peaks were near enough to allow the burgers to romanticize their nature given the proper cultural conditions.

Already during the Reformation, conditions were ripe for mountain glory. Conrad Gessner's grandiloquent vision united the mountains to his natural theology. In his letter to friend Jakob Vogel in June 1541, the Zurich physician (1516-1565) described his sense of mountain glory:
So long as God gives me the years to live, my most learned Vogel, I have pledged myself from now onwards to climb several mountains, or at least one of them, each year when the flowers are in bloom, partly to gain more knowledge thereof, partly to give some worthy exercise to the body and to cheer the spirit. What a joy, what a pleasure, for the awakened soul to gaze in admiration at the mountain mass as if one were in a theater, and to lift one's eyes to the heavens. I cannot explain why it is that, at the sight of these incredible heights, one's whole being trembles as it is gripped by the glorious splendors of creation. Petty beings are they who cannot bring themselves to admire anything, brooding in their retreats and neglecting the mighty display of the universe; as they creep into their holes in winter like the seven sleepers, they have not a thought that the human race is in the world to gain from its wonders an understanding of higher things, yes, even of Almighty God Himself.

So much for mountain gloom.

However, during the late sixteenth and seventeenth centuries, an icy and austere puritanism gripped the Swiss plain, until warmer eighteenth century conditions favored a resurgence of good feelings about the environment. Swiss made a number of first mountain ascents in the 1700's. At the end of their student days, Haller and Johannes Gessner followed Conrad Gessner's footsteps from Basel to Lake Geneva, along the Rhone through the Valais, over the Joch Pass to the secluded valley of the Engelburg monastery, and on the "Vierwaldstätterssee" (Lake Lucerne) back into the plain. The Genevan-born De Luc brothers, Jean-Andre and Guillaume-Antoine, made the first climb of the Buet in 1770. De Suisse climbed Mt. Blanc in 1787. "Mountain glory" was not an import. Swiss conceived of their
own environment and human character in a positive way long before the arrival of British mountaineers. When the British called Switzerland a paradise, they echoed the sentiments of their hosts.

Awareness of being part of a Switzerland prompted vigorous historical reconstruction. In this respect, thinkers of the Swiss Enlightenment paralleled their opposite numbers in the Aufklärung; that is, they created a Swiss identity grounded in the past. Scholars from nearly every canton and territory of the Confederation wrote histories, geographical dictionaries, topographical and political handbooks, biographies, and collected legends, legal statutes, and the like, relevant to Switzerland. Learned societies and journals appeared to expand study of Swiss history. They examined the ancient and medieval settlement of the land, the evolving structure of cantonal constitutions, the genesis of confederation, and the economic history of Alpine roads. They explored Swiss folklore, mythology, customs, and arts. Zurich scholars played a central role in this activity. Though Heinée's estimate of 800 publishing writers living in a single age is far too high, no other regime of the Confederation (other than the university town of Basel) can compare with Zurich in the scope and volume of its eighteenth century scholarship.36

Zurich's Bodmer stands central to the Swiss Enlightenment. Through his historical study, he encouraged several generations to discuss Swiss character. In 1727 he and friend Breitinger founded an "Helvetische Gesellschaft" dedicated to the collection of local
memorabilia, original documents, critical editions, patriotic poems and dramas, reviews, and travel notebooks. As an early historicist, he believed that the path for young men to an improved life lay through their active confrontation with Swiss traditions. Four volumes of his *Helvetische Bibliothek* (published between 1735 and 1741) glorified unique qualities of Switzerland: its "godly" (gottlich) and "sacred" (heilig) laws, its "courageous" (tapfer) citizens, its "fair" and "just" (billigmassig) wars.38

Shaped by the teachings of such Swiss conscious thinkers as Scheuchzer, Haller, and Bodmer, a new generation of Swiss "patriots" came together in the middle decades of the eighteenth century. Young intellectuals who had corresponded throughout the 1750's to discuss pressing social and intellectual issues met at Basel in 1760 to celebrate the 300th anniversary of the birth of the university. From the celebration, a tangible Swiss patriotism emerged, influenced to some degree by the more radical French writers of the same period.

Then, on 3 May 1761, a group of these "patriotic friends" met at Schinzach (between Aarau and Brugg): Lucerne's Franz-Urs Balthasar (who had recently published "Patriotic Dreams of a Confederate"), Basel's Isaak Iselin, Brugg's Dr. Zimmermann (he had already written a book on Swiss national pride), Uri's Beroldingen brothers, and Zurich's Salomon Hirzel, Salomon Gessner, and Heinrich Schinz. Together they established an inter-cantonal brotherhood, baptized in 1762 by Zurich's
Dr. Hans Caspar Hirzel the "Helvetische Gesellschaft" after Bodmer's earlier historical society. This body met annually at Schinznach until 1780. While the more aristocratic cantons occasionally directed antagonism against it because they overestimated the moderate nature of its program, the group survived four decades. After 1780 it met at nearby Olten and then at Aarau until the end of the Old Confederation in 1798. The Helvetic Society aimed to rejuvenate an imagined lost love between the Confederates. It wanted to create a popular Swiss consciousness by promoting study of native culture.

By encouraging post-Pietist feelings for religious toleration, members tried to combat confessional dissension within the land. They also called for the end of the traditional mercenary service and for the establishment of a unified military planning. They discussed methods by which the cantons could better administer their subject, common lordships.

Though working to strengthen the Swiss alliance, these Enlightened men recognized that their homeland was an inimitable blend of cultural forms. As poets, historians, naturalists, but primarily as concerned, active citizens, they explored the budding feeling of their membership in a unique historical community. They saw their customs and values based on the harmonious mixing of international with local qualities. For them, Switzerland defied mechanistic explanation. The land was more than the sum total of its parts. Regional peculiarities did not homogenize. Territories remained true to their own nature.
even while being "Swiss" and belonging to a political state. Bodmer's aesthetics and sense of historical uniqueness embodied this commitment to Swiss unity in diversity. To him, imposition of rules governing language equated with despotism and arbitrary rule. Free states allowed the profusion of dialects and the unregulated development of language.39

* * *

The concept of Enlightenment can shed only limited light. "European Enlightenment" displays a charming but misleading chiaroscuro; it illuminates intellectual peaks but deflects attention away from the often more meaningful regional, local, and socially-relevant outlines of eighteenth century culture; it highlights cosmopolitan centers but keeps major landscapes in darkness, casting them as shadowy imitations of superior Enlightened forms in England and France. "Aufklärung" clarifies a movement distinct and in some ways in advance of tendencies in western Europe. It wisely places Swiss Germans into the world of Halle and Göttingen rather than into the more foreign worlds of London or Paris. Yet, the life of Swiss Germans took place primarily amidst the polarities of Switzerland. Like hard cider and beer, the "Swiss Enlightenment" and the "German Enlightenment" had much in common but their distinct flavors discourage comparison.

The fabric of Helvetic thought directs our search for the most precise context of Physical Society activity to the
rich community life of Zurich. As was proper in a canton devoted to Ständestaat freedoms and to an organic political alliance, Zurich saw itself as a free and autonomous society directed by its own reason — its Lokalvernunft — and for its own purposes. Getting one's bearings within Zurich's social space is the key to understanding Zurich's particular contribution to eighteenth century Swiss science.
Peter Gay argues that the Enlightenment had no clear social derivation or social function. Philosophes and eighteenth century scientists, he asserts, did not come from a single class and they did not address a single class. They used knowledge in their campaign to humanize and modernize Europe, he continues, but knowledge itself was free and independent of contextual forces:

For knowledge has neither class nor time. It is a logical relation; it can be precise or vague, exhaustive or partial, but it cannot be bourgeois or proletarian, Protestant or Catholic, French or German. A knower has a social status, his ideas have existential roots, but the truth or falsity of his ideas is wholly independent of this status and these roots. It is dependent, rather, on the correspondence of their formulation with the reality they purport to describe.

Gay aligns his analysis of the Enlightenment with the sociology of Raymond Aron and the philosophy of Karl Popper.¹

It can help to see this matter differently. For Dolby the truth or falsity of scientific ideas depends upon factors in their transmission. The "more lasting scientific achievements", that is, those considered "true", at a particular time transcend local limitations and regional barriers; they "can fit into a wide range of social contexts, the kind of value-neutral self-contained facts and structures of knowledge which internalist historians have concentrated on".² There do exist, consequently, local and regional sciences which have unique chronological, spatial, and social characteristics. Historians concentrating
on the neutral positive science of the cosmopolitan arena never suggest the "full cultural context of socially relevant science which is truly international". In their perspective, Zurich's Physical Society wins a minor role in a deterministic march of ideas toward modernity, but by forfeiting cantonal identity, social foundation, and ideological connection, the Society loses its most real meaning.

In Zurich the impulse for Enlightenment was not the desire to change by creating a new world based on "modern" ideas. Rather, it was to perfect the old world by awakening sentiments perceived by the ruling class as virtues "original" or "natural" to the harmonious functioning of the cantonal community. The goal was essentially social: to raise the consciousness of every cantonal resident, but especially that of the town citizen, about what it meant to be part of and responsible to that special locality.

The impetus for a scientific society was in the air during the first half of the eighteenth century. Great national academies had established international reputations. Provincial and civic fellowships produced promising and serious work. However, the shell encasing Zurich cultural life was too hard and too thick to experience penetration by a "spirit of an age". The rulers of the Old canton conceived of a world designed to traditionalize every community direction. Zurich burgers did not occupy themselves in any central way with notions superfluous to their concrete home community. The Bodmer circle, for instance, did not read J.J. Rousseau's works for their
abstract theoretical value. Instead, they were moved by their intense preoccupation with the problem of perfecting the "Vaterstadt".6

Zurich naturalists did not escape this community orientation. The creation of their Physical Society cannot be explained by references to a science-minded Zeitgeist. Society members in their papers described the local ecological scene rather than dealing in the so-called "higher" theoretical sciences. Having this tendency, the Society must be studied as a reflection of the cantonal community from which its members came and from which its ideological supports and cultural function derived. The purpose of this chapter is to investigate the complex social issues important to the history of scientific participation and organization during the Zurich Enlightenment.

"Zunftregiment"

From the last decade of the fifteenth century to the last decade of the eighteenth century, Zurich experienced three centuries of remarkable socio-political stability. A closed corporation of patrician families, which perpetuated itself through control of the urban guilds, ruled the city-state. Though the constitution had undergone five distinct revisions between the "Guild Revolution" of 1336 and 1498 to resolve tensions between the crafts population and the feudal and commercial aristocracy, there had been no substantive alterations of the oligarchical formula from 1498 to 1798.7 By the Enlightenment
the weight of tradition had grown so great in Zurich that citizens conceived the state to be a finished work which needed only wise maintenance. They saw it as a divine creation wherein magistrates ruled "by God's grace" (von Gottes Gnaden). They believed that God had planned for them an organic union of socially differentiated estates governed by patriarchs. For generation after generation of Zurich burgers this vision endured. Long-term continuity subdued any impulse to tamper with basic norms and patterns of community life.

In the 1760's Dr. Hans Caspar Hirzel, an officer of the Physical Society and of the inter-cantonal Helvetic Society in Schinznach, called the Zurich constitution a "masterpiece"; it perfected the naturally just relationships between the various grades of citizens and between citizen and subject. In a quite literal sense, of course, it was a masterpiece, for the guilds dominated the town. Zurich was a "Zunftstadt" like no other.

In Berne, power belonged to a landed, military aristocracy. Bernese high society revelled in theatre, grand balls, and masquerades. In Basel, influential guilds competed for attention with a bishop and a university. St. Gallen cooperated with the abbot.

In Zurich, however, the guild structured all social activity and political participation. While the guild originated as an autonomous corporation of artisans designed to protect trade interests, it grew to become the chief organizer of civic and private life. It socialized the young into adulthood and
transmitted the craft's urban heritage across the generations. It acted as an essential community welfare agency. It watched over the morals and behavior of its membership. It regulated the distribution of resources, positions, and prestige within the society. Guild-halls provided the main meeting place for casual and serious conversation, for formal assemblies, and for eating, drinking, and entertaining. In sum, the guild was the fundamental institution of late medieval and Old Regime Zurich.

The guilds were also the basis of Zurich political arrangement. The urban unrest of the mid-fourteenth century had provided a strong democratic impetus for Zurich. The Guild Revolution had widened the circle of men who were able to participate in government. Guild membership meant burger rights and privileges. Guildsmen debated and determined community will. They elected public officers. Prominent guild rank was the springboard to political power.

In the guild regime, the "Large" or "Sovereign Council" (Grosser Rat) was the organ of self-government. Two hundred twelve representatives — though commonly called "the 200" — from the 12 officially recognized guilds and from the "Constabulary" (Constaffel) were elected. Each of the 12 guilds elected 12 sovereign councillors called "Twelvers" (Zwölfer). The Constabulary, an estate of old landed and commercial aristocrats which had been given the political rights of a guild in the constitutional mediation of the later Middle Ages, chose 18 councillors called "Eighteeners" (Achtsehnter). In
theory, the Sovereign Council had the "highest power" (der höchste Gewalt) and the "highest authority" (der höchste Behörde).\textsuperscript{10}

The other 50 members of the Sovereign Council were elite patricians. When sitting independently of the other 162, these men comprised the "Small Council" (Kleine Rat) or Senate. The Senate included 24 guildmasters (two from each guild), four notables of the Constabulary (the Constaffelherren), 20 senators (one Ratsheerr from each guild, two from the Constabulary, and six who were "freely elected" from within the Sovereign council membership), and two burgermeisters. Within this senate there was another concentration of power known as the "Privy Council" (Geheime Rat). It was made up of the nine "notables of the estates" (Ständeshauptern): two burgermeisters, four "Staathalter" (known in the Middle Ages as "Obristenzunftmeister" because they acted as popular tribunes who settled disputes between the guilds), two "Seckelmeister" who executed administration of the rural bailiwicks, and the "Obmann der gemeiner Kloster" who chaired the commission which maintained ecclesiastical property. Three senators were elected customarily to this body as well, making a total of 12 members, symbolic of the 12 guilds.

Together, these councillors made up the Regime. Strict division of responsibilities did not prevail. Generally the Small Council administered current business and acted as the highest court of appeal. By the eighteenth century the Privy Council grew to determine all important policy and to execute authority. Nonetheless, the Sovereign Council held the
constitutional prerogative of final approval. It had the right
to elect burgemeisters, Statthalters, the 20 senators, the rural
bailiffs (Amtmänner), and most of the higher officials. It alone
could entertain constitutional revision.

Even though sovereignty resided legally in the hands of
approximately 2300 burgers at the time the Physical Society was
created, a closed corporation of families actually ruled Zurich.
Like other small states of the early modern period which called
themselves "republican", Zurich was in fact a mixture of democratic
ideals and real aristocratic constraints. In a contemporary hand­
book to Swiss politics, Johann Caspar Fasi, a professor of history
at the Zurich "Kunstschule", called his home town an "Aristo­
Demokratie". Though the state formula required election of
politicians within the broadly based guild organization, the
eighteenth century regime was in truth an oligarchy of wealthy
merchants and hereditary land- and office-holders, a patrician
group of wigged and frock-coated "Gnädige Herren". Socially,
the ruler was clearly distinct from the general citizen, or
"gemeinen Burger".

Four groups comprised Zurich's ruling class: (1) the old
aristocrat, (2) the professional office-holder, or "Rentier",
(3) the merchant, and (4) the cleric and free professional.
Division between the four was not overly rigid or legally
recognized. Mobility within the ranks of the "Burgerschaft"
was legally possible, though there were old stipulations re­
arding aristocratic title. Political status changed with
socio-economic reality, and wealthy merchants bought their
way into the Regime. Extraordinary teachers and churchmen gained office after the community recognized their value.\textsuperscript{12}

The old aristocrats made up one class of ruler. Despite the guild victory over the town's feudal lords during the "Fourteenth Century Crisis",\textsuperscript{13} old noble families continued to exercise seigniorial privilege and to hold high rank in the political and military hierarchy of Zurich. As members of the Constabulary, they were elected into council. Junkers, however, were formally distinct from the merchant aristocracy which had developed from the town's lucrative silk trade. They showed their independent state by meeting at the so-called "Gesellschaftshaus zum Ruden".\textsuperscript{14} Burgers regarded the titled with suspicion. Ludwig Meyer von Knanau (1705-1785) recalled in his memoirs a popular schoolboy saying that no Junker could be elected a burgermeister.\textsuperscript{15} In 1742 the very popular Hans Blaarer von Wartensee (1685-1757), the father of the Physical Society's first economics secretary, had the support to become burgermeister, but following the dictates of custom he stepped aside for Johannes Fries (1680-1759). In 1784 Johann Heinrich Orell, a charter Physical Society member, sanctioned a title of nobility for his family ("von Orelli") only after he had been burgermeister for six years.

The old aristocrats enjoyed great prestige in the community. Although the guild regime limited their power and although the growing importance of commercial wealth made their economic position precarious, burgers sought to emulate their aristocratic
lifestyle. But only patricians could afford to do so. By the eighteenth century the social demarcation between "Herren" and "Burger" was unmistakable. Though non-titled, many patricians held proprietary rights in the countryside and spent part of each year on an estate. (A significant number of Physical Society members spent a major part of their adolescence in the rural canton, explaining in part the organization's attention to agricultural issues.) In manner, dress, and taste, all of Zurich's ruling class tried to appear aristocratic.

Aristocrats of office formed the second part of the ruling class. Originally engaged in the privileged crafts or in commerce, these citizens emerged as a class of professional politicians. They did not participate actively in real economic activity but acted as "Rentiers". They were occupied in mercenary or cantonal military service, in seignorial administration, and in rural government. Being untitled, these men successfully distributed themselves across all of the urban guilds as was necessary for political pre-eminence in the Old Regime.

Merchants constituted the third patrician type. In the seventeenth-century the rise of a cluster of new merchant families — some Protestant refugees — signalled one of the most significant transformations of the city's social outlook. Zurich's location at a key conduit to several Alpine passes produced economic prosperity dependent on its location at the confluence of trade routes. Salt, cereals, iron, and wine passed
through Zurich as through a relay-station. For religious pilgrims it was the last major stop before the Einsiedeln monastery.

Between the canton's decision to stay out of the Thirty Years' War and the arrival of French Revolutionary troops into Switzerland in the late 1790's, the merchant population of Zurich quintupled, rising from approximately 50 to 250, or from 4% to 13% of the total citizenry. In 1637 Zurich had exported only 8000 pounds of goods; in 1790 it exported 140,000 pounds.

Textile merchants organized into joint-stock companies like the "Kaufmannische Direktorium" developed an enormous mercantile network. The Direktorium promoted vested public policies frequently at the expense of guild trades, exploiting textile cottagers. Professor Leonhard Meister noted in 1779 that "whereas the free city-state of Geneva rests largely on the points of clock-hands", Zurich rests "on bales of silk and cotton".

In the seventeenth century moneyed wealth carved out a large piece of the urban pie for its plate. Having made a fortune outside of the closely regulated guilds, merchants then moved to acquire guild rank. A constitutional revision of 1654 known as the "Sixth Sworn Letter" (der Sechste Geschworenen Brief) allowed merchants to enter any of the twelve guilds. Every guild sent a good number of them on to the Rathaus. In the seventeenth and eighteenth centuries, Zurich merchants often moved into the Rentier class of the patriciate. They surrendered their enterprise to sons and other family members after they had attained council
tenure (which was life-long). In such an environment it was possible for an entrepreneur to make a fortune in textiles and to become an aristocrat of office with quasi-feudal privilege in one or two generations.

On the whole, the growth of a great merchant class damaged the artisan interest. Even before the penetration of merchant wealth into the guilds in the seventeenth century, the artisan had not competed successfully for political office. Still, as late as 1637, artisans occupied half of the council positions. The arrival of the great merchants aristocracized Zurich politics further, so that by 1790 artisans held only one-fifth of the Regime. In the Senate, they held only 6% of the slots. Whereas one in three patricians actually had council tenure in 1790, only one in 26 artisans held office. Merchants and Rentiers, growing ever more indistinguishable, virtually monopolized high government. So secure was their hold that in the last 191 years of the Old Regime, no artisan was elected burgermeister. Though the guild remained the foundation of power in Zurich, it was no longer recognizable as a medieval corporation of craftsmen. Structurally the same, guilds had changed functionally in subtle and not always clearly decipherable ways. As one observer has noted:

Institutions are sticky. They live on into ages for which they were not designed. Medieval guilds outlived the Middle Ages and forced new economic activities to grow up outside of their jurisdiction.... the old shell can fill up with new content. The opulent livery stables of the city of London play at being guilds but are frequently business and scientific associations.
Any study of the relationship between the structure and function of Zurich guilds must pay careful attention to the given time in the town's history.

Social statistics collected and organized by the Economic Commission of Zurich's Physical Society between 1760 and 1798, and presently stored in the Naturforschende Gesellschaft accession to the Zurich Staatsarchiv, exhibit the extent to which the craft shell of the Zurich guilds had changed by the late Old Regime. Table 3 shows the numbers and the percentages of real craft occupation within the twelve urban guilds based on a Commission population table from the year 1780. Only 42% (839 of 2130 guild members) were craftsmen. Artisans held a majority in only three of their twelve organizations: the Zimmerleuten (65%), Schmieden (63%), and Widder (52%). They amounted to less than 30% of the membership of four guilds: the Schuhmachern (29.5%), Gäbel (28%), Saffran (27%), and Schiffleuten (24.5%). These numbers display much of the deprivation suffered by Zurich artisans in the two centuries following the Reformation.

A Commission census of the urban guilds taken 18 years earlier in 1762 investigated the social background of the 24 guildmasters. In Table 4 we see that no guild had both of their masters from the artisan class, while every guild had at least one master who belonged to the patriciate. In fact, three guilds — the Schiffleuten, Schuhmachern, and Gäbel — counted both masters from the ruling class. Fourteen of the
### Table 3

Number and Percentage of Craftsmen in Zurich's 12 Guilds in 1780*

<table>
<thead>
<tr>
<th>Guild</th>
<th>Original Craftsmen</th>
<th>Total Membership</th>
<th>Craftsmen</th>
<th>%</th>
</tr>
</thead>
<tbody>
<tr>
<td>Zimmerleuten</td>
<td>Carpenters, masons, waggoners, wheelwrights</td>
<td>195</td>
<td>125</td>
<td>65</td>
</tr>
<tr>
<td>Schmieden</td>
<td>Smiths</td>
<td>245</td>
<td>155</td>
<td>63</td>
</tr>
<tr>
<td>Widder</td>
<td>Butchers, dealers in livestock</td>
<td>138</td>
<td>72</td>
<td>52</td>
</tr>
<tr>
<td>Weggen</td>
<td>Bakers, millers</td>
<td>184</td>
<td>85</td>
<td>46</td>
</tr>
<tr>
<td>Waag</td>
<td>Weavers, drapers, wool-shearers, hat-makers, bleachers</td>
<td>148</td>
<td>65</td>
<td>44</td>
</tr>
<tr>
<td>Schneidern</td>
<td>Tailors</td>
<td>163</td>
<td>71</td>
<td>44</td>
</tr>
<tr>
<td>Gerwe</td>
<td>Tanners</td>
<td>98</td>
<td>41</td>
<td>42</td>
</tr>
<tr>
<td>Meisen</td>
<td>Wine-dealers, painters, saddlers, innkeepers</td>
<td>137</td>
<td>51</td>
<td>37</td>
</tr>
<tr>
<td>Schuhmachern</td>
<td>Shoemakers</td>
<td>132</td>
<td>39</td>
<td>30</td>
</tr>
<tr>
<td>Cämbel</td>
<td>Gardeners, grain-dealers, oil-dealers</td>
<td>128</td>
<td>36</td>
<td>28</td>
</tr>
<tr>
<td>Saffran</td>
<td>Shopkeepers, girdlers</td>
<td>452</td>
<td>122</td>
<td>27</td>
</tr>
<tr>
<td>Schiffleuten</td>
<td>Shipbuilders, rope-makers, fishermen</td>
<td>110</td>
<td>27</td>
<td>25</td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td></td>
<td><strong>2130</strong></td>
<td><strong>890</strong></td>
<td><strong>42</strong></td>
</tr>
</tbody>
</table>

* From "Staetische Bevoelkerungstabelle, 1780". Zurich Staatsarchiv, B IX 13, 264-271.
### Table 4

Social Occupation of the 24 Guildmasters of Zurich in 1762

<table>
<thead>
<tr>
<th>Guild</th>
<th>Occupation of the Two Masters</th>
<th>Occupation of the Two Masters</th>
</tr>
</thead>
<tbody>
<tr>
<td>Schiffleuten</td>
<td>Rentier</td>
<td>Merchant</td>
</tr>
<tr>
<td>Waag</td>
<td>Dyer</td>
<td>Merchant</td>
</tr>
<tr>
<td>Gerwe</td>
<td>Rentier</td>
<td>Goldsmith</td>
</tr>
<tr>
<td>Meisen</td>
<td>Saddler</td>
<td>Merchant</td>
</tr>
<tr>
<td>Saffran</td>
<td>Rentier</td>
<td>Apothecary</td>
</tr>
<tr>
<td>Widder</td>
<td>Merchant</td>
<td>Butcher</td>
</tr>
<tr>
<td>Schuhmacher</td>
<td>Rentier</td>
<td>Merchant</td>
</tr>
<tr>
<td>Cämbel</td>
<td>Rentier</td>
<td>Merchant</td>
</tr>
<tr>
<td>Schmieden</td>
<td>Rentier</td>
<td>Book-dealer</td>
</tr>
<tr>
<td>Zimmerleuten</td>
<td>Merchant</td>
<td>Dyer</td>
</tr>
<tr>
<td>Schneider</td>
<td>Rentier</td>
<td>Goldsmith</td>
</tr>
<tr>
<td>Weggen</td>
<td>Rentier</td>
<td>Baker</td>
</tr>
</tbody>
</table>

* "Abzählung der Einwohner zu Zürich, vorgenommen im Monat Merz MDCLXII (Inhalt wie IX 10 plus Mitgliederverzeichnisse von Constaffel und Zünften mit Berufsangaben.) 1762", Zurich Staatsarchiv, B IX 11
total 24 (58%) were patricians (eight Rentiers and six merchants).

Another Commission population study illustrated the growth of patrician presence in the guilds from 1599 to 1790. Table 5 confirms the process of aristocratization. Whereas the Rentier and merchant populations numbered 121 (nearly 8%) in 1599, they increased to 301 (25%) by 1790. The merchant explosion is striking.

<table>
<thead>
<tr>
<th>Patrician Type</th>
<th>1599</th>
<th>1637</th>
<th>1730</th>
<th>1780</th>
<th>1790</th>
</tr>
</thead>
<tbody>
<tr>
<td>Rentier</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>A. Number in guild</td>
<td>80</td>
<td>102</td>
<td>213</td>
<td>272</td>
<td>301</td>
</tr>
<tr>
<td>B. Percentage</td>
<td>5</td>
<td>7</td>
<td>9</td>
<td>12</td>
<td>14</td>
</tr>
<tr>
<td>Merchant</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>A. Number in guild</td>
<td>41</td>
<td>64</td>
<td>205</td>
<td>252</td>
<td>248</td>
</tr>
<tr>
<td>B. Percentage</td>
<td>3</td>
<td>4</td>
<td>9</td>
<td>11</td>
<td>11</td>
</tr>
<tr>
<td>Rentier and Merchant</td>
<td>121</td>
<td>166</td>
<td>418</td>
<td>524</td>
<td>549</td>
</tr>
<tr>
<td>A. Number in guild</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>B. Percentage</td>
<td>8</td>
<td>11</td>
<td>18</td>
<td>23</td>
<td>25</td>
</tr>
</tbody>
</table>

* From "Staetische Bevolkerungstabellen, 1637-1790". Zurich Staatsarchiv BKX 8-14

Having been just under 3% of the total guild population in 1599, by 1780 the merohantry had grown to be over 11%. The Rentier class had increased in the same span of time from 5% to 14%. In 1790 merchants and Rentiers comprised one-quarter of the total guild membership.
The presence of merchants in the late Regime deserves a special look. Merchants amounted to 262 of the 2321 citizens found in the 13 recognized corporations (the 12 guilds and the Constabulary) in 1780. Table 6 shows merchants to have held 10% or more of the membership of six guilds and to have accounted for over 20% of the Schifferleute. While amounting to a significant 11% of the 2321 citizens, merchants controlled an even greater share of the guild hierarchy: a quarter of the guildmaster posts and a third of the councillorships. Eleven of twelve Waag councillors were merchants. Holding these key positions, the merchants of Zurich grew into an oligarchy without constitutional changes and without upsetting traditional ways.

The peaceful times enjoyed by post-Reformation Swiss strengthened this process of aristocratization. After shifting nervously between democratic and aristocratic government before Zwingli appeared, political neutrality of the early modern Swiss enabled prominent Zurich families (and those from other Swiss towns) to establish long-lived dynasties. The gap between ruler and ruled, between councillor and citizen, and between rich and poor widened, as did the gap between the Confederation and the rest of Europe. Jonathon Steinberg, a shrewd modern observer of the Swiss, explains the mentality of the ruling class in *Why Switzerland?* (1976):

> The Swiss began to associate neutrality with profit, virtue, and good sense. However they may have hated each other, they were better off living together as neutrals than dying apart as enemies. A natural feeling of superiority marked Swiss attitudes to the outside world.
Table 6

Number and Percentage of Merchants and
the Number and Percentage of Merchant Guildmasters
and Councillors in the 12 Guilds and the Constabulary in 1780*

<table>
<thead>
<tr>
<th>Guild</th>
<th>Merchants</th>
<th>Total Members</th>
<th>%</th>
<th>Masters</th>
<th>Councillors</th>
</tr>
</thead>
<tbody>
<tr>
<td>Schiffleuten</td>
<td>23</td>
<td>110</td>
<td>21</td>
<td>1</td>
<td>3</td>
</tr>
<tr>
<td>Waag</td>
<td>27</td>
<td>148</td>
<td>18</td>
<td>1</td>
<td>11</td>
</tr>
<tr>
<td>Gerwe</td>
<td>17</td>
<td>98</td>
<td>17</td>
<td>0</td>
<td>5</td>
</tr>
<tr>
<td>Meisen</td>
<td>22</td>
<td>137</td>
<td>16</td>
<td>1</td>
<td>3</td>
</tr>
<tr>
<td>Saffran</td>
<td>66</td>
<td>452</td>
<td>15</td>
<td>0</td>
<td>9</td>
</tr>
<tr>
<td>Widder</td>
<td>17</td>
<td>138</td>
<td>12</td>
<td>1</td>
<td>Uncertain</td>
</tr>
<tr>
<td>Schuhmachern</td>
<td>13</td>
<td>132</td>
<td>10</td>
<td>1</td>
<td>3</td>
</tr>
<tr>
<td>Gämbel</td>
<td>9</td>
<td>128</td>
<td>7</td>
<td>0</td>
<td>3</td>
</tr>
<tr>
<td>Schmieden</td>
<td>17</td>
<td>245</td>
<td>7</td>
<td>0</td>
<td>2</td>
</tr>
<tr>
<td>Zimmerleuten</td>
<td>13</td>
<td>195</td>
<td>7</td>
<td>1</td>
<td>4</td>
</tr>
<tr>
<td>Schneider</td>
<td>9</td>
<td>163</td>
<td>6</td>
<td>0</td>
<td>2</td>
</tr>
<tr>
<td>Weggen</td>
<td>9</td>
<td>184</td>
<td>5</td>
<td>0</td>
<td>4</td>
</tr>
</tbody>
</table>

| Constabulary     | 10        | 191           | 5  | Uncertain |
| Total            | 262       | 2321          | 11 | 6 (+)     | 49 (+)      |

* From "Bevölkerungstablellen der Stadt Zürich, 1780". Zurich Staatsarchiv B IX 13
In the pious seventeenth century Swiss willingly believed that God wanted them to prosper as a reward for their virtue.

The distance between the rulers and ruled of Zurich was well disguised, however. The idea of total community sovereignty remained a regulating principle of political posture and of social behavior even though the canton was ruled by an elitist hereditary patriciate. Formal elections were held twice annually within the guilds on "Meistertagen". Guildsmen assembled as they had since the fourteenth century for ritual selection of councillors. Councillors swore oaths to the public on "Schwortagen". Burgermeisters pledged fidelity as trustees of the urban collective in a great ceremony held in the Grossmunster cathedral. Though bereft of real democratic application by the eighteenth century, these traditions of state testified to the continuity of civic consciousness. They preserved the principles of burger sovereignty and "urban free air" (Stadtluft macht frei). These traditions no longer determined the town's actual power set-up — it is questionable that they ever did — but they were still the basis of Zurich consensus. Because they persisted, critics of the aristocracized regime were rare and muted.

"Enlightened" Middle Citizens

Poised between the three chief ruling groups (the old aristocracy, the Rentiers, and the merchants) and the general citizenry engaged in crafts was a middle group of clerics and professionals. In every gathering of five Zurich citizens, there
was on average one man from this "middle class". Middle citizens proved to be the major source and substance of the Zurich Enlightenment. They were the Physical Society's chief performers. As the most travelled and highly educated town-dwellers, they could be disposed to change. As learned men aware of new ideas, they were the citizens most receptive to reform and renovation of the traditional community. In this social sense, they paralleled Aufklärer.

Martin Hurlimann in Die Aufklärung in Zürich. Die Entwicklung des zürcher Protestantismus im 18. Jahrhundert (1924) listed 143 Enlightenment personalities belonging to Canton Zurich. Though he saw Zurich's movement to Enlighten as a stage in the intellectual development of Swiss Protestantism, the high percentage of middle citizens on his list suggests the social nature of the local Enlightenment. One hundred one of the 143 figures (70%) came from the clerical or professional strata of citizens. Sixty-four of the 101 (45%) were churchmen. The other 37 (25%) taught in the urban schools or practiced medicine.

The Reformation had brought to the canton a major increase in the extent of local authority and the scope of the state's public welfare responsibility. The patrician councils needed a few hundred of its citizens to assume administrative roles. The Reformed schools required new teachers sensitive to changed pedagogical priorities. A huge number of pastors were needed to instruct the rapidly growing subject population of the countryside, which had increased from 26,790-28,900 in 1467 to 69,975-
85,525 in 1585. By 1790 the rural folk numbered nearly 170,000.25

In 1599 one hundred forty-five clerics belonged to the 13 urban corporations. Table 7 shows that number to have risen to 403 by 1780. During the Enlightenment period, the city's clerical population amounted to between 15%-18% of total guild membership. By 1780 over 30% of the shoemaker guild was clerical. The guild of weavers and drapers (Waag) offered the smallest number of churchmen in that year, but it still counted a 12% clerical membership.

The city-country relationship within the canton was perhaps the basic ingredient in a consensus of interest between Enlightened middle citizen notions and the "patriarchal benevolence" of the eighteenth century ruling families.26 Though this relationship is a central point of discussion for Chapter 6 on the Economic Commission, it is useful to consider this point here. Of the nearly 180,000 cantonal inhabitants living in the last quarter of the eighteenth century, only 5,577 (5%) enjoyed full rights of citizenship. The other 174,000 were rural subjects who

as far as the canton Zurich was concerned, (had) no share in government, were hindered in their economic life by the city's monopolies, and were distinguished from the privileged burghers by various other socio-economic restrictions: educational barriers, sumptuary laws, limitations on entry to professions, and so on.

In short, a small group of privileged burghers, on the one hand, and the rest of the population squeezed into a sociopolitical strait-jacket, on the other, composed the set-up from which the textile industry of Zurich developed producing silk, wool, and — especially since the end of the seventeenth century — above all cotton goods on the domestic or putting-out
Table 7

Middle Citizens*

A. Their Number and Percentage of Citizenry from 1599 to 1790

<table>
<thead>
<tr>
<th>Year</th>
<th>1599</th>
<th>1637</th>
<th>1730</th>
<th>1780</th>
<th>1790</th>
</tr>
</thead>
<tbody>
<tr>
<td>Number of middle citizens</td>
<td>145</td>
<td>189</td>
<td>389</td>
<td>403</td>
<td>337</td>
</tr>
<tr>
<td>Percentage of citizenry</td>
<td>9</td>
<td>12</td>
<td>17</td>
<td>18</td>
<td>15</td>
</tr>
</tbody>
</table>

B. Number and Percentage of Clerics and Medical Doctors in the 13 Urban Corporations in 1780

<table>
<thead>
<tr>
<th>Corporation</th>
<th>Clerics</th>
<th>M.D.</th>
<th>Total</th>
<th>Percentage</th>
</tr>
</thead>
<tbody>
<tr>
<td>Schuhmachern</td>
<td>38</td>
<td>2</td>
<td>40</td>
<td>30</td>
</tr>
<tr>
<td>Gämbe</td>
<td>26</td>
<td>2</td>
<td>28</td>
<td>22</td>
</tr>
<tr>
<td>Schneidern</td>
<td>33</td>
<td>0</td>
<td>33</td>
<td>20</td>
</tr>
<tr>
<td>Widder</td>
<td>24</td>
<td>3</td>
<td>27</td>
<td>20</td>
</tr>
<tr>
<td>Gerwe</td>
<td>18</td>
<td>1</td>
<td>19</td>
<td>19</td>
</tr>
<tr>
<td>Weggen</td>
<td>34</td>
<td>1</td>
<td>35</td>
<td>19</td>
</tr>
<tr>
<td>Schiffleuten</td>
<td>18</td>
<td>1</td>
<td>19</td>
<td>18</td>
</tr>
<tr>
<td>Saffran</td>
<td>75</td>
<td>3</td>
<td>78</td>
<td>17</td>
</tr>
<tr>
<td>Schmieden</td>
<td>37</td>
<td>2</td>
<td>39</td>
<td>16</td>
</tr>
<tr>
<td>Zimmerleuten</td>
<td>30</td>
<td>0</td>
<td>30</td>
<td>15</td>
</tr>
<tr>
<td>Maissen</td>
<td>20</td>
<td>0</td>
<td>20</td>
<td>15</td>
</tr>
<tr>
<td>Waag</td>
<td>18</td>
<td>0</td>
<td>18</td>
<td>12</td>
</tr>
<tr>
<td><strong>Sub-total (12 guilds)</strong></td>
<td><strong>371</strong></td>
<td><strong>16</strong></td>
<td><strong>387</strong></td>
<td><strong>18</strong></td>
</tr>
<tr>
<td><strong>Constabulary</strong></td>
<td><strong>32</strong></td>
<td><strong>2</strong></td>
<td><strong>34</strong></td>
<td><strong>18</strong></td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td><strong>403</strong></td>
<td><strong>18</strong></td>
<td><strong>421</strong></td>
<td><strong>18</strong></td>
</tr>
</tbody>
</table>

* From "Staetische Bevolkerungstabellen", Zurich Staatsarchiv B IX 8-14"
system. In the seventeenth century a commercial group, among them Protestant refugees, a particularly entrepreneurial element, increasingly gained sociopolitical influence, not only operating out of their own guilds but also holding more and more of the important positions of various craft guilds. Thus, economic restrictions became especially rigid (more than other cantons, e.g. Bern, experienced.) As far as the cottage industry with its putting-out system was concerned, only burghers were allowed to purchase raw materials for the textile production and to trade finished or half-finished goods. The entire product had to be marketed through the burghers of Zurich. Hence, the rural population could only perform limited and subordinated functions in the production and trade system of the textile industry.

Although not essentially patrician or entrepreneurial and although circumscribed in some respects by the oligarchy, Zurich’s middle citizens were party to this system of exclusivity, paternalism, and rural exploitation. From the middle of the seventeenth century, state-tied positions were a formal monopoly of the Burgerschaft. Middle citizen occupation was as much a dynastic matter as was political tenure. The Hottinger family, for instance, held high church office in Zurich over many generations. Hirzels, Meyers, Rahns, and Schinzes controlled the town’s medical practices for decades. Professor or pastor, teacher or physician, all benefited from privileged urban status, just as craftsmen and textile merchants did. No class of citizen was disenfranchised from this interest.

Though a struggling teacher, physician, or minor church pastor hardly belonged to the surrogate nobility of Zurich’s political dynasts, highly esteemed middle citizens had Regime
status and exerted considerable influence within the city-state. History (and later theology) professor Hans Jakob Zimmermann (1695-1756) and Grossmunster preacher Johann Conrad Wirz (1688-1769) won the authorities over to a more tolerant and Pietistic church in the early eighteenth century with their public campaign against the witch-craze. History professor Bodmer, while criticizing the Regime for having closed the door to the sort of virtuous civic participation at the heart of republican society, was still elected to the Sovereign Council. His teaching in the public schools and the discourse he inspired in private societies and in print helped to produce a generation of regents and bureaucrats which supported Enlightened programs like the Physical Society. Greek language professor Johann Breitinger worked with Burgermeister Johann Conrad Heidegger in the 1760's and 1770's to carry out a comprehensive program of school reform.

The number of possible middle citizen examples makes the point clear. In order to arrive at a proper understanding of the Zurich Enlightenment, one must not polarize the community into hostile camps of progressives committed to change and conservatives attached to an old and deteriorating order. Instead the citizenry must be viewed as a group which had a strong mutual attachment to the shared meanings of cooperative living (to what the intellectual historian David Hollinger has called "ethical, aesthetic, and cognitive agreements"). Its conceptual and institutional arrangements were embedded in
a social and political constitution which had solidified at the end of the Middle Ages and which had changed very little from the time of the Reformation. Like most Swiss communities built from the bottom up out of free peasant or urban associations, Zurich society had a deep center to which all new thoughts gravitated.

"General citizens" engaged predominantly in craft activity can be included in small measure in the Zurich Enlightenment. Ten per cent of the people on Hurlimann's Enlightenment list were artisans, mostly from within the busy printing industry. Artisans interested in keeping craft privileges were as strongly tied to the existing order as were patricians. Their economic existence depended upon it. The dimensions of their lives were even more narrowly drawn than those of the oligarchy. General citizens read a hodge-podge of newspapers, novels, and pamphlets, but nothing they read could really undermine their support of the status quo. They were easy to control and did not offer any threat to the Regime as long as they were not plagued with too many taxes and as long as their trade status was maintained by the state.32

Consensus and Socialibility

There was no division of Zurich society into dialectical parties during the eighteenth century, at least before the revolutionary turmoil of the 1790's. Serious community controversies did exist: the constitutional reform struggle of 1713 involving the naturalist Dr. Johann Jakob Scheuchzer;33 the Grebel Affair
of 1762; Christian Heinrich Müller's banishment from the city in 1767 for publicly criticizing Zurich's military interference in the Genevan Revolution; the unrest in 1777 over renewal of the mercenary alliance with France; and the trial and execution of Physical Society economist Johann Heinrich Waser for high treason in 1780. But previous to the rural revolts in the industrialized areas of the countryside in the 1790's, controversy did not upset the formulae of community agreement.

Certain factors kept urban disquiet in bounds. First, burgers continued to voice opposition in ways traditional to guild procedure. Long-established ways existed to divert or to soothe feelings of ill-will. Secondly, the closed citizenry benefited from a subject countryside; it could voice strong sentiments but it could not shake the foundation. This is not to say that unanimity and harmony prevailed. A few personalities of non-conforming genius only found a satisfactory range of expression outside of the city (such as Pestalozzi) or outside of Switzerland altogether (such as Fuseli). But, in general, controversy in the community tended to maintain social equilibrium by reminding every citizen that he had a stake in compromise.

Active socialibility within and between the citizen groups seemed to overcome any unrest. Zurich's social intensity reflected the traditional comradery and conviviality found in Old Swiss communities. Unions, societies, and clubs, for nearly every conceivable purpose from drinking, singing and dancing, to shooting rifles, studying, and doing business, flourished. Of all the major
Swiss towns, Zurich appears to have had the most extraordinarily compressed and organized social life. Why was this so?

In the seventeenth and eighteenth centuries Zurich's demographic base narrowed significantly. In 1671 the absolute number of burgers was 7,755. By 1756 the number had fallen to 6,593. In 1790 it was down to 5,577. The responsibility for this decline did not rest in negative population checks: war, famine, or pestilence. Rather, it rested in social controls.

Peasants in the agricultural districts of Canton Zurich worked to prevent major alterations in the village way-of-life by fixing the number of households permitted to live within the confines of their community or by periodically raising the fee of newcomer settlement (Einzugszoll).\(^{38}\) Townspeople used similar legal and material checks to prevent what they perceived to be potential disruption of town life. By the end of the seventeenth century, the aristocracized merchant regime had closed the door to new citizens, thereby acting to preserve the privileged urban livelihoods, urban prestige, and urban wealth. William Coxe, a famous English visitor to Switzerland in the 1780's, remarked that "narrow spirit" marks the public policy of most Swiss communities, but that in Zurich that spirit is most "scrupulously observed", "where no citizen has been admitted for the last one hundred years".\(^{39}\)

Table 8 shows one result of a closed citizenry: a smaller and more dynastically dense ruling population. In 1790 families with guild membership numbered 241, less than one-half of the 485
families with socio-political status in 1599. By the end of the Old Regime, the Zurich Burgerschaft was two and one-half times as concentrated as what it had been in 1630; there were 8.3 citizens per family in 1790 compared to 3.3 citizens per family in 1630.

Table 8

<table>
<thead>
<tr>
<th>Year</th>
<th>1599</th>
<th>1637</th>
<th>1730</th>
<th>1790</th>
</tr>
</thead>
<tbody>
<tr>
<td>Number of citizens</td>
<td>1555</td>
<td>1529</td>
<td>2317</td>
<td>1991</td>
</tr>
<tr>
<td>Number of families</td>
<td>485</td>
<td>468</td>
<td>320</td>
<td>241</td>
</tr>
<tr>
<td>Density</td>
<td>3.2</td>
<td>3.3</td>
<td>7.2</td>
<td>8.3</td>
</tr>
</tbody>
</table>

* From "Staetische Bevolkerungstabenlen". Zurich Staatsarchiv B IX 8-14

In order to reconstruct the genealogy of an Old Zurich family — the smallest and most naturally intense social institution — one must rebuild the entire biographical history of the town. Within the various grades of the closed urban corporation, everyone was a relative of everyone else. Political regency, religious leadership, and professional or craft occupation all were a matter of families or clustered families.

The decreasing size and increasing density of the Zurich citizenry in the eighteenth century can be interpreted as a precondition of the Zurich Enlightenment. Though the Burgerschaft had closed its privileged ranks, within those ranks there was new occasion for vital interaction and innovation. In his overlooked study of scientific activity in the Old Confederation,
Emil Walter noted that Zurich had developed more organs of Enlightened discourse than had any other Swiss town. Even Table Nine's partial list of the more important civic foundations between 1679 and 1788 is very long. Its diversity points to the many groups caught up in the local spirit of Enlightenment.

These foundations continued the tradition of civic commitment to the locale. Following guild and Reformed traditions, these societies assumed community welfare responsibilities: for care of the poor and orphaned, for improvement of morals and manners, for rationalization of the economy, and for the education of citizens. In creating these societies, Zurichers abided by their formula of consensus. Their programs added to and enriched the meaning of living within Zurich's constitution; although apparently specialized, they did not promote particularized interests. New Enlightened concerns only added expression to an established town voice. The Old Regime endured three centuries, and time, after all, demanded some form of change. Zurich simply met the demand in its own way.

* * *

The German historian Wolfgang von Wartburg stated it correctly more than twenty years ago: Enlightenment in Zurich was a movement in completion of the Old Regime, not in opposition to it. Though chiefly inspired from within the educated middle citizenry, Enlightenment concerned all of the ruling socio-economic groups who saw themselves as benevolent administrators and patriarchs. New cultural directions flowed into an old shell as the ruling families socialized new supports for established needs. They still
Table 9
List of 23 Zurich Societies of Enlightenment,
Founded Between 1679 and 1788

<table>
<thead>
<tr>
<th>Year</th>
<th>Name of Society</th>
</tr>
</thead>
<tbody>
<tr>
<td>1679</td>
<td>Collegium insulanum</td>
</tr>
<tr>
<td>1686</td>
<td>Collegium anatomicum</td>
</tr>
<tr>
<td>1693</td>
<td>Society of Fireworkers (Gesellschaft der Feuerwerker)</td>
</tr>
<tr>
<td>1693</td>
<td>Society of the Well-Intentioned (Gesellschaft der Wohlgesinnten)</td>
</tr>
<tr>
<td>1719</td>
<td>Society of Moral Philosophers (Gesellschaft der Sittenmaler)</td>
</tr>
<tr>
<td>1727</td>
<td>First Helvetic Society (Erste Helvetische Gesellschaft)</td>
</tr>
<tr>
<td>1740</td>
<td>Society of Students (Studentengesellschaft)</td>
</tr>
<tr>
<td>1743</td>
<td>&quot;Wachsende Gesellschaft&quot;</td>
</tr>
<tr>
<td>1746</td>
<td>PHYSICAL SOCIETY (PHYSIKALISCHE GESELLSCHAFT)</td>
</tr>
<tr>
<td>1750</td>
<td>Tuesday Company (Dienstagskompanie)</td>
</tr>
<tr>
<td>1762</td>
<td>Historical-Political Society of the Gerwa guild (Historisch-politische Gesellschaft zur Gerwa)</td>
</tr>
<tr>
<td>1765</td>
<td>Helvetic Society of Schinznach (Helvetische Gesellschaft zu Schinznach)</td>
</tr>
<tr>
<td>1765</td>
<td>Society of Morals (Moralische Gesellschaft)</td>
</tr>
<tr>
<td>1765</td>
<td>Helvetic Fatherland Society (Helvetisch-vaterländische Gesellschaft)</td>
</tr>
<tr>
<td>1765</td>
<td>Mathematical-Military Society (Mathematisch-militärische Gesellschaft)</td>
</tr>
<tr>
<td>1768</td>
<td>Aesetic Society (Asketische Gesellschaft)</td>
</tr>
<tr>
<td>1769</td>
<td>Cosmographical Society (Kosmographische Gesellschaft)</td>
</tr>
<tr>
<td>1773</td>
<td>Medico-Surgical Society (Medico-chirurgische Gesellschaft)</td>
</tr>
<tr>
<td>1775</td>
<td>Art Museum Society (Gesellschaft auf dem Kunstaal)</td>
</tr>
<tr>
<td>1783</td>
<td>Daughters of the Zimmerleuten Guild (Die Töchter der Zimmerleuten)</td>
</tr>
<tr>
<td>1784</td>
<td>Society for the Promotion of Good (Gesellschaft zur Beförderung des Guten)</td>
</tr>
<tr>
<td>1787</td>
<td>Society of Artists (Künstlergesellschaft)</td>
</tr>
<tr>
<td>1788</td>
<td>Society of Corresponding Physicians and Surgeons (Gesellschaft der korrespondierenden Ärzte und Wundärzte)</td>
</tr>
</tbody>
</table>
inculcated in the rising generation the values of the generation before. Art, literature, history, and "science" were directed for the practical benefit of the community. Activity in these fields became a special form of civic humanism, with each expression having a moral and ethical tone echoing the predominant social values.

The nineteen citizens principally responsible for the organization of the Physical Society in 1745/46 represented all of the social grades of the Zurich citizenry. Though a few of the founders mentioned the English Royal Society as the model to emulate, the group in fact created a society quite different from that far-away international academy. The Physical Society was a product of forces of tradition and change working within the locality. It took on aspects of the patriarchal culture which supported it. It blended Enlightenment hopes with ruling class vision of a harmonious territorial organism maintained by wise urban regents. It concentrated on a study of the local ecology in order to contribute to the public good of the home community.
None of the men who helped create the Physical Society aimed to establish a sanctuary where rare, high-flying intellectuals flocked to feed on ideas only digestible by them. In fact, they understood that the size and character of the home canton dictated a scientific organization whose members' works were not high-fliers at all, but rather fowl fit for Zurich's table. To this end, the founders prepared a body from native ingredients and flavored it to local tastes. They created a scientific community which embodied both the social strengths and the ingrained problems of the Old Regime city-state. The newly defined community was to contribute more to the resolution of cantonal issues than to the progressive march of international science.

Dr. Johannes Gessner (1709-1790), the second son of a Reformed pastor and a distant relative of the Reformation era naturalist Conrad Gessner, loomed over Zurich's Physical Society as its wise and loving patriarch from its inception to his death. Educated under Boerhaave at the Dutch university of Leyden and under the Bernoulli family of mathematicians in Basel, he studied alongside his Alpenreise companion Albrecht Haller. Gessner matured into one of the most important threads in the cosmopolitan network of Enlightenment science. He made his name as an Alpine botanist,
one of the strongest proponents of the Linnean scheme of binomial classification, and as an early advocate of the principle of geochronological extrapolation. Important learned societies from the Baltic to the Mediterranean elected Gessner to their memberships.

Figure 1
Portrait of Dr. Johannes Gessner as a Young Man

Though contemporaries considered him one of Europe's greatest scientists and though even today's Dictionary of scientific biography includes a full page entry on him, the record of Gessner's life-work is little known outside of Switzerland. Soon after his death, history seems to have forgotten him, wrongly attributing plants which he first described to Haller or Conrad Gessner, or confusing him with Johann Matthias Gessner (a German botanist of the early nineteenth century). The memory of his career, like the memory of his Physical Society, remains at home.
In late winter 1745 Dr. Johann Heinrich Rahn, a 36-year old city senator whose grandfather had been a noteworthy mathematician, urged Johannes Gessner, then also 36, to investigate the establishment of a local scientific organization. The 60-year old Junker Johann Ulrich Blaarer "von Wartensee" (an active sponsor of polite gatherings) subsequently seconded the suggestion, as did his 28-year old son Hans Ulrich Blaarer and 35-year old Johann Conrad Heidegger, a future burgermeister then serving in the city chancellery.

Gessner immediately embraced his friends' idea and to prepare for the job he rushed to improve his teaching tools, to organize and to expand his library and nature cabinets, and to plan a scientific agenda. He was not happy with the public situation of the

* A Physical Society codification or "Gesetzesammlung" completed in 1776 included the following manuscript account of the inception of the scientific organization:


From Zurich Staatsarchiv, B IX 208, "Erster Ursprung der Naturforschenden Gesellschaft in Zürich, Gesetze und Übungen derselben, wie sie nun in dem Jahr 1776 geordnet und bestätet sind, und auch für die folgenden Zeiten dienen sollen".
local "Naturforscher". Though Old Regime Zurich had from the Reformation supported a small number of urban physicians (Stadt-äerzte), one professor physicae et mathematicae, and a few fortifications engineers, a regular civic program of scientific study had not as yet developed. The activity of a Naturforscher, unrelated for the most part to the everyday economic and political concerns of the local elite, had not achieved modern status; society did not perceive it to be fundamental to its progress. Men in search of natural knowledge pursued it in small private circles of middle citizen professionals. They lacked material resources and, especially, the political clout to advance the image of science before the public eye. At the Carolinum Gessner's own classes suffered because student interest was low: with nearly every student preparing for the ministry, few saw any advantage in studying the properties of electricity. Virtuous preaching of a Zwinglian version of Christ's Word appeared to require little precise knowledge of nature. In letters to friends Gessner cited the city's need for an anatomical theatre, an astronomical observatory, and, in particular, a botanical garden. He lamented the inaccessibility of the hospital, whose authorities blocked innovative treatments and persistently discouraged autopsy. ³

Dr. Gessner knew that even those citizens interested in natural philosophy were mostly unprepared for advanced discussion, so he decided to ready candidates for "Physical Society" membership by lecturing to them on subjects in natural history and experimental physics. Between October 1745 and July 1746 eighteen Zurich
citizens packed into Gessner's small living room to hear him speak on the nature of the elements, the principles of motion, and on the structure and theological meaning of the world system. In offering this preparatory course, Gessner continued a long-established tradition of private tutorial in scientific subjects. From the time that Conrad Gessner had first filled the newly-created position of professor of physics at the theological academy in 1541, Zurich physician-naturalists taught the organic language of Aristotelianism and the virtues of Reformed theology to pastoral students; in private collegia, they taught subjects excluded from the public school curricula to doctors, surgeons, apothecaries, anatomical operators, and to educated clergy. Dr. Johannes von Muralt (1645-1733) held an anatomical collegium in the 1680's within the "House of the Black Garden", the meeting-place of local barbers and surgeons, and Dr. Johann Jakob Scheuchzer presented collegia from the 1690's to paying students in anatomy, mathematics, and experimental physics. Here in these private meetings, the science of early modern Zurich bloomed; Gessner had received instruction from both Muralt and Scheuchzer.

Time for Fellowship

Sixteen of the 19 men meeting in Gessner's home had been born between 1709 and 1717. The group averaged 33 years old. As seems to be often true in the history of a scientific development, young people played a critical role in the organizing and early growth phase of the Physical Society. The young burgers who belonged to Gessner's course were unencumbered enough by age, by vested status
in established institutions, and by the weight of political responsibility to spearhead the development of a new instrument of community.

Gessner and his contemporaries matured in a town already ripe with two generations of pre-Enlightenment thought. Scheuchzer (born in 1672) and his generation had fought for religious tolerance and humanitarianism, against superstition and dogmatism; they championed a new heroic vision of the Swiss people flourishing in their wonderful Alpine environment. Bodmer (born in 1698) and Breitinger (born in 1701) had led their generation in a move toward greater political consciousness, toward patriotism and civic virtue. Now, a third generation which had taken shape at a time when the Zurich state itself was adapting to certain Enlightened notions was on the local scene. In 1737 authorities after heated debate chose Johann Conrad Wirz (1688-1769) as pastor of the Grossmunster ("Antistes") and as president of the college of pastoral examiners (of the "Collegium der Examinatoren"). In the same year, they named Johann Jakob Zimmermann (1695-1766) as a professor of theology. Both men promoted new learning and preached relaxation of the religious stringency which had bottled up local feeling since the "Formula Consensus" of the seventeenth century. Finally, in 1740, the guilds had elected Johann Caspar Escher (1678-1762) a burgermeister. His version of political rule called for the wise maintenance of the canton's organic harmony through the loving concern of an "enlightened patriarch". The Gessner fellowship, therefore, lived at what seemed to it to have been, a dawn of a new age.
The men of the adolescent Physical Society were living in a decade critical for their local careers. In Old Zurich a man customarily became a formal citizen in his late twenties or early thirties upon election into a guild. Sons then escaped trials of apprenticeship, gained appointment to professional or clerical position, assumed the direction of a family business, or succeeded to a father's land- or office-holding. Fortified with yet untested abilities and education, personal drives, and formative experiences, young burgers met their society's call for commitment to the perpetuation of the healthy life of the community: marriage, children, business, and government. Moreover, by the 1740's, the 30 to 40 year old citizen grew to be an even more important figure in the town. With post-Reformation forces producing an ever smaller and more concentrated urban corporation, society had to move young people more quickly into the important roles. It could not afford to have native talent escape.

Though only one in four of the charter members of the Physical Society held political office in 1746, most of them had already plugged into the Regime. Be the member an artisan, a middle citizen, or patrician, he had little reason to feel at great odds with his home town. The political elite nurtured Heidegger, for instance, to be a high state officer by allowing him at an early age to deal with important cantonal business and a series of key diplomatic missions. In 1741 (he was 31) Heidegger already sat on the city's ruling council and served on the "Collegium der Examinatoren und Aufseher über die Geistlichkeit". 6
Johannes Gessner serves as the best illustration of the possibly critical importance of generational turn-over to a civic program of science. When 21-year old Gessner returned to Zurich in 1730 with a University of Basel medical certificate, 85-year old Dr. Johannes von Muralt still occupied all of the treasured urban posts available to a local Naturforscher; he was professor of physics, Stadtarzt, and canon of the cathedral. His extremely long tenure, not that abnormal in gerontocratic Zurich, had reduced J.J. Scheuchzer to endure several decades of utter frustration. At 55 Scheuchzer, an honored member of The Royal Society (London) and of the Prussian Academy of Sciences and a correspondent of major scholars across Europe, still had no public employment. For 35 years he suffered the insecurity and anxiety of a highly-trained professional without a job, relying for his livelihood on wages earned from private tutorials or from payments from his publishers.

Given Scheuchzer's unfortunate situation and his place in the hierarchical succession, Gessner could anticipate enduring local life in much the same way. In the early 1730's he faced an uncertain future as an unenthusiastic medical practitioner. (He never liked practice and his older brother already claimed the lion's share of paying clientele in the town.) He taught a few students materia medica and mathematics. His old professor Boerhaave wanted him to teach botany in St. Petersburg, but he did not want to go to Russia. He wrote Boerhaave that his health was poor (it always was) and he wanted to be near his parents. Gessner must have wondered how much longer old Muralt could go on. Besides, Scheuchzer was his successor.
If Scheuchzer too lived to be an octagenarian, Gessner would have been in Scheuchzer’s own uncomfortable shoes. Moreover, city authorities had already passed over Gessner for even the minor position of assistant to the city physician (*Pollster*).^9^

Finally in 1733 Muralt died (he was 88) and Scheuchzer inherited all of his positions. Sadly, Scheuchzer lived to hold them for only a few months. He died in mid-June 1733 and was buried, with the ceremony his city had denied him so long in life, alongside Conrad Gessner in the Kreuzgang of the Grossmunster. Gessner’s good luck began with his teacher’s sad end. The city divided the responsibilities held by Muralt (and then Scheuchzer) into two parts. Scheuchzer’s younger brother Johannes (1684-1738), a Landschreiber in Baden, was recalled to the city to occupy the duties of physics professor, *Stadtarzt*, and canon. Gessner was appointed to the teaching chair in mathematics. From this point on, Gessner’s life grew secure. He joined the Saffran guild and married Katarina Escher, the daughter of a wealthy patrician. His letter to Haller in 1742 showed his content with his loving wife, his pleasure in his familiarity with high-placed friends, and his comfort with an ample teaching stipend.*

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* "Caeterum beatissime vivo cum carissima mea conjuge, prole licet adhuc destitutus, stipendium professionis meae satis amplum est, et aedes commodae, nec hortulus et villa desunt, fruor etiam amicis, paucis vero qui Medica aut Physica amant". Cited by Rudolf Wolf in "Johannes Gessner", in the Neu.iahrstücke der naturforschenden Gesellschaft in Zürich. An die zürcherische Jugend. (Zurich, 1845) II: 9 n. 29.
In 1738 a moment arrived for Gessner which J.J. Scheuchzer had had to wait for until the last year of his life. When Johannes Scheuchzer died the city honored Gessner with the teaching chair in physics and the Grossmunster canonric. He gracefully declined to act as Stadtarzt. Gessner experienced the security and prestige of community support before his thirtieth birthday. At 29 he served as the youngest canon since the appointment of Heinrich Bullinger at age 27 in 1531. Unlike Scheuchzer who had suffered long from an unpredictable lag in generational turn-over (and partly from Regime suspicion of his activity on behalf of constitutional reform in the city), Gessner profited from early and persistent enrichment of his local identity. He experienced no severe disenfranchisement; by 1738 he certainly felt that Zurich was an altogether agreeable home town which deserved greater service and civic commitment from its Naturforscher. Rarely did he leave it. For forty-five years (1733-1778) he taught Zurich youth in the urban theological academy. He spent so much of his time teaching or preparing short annual dissertations for pastoral dissertation, he left most of his papers unpublished.  

On 10 August 1746 Gessner's preparatory course met and approved ten by-laws which were to govern the arrangement and course of Physical Society activity. Heidegger, a talented clerk in the Stadtkanzlei who had accepted the responsibility to prepare the necessary legal papers for council recognition of the body, read them in a final form. (The constitutional ideas had emerged from conversations between Heidegger, Gessner, Rahn, and Blaarer, Jr.)
A short first article stated the Society's main intent: to make natural knowledge as useful as possible to the Fatherland. Articles Three and Four called for 4:30 P.M. meetings on alternating Monday afternoons in the House of the Black Garden. Articles Five through Eight described the various duties and privileges of members. Two final paragraphs outlined the manner of elections into the fellowship and the nature of executive authority.*

* The "Gesetzesammlung" of 1776 outlines the original ten by-laws:
1. "Die Absicht dieser Societet ist die erkenntniss der Natur, insoweit dieselbe zur bequemlichkeit, nutzen und notwendigkeit der menschlichen Gesellschaft uswerhaupt, besonders aber unseres werthen Vaterlandes dienet".
2. "Die Eintheilung derselben in Membra Ordinaria und Honoraria, und derselben Zahl, die man nicht über 50 und nicht unter 30 setzte, von welchen 6-20 Ordinaria seyn solten".
3. "Ueber den Ort der zusamenkunft bis zu dessen bestimmmung dieselbe in privathausem, oder in einem Zunft- oder Gesellschahthouse zu halten vorgeschlagen worden".
4. "Ueber die Zeit allen 14 Tagen. Dabei auch ueber den Sommer und Herbst Vasentzen anzusetzen für gut angesehen worden".
5. "Ueber den Pflicht der Membrorum Ordinariorum in ansehung der beschaeftigungen".
6. "Ueber die Freyheiten der Honorariorum".
7. "Ueber die Pflichten in Abstattung der auflagen, zuschussen, Honorantzen und abschiedsgeldern, auch der Blussen der Ordinariorum für ausbleiben und den spätheren besuch der Congressen".
8. "Ueber die Freyheiten in der Ordinariorum und derjenigen aus den Membris Honorarisi, welche geschaefte uebernehmen".
9. "Ueber die einrichtung der Wahlen der Ordinariorum, des Praesidis, Quaestoris, und beyder Secretariorum".
10. "Von dem Amt eines Praesidis, Quaestoris (sic) Secretariorum et Oeconomiae".

Zurich Staatsarchiv, B IX 208, "Erster Ursprung der Naturforschenden Gesellschaft in Zürich, Gesetze und Uebungen derselben, wie sie nun in dem Jahr 1776 geordnet und bestätet sind, und auch für die folgenden Zeiten dienen sollen".

Ferdinand Rudio examines these by-laws in the Festschrift der Naturforschende Gesellschaft in Zürich (Zurich, 1896), 18-20.
The content of the second article of the constitution proved over the years to be the spring-board for the Society's success as a long-lasting local institution. It organized the membership into two classes: a small working core of "performers" (Ordinaria) who provided the stuff of scientific discourse, and a larger "audience" of scientifically-curious supporters and patrons (Honoraria) which received the scientific performances. The latter were not "honorary" in the sense of a modern honorary degree bestowed by a university upon a famous person for consenting to give the commencement address; rather, honorary implied belonging to an important group of onlookers who could participate in scientific discourse should they choose but their participation was neither expected nor required.

This distinction between "performer" and "audience" in part worked to perpetuate the insulated arrangement of past scientific discourse in the town. Article Five of the constitution, for instance, gave to Ordinary members alone the duty to perform research and to produce scholarship, to determine the calendar of events and transactions, and to make presentations. The first responsibility of Ordinaria was to alternate with their fellows in the delivery of learned papers; the second responsibility was to give to the group regular critical summaries, or "Recensionen", of new works in the various assigned fields of specialization: mathematics, physics, natural history, the arts and crafts, meteorology, botany, medicine and chemistry, materia medica, agriculture, mechanics, and optics.
Performers were to be limited in number to between six and 20 men. Meeting-room size restricted the total audience, including performers, to no more than 50 men.

On 21 September the Ordinaria gathered in private to elect officers. In a procedure undoubtedly borrowed from guild elections, they voted by writing on a ballot the number (listed in front of the names of all the members in a "Gesellschaftstafel") of their choice. The results of the secret voting were predictable: Johannes Gessner was chosen "Vorsteher", or president. According to Article Ten of Heidegger's constitution, Gessner now had the right to institute the Society's calendar of business. All suggestions for executive administration of the body had to be submitted to him for approval. Heidegger became the "secretary of scientific affairs" ("Secretarius ueber die wissenschaftlichen Verhandlungen"). He had the duty to keep a diary of meetings, to make abstracts of major presentations (Abhandlungen), and to keep all of them nicely organized and available in a continually updated bound book, and to maintain all manuscripts, notes, and formal correspondence in a locked case to which only he and President Gessner had keys. At the end of every year Heidegger was also to prepare a catalog of Society business for that year. Because of the heavy work load expected by the founders for this secretary, the constitution did not require him to prepare papers for presentation, though, like an Honorary member, he could do so if he wished. Junker Hans Ulrich Blaarer, Jr. became "Notariat" or "secretary of economic affairs" ("Secretarius ueber das
Oekonomische"). He maintained the legal and financial archive of the Society and read the names of the Ordinaria at meetings to note absences and tardiness and to levy a set fine on offenders. He also read a budgetary report at each meeting. Since the constitution expected this officer to be less busy than the scientific secretary, he was required to work as a performer. Hans Conrad Meyer, the oldest member of the group at 53 and a guidlmaster, acted as "Quaestor" or treasurer. In the early years of the Society, this officer was held responsible only for collecting dues and fines. Later his responsibilities grew more complicated. Thus, the Physical-Society's assembly of working Naturforscher was still partly an enclave: Ordinaria could gather privately, elect the entire board of directors, chair all committee meetings, and control nearly all matters of agenda, budget, and administration.11

Yet, the organization of the Society suggested transformation in the cultural meaning of scientific activity in Old Zurich. Heidegger's constitution invited the non-scientifically inclined burger with perhaps only a mild curiosity about nature to participate in its discourse; he needed the support of only one-third of the total membership for election. Earlier polite gatherings dealing with natural knowledge, such as the "Collegium insulanum" (1679-1683),12 were more insular in their social composition and limited in their number of participants. This new type of citizen involved in science was not the frequently mentioned scientific 'amateur', for even at the amateur level he was not actively engaged in science. Rather, he was the respectable citizen in a
position to support science when science was packaged in a fashion respectable to the patrician elite and deemed a public activity to support. Previously the burgers had not been exposed to conversation on scientific subjects; now they became key figures in science's audience.

The Social Cast

On 31 August 1746 the 19 men in Gessner's preparatory course voluntarily segregated into the two grades of Physical Society membership spelled out by Heidegger's constitution. Eleven of them chose to work as performing Ordinaria. They were:

1. Dr. Johannes Gessner. Professor of physics, Grossmunster canon.
2. Dr. Johann Heinrich Rahn. Sovereign councillor.
3. Dr. Hans Jakob Schulthees "zum oberen Hammerstein"
4. Dr. Hans Jakob Gessner
7. Johann Conrad Heidegger. Magistrate's clerk ("Landschreiber").

Seven decided to sit apart as supporting Honoraria. They were:

1. Captain ("Hauptmann") Hans Conrad Lavater

3. Captain Johann Heinrich Orell


5. Magistrate ("Gerichtsherr") Felix Werdmuller "von Elgg"

6. Heinrich Escher "im Schoenenhof"


One member of the group, Johann Heinrich Waser, withdrew from the fellowship because he was assuming a post of deacon in Winterthur.\textsuperscript{13}

The make-up of the charter membership reflected change in the traditional middle citizen outlook of Zurich science. The group included four medical doctors, a clockmaker, and a surgeon, but it also counted twelve patricians. Table 10 shows that over a quarter of the men held political office in 1746. Six would eventually serve as cantonal bailiffs. Two became burgemeisters. Altogether the group was more representative of a future ruling regime than of either the class distribution of burgers of the composition of a previous learned society in the town.

The original members of the Physical Society belonged to some of the most important families of Old Zurich. The two Eschers (and perhaps Johannes Gessner whose wife was an Escher) dated their family's citizenship as far back as the fourteenth century. From the Reformation to the Helvetian Revolution the "Glas" branch of the Escher family gave five burgemeisters to the town. In the eighteenth century 59 members of the Escher-Glas sat in the Zurich Rathaus as sovereign councillors, 26 as senators, and six as privy councillors. Hans-Heinrich's grandfather, Heinrich
Table 10
Charter Members Holding Political Office

on (A) 31 August 1746 and (B) at the high-point of their careers,
arranged by Urban Class

<table>
<thead>
<tr>
<th>A. TOTAL</th>
<th>PATRICIAN</th>
<th>MIDDLE CITIZEN</th>
<th>ARTISAN</th>
</tr>
</thead>
<tbody>
<tr>
<td>5*</td>
<td>4</td>
<td>1</td>
<td>0</td>
</tr>
</tbody>
</table>

B.

| 15**     | 12        | 2              | 1       |

* Though the group of 18 charter members is too small to make the calculation of percentages meaningful, the five members holding political office on 31 August 1746 amounts to a little over one in four.

** This number means that over four in five of the charter members eventually sat in the Rathaus. The 12 patricians, naturally, became members of the ruling elite.

Highest Office Attained by Charter Members

**BURGERMEISTER**

- Heidegger (Ordinary)
- Orell (Honorary)

**STATTHALTER**

- Hans Heinrich Escher (Ordinary)

**SECKELMEISTER**

- Johann Jakob Ott (Ordinary)

**SENATOR**

- Rahn (Ordinary)
- Blaarer (Ordinary)

**GUILDMASTER/COUNCILLOR**

- Friess (Ordinary)
- Lavater (Honorary)
- Hans Caspar Ott (Honorary)

**BAILIFF**

- Hans Jakob Gessner (Ordinary)
- Meyer (Ordinary)

**MAJISTRATE/GERICHTSHERR**

- Wermuller (Honorary)

**COUNCILLOR**

- Usteri (Honorary)
- Heinrich Escher "im Schonenhof" (Honorary)
Escher (1626-1710), who helped to negotiate Swiss commercial privileges from Louis XIV's government, had five sons who served in the ruling councils. Other founders of the Society also came from political dynasties. Six to eight members of the Schulthess family, about the same number of the "Rosen" branch of the Meyer family, and ten to twelve Werdmullers sat simultaneously on council throughout the eighteenth century. Werdmullers, in fact, were among Zurich's wealthiest burgers; they constructed some of the town's most impressive homes, including the "Old" and "New Seidenhof", the "Wollenhof", the "Krone", the "Muraltengut", and the "Maison zum Garten". The Usteri family (originally millers from Uster in the rural canton) and the Orell family (refugees from Locarno engaged in the free silk trade) entered the guild hierarchy in the seventeenth century. The Orell distinguished itself during the Enlightenment in government and in publishing through the printing establishment "Orell, Gessner, Füssli, und Co.". Heidegger's father — not an especially well-to-do man by Zurich standards — rose during his lifetime to the position of governor ("Landvogt") and had married a daughter of one of the city's most respected theologians (Anna Elisabeth Hottinger). Johann Jakob Ott's grandfather had served as a director of the city schools. Dr. Rahn's father and grandfather had both acted as Statthalter.  

Success in textile industry had launched several families into the local limelight, among them the Werdmuller, Orell, Usteri, and Escher. In 1575 David (1548-1612) and Heinrich
Werdmuller (1554–1627) moved away from their work as millers to begin a firm which transformed cheap silk scraps into a rich sarsanet. With the technical assistance of an Italian refugee and the capital support of both a Frankfurt banker and a Genevan merchant, the 'Gebrüder Werdmuller' developed a sophisticated import–export business in raw and finished goods. They annually realized 80% profit, so that at their deaths the brothers were worth an estimated 630,000 florins. By the early eighteenth century Werdmullers were Rentiers. In 1712 Hans-Felix Werdmuller (1658–1725) purchased the seigniory of Elgg (a small market town east of Winterthur in the northeast section of the canton) using part of the fortune he amassed as a general-major for the Dutch in the War of the Spanish Succession. The Physical Society founder, Felix Werdmuller, inherited this feudal landholding. As a Werdmuller "von Elgg", he commanded considerable wealth and aristocratic privilege.¹⁵

The arrival of the family Orell (or Orelli) from Locarno in 1555 had breathed new life into Zurich's economy. The Orells (along with other Protestant refugees from Ticino who had fled to Zurich to escape Canton Uri's move to suppress "heretics") introduced a number of technical improvements in textile manufacturing — in wool weaving, in dyeing, and in the dressing of cloth. Although the guild regime restricted the rights and privileges of the newcomers for many decades, the Orell family suffered through set-backs to establish a lucrative silk trade free from guild proscription. By the late seventeenth century
the family's economic muscle finally forced open the door to the
Regime. In 1679 Daniel Orell (1597-1684), the great-grandfather
of the Physical Society charter member (Johann Heinrich), maneuvered
his way into the patriciate by threatening to move his manufacturing
to Berne if authorities continued to deny him full citizenship. 16

Another Physical Society organizer, Paulus Usteri, was the
third generation proprietor of a silk and linen manufacturing firm.
His grandfather had established the firm at the "Neuenhof" in a
newly-urbanized western zone of the city (the "Talacker") between
the old city walls and the Sihl River. Here, in an area of rapid
development and a vibrant economy, entrepreneurs like the Usteri
created the modern capitalistic heart of Zurich. Today, the
Neuenhof belongs to the "Paradeplatz" (the Boardwalk on a Swiss
Monopoly game) cluster of great banks, "gnomeries", and hotels
on the "Bahnhofstrasse", perhaps the most elegant avenue of shops
in the world. 17

The fortune of the Escher dynasty also rested in silk trade.
In the late sixteenth century, an ancestor of the Physical Society
founders had impelled one of the greatest technical developments
in the local history of textiles by discovering the production
secret for Bolognese "mourning crepe". Johann Heinrich's father,
Statthalter Heinrich Escher (1688-1747) installed in the 1730's
the first hydraulic motor-powered silk spinning mill in northeast
Switzerland. Eschers, in fact, pioneered several moves in the
change-over from the cottage to the factory system of industry.
In the early nineteenth century Hans Caspar Escher (1775-1859)
constructed one of Europe's first and largest mechanical workshops at "Neumühle". The factory "Escher, Wyss, & Co." exported spinning-jennies; by the late 1820's it built locomotives and steam engines.18

Zurich's post-Reformation commercial boom did not generate heirs dedicated to Zwinglianism, however. Entrepreneurial families in the city tended to champion new cultural impulses; they promoted secular education in the public schools (practical mathematics, modern languages, history, and civil law). Werdmuller family history, for instance, sported a number of "baroque personalities" who helped to transform Zurich's puritanical countenance. Hans Rudolf Werdmuller (1570-1617), the eldest son of 'Gebrüder' David, shocked his home town in 1614 when he married the daughter of a rich Catholic from Constance; then, he aggravated the social sensitivity of the Reformed public when he constructed the "Seidenhof", an openly luxurious home. His two free-spirited sons, raised by the widowed Catholic mother, provoked other community scandals. In the 1650's authorities suspected one of them (Hans-Rudolf, 1614-1677, a wild-looking, nonconforming mercenary-adventurer) of plotting against the state with France's Cardinal Mazarin. Forced into exile, he converted to Catholicism and died as a baron in the Emperor's service. The city fined his brother (Hans-Georg, 1616-1678, known as Jörg) for permitting his wife to dress in violation of sumptuary law. Eighteenth century Werdmullers also caused an occasional uproar. Around 1750 Johannes Werdmuller (nicknamed the "Marquis" after his French tastes and ostentatious lifestyle) purposefully antagonized the State Church by carrying a volume of
Family involvement in science-related fields may have prepared the way for some of the Physical Society founders' interest in organized scientific discourse. The Gessners claimed an interest in medicine and natural history dating back to Conrad Gessner. Dr. Rahn's grandfather, Johann Heinrich Rahn (1622-1676), was a mathematician who had published the first algebra in the German language. Several members of the seventeenth century Lavater family held medical doctorates and had served as Zurich's professors of physics. Werdmullers worked in engineering. In the 1620's the Davos-born engineer Johann Arduiser (1584-1665) served as the Werdmuller family tutor. He trained nonconformist Hans-Rudolf and Jörg outside of the Zurich public school tradition in mathematics, geometry, surveying, and modern languages. Both of his pupils attended the Academy of Geneva and then studied in Paris. Jörg helped Arduiser to direct the comprehensive re-modeling of Zurich's fortifications and invented several mechanical devices, including a pump to transfer water from the Limmat to the Lindenhof. Bernhard Werdmuller (1635-1669), the son of the exiled mercenary and Jörg's nephew, fortified Flemish towns. Heinrich Werdmuller (1651-1735) founded Zurich's "Gesellschaft der Feuerwerker". In the 1770's and 1780's "Marquis" Johannes Werdmuller, as the town's buildings officer ("Bauherr"), sponsored the use of lifting gears and other new construction machinery.
Gessner's Agenda

Young patrician interest in science did not have to translate into old patrician interest in science, however. As institutional entrepreneurs, Physical Society organizers still had to carry out a new constitutional framework. They had to articulate collective goals for the fellowship, to crystallize a program of activity socially valid for and acceptable to their audience, and they had to secure resources (money and political support). Had Gessner, the entrepreneur, failed to articulate Society goals which responded to certain felt needs of his home canton, a regular program of civic science would never have arisen in the last decades of the Old Regime.

From the very beginning of the preparatory course in autumn 1745 Gessner stressed fields for study which offered to his community the possibility for real applications. At the inaugural meeting of the formally-established Society on 18 October 1746, and again at the first meeting of the working year on 9 January 1747, Gessner outlined a program of civic science which underscored the social purposes of the new fellowship. By charting a "plan of affairs" ("Entwurf von den Beschäftigungen der Physikalischen Gesellschaft") and by emphasizing a quest for knowledge of Zurich's own natural history ("Abhandlung von der Lage und Grösse der Stadt Zürich, auch denen daher rührenden natürlichen Folgen"), Gessner fathered an organization which meant to sensitize the Regime to the potentially great advantages of a more scientific administration of the canton.
Gessner's personal faith was that Naturforschung offered the best means by which he could come to know and to honor God. In his lectures both at the Carolinum and to the Physical Society he chose to replace the scholastic method of his local predecessors with the rational philosophy of the German Christian Wolff. He had little truck with the mechanistic approach of the Cartesian or Newtonian. Wolff, a professor of great notoriety at the University of Halle, offered Gessner a teaching method. With it, Gessner could teach to Zurichers the systematic delineation of principles, the clear expression of ideas, and the rigid logical testing of hypotheses. Though Gessner planned to move Zurich natural philosophy toward a more rational and utilitarian function, he wanted to do so within the limits of Reformed theology. The son of a pastor and himself the canon of the cathedral where Zwingli had preached, Gessner never challenged orthodoxy as Wolff did. He never failed to stress the edifying virtues of research into the Book of Nature. In the 18 October 1746 "Entwurf von den Beschäftigungen der Physikalischen Gesellschaft", Gessner said:

It is our design to turn our knowledge of Nature to practical use. We hope that no one can disapprove of our resolve to examine the material work of our Wise Creator and the ordered laws which He commanded. We are convinced that God has made everything for the best and that there is nothing more permanent or better-founded than His Nature. From it we can learn of His goodness and omnipotence and we can come to a truer reverence and more ardent love of Him. Nature sets us on the path to virtue. Our enterprise can show us the uses to which we can apply our understanding of His Creation. His rich gifts can be utilized to meet our needs, to supply our conveniences, and to produce our pleasures. This is the principal aim of all our future efforts: namely, to adapt the uses the uses of Creation for the benefit of the Fatherland.
For Gessner, Naturforschung served God. It became a form of public worship when linked "zum Nutzen des werthen Vaterlandes".

The thrust of Gessner's first address to the Physical Society in October 1746 was to display his version of the tree of physical knowledge. It differed in important ways from the logical system of Christian Wolff. Figure 2 (A and B) compares the system of Gessner to the system of Wolff. In Figure 2-B we see that Wolff divided knowledge into a hierarchy which placed theoretical sciences on the top branches of the tree and practical sciences on the lower branches. Mathematics rested at the summit as the only sure method by which to arrive at truth. History sat at the bottom as the least reliable method. Between them, Wolff ranged metaphysics, physics, logic, natural law, ethics, politics, rhetoric, and technology. Though Gessner too privately considered mathematics to be the ultimate form of knowledge, in his October address he underplayed his Society's interest in "purer" types of scientific discourse. He defined mathematics as "the most useful science to discover Nature's secrets" and described calculus as "the most marvelous study", but he told his audience that he would not bother them much with the confusing higher forms of mathematical study.23

Gessner's doctoral thesis at Basel, De exhalationum natura, causis et effectibus (1729), had been a scholarly if often unoriginal treatise on the uses of mathematics in medicine. Subsequent to it, he read in the 1740's D'Alembert's work on fluids, Leonhard Euler's papers on the properties of light,
From Gessner's "Plan of Affairs" for Zurich's Physical Society, 18 October 1746.

Figure 2

Comparison of Johannes Gessner's Division of the Physical Sciences with the Division of the Sciences by Christian Wolff
From Wolff's "Preliminary Discourse on Philosophy in General" (1728)
Clairault's observations on the earth's shape, and Waitz' recollections of his experiments with electricity. In the 1750's he completed one work on plane geometry, *De Triangulorum Resolutione, Primario Matheseos ad Physicam applicatae Fundamento* (1757), and another on spherical trigonometry, *De Triangulorum Resolutione, Pars Altera De Triangulis Spharicis* (1758). Though he summarized these higher mathematical works to the working Ordinaria, to the larger audience he preferred to offer mathematical work with a utilitarian aspect. All Zurich citizens appreciated practical mathematics. The city was full of speculating merchants, bankers, industrialists, and politicians. In 1748 he read to the Society *De Termino Vitae*, a dissertation on population dynamics. It contained a table, "Scali Periodi Humanae Vitae", summarizing the thoughts of Christian Huygens and Daniel Bernoulli on mathematical probability. His early orientation of the group toward social statistics stimulated an important part of the future scientific program. After 1760 the Economic Commission's statistical analysis of the human and natural resources of the canton was a chief mode of scientific investigation by the fellowship.

Figure 2-A shows that Gessner divorced completely Wolff's classification "Metaphysics" from his plan for the Society. He sidestepped this traditionally volatile field by clustering under "Natural Philosophy" such areas as "general physics", "mechanics", "hydraulics", "hydrostatics", "aerometrics", "pyrometrics", and "optics". He also omitted the difficult speculative fields
Wolff called "ontology", "cosmology", and "pneumatics". He had reason to omit them. City authorities in the 1660's had banished pastor Michael Zingg from the city for teaching the heliocentric system as a mathematical model. When in the eighteenth century J.J. Scheuchzer had championed community acceptance of the Copernican universe in his book *Physica Sacra* (1730), he found it necessary to couch his defense in cautious language; he praised the Christian merits of the Polish astronomer's insight in a way reminiscent of Galileo's "Letter to the Grand Duchess Christina". Gessner lived in a less dogmatic and puritanical age than either Zingg or Scheuchzer, but he still lived in Zurich. Open avocation of suspect ideas could hardly deliver important citizens into the lap of science and into the Age of Enlightenment. While he included difficult and complex subjects in the Physical Society agenda, he did not casually embrace dangerous ideas for public discussion.

We also see in Figure 2-A that Gessner, unlike Wolff, gave natural history a prominent status in his scheme of physical knowledge. Though he strongly advocated Wolff's rigorous methodology, he opposed the German's near total reliance on logic as the means by which to penetrate nature's meaning. He did not look himself away to think about monads or transcendental cosmology; rather, he was a careful, sensitive observer and nature enthusiast. His enthusiasm began young, when as an 11-year old boy in the "fourth class" of Latin school, he set out on his first botanical
excursion up the nearby Uetliberg (a 2,867-foot hill overlooking Lake Zurich southwest of the city). It increased when as a 14-year-old he travelled with walking-stick ("zum Wanderstab") beyond the lake, toward the snow-capped Alpine ranges, and into the isolated mountain valleys of Appenzell and Toggenburg. In the following summer he climbed "the island mountain", Mount Rigi, overlooking Lake Lucerne. At age 17 he made the long and dangerous Alpine trek across the Bundner passes into the Italian-speaking territories of the Ticino, picking up specimens for his herbarium all along the way. Finally, at the end of his university days, he made with Albrecht Haller his longest Alpine tour.

Gessner's reputation rests in his work in botany. In 1743, three years before the first official meeting of the Physical Society, he completed *Dissertationes de partium vegetations et fructificationis structure*, a work in plant morphology supporting Carl Linnaeus' system of nomenclature. In 1747 he finished *Dissertationes physicae de vegetabilus* and six years later he discussed plant physiology in *De Ranunculo bellidiflora et plantis degeneribus*. In 1756 (he was 47) Gessner recognized the paleo-botanical nature of several fossils in his *De petrificatorum variae originibus praecipuarum telluris mutationem testibus*. Moved by the appearance of Linnaeus' *Species Plantarum* in 1754 (now considered to be the starting-point for the systematic classification of flowering plants and ferns) Gessner devoted sixteen years (1757-1773) to preparing *Phytographia sacra*, an eleven volume dictionary of plant types described in the Old and New
In his opening address of working year 1747, "Abhandlung von der Lage und Grosse der Stadt Zurich, auch denen daher ruhrenden natürlichen Folgen", Gessner reconstructed the natural history of the Zurich region instructing Society members on how they could refine his work. First, he discussed his determination of Zurich's latitude and longitude, reviewed the solstices, and calculated the town's elevation from sea level. Secondly, he estimated the area and population of the canton. He considered the effects of environment on the people of the region; he studied temperature of the ambient air, its weight, purity, and refracting power, and the effect of its "thinness" or "roughness" on respiration. He described a climate by noting such things as how long weather patterns lasted, which patterns produced atmospheric phenomena, and what diseases accompanied what weather changes. He analyzed the relationship of topography to agriculture and of population density to social life. In all of his natural history, he worked first to clarify natural phenomena unique to the northeastern Swiss plateau and special to Zurich: the "Föhn" and its associated "dangers", the clear appearance of the Alps as a presage to rain, the higher-than-should-be-expected temperature of the city generated by the surrounding mountains.
Throughout Gessner's career a strong attachment to the ecology of his homeland dominated his research, giving it social import. For example, when he determined the angle of the confluence of the Sihl and Limmat rivers north of the old city walls or when he measured the distance of the Sihlenberg from the Grossmunster, he gave a spatial dimension to local life. When he named plants found on area hills or estimated the depth of Lake Zurich, he vivified the local experience. He deepened the meaning of what it meant to a people who had, after all, literally created their cantonal world by dispossessing nobles, by secularizations, by land purchases, by wise political negotiations, and by military conquest. Common human perception of the physical environment served for Gessner as a social glue. Gessner understood what at least one social geographer has argued: the landscape projects a "vast mnemonic system for the retention of group history and idols". In Image and Environment (1973) Roger Downs said that every detail of the countryside can cue members of the group to recall some myth or belief of its culture. In Gessner's January 1747 speech reconstructing Zurich's natural history, he both projected a landscape and heightened group intensity. He offered to the burgers an exact and positive mental image of their unique habitat. He reiterated, perhaps unconsciously, the traditional commitment to the established cantonal order, but he used the new, often quantified language of Europe's eighteenth century scientist. He called for self-improvement of the hometown through local application of scientific learning. 'I believe',
he said, "that we can turn our knowledge of Nature to the best use of the Fatherland if we look into the special circumstances of Switzerland and especially those of our home canton". If his science was really new, its stated function was not; he aimed to bind the estates of the Zurich community together with an image of environment to promote a shared human reverence for the natural order of things. To a Regime interested in keeping things mostly as they were, such a program had an obvious appeal.

"Medicine" — Gessner's fourth unit of physical knowledge — offered him an established field upon which he could build increased public support for the other sciences. The social importance of individual and community health had guaranteed a civic role for medical men since at least the High Middle Ages. In the twelfth century at Wolfbach atop the Zurichberg the Church had established an "Heiliggeistspital"; later religious brethren like the Lazarites and Johannites cared for the sick at the "infirmary" ("Siechenhaus") of St. Jakob "an der Sihl". During the Black Death, secular medical men (the "Scherer" and "Bäder") assisted the clerics by caring for and transporting stricken patients to the Selnau hospital (outside of the city walls). In the fifteenth century the expanding city-state called upon medical practitioners to serve the military forces. Finally, during the Reformation, city authorities rationalized the Church's diversified health care system: they employed two municipal physicians who were to assist the sick poor in the new civic hospital and to supply expert management of sanitation, epidemics, and other health care emergencies; they
authorized a special "Blatterhaus" at Oetenbach for the care of syphilitics; and they delineated a formal division of local medical practices between the barber-surgeons, apothecaries, and physicians.²⁸

Gessner viewed the practice of medicine falling in six parts:

1. Anatomy ("die Wissenschaft von dem Bau des Corpers" and Physiology ("die Wissenschaft von der Möglichkeit der Wirkungen der Theile im Leibe");
2. Pathology ("die Wissenschaft von dem Krankheiten");
3. Semiotics ("eine Wissenschaft von dem Zeichen des gesunden und kranken Zustand des Leibs");
4. Dietetics ("die Wissenschaft den Leib lange gesund zu unterhalten");
5. Therapeutics ("die Wissenschaft der verlorne Gesundheit herzustellen"), which included surgery, diet, materia medica, and pharmacology; and

Dividing medical research and practice in this way could be exploited to unite the further efforts of the various levels of local medical practice. Into the seventeenth century artisan-surgeons dominated the city's medical fraternity. Their urban association (the Society of the Black Garden) after 1534 became a specially recognized body of the smithy guild (Schmieden). It enjoyed a guaranteed percentage of the guild's political representation. With their political status regularized, they had fought competition from apothecaries and doctors successfully.
The victory made medical cooperation difficult. The physicians, members of a liberal profession, were unwilling and too few to organize within a guild; but during the seventeenth and eighteenth centuries as the aristocracy took over the Regime, physicians wielded increasing power. In part as a result of Gessner's program, doctors who were political office-holders (Physical Society founder Johann Heinrich Rahn is typical) linked their medical work more closely than had been possible previously to the programs for the city-state; they crusaded for political causes as "patriotic" members of the Helvetian Society; they championed a back-to-nature economic movement; and they studied the effects of poor housing, bad sanitation, inadequate education, and community negligence on public health. Too busy with civic concerns to entertain highly theoretical issues, Zurich Enlightenment physicians mostly avoided Romantic medical philosophies like Mesmerism. Such speculative inquiry could have splintered local medical activity into heated factions.30

For his last division of physical knowledge -- "Technology"-- Gessner painted another rich landscape of public science whose pursuit offered to Zurich a large yield of benefits. He divided technology ("die Wissenschaft von verschiedenen Künsten und Handwerken die zur Notwendigkeit, Bequemlichkeit, und Ergoetzung des Lebens dienen") into five parts: (1) Domestic economy ("Hauswirtschaftskunst"); (2) Manufacturing ("Wir gebrauchen dazu die Wolle, Haar, Felle, Federn, Seide, Flachs, zu deren Sammlung
108

so viele Anatalten, und zu der Zubereitung so viele Handwerke und
Kunstler, die Fabricarrten, Washer, Faerber, Bleicker, Walker u.
erfodert werdan"); (3) Architecture ("Bankunst"); (*0 Civics ("der
Buergerliche Theil"), including bridge-building, street maintenance,
shipbuilding and navigation, fortifications and the military arts,
the manufacturing and distribution of books, music and painting; and
(5) Machines and Instruments*

"The whole Empire of Nature stands

open to us", Qessner told his audience, "we must only take possession
of it".31
Gessner's discussion of technology glorified bttrgerllch
culture. It suited especially well Europe's current aristocratic
vogue for agriculture.

Already in the early eighteenth century

during the reign of William and Mary, a leisured craze for gardening
existed in Britain and the Low Countries. Economic societies
glorified agriculture by George II's time, and nobles and gentlemen
lent their prestige to them. In 1723 Scots founded the "Society of
Improvers in the Knoweldge of Agriculture". Their membership roles
amounted "to upwards of 300 of the Flower of the Nation, whereof
about 50 were peers".32 In 1736 when interest peaked in Jethro
Tull's bold theories about dirt-eating plants, Dublin notables
followed Edinburgh's lead. They formed the "Society for the '
Improvement of Agriculture"• London gentlemen more cosmopolitan
than rural did not establish the "Society of Arts, Manufacture, and
Commerce11 until 1753* By then, the program of the Physiocrats had
arrived in Switzerland from France. The cantons embraced "economic
movements" of their own.


In Zurich the back-to-nature movement had barely arrived at the time of Gessner’s address in January 1747. Fashionable interest in agriculture could not yet match the English vogue. But, Zurich’s patrician class controlled a large subject countryside full of farming and industrial potential. Burgers were keenly interested in economic matters. Gessner’s message of public progress through technology appealed to craftsmen, manufacturers, commercial factors, and landholders interested in the profit of invention, increased production, improved technique, and economic growth.

* * *

Taken as a whole, Gessner’s project ("Entwurf") articulated a scientific package which fit eighteenth century Zurich needs precisely. He had solicited approval of the Physical Society throughout all of the urban estates and planned to combine their scientific efforts into civic programs. He charted a new public course for Naturforschung adapted to the patriarchal order: political regents would administer God’s world for the welfare and happiness of their subjects. Pointedly, Gessner favored human cooperation over austere, self-righteous isolation. With such an orientation, his fellowship should have flourished.
VI. SCIENTIFIC ENTERPRISE IN PATRICIAN SOCIETY, 1747-1759

A recognizable first stage of Physical Society activity lasted from the formal organization of Gessner's fellowship in the summer of 1746 to the creation of the Economic Commission in 1759. Despite the promise of the institutional package, these early years of the Society showed few signs of prosperity. For ten years the young organization struggled with a small membership and sagging attendance. Lean working resources limited programs. In 1750 only the boldest well-wisher would have ventured to predict long-term success. A level-headed observer might have thought that the fellowship would soon expire, another victim in a long line of private collegia.

Yet, despite difficulties the Society's entrepreneurial group continued to develop a broader civic science program. In the early 1750's through a public lottery, it generated a positive bank balance. In late 1756 it relocated its meetings from inadequate quarters in a private residence to a magnificent guildhall. These two developments gave greater public force and animation to Gessner's "Plan of Affairs". The second stage of Society activity from 1760 to 1779 would work to confirm scientific discourse as a fundamental cultural form of eighteenth century Zurich.
Urban Wealth

The concentration of money in the right hands is both a social and economic factor which accounts for many peaks of scientific achievement. Unquestionably, such concentration played a role in the health of scientific interests in eighteenth century Zurich. The city-state offered a cornucopia of material resources. The coffers of Zurich, stuffed not just with a generation or two of riches but with an entire post-Reformation epoch of prosperity, were as full as any in Europe. Commercial boom gave great wealth to many Zurich families. Several mercantile dynasties held vast fortunes. In 1737 one lieutenant-colonel (De Rocairol) dispatched to the canton to secure a large loan for Habsburg emperor Charles VI appealed to Zurich's sovereign councillors: "Comme je sçay, magnifiques seigneurs, qu'il ne vous manque pas de l'argent". In the five decades after his mission, eight great banking houses arose in the city. By the end of the Old Regime the state possessed so much money — economic historian Hans Conrad Peyer estimates in excess of one million pounds ready money (Barshaft) and four million pounds in securities (Wertsschriftenbestand) — that its only fiscal crisis was over how to invest it all. Little wonder that an army of Revolutionary France moved so quickly against it in 1799.

The Physical Society's financial arrangements, however, dipped only a baby's hand into the city's overflowing treasury. Entrance fees, annual dues, fines collected by the "Quaestor" for tardiness and absenteeism, and contributions supplied all of the early revenue.
Article Seven of Heidegger's constitution required initiates to pay an eight guilder entry fee and an eight guilder annual due (collected in quarters). Furthermore, it stated that any colleague earning a career promotion or winning a public honor should offer the Society "eine Honoranz", a small monetary gift. Members permanently leaving the group were required to contribute a few ducats as "eine Abschiedsgabe", a farewell gift. Failure to meet these two stipulations (both of guild lineage) was to be noted in a formal book of protocol as behavior unbecoming to a gentleman and to a citizen of Zurich. These arrangements gave the Society little monetary working room. Between 1749 and 1754 income never exceeded 1,000 guilders; balances for 1748 and 1749 amounted to less than 80 guilder.*

From the start, the Ordinary members decided to concentrate spending on key purchases: books, the botanical garden, some rare natural history specimens, and a few experimental devices. Its most expensive early purchases were a double-cylinder air pump (1747), an azimuthal quadrant with a three-foot radius, and an assay-balanoe (1748). However, because there was no money for a proper observatory, the instruments had to house at Johann Jakob Ott's home "in der Schipfe"; this settlement hardly satisfied the membership. Members soon pigeonholed plans for an observatory and for a large botanical garden until funding was available.

* Appendix E contains a year-by-year survey of the Physical Society budget from 1747 to 1798.
The economic problems of the adolescent scientific organization pressed its leaders to action. During the summer of 1747 the working membership investigated the ways and means to make their Society a more resourceful, multi-faceted, and remunerative institution aiding the public welfare. They appointed a special committee to the task: Quaestor Hans Conrad Meyer, his fellow guildmaster Johann Conrad Pestalutz, Society notary Hans Ulrich Blaarer, scientific affairs secretary Johann Conrad Heidegger, Senator Dr. Johann Heinrich Rahn, and Johann Heinrich Orell (like Heidegger, a future burgermeister).

Within a few months this elite, serious-minded, hard-working, frugal, profit-motivated and patrician Zurich citizens, recommended to the fellowship the creation of "eine Geldlotterie", a public lottery. After formal acceptance of the idea by the Ordinarii on 18 March 1748 and its formal licensing by an officer of the "Finanzamt" on 27 May 1748, the "Lottery Commission" held public drawings from the summer of 1748 to 2 March 1752. Though little about the administration of the lottery exists in the remaining records (nothing, for instance, is known about ticket costs or the prize-winning amounts), the most important detail was noted for posterity. The Commission reported a final accumulated profit of 8,071 guilder.  

A special "Lottery Fund" quaestor, Caspar Scheuchzer (1719-1788) who had acted throughout the period of public drawings as the lottery committee's treasurer, laid out a stringent set of rules regulating the use of this money. The Ordinarii adopted them on 2 February 1754. Scheuchzer guaranteed that the lottery profit could not be wasted in a flurry of extravagance. In a conservative investment fashion
worthy of a later day Zurich "gnome", he converted the capital into an "unantastbare Stammgutkapital". By law Scheuchzer and his successors could transfer from this so-called "Hauptfond" to the Society's working "Brauchfond" no more than 200 guilders annually. Any transfer above this ceiling could only be done after the unanimous approval of the Physical Society's board of officers. Until 1800 this "untouchable" stock fund kept the Society interest-rich. 

In early 1755 the Society placed the lottery fund into the newly opened "Zinscommission" of the local bank Leu & Compagnie, a vigorous institution with Heidegger as one of its directors. The Zinscommission acted as a semi-public agency out of an office in the Rathaus. It invested capital mostly in ventures outside of Switzerland. Over the course of the last five decades of the Old Confederation, it returned three and one-half per cent interest per annum on the Physical Society account. By 1792 the original lottery proceeds had doubled:

<table>
<thead>
<tr>
<th>Year</th>
<th>Amount</th>
</tr>
</thead>
<tbody>
<tr>
<td>1762</td>
<td>10,477 guilders</td>
</tr>
<tr>
<td>1772</td>
<td>12,776 guilders</td>
</tr>
<tr>
<td>1782</td>
<td>15,276 guilders</td>
</tr>
<tr>
<td>1792</td>
<td>16,700 guilders</td>
</tr>
<tr>
<td>1802</td>
<td>18,900 guilders</td>
</tr>
</tbody>
</table>

Though rules prohibited eighteenth century Society members from cannibalizing this account, they did relax enough occasionally to invigorate the program. For instance, in 1781/82 officers made
an exception in Hauptfond rules and authorized a special "gift" to subsidize the construction of a greenhouse at the botanical garden.

One cannot measure the total value of the lottery fund for the Physical Society in guilders acquired or spent, however. This fund marked a significant departure in the character of Old Zurich scientific discourse: it conjoined scientific activity with a profit-making, public enterprise which had a thoroughly practical and patrician air. Institutional solvency greatly enhanced the local community's image of science and evened the Society's odds for long term success: The far-sightedness of the lottery commissioners proved to accomplish one last thing, though no one could have anticipated the result: it sustained Zurich scientific activity through the desperate years of the French and Helvetic Revolutions. Few citizens then had the time or inclination to finance science. In the early nineteenth century, the money helped to set organized science back on to its feet.

Meetings in the Zunfthaus zur Meise

At first the promise of the lottery revenue did not seem to guarantee a brighter path for the future of the Physical Society. So limited were funds in 1753 that expenditures fell to nearly one-third of what they had been in 1748. Between 1749 and 1755 the fellowship added only 12 new members. From 1753 to the end of 1756 the Ordinarii decided to congregate on only one Monday afternoon a month rather than on the two Mondays a month suggested by the charter. A new socio-economic condition threatened the group.
After 1747 the original enthusiasm of the founders diminished because of their poor physical surroundings. For the first meeting of 1747 the organization had moved from a room in the House of the Black Garden into quarters of a privately-owned building known as the "Limmatburg". It was here on the east bank of the Limmat River just outside of the old city walls that Johannes Gessner had outlined the natural history of the Zurich region.

In a few aspects the Limmatburg was preferable to the Black Garden. The apartment (rented from "Quartierhauptmann" Johann Heinrich Schulthess) held nearly 100 men, if without elbow room; the Black Garden held only about 50. Moreover, just outside of the Limmatburg stood a 22,400 square foot vacant property owned by the adjacent Rahn Family dye-works. The Physical Society rented the property from Hans Heinrich Rahn "in der Farb" (1694-1766) for 30 guilders a year. Here work on the first botanical garden began. The Limmatburg's interior was less satisfactory, however, for it offered little more than additional seating. Over all, its atmosphere was drab, certainly not appropriate for a rising burger class. There was still no place for a proper observatory, no place to accommodate and correctly display instruments and nature cabinets; there was not enough room to house the expanding collection of books.

On 3 September 1751 Gessner suggested that the Society move into the new "Zunfthaus zur Meise", the guildhouse of wine-dealers, painters, saddlers, and innkeepers then under construction on the west bank of the Limmat. He selected a committee to study the
logistics of the re-location and to contact the guild's officers about the Society's interest. The Meisen's masters notified Gessner that arrangements could be made. However, he was asked to speak to building architect David Morf (1700-1773), the city's "Obmann der Maurer", about any special construction required by the scientific fellowship. On 2 October 1756 the Society agreed to a 20-year lease with the Meisen. The contract read that for a yearly fee of 150 guilders the Society had access to the following rooms:

(1) the south wing of the second floor opposite the Fraumunster;
(2) a large northeast corner room of the second floor facing the city warehouse (Kornhaus) and the Limmat;
(3) a small chamber adjoining the large corner room;
(4) a kitchen connecting the corner room and the small chamber;
(5) a storage room on the top floor for wood, peat, and implements, and;
(6) a high attic chamber perfect for an astronomical observatory. (One was opened there in May 1759.)

The Physical Society's re-location into the Meisen held a social significance which went far beyond the advantages of additional space for members and materials. Upon its completion in late 1756 the Zunftthaus zur Meise stood as the finest late Baroque and Rococo structure in Old Zurich. Built at a huge cost, the guildhall rested between two of the town's oldest religious institutions, the Fraumunster abbey and the parish church of St. Peter. It faced the
facades of several guildhalls lining the Limmatquai, the old "Wasser-
kirche", and the two imposing towers of the Grossmunster cathedral
(reformer Zwingli's preaching place and the site of the theological
academy). It was only a short walk to the Rathaus.

The Physical Society was now situated in the midst of the
town's three dominant spheres of influence: the guilds, the governing
councils, and the church. This move from a private room in the
peripheral Limmatburg into a public hall of the finest guildhouse
of the city embodies the conjuncture of scientific activity with the
essential culture of the Old Regime. Discourses offered in the
Meisen's milieu changed in tone and import. The atmosphere was
strikingly new for local Naturforscher, with high-windowed walls
melting away into spacious, brightly colored vaults, rooms full of
cheerful light. As Society members entered the Meisen they saw
above the exterior windows tendrils and foliage sprays which marked
new aristocratic taste for sophisticated stylings and symbolized a
movement away from the architectural spirit of the post-Reformation
period. Inside the congress room hung a new portrait of Johannes
Gessner and, in a golden frame, a portrait of Isaac Newton. Natur-
forschung left the world of meager-salaried middle citizens in
crammed private quarters for an environment not altogether unlike
a Paris salon, decked in wealth and wit but stamped with Zurich's
peculiar brand of aristocratic bearing and formal ceremony. In
such a world the cast, operating procedures, and goals of science
changed.
On 10 January 1757 the Society celebrated its first assembly in the Meisen in a grand style. First, a reception was held to welcome eight new members: Dr. Salomon Schinz, Caspar Schinz "auf dem Graben", Johannes Escher "im Berg", Johann Georg Stocker, Martin Usteri, Rudolf Pestalutz, Lieutenant Johann Schneider, and Caspar Lavater. This group of new members was the biggest since the first months of the fellowship in 1746/47. Then following the reception Dr. Hans Caspar Hirzel, the Stadtarzt who was the Society's Secretary, highlighted the festivities with an address entitled "Von dem Einfluss der gesellschaftlichen Verbindungen auf die Beförderung der Vortreuel, welche die Naturlehre dem menschlichen Geschlecht anbieten, und dem Nutzen, der unser Vaterland von der Naturforschenden Gesellschaften erwarten kann".  

President Gessner's opening speeches to the newly-formed Society in October 1746 and January 1747 clearly expressed an Enlightened intention to make science serve the Zurich public; Hirzel's address in the Zunfthaus zur Meise in January 1757 brought home the same message with an ideological force and style better suited to the patrician rulers of the canton. Hirzel himself, unlike Gessner, spoke with the socio-political prestige of a regent. His father (1698-1752) and grandfather (1675-1752), both Hans Caspars, had served the state as "Statthalter", a position of authority superseded only by Burgermeister. Since his parental name-sakes had died in 1752, Zurich treated the Stadtarzt with special deference due his family. A student of philosophy, literature, history, and law under Bodmer and Breitinger, Hirzel
possessed a more political nature than did Gessner. He directed more of his own research interests to agriculture, state economics, and philanthropy. Hirzel better articulated the potential civic value of the scientific society than did the Physical Society president. In the Meisen he was the appropriate speaker.

The thesis of Hirzel's inaugural address centered on Zurich's special collective capacity to stimulate a beneficial social exchange of scientific ideas. Centuries of Swiss peace, he told his audience, allowed the canton to concentrate its genius upon the practical welfare and happiness of its people. Other European states had the time and energy only to deal with problems, misfortunes, and emergencies, and to think solely in terms of power arrangements. Zurich, quite fortunately, had the chance to order its world according to the harmony of nature, to stimulate progress in agriculture, medicine, trade and industry, the arts and the sciences, and to elevate the moral and political state of its people.*


Hans Caspar Hirzel, "Rede von dem Einfluss der gesellschaftlichen Verbindungen", Abhandlungen der Naturforschenden Gesellschaft in Zürich (Zurich, 1761), I: 3.
Though Hirzel observed that the city-state profited from commerce in all sorts of ideas, he argued that scientific work benefited most from the social interchange of opinions and resources. An often sophisticated thinker who later embraced the spirit of Jean-Jacques Rousseau's writings, Hirzel related that community understanding of nature soon exceeded any one individual's ability to comprehend it. Here was a political sentiment of consensus common to Zurich's Old Regime phrased in a dynamic new form:

*Scientists have the gift to make great discoveries which can benefit mankind. But a scientist working alone does not guarantee to (society) the fruits of his work. Collective talent, insight, and resources will soon surpass the understanding of any single scholar.... Science should not act as a prostitute giving pleasure, or as a maid serving to profit only one master, but should live as a bride which yields offspring and nurtures families.*

It is a sentiment reminiscent of Rousseau's expression of the "general will".

Hirzel's message worked well on the Meisen audience. The local newspaper, the Monatliche Nachrichten, reported on the Society's festivities with the highest public praise the fellowship had yet enjoyed. It called for support of the organization as a civic duty.* Eleven new members heeded the call, entering the Society in 1757. Their number nearly equalled the number

* "Es ist nicht zu zweifeln, dass die Bemühung und der Fleiss dieser Gesellschaft mit Aufwendung vieler Zeit und Kosten, andere verständige Liebhaber der Naturwissenschaft ausser der Societät gleichfalls aufmuntern werde, auch das Ihrige zur Unterstützung dieser den allgemeinen Nüzen zur Absicht habenden Gesellschaft, nach Gelegenheit und Vermögen beyzutragen, und was Merkwürdiges vorfallet, einzusenden und einzuberichten". Cited in Ferdinand Rudio, Festschrift der NGZ (Zurich, 1896), 47.
admitted between 1750 and 1756. From 1757 to 1778 membership almost doubled, rising (from 72) to 130. Meetings could now be held every Monday afternoon, though at 2:00 P.M. rather than at 4:30 P.M. to accommodate those who had to supervise the closing of their business day. Budgets fattened, permitting purchases of long sought after fixtures. Collections now expanded through annually budgeted subsidies rather than through sporadic gifts or the raising of a special fund. In 1759 the Society opened its observatory in the Meisen. Instrument purchases stepped up considerably, as did the collection of books and natural history specimens.10

By grooming the Physical Society to conform to the community image of what a valuable organ of the Zurich Enlightenment should be, Dr. Hirzel further adapted scientific discourse to Regime interests. The most significant social development of the scientific organization in the years after the move into the Zunfthaus zur Meise was the steady rise of patrician participation. Middle citizens continued to dominate scientific performance, but their work grew to reflect the more aristocratic atmosphere. Locally-descriptive papers with natural historical, economic, and public health themes prevailed. Research in "purer" or more "exact" fields of study (such as higher mathematics, astronomy, physics, and chemistry) languished.
Performers: Professional and Patrician

In the 13-year "growth" period of the Physical Society (1746-59), balance existed within the circle of working Ordinaril between patrician and non-patrician members. The reader may remember (from Chapter Three **) that six of the founding Ordinaril came from the middle or general citizenry. * Five of them belonged to the patriciate. ** That balance soon changed, however. Between the meetings of 31 August 1746 and 9 January 1747 nine men joined the cast of performers; eight of them were non-patricia *** Only 39-year old Captain Johann Heinrich Schultess, the proprietor of the house "zur Limmattburg", entered with the prestige of a patrician. With 14 of the 20 Ordinary members at the beginning of the first working year

* Dr. Johannes Gessner; Dr. Johann Heinrich Rahn; Dr. Hans Jakob Schultess; Dr. Hans Jakob Gessner; surgeon Hans Ulrich Friess; and clockmaker Hans Ludwig Steiner.

** Captain Hans Heinrich Escher; bailiff Hans Conrad Meyer; chancellery clerk Johann Conrad Heidigger; Junker Hans Ulrich Blaarer; and merchant Johann Jakob Ott.

*** Dr. Hans Caspar Hirzel (a 21-year old M.D. who had just returned from Leyden); 31-year old Dr. Hans Conrad Meyer "zum Felsenegg"; 32-year old professor of theology Johann Jakob Gessner; 52-year old pastor Hans Jakob Gessner; 29-year old pastor Hans Heinrich Gossweiler; 41-year old coppersmith and engraver Johann Jakob Wirz; and 24-year old engraver Hans Felix Corrodi.

Appendix B surveys the performing group of Ordinary members from the beginning of the fellowship to 1798.
occupied as either a medical doctor, pastor, professor, or as an artisan, the traditional middle citizen domination of local scientific discourse was sustained. Private enclaves of the Ordinarii outnumbered public assemblies designed for the entire Society. Three medical doctors — Gessner, Hirzel, and Stadtarzt Meyer — alone presented half of the 28 papers in 1750.11

Yet the working membership tended toward social equilibrium over the remaining course of the first stage of Physical Society history. Two of the factors which rescued the struggling organization from possible oblivion in the 1750's — the procurement of public lottery funds and the move into the Meisen — encouraged greater aristocratic participation in both classifications of Society membership. Between 1747 and 1760 only three additional middle citizens were elected into the performing group. One of them, 30-year old Johann Jakob Koechlin, was elected in 1751 primarily to act as the Society librarian. Another, Dr. Salomon Schinz, elected in 1758, was a recent graduate of Leyden and Johannes Gessner's prized pupil. However, during the same period, six patricians joined to work as Ordinaria.**

The state of the early working membership suggests several salient points about the organization's development. First of all, the number of additions to the charter group of performers

* The other middle citizen to become an Ordinaria was 26-year old deacon Rudolf Freytag in 1754.

** They included: 26-year old Hartmann Rahn (the son of the proprietor of the Niederdorftor dye-works) and 28-year old Johann Caspar Scheuchzer "aus dem Lindenhof" (the treasurer of the Society's lottery fund) elected in 1747; 22-year old
was small. The Society added only nine men between 1747 and 1760 to the original circle of 20 Ordinarii. Moreover, only three of them were middle citizens who saw scientific work as a means of livelihood. The six new patricians, averaging 27 years old, saw science best perhaps as rational entertainment or as an appealing form of polite knowledge that helped to round out their community image of mature gentlemen. But, even though they contributed no measurable scientific work to the Society, they were crucial to the organization's success. When they joined they had, still, too weak a stake in the concerns of the Regime to use science as a means to ratify ruling class principles; but, later in their careers, during the period of the Economic Commission and after, their belief in the value of organized science served to stimulate state support for the Society.

Secondly, the small number of new performers underlined the greater importance of the charter members. Dr. Johannes Gessner, Dr. Hans Caspar Hirzel, and Dr. Hans Conrad Meyer dominated scientific performances into the 1780's. Table 11 illustrates that in the organizational hierarchy there was little turn-over. In the 54-year life of the Old Regime Physical Society, there were only two presidents, five quaestors, and seven secretaries. Only eight of them had not been elected on 21 September 1746. Gessner presided over the botanical commission and over the general society until he tied (at 81) in 1790. Then, 65-year

Salomon Hirzel, elected in 1749; 33-year old Heinrich Rahn, elected in 1751; 25-year old Heinrich Lavater, elected in 1756; and 30-year old Johann Heinrich Schinz, elected in 1757. The two Rahns and Schinz belonged to commercial families; the others came from the Rentier class.
Table 11

Officers of the Physical Society and Their Terms in Office, 1746-1798

<table>
<thead>
<tr>
<th></th>
<th>President</th>
<th>Secretary</th>
<th>Quaestor</th>
</tr>
</thead>
<tbody>
<tr>
<td>Johannes Gessner</td>
<td>1746-90</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Johann Heidegger</td>
<td></td>
<td>1746-52</td>
<td>(&quot;of scientific affairs&quot;)</td>
</tr>
<tr>
<td>Hans Ulrich Blaarer</td>
<td>1746-53</td>
<td></td>
<td>(&quot;of economic affairs&quot;)</td>
</tr>
<tr>
<td>Hans Conrad Meyer</td>
<td></td>
<td></td>
<td>1746-59</td>
</tr>
<tr>
<td>Hans Caspar Hirzel</td>
<td>1790-1803</td>
<td>1752-59</td>
<td>1759-90</td>
</tr>
<tr>
<td>Salomon Schinz</td>
<td></td>
<td>1759-78</td>
<td></td>
</tr>
<tr>
<td>Johann Heinrich Orell(i)</td>
<td>1778-90</td>
<td></td>
<td></td>
</tr>
<tr>
<td>David Rahn</td>
<td></td>
<td></td>
<td>1790-96</td>
</tr>
<tr>
<td>Johann Heinrich Rahn</td>
<td></td>
<td></td>
<td>1790-1803</td>
</tr>
<tr>
<td>Caspar Scheuchzer</td>
<td></td>
<td>1751-87</td>
<td>(of the lottery fund)</td>
</tr>
<tr>
<td>Hans Conrad Lochmann</td>
<td></td>
<td>1787-1814</td>
<td>(of the lottery fund)</td>
</tr>
</tbody>
</table>
old Dr. Hans Caspar Hirzel (an Ordinaria since autumn 1746) succeeded him. He sat in the president's chair until 1803 (he was then 78), after having already served as secretary and quaestor. Another charter member, Johann Jakob Ott, presided over the Economic Commission into the 1770's. Like the state formula which called for annual democratic elections but which in fact permitted the perpetual rule of gerontocrats, the Physical Society allowed its regents life-long tenure. Article Nine of Heidegger's constitution suggested only a vague avenue by which to reappraise elected officials. Though this situation may have obstructed the penetration of new ideas into the arena of Society discourse, it also assured institutional continuity, peace, and stability.12

Young men did stream into the fellowship. Of the 127 Honorary members admitted to the fellowship between 1746 and 1798 with known birth dates, nearly 80% of them (101) were 37 years old or younger at the time of their entry. Fifty-four per cent were between 21 and 31 years old and 20% were 23 or younger. The now Ordinarii were even younger when they were elected; their median age (1746-98) was 24.*

However important the growing pains of Zurich youth were to the foundation and ensuing history of the Physical Society, seniority and the precedence of elders came to play a major role in the organization. The charter members had a striking survival rate. Table 12 shows that 12 of the Society organizers lived into their mid-sixties. By 1770 only five of the founders had died. In 1790 five of them

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* If calculated by decade, the figure deviates only slightly, rising only as high as 27 (1746-49) but dipping as low as 22 (1770-79).
### Table 12

Year of Death and Age at Death

of 12 Founding and 10 Early Ordinary Members

<table>
<thead>
<tr>
<th>Founder</th>
<th>Year of Death</th>
<th>Age at Death</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. Hans Caspar Schulthess</td>
<td>1804</td>
<td>95</td>
</tr>
<tr>
<td>2. Hans Conrad Lavater</td>
<td>1795</td>
<td>84</td>
</tr>
<tr>
<td>3. Hans Ulrich Blaarer</td>
<td>1793</td>
<td>76</td>
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<tr>
<td>4. Johannes Gessner</td>
<td>1790</td>
<td>81</td>
</tr>
<tr>
<td>5. Hans Caspar Ott</td>
<td>1790</td>
<td>75</td>
</tr>
<tr>
<td>6. Johann Heinrich Rahn</td>
<td>1786</td>
<td>77</td>
</tr>
<tr>
<td>7. Hans Ulrich Friess</td>
<td>1786</td>
<td>70</td>
</tr>
<tr>
<td>8. Johann Heinrich Orell</td>
<td>1785</td>
<td>70</td>
</tr>
<tr>
<td>9. Hans Ludwig Steiner</td>
<td>1779</td>
<td>68</td>
</tr>
<tr>
<td>10. Johann Conrad Heidsegger</td>
<td>1778</td>
<td>68</td>
</tr>
<tr>
<td>11. Hans Heinrich Escher</td>
<td>1777</td>
<td>64</td>
</tr>
<tr>
<td>12. Hans Conrad Meyer</td>
<td>1766</td>
<td>64</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Ordinary</th>
<th>Age at Death</th>
<th>Year of Joining</th>
<th>Yr. of death</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. Salomon Hirzel</td>
<td>91</td>
<td>1749</td>
<td>1818</td>
</tr>
<tr>
<td>2. Hans Caspar Hirzel</td>
<td>78</td>
<td>1746</td>
<td>1803</td>
</tr>
<tr>
<td>3. Johann Jakob Gessner</td>
<td>83</td>
<td>1747</td>
<td>1787</td>
</tr>
<tr>
<td>4. Johann Heinrich Schulthess</td>
<td>75</td>
<td>1746</td>
<td>1782</td>
</tr>
<tr>
<td>5. Hartmann Rahn</td>
<td>74</td>
<td>1747</td>
<td>1795</td>
</tr>
<tr>
<td>6. Hans Conrad Meyer, Dr.</td>
<td>73</td>
<td>1746</td>
<td>1788</td>
</tr>
<tr>
<td>7. Ludwig Steiner</td>
<td>73</td>
<td>1747</td>
<td>1761</td>
</tr>
<tr>
<td>8. Johann Caspar Scheuchzer</td>
<td>69</td>
<td>1747</td>
<td>1788</td>
</tr>
<tr>
<td>9. Heinrich Rahn</td>
<td>69</td>
<td>1751</td>
<td>1785</td>
</tr>
<tr>
<td>10. Johann Jakob Koechlin</td>
<td>66</td>
<td>1751</td>
<td>1787</td>
</tr>
</tbody>
</table>
still lived on. Ten of the fifteen Ordinarii added to the original fellowship between September 1746 and the end of 1751 lived to be at least 66 years old. The result was that the average age of the performing membership increased significantly. From 1746 that age rose by 14 years from 35 to 49.*

The age difference between the important troupe of surviving charter members and the working initiates was a matter of at least 20 years by 1760 and of over 40 years by 1780. This widening chronological split worked to reinforce the pedagogical aspect which the fellowship had had since Gessner's preparatory course. Those young citizens chosen to act as Society players were usually protégés or relatives of members. Over the decades many former star pupils of Johannes Gessner became part of the Ordinaria, including Hans Caspar Hirzel, Salomon Schinz, Johann Jakob Koechlin, David Breitinger, Johann Heinrich Rahn, and Paul Usteri. Hirzel, rahn, and Usteri also were the second, third, and fourth presidents of the Physical Society, succeeding Gessner. Twenty-eight performers of the eighteenth century organization came from eight families: there were six Rahns, four Schinz, and three Gessners, Schulthess, Lavaters, Usteris, Schauchzers and Eschers.

Scientific Performances, 1746-1759

At the October 1746 meeting of the Physical Society in the house of the Black Garden, fifteen Ordinary members accepted the

* The average age of the Ordinarii was 35 in 1746; 36.5 in 1750; 42 in 1760; 43 in 1770; 49 in 1780; and 46 in 1790.
responsibility to make scientific presentations during the year 1747. Johannes Gessner chose to deliver papers in mathematics, physics, and natural history, while reviewing for members Berlin’s Histoire critique. Dr. Rahn, who had studied medicine at the University of Halle and who had travelled extensively in the German states, offered to survey journals from Leipzig and to prepare papers on medicine and chemistry. Professor Johann Jakob Gessner (Johannes’ brother) decided to review the Nova acta eruditionis Lipsiensia and the Nouvelle bibliothèque germanique. Merchant Johann Jakob Ott proposed to review Italian journals and to study topics in mathematics and botany. Professor Johann Kramer committed himself to report on the literature he found in Göttingen journals. The other nine men volunteered to perform general research: Dr. Schulthess in natural history and materia medica; Stadtarzt Meyer and Surgeon Friess in anatomy; Quaestor Meyer in the arts; Pastor Gossweiler in natural history; Captain Schulthess in agriculture; Coppersmith Wirz and Clockmaker Steiner in mechanical technology; and Felix Corrodi in painting and optics. These contributions constituted the first agenda of the nascent scientific organization.

What was the nature of the scientific work which resulted from these elaborate plans? To answer that question we shall survey the themes of 657 papers read before the fellowship during the first 15 years of Physical Society activity (1747-1761). Though this analysis of lecture topics in not inclusive — the records for 1751-54 are incomplete and the record for 1755 is completely missing — it nonetheless indicates the thrusts of
scientific work made by the Ordinarii in the early stage of the organization's history.13

Table 13 shows the 657 papers divided into five principal fields of physical inquiry for two time periods (1747-54 and 1756-61). These fields include: (1) descriptive sciences (i.e. natural history, botany, zoology, topography, travel literature); (2) technology; (3) exact sciences (i.e. mathematics, physics, chemistry, astronomy, meteorology); (4) medicine; and (5) philosophy. Only two of these fields — technology and medicine — parallel divisions of physical knowledge outlined by Johannes Gessner’s "Plan of Affairs". Whereas Gessner saw "Natural Philosophy" (including "general physics", "mechanics", "hydraulics", "hydrostatics", "aerometrics", and "optics") and "Natural History" (including "astronomy", "geography", "hydrography", "meteorology", "lithology", "botany", and "zoology"), here we organize those sub-fields under the modern labels of "descriptive" and "exact" sciences. Though Gessner and his Physical Society did not understand physical knowledge organized by such a concept, it differentiates for us more clearly than does Gessner's scheme the Society's degree of interest in practical versus theoretical subjects and in qualitative versus quantitative methods of research and languages of presentation.

Table 13 shows that 164 of the 657 papers (25%) centered in work within an exact field of physical knowledge (19 in mathematics and 145 mostly in physics and meteorology). It shows too that the greatest number of papers (234, or 36%) concerned descriptive sciences
Table 13

Division of Physical Society Papers,
Presented between 1747-1761,
Into Five Principal Fields of Study

<table>
<thead>
<tr>
<th>Field of study</th>
<th>1747-54</th>
<th>1754-61</th>
<th>Percentage of papers, 1747-54&lt;sup&gt;+&lt;/sup&gt;</th>
<th>Percentage of papers, 1754-61&lt;sup&gt;-&lt;/sup&gt;</th>
<th>Percentage of papers, 1747-54&lt;sup&gt;+&lt;/sup&gt;&lt;sup&gt;+&lt;/sup&gt;</th>
<th>Percentage of papers, 1754-61&lt;sup&gt;-&lt;/sup&gt;&lt;sup&gt;-&lt;/sup&gt;</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. Descriptive sciences</td>
<td>234</td>
<td>27</td>
<td>38</td>
<td>+11</td>
<td>36</td>
<td></td>
</tr>
<tr>
<td>2. Technology</td>
<td>131</td>
<td>16</td>
<td>21</td>
<td>+5</td>
<td>20</td>
<td></td>
</tr>
<tr>
<td>Sub-total</td>
<td>365</td>
<td>43</td>
<td>59</td>
<td>+16</td>
<td>56</td>
<td></td>
</tr>
<tr>
<td>3. Exact sciences (including math)</td>
<td>164</td>
<td>30</td>
<td>23</td>
<td>-7</td>
<td>25</td>
<td></td>
</tr>
<tr>
<td>4. Medicine</td>
<td>115</td>
<td>25</td>
<td>16</td>
<td>-9</td>
<td>17</td>
<td></td>
</tr>
<tr>
<td>Sub-total</td>
<td>279</td>
<td>55</td>
<td>39</td>
<td>-16</td>
<td>42</td>
<td></td>
</tr>
<tr>
<td>5. Philosophy</td>
<td>13</td>
<td>2</td>
<td>2</td>
<td>-</td>
<td>2</td>
<td></td>
</tr>
<tr>
<td>Total</td>
<td>657</td>
<td>100</td>
<td>100</td>
<td>-</td>
<td>100</td>
<td></td>
</tr>
</tbody>
</table>

* From "Protokolle der Ordinarii der Naturforschenden Gesellschaft", Zurich Staatsarchiv, B IX 172 (1746-1750) and B IX 173 (1751-1762)
(particularly botany and natural history. Usually the focus was local or regional.) One hundred and thirty-one papers (20%) concerned technology (predominantly agriculture) and 115 papers (17%) concerned medicine. The fewest numbers of papers (13, or 2%) had a formal philosophical orientation.

Dividing the lecture themes into an early (1747-54) and later period (1756-61) suggests one result of the changing social outlook of the membership during the first stage of Physical Society history. Before the move into the Neisen in late 1756 — when private enclaves of middle citizen-dominated Ordinarii prevailed over general meetings — performers dealt more in such subjects as mathematics, physics, and medicine than they did in the later period. Work in exact sciences fell from 30% in the early period to 23% in the later period, and work in medicine fell from 25% to 16%; together loss amounted to 16%. It was compensated by an increase in performances in descriptive sciences (they rose from 27% to 38%) and in technology (they rose from 16% to 21%). Work in philosophy remained constant at 2%. The discourse of the local Naturforscher appeared to be moving away from fields of uniquely professional occupation to those of broader civic (specifically, patrician) application.

In the first stage of its history, the Physical Society spent about 1900 guilder on research instruments. More than half (approximately 1000 guilder) was spent before 1750 on such items as the double cylinder airepump and the azimuthal quadrant. The Ordinarii had also purchased an armillary sphere, a pendulum
dock, an electrical machine, cylindrical and conical mirrors, sundials, and a number of magnetic needles.\textsuperscript{14} The availability of these instruments stimulated research in the more exact sciences (30\% of all papers before the Society between 1747-54). The azimuthal quadrant (an arc of 45 degrees graduated to measure 90 degrees, with a moveable radial arm carrying a sighting pin), for instance, measured the altitude of heavenly bodies. All members could use it, though it was mounted in a small tower of Society member Johann Jakob Ott's house "in der Schipfe". Dr. Gessner, whose special interests greatly influenced the Society's choice of programs and priorities and who was the foremost "exact" scientist of the fellowship, used these instruments to conduct major studies of basic physical problems: the motion of free-falling bodies, the pendulum, and the motion of projectiles, in 1749; the motion of heavenly bodies, in 1750; the nature and specific gravity of fluids, in 1754; and the principles of plane geometry and spherical trigonometry in 1757 and 1758.\textsuperscript{15}

Between 1750 and the move into the Zunfthaus zur Meise in 1756, however, the fellowship spent only a little more than 400 guilder on research instruments. Here too we can perhaps see a result of the changing social outlook of the Society membership during the first stage of its history. From 1756 to 1761 the percentage of papers in the exact sciences fell from 30\% to 23\% while the percentage of papers in the descriptive sciences rose from 27\% to 38\%. The most critical instruments in the later period were "aerometrical" (i.e. barometers and thermometers). They had
potential experimental value but were chiefly used for the purpose of describing the local and regional environment.

From the first days of the fellowship, the establishment of a botanical garden had the highest priority. Botany was Gessner's favorite field of study, an experimental garden his pet project. His ancestor, Conrad Gessner, had failed to convince Zurich's Reformation era authorities of the benefits to be derived from a publicly-financed garden. As a result, only small, poorly funded, and miserably organized gardens existed in the city.  

Between 1747 and 1761 Gessner wrote several major academic dissertations on botanical topics, on plant morphology, physiology, and habitat, and began a multi-volume dictionary of plant types. Dr. Hans Caspar Hirzel, during his address in celebration of the Society's first meeting in the Meisen, praised Gessner's horticultural collection (Hortus siccus Societatis Physicae tugurineae, collectus et Linnaeana methodo dispositus a Joane Oesnero. A. 1751.) as "the greatest credit" ("die grösste Zierde") to the fellowship. *  

* "Die grösste Zierde unsers gesammleten Vorraths machet die Sammlung ausgetrockneter Krauter aus, welche aus 36 Bänden in gross Regal-Folio besteht, deren jeder 200 Blätter enthältet, und daher auch an der Zahl der Pflanzen wenig seines gleichen hat, so wie sie sich in der gründlichen und geschickten Einrichtung besonders ausnimmt. Es ist diese die Frucht einer fast 30 jährigen Bemühung und besten Zeitvertreibs unsers theuresten Herrn Vorstehers, der schon von seinen kindlichen Jahren an, mit einem ausserordentlichen Fleiss, die Krauter und andere natürliche Corper zu sammeln angefangen, und es darinnen so weit gebracht, dass er schon in seinen ersten Junglingsjahren (nach dem Zeugniss des berühmten Hallers in seiner Vorrede zu der Pflanzengeschichte des Schweitzerlandes) durch eine weitläufiges Kenntnis in der Naturhistorie sich die vertraute Freundschaft des
The English visitor William Coxe, though in his *Travels in Switzerland* highly critical of the Society's instrument collection, thought that:

> the curiosity of the naturalist will be amply gratified by a view of the library and cabinet of Mr. John Gessner, professor of physics and canon of the cathedral, who inherits the seal for natural history which characterized his great ancestor Conrad Gessner.

Gessner's herbarium — the result of 30 years effort — contained more than 3000 dried plants and several hundred types of moss and grasses, all classified according to the Linnean system.

On 15 January 1748 at the first meeting of the Society's second working year, the circle of Ordinarii elected Gessner to head a botanical commission responsible for creating and maintaining a public garden. The commission was comprised of four other leading members: Quaestor Meyer, scientific affairs secretary Heidegger, Johann Jakob Ott, and Dr. Johann Heinrich Rahn (appointed treasurer of the 200 guilder per year "Botanical Fund"). Five patrician Honorary members belonged as well: guildmaster Hans Conrad Escher (d. 1755), Heinrich Schulthess "von Rottingen" (1707-82), Hans Conrad Gossweiler "zum Güggenhuhrli" (d. 1771), Jakob Pestalutz "zum Brünneli" (1707-82), and

(cont.) "unsterblichen Boerhave erworben hat. Auf die Einrichtung dieser Sammlung hat unser große Pflanzenkenner sein ganzes Kenntnis in diesem Theil der Naturhistorie angewendet, um die Geschlechter und Gattungen der Pflanzen mit Gewissheit zu bestimmen, und denselben ihren wahren Namen beyzuschreiben.

Er bediente sich, in Ansehung der Ordnung, des Linnaischen Systems, und zeigte meistens den Linnaischen Namen, nach der in seinen Speciebus entsprechenden Nummer an".

Hirzel, "Rede von dem Einfluss der gesellschaftlichen Verbindungen", *Abhandlungen der Naturforschenden Gesellschaft*, I: 63-64.
Captain Johann Heinrich Orell (1715-85). All nine of Gessner's botanical commissioners served as ruling councillors; two were future burgermeisters. On 10 September 1748 they closed a contract with dye manufacturer Heinrich Rahn "in der Farb" to rent (at the price of 30 guilders per year) a 22,000 square foot piece of his property adjacent to the Limmatburg. After a quick ratification of the contract by the Ordinarii, Gessner began to supervise the preparation of the ground.

In the spring of 1749 the botanical commission sowed its first seeds in Zurich's first public garden. The city's private gardeners donated many seeds; but the greatest curiosity centered upon the fortune of two packages of seeds sent to Gessner by naturalists from outside of the Confederation: from Gleditsch, the director of the Berlin botanical garden, and from Johann Georg Gmelin, a well-known Naturforscher who had collected seeds from as far away as Siberia. A small "Gartenhaus" was built to preserve plants over the long harsh winters. By the summer of 1751 Gessner lectured both to Society fellows and to paying visitors in a large, well-organized and finely tended teaching and experimental garden. Between 1748 and 1760, (when Rahn decided to reclaim the use of his property to expand his dye-works and forced the Society to move the location of its garden) the organization spent nearly 3000 guilder on the garden. On the list of expenditures this figure ranked second behind only that spent on books. It was clearly more than the sum spent on research instruments. Gessner's plan of action appeared most concretely as a plan for botanizing. His predilection for gardening suited
the aristocratic taste of eighteenth century Zurich. Its burgers enjoyed the role of rustic philosopher, plowing furrows with beribboned plows or digging in the dirt among cabbages and potatoes.

* * *

The factors which explained the birth and initial development of Zurich's Physical Society were not necessarily those which explain its continuity. Youthful enthusiasm for a new community instrument of Enlightenment, the fortunate timing of generational turn-over, professional concern over the public situation of scientific learning, and the delivery of an articulate and intelligent package of institutional norms, goals, and environment were the conditions which determined the early history of the Gessner fellowship. Other circumstances, however, saved the body from becoming defunct. First, in the early 1750's, a committee of members built for their company a secure financial base through the profits of a public lottery. Secondly, in late 1756, the Society moved its meetings from the peripheral Limmattburg to the centrally-located, aristocratic Zunfthaus zur Meise. Finally, in 1759, it created a special sub-group devoted to economic issues and the practical improvement of the canton's agriculture. A significant wave of important new members entered the fellowship, attracted not only by the current enthusiasm for physiocratic literature and back-to-nature philosophy, but also by the real advantages of rational exploitation of the countryside. By the
mid-1760's the Physical Society stood, in no less than the opinion of Bodmer, as the healthiest polite association in Zurich.
VI. THE SOCIAL PROGRAM OF THE ECONOMIC COMMISSION, 1760-1779

In 1759 the Physical Society created a special "Economic Commission" to turn the study of nature toward the practical improvement of cantonal agriculture. From 1760 to 1798 affairs of this body so dominated the life of the larger fellowship that most contemporaries thought of it as the "physikalisch-oekonomischen Gesellschaft". Agricultural essay competitions highlighted the season's agenda. In 1767 the Society adopted its first seal: the "Sigilum Soc. Phys. Turicensis"; it showed a concave mirror concentrating the sun's rays onto an altar ornamented with the physician's symbol, flowers, a plow, a hoe, and a shovel. (See Appendix G.) While other spheres of scientific activity continued, they were shadowed by the activities of the Economic Commission.

* * *

Agricultural Enthusiasm

Commissions were an accepted part of Old Zurich's administrative formula. After the Reformation the ruling councils had created over 70 commissions to handle every arena of civic business from marriage and dress to sanitation and fishing. The Physical Society had itself already in the first years of life organized small working committees. In September 1748 Johannes Gessner had approved
of a section to investigate the establishment of the botanical garden. He appointed the lottery committee and the committee to relocate to the Meisen. Other committees maintained the library or purchased and cared for instruments and natural history relics. Later, one supervised the erection of a new observatory in a tower of the Grossmunster. On at least two occasions, Society commissions joined with state agencies. In 1771 the Regime, convinced of a mercantile need to regulate the economy, called upon an "Ehrenkommission" to study cantonal dependence upon imported grain. Most of its members were Economic Commissioners of the Physical Society. In 1780 the ruling councils created the "Hoch-Obrigkeitslische landwirtschaftliche Kommission", an official state commission on agriculture formally distinct of the Society commission but with nearly an identical membership.¹

The Physical Society's specific attachment to economic matters did not make it a scientific institution unique to Europe. Every variety of polite association during the Enlightenment seems to have enjoyed agricultural enthusiasm at some time. Over 300 national, provincial, and local learned societies developed in Europe devoted to social and economic progress in the countryside. The great international academies at Berlin, London, and Paris — bodies which one customarily considered to have dealt principally in theoretical fields — deliberated extensively on matters relating to farming and manufacturing.²
Prize essay competitions asking predominantly for scientific applications came to characterize European academic life. The Prussian Academy, for instance, sponsored "Preisfragen" involving the introduction of fodder crops, the scientific uses of fertilizer, the uses of the sugar beet and potato, enclosures, stallfeeding, and convertible husbandry. Zurich's Economic Commission shared interest in these issues. Berlin, in fact, preferred economic Preisfragen to those of Geisteswissenschaft at a rate of 56 to 10 in the last quarter of the century. The great annual celebrations, usually in May, when a distinguished society announced its prize question and the 100 ducat first place award of the previous year, stimulated the best minds of Europe to submit essays. By offering such tribute, academies helped to channel research into certain issues and away from others. In Germany the professional dependence of Naturforscher on political authorities (interested in state development and its concomitant socio-economic meanings) led scholars to such reforms as the reduction of serfs' obligations, the abolition of wasteful feudal privileges, and the improvement of tenants' rights.

Switzerland's version of this economic movement rooted quickly in urban organizations like Berne's "Schweitzer Landwirtschaftsgesellschaft" (founded in 1758) and Zurich's Economic Commission. The Bernese society developed into a vast network of agricultural correspondents with daughter societies in the Emmental and Simmental, and in Nidau, Lausanne, Vevey, Fayerne,
and Yverdon. Other Swiss towns followed their leaders: Soleure and Biel citizens founded "oekonomische Gesellschaften" in 1761 and 1767 respectively; Genevois created the "Société pour l'encouragement des arts et de l'agriculture" in 1776; Baselers organized the "Gesellschaft zur Beförderung des Guten und Gemeinnützigen" in 1777; burgers of Chur (Coire) gave birth to the "Gesellschaft landwirtschaftlicher Freunde in Bündten" in 1779; and Neuchâtelois founded the "Patriotische Nacheiferungsgesellschaft" in 1791.

Even before the formulation of Zurich's Economic Commission in 1759, agricultural concerns had played an important role in Physical Society affairs. On 21 September 1746 Gessner accepted Captain Johann Heinrich Schulthess's offer to review agricultural literature for the fellowship. Schulthess presented several papers with economic themes before the Society in the late 1740's and 1750's. He called the group's attention to reports of the Prussian Academy's "Preisaufgaben" in the local "Freimüthige Nachrichten von neuen Büchern und anderen zur Gelehrsamkeit gehörigen Sachen" (edited by Bodmer and Breitinger between 1744 and 1755). Also, in the 1750's, scientific affairs secretary Heidegger outlined a number of economic problems for Society discussion. Subsequently they became central issues for the program of the Economic Commission. In fact, between 1747 and 1754 over 16% of the papers read before the body had an announced agricultural theme; a number of others had geographical or
meteorological themes with agricultural import. 

The original Economic Commission of 1759/60 consisted of six working Ordinarii: merchants Johann Jakob Ott (elected director) and Johann Heinrich Schinz; military officers Johannes Beyel and Caspar Schinz; banker Heinrich Schulthess; and Dr. Hans Jakob Gessner. A year later five more men became Commissioners: Statthalter Felix Nuscheler; guildmaster and director of the city granary (Kornmeister) Hans Caspar Schaufelberger; clerk of cantonal accounts (Landschreiber) Hans Caspar Waser; and canton finance directors (Seckelmeister) Johann Conrad Heidegger (he had resigned his secretariate in 1752) and Johann Heinrich Orell. 

Many of these men had spent a large chunk of their childhood and adolescence in the Zurich countryside. They were sons of rural pastors, of land proprietors, military officers, bailiffs, and governors. Johannes Gessner lived as a boy at his father's parsonage in the village of Wangen. Dr. Hans Caspar Hirzel, a later Commissioner and second president of the Society, wrote that husbandry had been the favorite amusement of his early days:

I resided in the abbey of Cappel from my ninth to my sixteenth year, the age more than all others when the mind is susceptible to lasting impressions. [His father was the abbey's intendant.] So extensive a tract of land, farmed under my observation, furnished me with countless opportunities for enlarging and completing my acquaintance with the various branches belonging to the cultivation of land, and the breeding and increase of cattle. I went through the whole rotation of country business, constantly sharing the occupations of the laborer, according to the vicissitudes of the seasons. As I advanced in years, I employed the hours of relaxation from study in conversing with the most intelligent husbandman
I could meet. Our discourses generally turned upon agricultural defects and remedies that might be applied. I was then convinced of the advantages attending a rural life. The natural beauties of the countryside, so profusely diversified, delighted my senses, and influenced my choice of a professional study associated with the contemplation and analysis of Nature."

As adults, many of these men sowed grain with a drill, plowed furrows, and inspected manure piles. Commission president Johann Jakob Ott, hoe in hand upon his small farm "im Röthel" near Wipkingen in the Limmat Valley, experimented with fertilizers and fodder crops, cultivated potatoes, planted mulberry trees in the hope of providing food for a crop of silk worms, and took regular readings from seven thermometers set to seven different depths in the soil. He aimed to test the rate of geothermal transmission. When Heinrich Rahn decided in the fall of 1760 to expand his dye-works and forced the Society to abandon its original garden, the fellowship accepted Ott's offer to relocate many plants, fruit trees, and irrigation pipes on his farm. It replanted some specimens in the private gardens of members Johann Martin Usteri "im Thaleck" and Georg Stocker in Stadelhofen. Those plants remained until 1767 when the Society made an arrangement with the city to lease five acres of land "zum Schimmel" in Wiedikon, where a new garden was established.*

"The Rural Socrates"

Shortly after the establishment of the Economic Commission, the Physical Society decided to publish its first collection of papers. For nearly 15 years the fellowship had not seen a need to circulate news of its transactions widely. The organizers' intent had not been to publicize the work of any of its members; rather, it was simply to investigate the natural history of Zurich's own region and to make that natural knowledge as useful as possible to the Fatherland. The editor of the collection noted the reason for the change of policy in a preface to the Abhandlungen der Naturforschenden Gesellschaft in Zürich (1761): a growing number of Society members worried that the lack of an organ moved people to think that the association of naturalists really did not do anything. It was time, therefore, to venture a little publication even if a number of the potential readers of the work


Mit grosser Freude ging die Gesellschaft im Frühjahr 1767 an die Anlegung und Einrichtung des Gartens, wobei sich namentlich Dr. Joh. Georg Locher und Dr. Johannes Scheuchzer auf's eifrigste bethatigten. Auch dieser Garten wurde nach Gessner's Anleitung nach dem Linne'schen System geordnet. Die nötigen Mittel für die erste Einrichtung lieferte der bereits auf 1600 Gulden angewachsende botanische Fond".

Ferdinand Rudio, Festschrift der NGZ, 200.
had not even as yet heard of the Physical Society.

In 1761 'Heidegger und Compagnie' printed the first of three small-sized volumes, or Bländchen, of Abhandlungen der Naturforschenden Gesellschaft in Zürich.* Volume One contained 13 articles, most of which had economic themes: (1) a copy of Hirzel's address of 10 January 1757 celebrating the Society's early history and its relocation into the Meisen; (2) Johannes Gessner's January 1747 speech on the ecological circumstances of Zurich; (3) a short description of the agriculture of Appenzell by Laurentius Zellweger [the Society soon elected him one of its first 'Ehrenmitglieder']; (4) a report by Heinrich Schinz, Jr. on a new method for storing grain in the city; (5) anonymous observations on the effectiveness of quinine in the treatment of various illnesses; (6) a report by Johann Conrad Heidegger on the experimental use of peat in the fields of Rüti near Zurich; (7) Dr. Gessner's report on ways to preserve grain; (8) surgeon Hans Rudolf Burkhard's confirmation of Albrecht von Haller's work on insensitive parts of the human body; (9) instructions to the Zurich peasantry concerning techniques by which to graze and care for cattle; (10) Hirzel's essay on the domestic economy of a "philosophical farmer" in the rural canton; (11) Captain Johann Heinrich Schulthess's proposal to remedy corn blight; (12) Dr. Salomon Schinz's description of a curiosity from the vegetable kingdom; and (13) Hans Conrad Meyer's meteorological observations.

* Appendix F includes a photocopy of the title page of the first volume of Abhandlungen and photocopies of the original tables of content for volumes I-III.
The most important work of this collection is Hirzel's "Die Wirtschaft eines philosophischen Bauers". This essay, which came to exemplify the urban creed of humble rustic virtue so dominant in the Economic Commission program, related the success story of a real peasant, Jacob Guyer, locally nicknamed "Kleinjogg". He had inherited a small and decaying farm near "Wermatswil bei Uster" on the plain east of the Greifensee some 12 kilometres from Zurich. Little Jake and his farm were so saddled with debt that neighbors doubted that they could ever prosper. Yet, Hirzel told his reader, due to Kleinjogg's industry, to his moral virtue, and to his use of certain agricultural techniques (the use of manure, laborious mixing of soils, adding to compost slivers whittled on winter evenings from tree prunings), he was able to elevate his large household to a condition of rural comfort. [He supported a wife, six children, a younger brother and his wife, and their five children.]

Hirzel's essay enjoyed a sensational reputation. By the 1770's his "Philosophical Farmer" stood alongside Winckelmann's ancient Greek of "noble simplicity and sublime grandeur" and Rousseau's "noble savage" as one of the great classical embodiments of the Enlightenment's back-to-nature movement. Hirzel stirred his readers' emotions. He presented them with a simple husbandman who was an unspoiled child of nature. He contributed to the controversy as to whether the cultivation of the arts and sciences had done humanity more harm than good.
Immediately after its publication in Zurich, editors in other cities dug the work out of the Abhandlungen to reprint it. Basel's Johann Rudolf Frey (1727-1799), a mercenary serving Louis XV's France, translated it in 1762 for an editor in Lausanne under the title "Le Socrate Rustique". Subsequent French editions appeared in 1764, 1768, and 1777. In a letter to the editor of the 1762 edition, the elder Mirabeau reported that Kleinjogg's reputation was already established at Paris and that he considered Hirzel's piece "one of the most useful books which has ever been published, a sublime pre-eminence.... In everything Kleinjogg is my hero". German editions appeared in 1774 and 1785. Goethe came to Zurich for the first time in 1775 expressly to meet Kleinjogg. Prince Louis Eugen von Wurttemberg came to a meeting of the Schinznach Helvetic Society ten years earlier to meet the "philosophical farmer". When Prince met peasant, Hirzel reported that he embraced Little Jake teary-eyed and kept him at his side constantly for two days. In 1768 a Viennese printer offered a new edition of Hirzel's work and in 1777 an Italian translation appeared. Arthur Young sponsored an English edition of "The Rural Socrates" in 1770 with subsequent editions in 1773, 1776, and 1792. By the 1780's demand for new information about Kleinjogg had grown so great that Hirzel offered two long follow-ups to his original story: Neue Prüfung des philosophischen Bauers (Zurich, 1785) and Auserlesene Schriften zur Beförderung der Landwirtschaft und der hauslichen und bürgerlichen Wohlfahrt (Zurich, 1792). By then, Kleinjogg's fame had reached America. In 1792 a New Jersey printer brought out Young's translation into a new English edition, and in 1800 Benjamin Vaughn
(a distinguished member of the Massachusetts Society for Promoting Agriculture) published an edition on Kleinjogg at Hallowell in the District of Maine. 13

Though the "Rural Socrates" grew to be famous outside of Canton Zurich, his real function rested inside it. Jacob Guyer, after all, was simply a moderately prosperous and somewhat eccentric peasant. Perhaps he was shrewder or more beguiling than most. At any rate he became the "philosophical farmer". Zurich's agricultural enthusiasts ostensibly chose him to shape into a role model for the canton's subject population. Kleinjogg developed into an internationally acclaimed symbol of the back-to-nature movement because his attitudes and activities — at least as Hirzel described them — corresponded to an elite's idea of what a peasant should be thinking and doing. His basic function in the canton was to further the Economic Commission's program of rural rationalization. His simple rustic image assisted ideologically in the city's injunction against growing industrial activity in the countryside, activity which in creating rural entrepreneurs and a rural proletariat had serious social and political meaning for the fate of the Old Regime.

Zurich burgers, especially those like Hirzel who idolized the countryside, understood the city-country relationship as something other than economic and political despotism. They saw the canton's well-being as historically founded in an organic division of labor. They believed that the social order mirrored the natural order and vice-versa. In a "History of the Commerce of the City of Zurich and its Countryside" read before the Physical Society on 21 December
1761, Ordinary member Hans Heinrich Schinz (1725-1800) argued that equality in the canton meant inter-dependency. The "proper" activity of the rural folk was to farm and to supply the town with its sustenance. For Schinz, it was not tyranny for townspeople to possess an exclusive hold on crafts and certain trades. The canton was the creation of an economically-strong city. As an historian, he saw Zurich's "freedoms" originating in the strength of its commercial class to win imperial concessions in the early Middle Ages. In return for the town's promise to protect the countryside, Saxon emperor Heinrich I in 919 A.D. had given the burgers certain "Freyheiten über die Landleute". Among these freedoms, Schinz included the city's right to establish and maintain a relationship of mutually beneficial trade. He also recognized the right of urban councillors to act as the political guardians of the peasantry.\(^\text{14}\)

Schinz offered an historical justification of "enlightened patriarchalism". Capitalism had changed the world. Peasants knew only old ways; they could not adapt well to a new order by themselves. A wise Landesvater aware of both urban and rural circumstances could recommend benevolent programs for the improvement of the countryside. If the rural population was too backward to voluntarily make changes which might rationalize the life of the canton, the city regents with their God-given, imperial duty to maintain a harmonious territorial organism had Schinz's blessing to institute changes. Were they to improve the lot of the peasantry, they would enhance the common good of the state. In the 1760's Schinz and his fellow citizens failed to see the defects of this
approach: for those who lived into the late 1790's, rural folk made the defects crystal clear.

Dr. Hirzel painted an idealized portrait of Jacob Guyer which taught the viewer the proper social features of a Zurich peasant. He drew the man as "an uncommonly singular character" "void of pretension and ostentation" with "the most exalted faculties of the human soul". His genius was "natural" and his spirit was of "nobly engaging simplicity". He rose "to the sublime heights of philosophy entirely by means of his own genius, by his own reflections, and without the aid of books or the company of learned men".15 His strength of character was not reduced by frequent conversations with the inhabitants of some neighboring city to assume and be despised for affecting manners incongruous with the situation of peasants; much less one, whom the society of men of letters, or a superficial knowledge of books, has made a pretender to learning. Kleinjogg is obliged to Nature and to his own reflections for the wisdom he possesses; he owes nothing to art. Contented with his lot, he perseveres in refusing to accept an office that might give him consequence in the village where he resides. (16)

Never melancholic, Kleinjogg always showed "a smiling open appearance that disposes all the beauties of the soul to a skillful physiognomist".*

* The physiognomist and Physical Society performer Johann Caspar Lavater described Kleinjogg:

"There are few men whom I have examined so rigorously and whom I have observed on so many sides and on so many different occasions as Kleinjogg. I can truly say that I have not found one, a single one, who resembled himself so much in all points... He reflects nothing but what he is and what he was designed to be.... it was as if a faint image of ideal man fought to acquire life and distinctness in my bosom". Physiognomische Fragmente I, 234.
Kleinjogg began his daily work with a morning prayer, but being opposed to formal religious feeling without impulse or sincerity, he made no one in his household take part. Real peasant piety, he told Hirzel, manifested itself most clearly in efficient farming. Rural pastors would better serve their flocks by giving them agricultural lessons than by preaching subtleties no one cared or needed to understand. 17

Hirzel stressed that the success of the "Philosophical Farmer" proved how easy it was for a man to be happy "if he seeks only to procure true contentment in the fulfillment of his duty, instead of running after the phantoms of happiness and grandeur". Whenever Kleinjogg was questioned on subjects which did not respect his profession as peasant husbandman, or "the civil relations in which he stands placed as a member of society, he answers: I understand none of these things". 18 Hirzel responded to such a social posture "with veneration". "While I listened", he wrote, "my cheeks were moistened with tears and I fancied myself transcended into the company of one of the sages of ancient Greece". If all men tilled the soil and nourished themselves by the labor of their own hands, Hirzel concluded, "there would be no more treachery or violence, and tranquility and peace would reign everywhere". 19

For Hirzel, and for Zurich, the real perfection of Kleinjogg's character consisted in his conformity to an established position in an organically-conceived society. Kleinjogg recognized the Regime's patriarchal role. Hirzel stated that the peasant often repeated:
how many grievances would be redressed if the government and the laboring hand mutually concurred in promoting the common good. But the peasant is seldom enlightened enough to discern his real advantages. It must then be from the magistrates who are appointed by the State to watch over the good of the community that we can hope for relief. It is they who should prescribe to cultivators the best methods of husbandry, and exert the authority lodged in their hands to oblige the idle to work or punish their obstinancy. The public officers should inspect the conduct of every individual, leading back to their duties such subjects who have deviated from it, by reprimands, warnings, and salutary correction. The clergy might be particularly instrumental in admonishing their parishioners either from the pulpit or in their pastoral visits, to the uniform practice of the duties of Christianity. (20)

Hirzel responded with paternalistic praise for his obedient peasant. If all peasants fulfilled the duties of their station "with equal intelligence and assiduity", they, like Kleinjogg, would "draw upon their heads the benediction of Heaven and the universal esteem and approbation of Mankind". 21

It is significant to note that the main burden of Hirzel's essay -- the best known published piece of the eighteenth century Physical Society and the guiding spirit of the Economic Commission program -- was not really instruction in new agricultural techniques but instruction in moral behavior. Kleinjogg's farming practices were in truth conservative and favored empirical practicality (the rule of thumb). Though he used certain unusual methods (he preferred ox power to horse power since the former could be eaten when too old to work; he used lime, mixed soils, and much manure on constantly-tilled land; he favored enclosures) he argued that more intelligent use of already existing ways could improve agricultural production.
more than could any new crop or new tool. He believed book-farming foolish and felt that long hours of hard work was the cardinal principle of good farming. Hirzel applauded this approach:

I have no intention to deprecate the merit of those noble-minded fellow citizens who have appropriated a considerable part of their excess income to procuring new implements for husbandry; several sorts of grain and grass seeds, trees and shrubs unknown in our climate, which other countries have found profitable, as well as the experiments made with them before they were sent here. These public-spirited attentions of whose good effects we have already reaped some advantage undoubtedly merit our commendation and knowledge. The introduction of the potato, turkey corn or maize, and the progress in preparing turf or peat for fuel can be counted among the worthwhile efforts.

Yet, Hirzel decided, this kind of plan for improving Zurich's agriculture was more uncertain than Kleinjogg's plan. A peasant life of thrift and toil, with only the simple pleasures and basic comforts customary to his caste, was still the best way to realize the full natural capacity of the land.  

Preisfragen

According to Hirzel, Kleinjogg inspired two important practices of the Economic Commission: cantonal prize essay competitions, Preisfragen, and formal assemblies at which city fathers conversed with a selection of the country's husbandmen, the so-called "conversations with farmers", or Bauerngespräche. "These different operations of the Physical Society", Hirzel reported, "are the consequence of its connection with Kleinjogg. Thus the virtue of a single peasant life may extend its influence to the whole of human society."
In fact, both the idea for *Preisfragen* and for *Bauerngespräche* had circulated within the Physical Society before its association with Guyer. In the 1750's Heidegger had recommended both exercises; in 1758 he wrote two accounts of his own conversations with farmers. However, Dr. Hirzel's version served as a nice myth. As he supposedly was told by Kleinjogg:

The farmer imagines that he is better informed than yourselves in matters which concern him; and you must be careful not to oppose his opinion. You should rather flatter him and leave him to suppose that you have a high idea of his capacity, if you mean to excite his effort to emulate and incline him to such instruction.

Heidegger's intention hardly could have been more furtive.

The essay competitions turned into one of the most lasting procedures of the Society. At the first meeting of the fellowship in May of a given year, the president of the Economic Commission named the winners of the last contest and announced the new question. All answers then had to be submitted to the Commission by the last day of January. From February to mid-April the Commissioners studied the submitted papers, and on the third Monday of April they read abstracts of the answers before the general Society, recommended the prize worthy, and circulated the manuscripts among the *Ordinarii*. The amounts of the awards were small: two ducats to the winner, one ducat to second and third place, a half-ducat to places four through seven. But they served a local purpose. While the prize essay competitions of international academies functioned to attract big name intellectuals establishing criteria for measuring value and prestige, the contests of the Economic
Commission functioned to stimulate rural acceptance of the city's economic hopes for the immediate area. They focused on the care of cantonal forests, the preparation, collection, and application of manure, the mixing of soils, irrigation and land drainage, the use of new implements and new crops, and the cultivation of the vine. 26

The course of Society publications during this period mirrored their parochial emphasis. Only three authors whose work appeared in the Abhandlungen lived outside Canton Zurich: Dr. Laurentius Zellweger (author of a report on agriculture in Appenzell in Volume One [1761] and of some physico-medical observations in Volume Two [1764]) lived in Trogen near St. Gallen; Dr. Moritz Anton Cappeler (who wrote on the preparation and uses of a tartar emetic for Volume Three [1766]) lived in Lucerne; and Dr. Johann Georg Zimmermann (who wrote on dropsy for Volume Two) served as the Stadtarzt of Brugg. The Society decided to stop publishing the Abhandlungen in the midst of preparing the fourth volume; it chose rather to finance the circulation of economic instructions ("Anleitungen") to the countryside. Beginning in 1765 it sent these "Instructions" — edited abridgements of selected arguments made during prize essay competitions (which were not available in the book market) — to all rural parishes. Pastors were to post them in their school-rooms to instruct the young. Further, they were to promote them on their pastoral visits. The Society published "Instructions" yearly from 1771 to the end of the Old
Regime.

The first Preisfragen sponsored by the Economic Commission in 1762 asked a three-part question on the value of land enclosure:

(1) "In what cases are fences necessary and in what circumstances may they be omitted as superfluous or detrimental?"

(2) "Where fences are agreed to be detrimental, by what more suitable method can land be protected?"

(3) "Where fences are judged necessary, in what manner may they be rendered the most useful, according to different circumstances, or at least be attended with the fewest ill consequences?" 27

According to Hirzel, again, Kleinjogg had recommended this issue for the first agricultural contest because he had it particularly at heart to persuade the peasants of his community to consent to enclosing their common pasture, which is an extensive tract of land, very swampy and wet, and in its present state, of small advantage; but, in his opinion, when enclosed, capable of furnishing every farmer with food for a much greater number of cattle, while simultaneously augmenting manure production. 28

The decision to tackle an issue as important and highly controversial as enclosure illustrates very well both the appeal and the predicament of the Physical Society's economic program. Zurich's economists generally supported the movement to enclose the canton's common land. Their politics required it. According to the Economic Commission's calculation, only 217,424 acres of the canton's 475,276 acres were arable; they produced only 100,000 "Mutt" of grain annually (approximately one-third less than the
minimum required to feed over 150,000 mouths).\(^2^9\) Zurich, therefore, was an unfortunate dependent of German grain exporters. City thinkers held that agricultural intensification via the best utilization of vast unproductive land offered a way to lower food costs and perhaps even to self-sufficiency.

However, the closely-knit and firmly articulated socio-economic structure of the countryside inhibited the enclosure of common lands. The major problem centered in the difficulty of getting a general agreement to enclose from long interdependent villagers. They lived in an age old system wherein no man could use his land as he pleased and where methods and timing of work, as well as the allocation of fields, were fixed down to the smallest detail. The mass of Zurich peasants, like those all over Europe, greeted enclosure policies "grudgingly if not with downright hostility".\(^3^0\) Small farmers and squatters opposed them because they meant their dislocation; those men who were least capable of making their voices heard or their will felt (but ironically to whom the creed of humble rustic virtue most honestly applied) would be hurt most by enclosure of land into private parcels. Even village leaders opposed the movement. They administered common holdings as a way to control settlement in their community and to guarantee the livelihood of the established members of the village society. The more common property they administered, the higher the fee they received from newcomers wishing to settle there.\(^3^1\)
Some villages dominated by large landholders did favor enclosure. The Economic Commission mediated several enclosure disputes between neighboring villages sharing pasture. In the late 1760's, for instance, it investigated an argument between the three villages of Güntalingen, Ober- and Unterstannheim over their Allmend. Stannheimers supported the idea of enclosure, but Güntalingers objected, claiming both legal and customary rights. It became clear to all that completely free agreement was impossible so the case was reported to the Economic Commission. Though the idea of enclosure was principally at stake (Güntalingers argued that their livestock would suffer sorely from the loss of free grazing), even Stannheimers could not as a collective fully decide on the timing and terms of enclosure. In 1768 the three villages of Feuerthalen, Flurlingen, and Langwiesen became embroiled in a similar disagreement. Again the Economic Commission intervened. \(^{32}\)

How did the Commission react to these enclosure arguments? In both cases, it ruled to abolish common pasture. It argued, among other things, that enclosure produced a more hygienic village stock. Separate herds prevented the spread of fever and other diseases. However, though intent on agricultural intensification through the abolition of Allmend, the Commission, representative of the Old Regime, did not have the will to subvert the old land system. In negotiating these village disputes and in answering their legal claims, Commissioners referred to their agricultural tables and statistical data concerning population, production, and livestock conditions in the communities. The intention was to convince the
village leaders that enclosure was in their best interest and that they should adapt to it out of their own convictions; the city did not want to order them to do so.\textsuperscript{33}

Why such a posture? As Old Regime cantonal administrators, Commissioners understood intuitively that a program of Agrarian individualismus tipped the human bases of an old order. They wanted a voluntary transformation of the ancient cooperative system, but they could not pursue fully an absolutist or physiocratic land policy. That policy subverted the Regime's own feudal authority and its advantageous conditional property relationships. It made men fence off little islands of land, keep neighbors off it, and work to accumulate private wealth at the expense of the community. Zurich economists could not advocate (as French Physiocrats did\textsuperscript{34}) private property as an individual right while much of the state's authority remained contractual. Absolutism in the Swiss cantons, Jonathon Steinberg explains:

\begin{quote}
resembled the process of sawing off the branch on which one sits. If the absolutist abbot of St. Gallen tried to destroy the traditional rights of the 'free' Toggenburg valley, he would be destroying a part of his own rights, since both belonged to the same fabric of law and custom.\textsuperscript{35}
\end{quote}

Economic Commissioners found it impossible to support the peasants' dearest hopes; the abolition of perpetual land taxes, ground rents, the tithe, countless other feudal dues, and the end to urban economic monopolies would have opened the door to a system outside of the government's control.
Similarly, the Economic Commission could not enforce enclosure rulings, or any other agricultural "reform", without oppressive council mandates. Such exercise of authority would have surely caused widespread rural protests; it may have led to an even earlier end to the old Ständestaat than what in fact occurred. The only viable means to encourage an economic program was through an enlightened policy of patriarchal benevolence.

Kleinjogg served a further function. He favored enclosure, delighting more in the private part of his estate "because he is at free liberty to farm as he pleases without those restrictions that confine him to established customs in the culture of common fields". He wanted a certain independence from the village of Wermatswil.

The result of the tactic for the move to enclose common land and intensify cultivation was mixed at best. Certain villages agreed to enclose common land and to try new crops and fodder materials. The rest kept to the old extensive, cooperative three-field system. Into the nineteenth century, subsistence farming persisted. Every family member worked long and hard, with the help of few hired hands.

Bauerngespräche

In 1762 Dr. Hirzel brought Kleinjogg to the city to talk with the Economic Commission. This visit, he claimed, inspired the series of official "conversations with farmers, or Bauerngespräche, which lasted into the 1780's. Kleinjogg had told the Commissioners
that prize essay competitions were a good idea but that direct
conversation between the canton's best husbandmen, often the worst
stylists, and the city fathers would have a greater effect on
agriculture.  

On 15 March 1763 the Commission held its first formal
Bauerngespräche in the Zunfthaus zur Meise. It had sent invitations
to 15 contributors to the last season's essay competition on enclosure
and to all of the members of the larger Physical Society. Every­
thing was planned down to the smallest detail to make a proper
impression on the rural folk. The event could not have taken
place in the drab Limmatburg.

Each farmer had ample opportunity to speak about his parcel
of land and about the methods by which he cultivated it. Hirzel
recorded his evaluation:

My astonishment and that of the Physical Society
in general (several of whom seconded me with
pleasure) was extreme when we heard the greater
part of the peasants, each in his turn, describe,
with order and precision, the course of husbandry
in his part of the canton, compute the advantages
and the defects, and propose the methods he thought
most likely to remedy the latter. No one transgressed
the bounds of prescribed decency; the peasants spoke
alternately, without interrupting each other, and
without the least symptom of animosity or confusion.
When their opinions were divided, they objected
with modesty and supported them by citing instances
drawn from their own experience.

If any of the peasants wandered from his subject, Hirzel and the
other Society members brought him back.  

At the end of the meeting, Hirzel (who presided over the later
part of the affair when Heidegger was called away on business) told
the assembly that he had never in his life experienced:

a satisfaction equal to what I am experiencing
now at this most agreeable moment when I behold
men of worth from the city and the country unite
their common endeavors for the public benefit.
And you, my friends from the country, must now
be convinced that all of our views center in
the discovery of such methods as may tend to
augment the prosperity of our republic by
giving fresh vigor to the industry and activity
of our laborers, and endeavoring to instruct
them in the most certain rules for cultivating
and improving the fertility of the soil....
Continue then, my friends, give us your con­
fidence and friendship. You shall see us, in
our turn, do everything in our power to convince
you of our sincere regard and to render of
general use the maxims we have learned from
books, from experiments, and from your
conversation.

Then everyone retired to a great banquet "where there was so
general an appearance of cordiality that the conclusion of the
day was not less affecting to a well-wisher" than the beginning
had been.38

One can only guess what the farmers present at a Bauern­
gespräche really thought of the event. The myth perpetrated in
Society records, and in other urban records*, was that rural folk

* In October 1770 Conte di Sant' Alessandro wrote two letters
to his wife in Rome from Zurich [one was dated 1 October and
the other 13 October]. In these two letters, the Count
described his favorable impressions of a Bauerngespräche.
He attended a Physical Society meeting as a guest of Burger­
meister Heidegger; it concerned the value of summer stall­
feeding of livestock. The account sent to his spouse
parroted Old Zurich's interpretation of the "conversations":
"dass die Bauerngespräche keine obrigkeitliche Verordnung,
sondern lediglich die Anstalt einer Gesellschaft von
Liebhabern des Feldbaues sei"

His letters were printed in the Helvetischer Kalender in the
1790's and re-printed in the Neue Zürcher Zeitung in June 1885.
enjoyed them, felt honored to participate in them, and benefitted from them, and that the conversations demonstrated the democratic aspect of Zurich society. It is doubtful, however, that a subject peasant would have relished sitting before a formal assembly of their socially superior Gnädige Herren in the richest guildhall of the city, the bastion of urban privilege. Everything about the ceremony reeked of paternalism and reinforced the unequal distinction between city and country. Some rural folk did perhaps enjoy an association with the authorities. A survey of the Preisfragen contributors, who made up most of the Bauerngespräche participants, shows that the great majority of them were either large landholders, village notables, rural officers, pastors or schoolteachers, living in conservative agrarian areas largely free of proto-industrial development. Many of them experienced envy and malice. Hirzel noted that Kleinjogg was made out in Wermatswil to be a flatterer who insinuates himself into the favor of men of place in order to depress his neighbors, though the only use which he has made out of the access which the sublime simplicity of his character procures him among the most respected and best-intentioned members of our government has been to acquaint them with the true state of what happens in the country and to lead them to favor the industrious cultivators.

But, despite a decade of "favors" (hard cash prizes for winning essayists; "premiums" for farmers who found methods to improve the common pasture or to keep the common wood in order; "subscriptions" of experimental seeds, plants, and grasses distributed to "worthy" husbandmen through rural bailiffs and curates), Kleinjogg still reported to the Physical Society in 1774 that country folk were
"not being sensible of the value of their aid", on the contrary they felt diffident or even hostile toward it.

What condition really accounts for the activity of the Economic Commission after 1759, activity so crucial to the vitality of the larger scientific fellowship? The answer rests principally in the urban classes' growing awareness of complex and disturbing developments taking place in the canton. These developments involved a process of rural industrialization which had begun in the seventeenth century.

By the last decades of the eighteenth century, about one-third of the total population of the canton was employed at least part-time in the domestic or "putting-out" system of textile industry, the Verlagssystem. According to Economic Commission statistics of 1787, there were approximately 34,000 cotton handspinners, 6,500 cotton looms, and 2,500 silk looms operating in the canton. Prosperous agrarian villages in the canton's flat central land possessed ways to check industrial penetration; they were rigidly ordered communities. But villages along the lake and especially in less productive hilly and mountainous regions (like the Zurich Oberland) quickly embraced cottage work; villages lacked the collective spirit to prevent industrial diffusion. People in them shared little or no common ground, had no scrap of good land to call their own, and had no trust in the "nobly rustic" image of Kleinjogg. Industrial work gave to these rural folk the material possibility of starting an improved way of life.
Industry brought to the countryside important changes in its way of life. New circumstances of labor changed the terms of property, wealth, and inheritance. A new attitude toward marriage and children altered family life. Population growth accelerated. A class of well-to-do entrepreneurs, the Fabrikanten, developed, independent of urban monopolists, unwilling to accept subjection to the city. Without a function in the old organic constitution, they grew enamored of ways previously foreign to the rural folk: they drank coffee, ate red meat and white bread, participated in reading groups, and frequented taverns). Zurich burgers, members of a socio-political group rooted in a traditionally secure system, observed these developments with great concern. The modern social historian and demographer Rudolf Braun has claimed that eighteenth century Zurichers:

were convinced of the fact that these transformations would have a great impact upon social conditions, economic circumstances, and the future of the state. Proposals to cut the size of the 'dangerously' growing number of property-less people... became more numerous and intrusive.

This spectre of pauperism haunted the urban mind, especially after 1789. The Physical Society with its paternal sense of urban responsibility placed a negative value on these social consequences of industrialization while it sang the praises of peaceful rural life. In 1761 the "Philosophical Farmer" already criticized them. Kleinjogg did not:

hold in high esteem the works carried on by a great number of peasants in manufactures of various kinds where a small exertion of strength is required, and
which from this their sedentary nature, relaxed their ardor for the rougher labors of the field and diminished their strength. [To encourage] manufactures will [be to] insensibly deprive the land of proper culture and consequently occasion the ruin of agriculture.

He felt it foolish for healthy peasants to leave the secure, virtuous, and ever-expanding capital of property and hard work for the "phantoms of happiness and grandeur" found in inflation-riddled industrial wages. But he did not absolutely reject cottage work; it afforded:

subsistence to a great number of persons who have no land to cultivate, and to others whom natural infirmities, or the effects of disease, render incapable of the toils of husbandry. Manufactures ...are to be considered in the same light as hospitals; these sort of establishments are an invaluable resource to the sick and decrepit but when we receive into them the healthy and robust, we open a door to idleness.

Kleinjogg feared becoming an accessory to the destruction of his country.

In the second half of the eighteenth century, the city fathers adopted new functions in order to meet the challenge of change in the subject countryside. They increased the government program for food storage, instituted price controls, improved public health efforts (particularly through new measures against epidemics and the training of rural midwives and rural surgeons), and arranged special meals for the poor during famine. They also took steps to handle specific problems. In 1777, for instance, the State Church sent out a pastoral letter — the "Hirtenbrief über die Erziehung der Kinder auf dem Land" — to check the growing practice of Rastgeben. More and more industrial families in the countryside obliged their children to earn a certain amount of money per day or week for their maintenance; in poorer homes children left their
parents to help landladies who often did not even live in the same
community. In 1779 the city council issued a mandate against the
practice. It ordered children who had not finished school to refuse
Rast in the home of strangers unless they had their parents' permission
and the permission of the local pastor. 49

The Economic Commission assumed similar patriarchal functions.
Several economists studied the effects of industry on rural popula-
tion. Hirzel tried to establish statistically that changes in
inheritance custom in industrialized areas increased marriages
and stimulated an "artificial population" which the land could not
feed in bad times; at all times this population upset the organic
balance of the "simple" Old Regime. In his Beantwortung der Frage:
Ist die Handelschaft, wie solche bey uns beschaffen, unserem Lande
schädlich, oder nützlich, in Absicht auf den Feldbau und die Sitten
des Volkes (1792), Hirzel showed that the community of Fischental
in the Oberland had averaged only 42 marriages per year between
1701 and 1750, and 165 marriages between 1751 and 1760. When the
custom had been to leave the landholdings of a family together
so that the son(s) who inherited it would be capable of supporting
a family, population had increased only slightly. But now, in
the new industrial times, fathers thought:

I have three to four sons; each one gets some
herbage, at least enough for a cow, a bit of
field, and so on. This should go a long way
toward maintaining the household, and the
working of this property will leave enough
time to earn the rest through manufacture."
Hirzel felt that such an arrangement destroyed the virtue of agriculture.

* * *

From 1759 to 1798 the Physical Society's involvement in concrete issues of rural administration greatly strengthened the fellowship's position as a Zurich institution. With the political force, economic strength and ideological connection of the ruling class behind it, scientific activity grew in from the cultural margins of the community to stand as an essential concern and preoccupation of civic life. It paid the price of the involvement. Simultaneously, the Society linked its work to the political program, and to the political fate, of the Old Regime. Hirzel's portrayal of Kleinjogg as the "philosophical farmer" propagandized rural acceptance of the city's enlightened program of patriarchal benevolence. In the 1760's Society members could not begin to see the inevitable failure of such an approach to reform, for it was one steeped in a persistent mentality. In the 1790's rural revolts sparked by the influence of the French Revolution actually had their basis in prolonged urban exploitation. Members who lived to the end of the century saw the program fail disastrously.
VII. TWILIGHT OF FELLOWSHIP
1780-1798

From 1780 to 1798 the life of the Physical Society passed through the troubled twilight of a grizzled Old Regime. During this last period of the eighteenth century scientific fellowship, turbulence in the Limmatstadt finally shattered belief in the appearance of an organically harmonious canton, a die-hard belief upon which the identity of the local organization of naturalists had been formed. By the 1790's the foundation of Enlightenment consensus shook under western rumblings of revolution; it finally shattered under the storm clouds of urban debate over the propriety of the traditional subjection of the countryside. When Zurich's Old Regime died in 1798, the Physical Society survived to stumble on into the Helvetia period, but barely and thread-bare.

* * *

Scientific Performance, 1760-1780

Middle citizen performers dominated the agenda of the Society from its creation in 1746 to the establishment of the Economic Commission in 1759. In the 1760's and 1770's, however, patricians flowed into the scientific fellowship in great numbers. Table 14 shows that nearly 50% of those who joined the Ordinarii (13-28) and nearly 75% of those who joined the Honorarii (73-99) between 1760 and 1779 came from the ruling class. These citizens were not the frequently mentioned scientific 'amateur', for even at the amateur level they were not busy with science. Heidegger's
Table 14

Number and Percentage of Physical Society Members
Who Joined the Fellowship between 1746-59, 1760-79, or 1780-98,
Arranged by Social Status

<table>
<thead>
<tr>
<th>Membership class</th>
<th>Period</th>
<th># of New members</th>
<th>Patrician %</th>
<th>Middle Citizen %</th>
<th>Artisan %</th>
</tr>
</thead>
<tbody>
<tr>
<td>Ordinary</td>
<td>1746-59</td>
<td>31</td>
<td>42</td>
<td>43</td>
<td>15</td>
</tr>
<tr>
<td></td>
<td>1760-79</td>
<td>28</td>
<td>48</td>
<td>41</td>
<td>11</td>
</tr>
<tr>
<td></td>
<td>1780-98</td>
<td>13</td>
<td>30</td>
<td>54</td>
<td>16</td>
</tr>
<tr>
<td></td>
<td>Total</td>
<td>72</td>
<td>42</td>
<td>43</td>
<td>15</td>
</tr>
<tr>
<td>Honorary</td>
<td>1746-59</td>
<td>82</td>
<td>70</td>
<td>16</td>
<td>14</td>
</tr>
<tr>
<td></td>
<td>1760-79</td>
<td>99</td>
<td>74</td>
<td>12</td>
<td>14</td>
</tr>
<tr>
<td></td>
<td>1780-98</td>
<td>50</td>
<td>56</td>
<td>18</td>
<td>26</td>
</tr>
<tr>
<td></td>
<td>Total</td>
<td>231</td>
<td>69</td>
<td>15</td>
<td>16</td>
</tr>
</tbody>
</table>
constitution invited the non-academically inclined burger with perhaps only a mild curiosity about nature to participate in the discourse; he needed to gain the support of only one-third of the total membership for election. This amateur was a respectable gentleman: a merchant, banker, land proprietor, or office-holder. He was in a position to support science when he perceived it as a worthwhile civic activity. Previously the patrician had not been heavily exposed to conversation on scientific subjects. Now he became perhaps the key figure in an institution of public science.

The single most identifiable patrician group to enter the Physical Society between 1760 and 1780 was an association of cantonal military officers. On 11 March 1765 ten Zurich officers, one ranking as high as regimental commander, founded the "Mathematisch-militärischen Gesellschaft". It aimed to improve local military operations. In 1768 this elite union of military men — some of whom already belonged to the Physical Society -- entered into a formal agreement with the scientific fellowship. In exchange for the payment of a 12 guilder entry fee and an 8 guilder annual due per member, the Physical Society allowed the Mathematical-Military Society to use its library, its physical collections, and to meet on Friday afternoons in the Meisen's congress room. In addition, the president of the military fellowship was to enjoy the full privileges of an Ordinaria.
The remaining military officers in the body would belong to the Physical Society only as Honoraria.*

The Physical Society had associated with the surgical society of the Black Garden; but, this association with a patrician military union was novel. Linkage between the two organisations produced after 1768 an early modern version of "technology transference". Physical Society members oriented more of their research toward military application. Before a general meeting of Ordinarii and Honorarii, Pastor Johann Heinrich Waser read a history of artillery and Professor David Breitinger explained the military uses of experimental apparatus. The naturalists passed along to the Mathematical-Military Society the results of Lambert's experiments on the force of air upon projectiles. In 1789, the Ordinarii thought to purchase from a London manufacturer a "theodolite", a surveyor's instrument, at the cost of 300 guilders. It was made up of a small telescope mounted so that it could rotate in both a vertical and horizontal plane; it could be used by the military to measure angles and to determine distances and heights for artillery. Finally, however, they decided to pay 400 guilders (a very large sum in comparison to other instrument purchases during the period) for a "Circular-Instrument". It had a telescope of greater amplification and could be put both to better military and astronomical uses.  

* "Überdies wurde das Verhältnis so aufgefasst, dass die mathematisch-militärischen Gesellschaft der physikalischen, gewissermassen als einer oberen Instanz, jährlich Bericht über ihre Thätigkeit in Form von 'Jahresabschieden' ablegen sollte". Ferdinand Radio, Festschrift der NGZ, 232.
In return for this Physical Society consideration, members of the Mathematical-Military Society contributed a new mode of scientific work: military science. They undertook several studies of geometry "so weit sie für Kriegskunst notwendig ist"; of tactics "die man sich damals ebenfalls in geometrischen Formen vorgestellt"; of fortifications "deren Kenntnis für jeden Offizier als unentbehrlich angesehen wurde"; and of offensive and defensive strategies. Upon tabletops in the Heisen, officers moved toy soldiers made out of wood and tin to test tactics used in the Seven Years' War; in the Zürich countryside they held field expeditions, or "Rekognoszierungen", to perfect their knowledge of regional topography. They conducted experiments in ballistics.  

By 1796 nearly one in every four members of the Physical Society (26-110) belonged to the Mathematical-Military Society. Moreover, thirty-three of the 38 eighteenth century members of the military fellowship were patricians. In retrospect one cannot be certain whether the socio-political posture of the Physical Society in the 1760's attracted high-ranking military men to scientific organization, or whether the conservatism of the military ultimately shaped the course of the Physical Society during the late Regime. One is sure that both societies remained strongly committed to the establishment throughout the eighteenth century.

Though a patrician embrace seemed to control the program of the Physical Society in the period of the Economic Commission and of the liaison to the Mathematical-Military Society, the real
production of scientific items (i.e. reviews, papers, books, experiments, demonstrations, collections) remained principally the work of a small group of middle citizens. Table 15 illustrates that four middle citizens delivered nearly 40% of the papers (290-727) between 1766 and 1783. Dr. Johannes Geisser performed 112 papers; Pastor Johann Heinrich Waser read 82; Professor David Breitinger delivered 50; and Dr. Salomon Schins performed 46. If one adds to this total 140 more papers delivered by the other medical doctors in the fellowship, one sees that this middle citizen coterie performed 430 papers, nearly 60%. Hans Caspar Brunner of the Economic Commission, the busiest patrician performer, read 41 papers until his death in 1780; but, he was an exception. Few of his peers read more than a single paper in a year, if that. Surgeons, the most active artisan performers, read only 37 papers in this period.

One way to visualize the thrust of scientific work in the period 1760-1780 is to survey statistically the lecture topics recorded in the "Protokolle" of the Society. Table 16 shows Society lectures offered in two years (1762 and 1778) divided into the five principal fields of physical inquiry (descriptive sciences, technology, exact sciences, medicine, and philosophy; See pp. 131-133). Though the years 1762 and 1778 generally belong to the period dominated by the work of the Economic Commission, analysis of their programs shows certain important differences in scientific orientation from the beginning to the end of the period.

* Seven hundred twenty-seven papers have identifiable authors. One hundred eighty-nine do not.
<table>
<thead>
<tr>
<th>Year</th>
<th>Total # of papers</th>
<th>A</th>
<th>B</th>
<th>C</th>
<th>D</th>
<th>E</th>
<th>F</th>
<th>Total A-F</th>
</tr>
</thead>
<tbody>
<tr>
<td>1766</td>
<td>21</td>
<td>3</td>
<td></td>
<td></td>
<td>1</td>
<td>8</td>
<td>1</td>
<td>12</td>
</tr>
<tr>
<td>1767</td>
<td>35</td>
<td>8</td>
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<td>3</td>
<td>6</td>
<td>22</td>
</tr>
<tr>
<td>1768</td>
<td>38</td>
<td>8</td>
<td>3</td>
<td>4</td>
<td>1</td>
<td>10</td>
<td>1</td>
<td>26</td>
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<tr>
<td>1769</td>
<td>50</td>
<td>4</td>
<td>4</td>
<td>5</td>
<td>1</td>
<td>10</td>
<td>1</td>
<td>24</td>
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<tr>
<td>1770</td>
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<td>1</td>
<td>28</td>
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<td>1771</td>
<td>66</td>
<td>10</td>
<td>5</td>
<td>3</td>
<td>2</td>
<td>7</td>
<td>2</td>
<td>27</td>
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<tr>
<td>1772</td>
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<td>2</td>
<td>17</td>
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<tr>
<td>1775</td>
<td>34</td>
<td>7</td>
<td>8</td>
<td>2</td>
<td>1</td>
<td>5</td>
<td>0</td>
<td>23</td>
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<tr>
<td>1776</td>
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<td>7</td>
<td>3</td>
<td>3</td>
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<td>3</td>
<td>23</td>
</tr>
<tr>
<td>1780</td>
<td>33</td>
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<td>4</td>
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<td>8</td>
<td>1</td>
<td>25</td>
</tr>
<tr>
<td>1781</td>
<td>28</td>
<td>5</td>
<td>4</td>
<td>4</td>
<td>3</td>
<td>10</td>
<td>2</td>
<td>24</td>
</tr>
<tr>
<td>1782</td>
<td>30</td>
<td>4</td>
<td>3</td>
<td>3</td>
<td>7</td>
<td>3</td>
<td>0</td>
<td>17</td>
</tr>
<tr>
<td>1783</td>
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<td>4</td>
<td>4</td>
<td>4</td>
<td>7</td>
<td>0</td>
<td>19</td>
<td></td>
</tr>
<tr>
<td>Total</td>
<td>727</td>
<td>112</td>
<td>82</td>
<td>50</td>
<td>46</td>
<td>140</td>
<td>37</td>
<td>454</td>
</tr>
</tbody>
</table>

A= Dr. Johannes Gessner  
B= Pastor Johann Waser  
C= Professor David Breitinger  
D= Dr. Salomon Schins  
E= Medical doctors, excluding Johannes Gessner and Salomon Schins  
F= Surgeons  
(Note: Surgeons were artisans, not middle citizens. By including the number of papers by surgeons in this table, the prevalence of non-patrician performers is shown more clearly.)
Table 16

Division of Physical Society Papers
Presented in 1762 and 1778,
into 5 Principal Fields of Study
and their Sub-Fields

<table>
<thead>
<tr>
<th>Field of Study</th>
<th>1762</th>
<th>1778</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. Descriptive sciences</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Botany</td>
<td>15</td>
<td>4</td>
</tr>
<tr>
<td>Zoology</td>
<td>12</td>
<td>1</td>
</tr>
<tr>
<td>Geology &amp; Mineralogy</td>
<td>6</td>
<td>4</td>
</tr>
<tr>
<td>Geography</td>
<td>3</td>
<td>7</td>
</tr>
<tr>
<td>2. Technology</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Agriculture</td>
<td>11</td>
<td>6</td>
</tr>
<tr>
<td>Statistics</td>
<td>11</td>
<td>11</td>
</tr>
<tr>
<td>Machinery</td>
<td>6</td>
<td>2</td>
</tr>
<tr>
<td>3. Exact sciences</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Meteorology</td>
<td>9</td>
<td>6</td>
</tr>
<tr>
<td>Physics</td>
<td>8</td>
<td>9</td>
</tr>
<tr>
<td>Chemistry</td>
<td>3</td>
<td>2</td>
</tr>
<tr>
<td>4. Medicine</td>
<td>15</td>
<td>4</td>
</tr>
<tr>
<td>5. Philosophy</td>
<td>1</td>
<td>2</td>
</tr>
<tr>
<td>Total</td>
<td>100</td>
<td>60</td>
</tr>
</tbody>
</table>
In 1762 the Physical Society exhibited features of an organization in full bloom. Public interest in the fellowship had intensified after its move into the Heisen in late 1756. The Society began to conduct grander ceremonies; it initiated a class of "Ehrenmitglieder" to honor Swiss naturalists and notables. Membership boomed. Local scientific work enjoyed accelerated rate of production and increased range: the program of the Economic Commission was under way; an observatory had been opened; in 1761 the first volume of Abhandlungen, containing Hirzel's "Philosophical Farmer", appeared. In 1762 members delivered 100 papers to the Society, 72 more than they had delivered in 1750 (and the greatest number of papers delivered in any year of the eighteenth century).

Table 16's statistical analysis of the 100 presentations of 1762 shows clearly that the interests of the Economic Commission prevailed over the general Society agenda. Sixty-four of the 100 papers concerned either a field of descriptive science (15 in botany, 12 in zoology, 6 in geology or mineralogy, and 3 in geography) or a field of technology (11 in agriculture, 11 in cantonal statistics, and 6 in machine technology). Twenty papers centered in work within an exact field of physical knowledge (9 in meteorology, 8 in physics, and 3 in chemistry); however, several of them — especially those in meteorology — also described the Zurich region.

* Appendix C lists the Society "Ehrenmitglieder", 1762-1798.

** Johannes Gessner and his protégé Salomon Schins read the majority of papers in exact science. Schins, a recent medical graduate of Leyden, authored several chemical and physical treatises based upon his doctoral research on calcination ("De Calce Terrarum et Lapidum Calcariorum", 1756).
By the end of the 1770's, however, professional research in exact science stood more prominently within the Society program. Nineteen of the 60 papers read by fellows in 1778 concerned exact science; papers in technology numbered only the same (19) and papers in descriptive science numbered three less (16). The total number of papers had fallen from 100 in 1762 to 60 in 1778 partly because experimental research required a longer time for execution and preparation of results than did observation and description.

This change to more exact scientific work seems to have reflected several forces working upon Zurich and its scientific society. First of all, a new generation of local naturalists felt the power and attraction of Europe's rising tide of experimental science. In 1777 Haller died and Gessner resigned his public offices. In France Lavoisier proved that air consisted mainly of oxygen and nitrogen and C.A. Coulomb invented the torsion balance. Volta crossed the Alps to demonstrate his electrophor before the Physical Society; his visit moved several younger members to conduct electrical research. In papers read in 1778, Salomon Schins described various electrical devices, discussed Franklin's theory of lightning, and proposed the public use of lightning rods. He also attempted to define the properties of several important gases. Professor David Breitinger delivered papers on acoustics, electricity, and magnetism.

Secondly, ruling class pre-occupation with politics reduced the possibility of a patrician having sufficient time or energy to perform scientific work. In 1777 a major crisis gripped the city
over the regime's decision to renew the mercenary alliance with France. Difficult constitutional issues separated the usually cohesive urban classes.6 Moreover, agricultural enthusiasm had diminished; Burgermeister Heidegger, the greatest patron of rural reforms, died in 1778. Middle citizens again dominated the fellowship. Table 14 (p.172) illustrates that only 30% of the performers and 56% of the audience who joined the Society between 1780 and 1798 came from the patriciate.

The patrician era of the Physical Society between 1760 and 1780 had lasting effects on local science, however. Whereas physicians, professors, and clerics within private assemblies could choose to occupy themselves with "purer" scientific subjects and "basic" research, once in the company of "Gnadige Herren" they realised the broad civic application of scientific subjects. In the period 1780-1798 middle citizens kept their discourse in the public arena. The presentations of the medical men primarily concerned community health. Their subjects included the protection of the city from influenza, better sanitation, recommended personal hygiene and diet, the proper storage of food reserves by the city, and case studies of cantonal residents who had committed suicide. In 1782 several members of the Society (Salomon Schins, Conrad Rahn, "Chorherr" Johann Heinrich Rahn, Hans Caspar Hirzel, Jr., the brothers Johann Ludwig and Hans Conrad Meyer, Christoph Salomon Schins, Paul Usteri, David Rahn, Johann Jakob Romer, and Heinrich Rudolf Schins) founded the Medico-Surgical Institute of Zurich.*

In 1784 Ordinaria Johann Heinrich Rahn — the third president of the Society (1803-1812) — founded a local society ("Die Züchterischen Lokalgesellschaft zur Aufnahme sittlicher und haushalter Glückseligkeit") aiming to promote civic morality, fraternity, patriotism, and the education of youth. During the Helvetic period, Ordinaria Paul Usteri — the fourth Society president (1812-1831) — served as an executive Swiss representative to the government of Napoleonic France; his city later elected him burgemeister. Scientists and Zurich society were not at odds.

The Waser Affair

The second period of the eighteenth century Physical Society began with the establishment of the Economic Commission in 1759/60. It ended with the public execution of one of its members in late spring 1780. On 27 May 1780, just a few months after the publication of Lessing's great tract on toleration, Nathan der Weise, Zurich's oligarchs executed "perhaps the most gifted but most certainly the most unfortunate pupil of Gesner", Pastor Johann Heinrich Waser. Waser's trial for a crime of "high treason" (Hochverrat) and his ultimate beheadal sent shock waves through the quiet lake town which rippled far beyond the canton. Goethe wrote cryptically about the "Waser affair". Johannes von Muller argued in print that one was either for Waser, Enlightenment, and freedom, or for stupid orthodoxy and slavery. The University of Göttingen's von Schlozer widely condemned Waser's eventual "murder" as an injustice comparable to the Calas case.
History recalls Pastor Waser more in memory of his tragic end than in recognition of his substantial intellectual achievements. He proved to be one of eighteenth century Switzerland's most enterprising naturalists, historians, economists, and sociologists. A talented humanist who wrote in Latin, Greek, and German, Waser entered the Physical Society on 4 March 1765 at the age of only 23.* The next year he reported to the fellowship on the impact of a lightning bolt hitting Regenberg and discussed the use of an *ductores fulmini (lightning rod). Thereafter, he worked on logarithms and on subjects in optics, geography, and artillery. In 1770 he experimented with magnetism, and in 1771 he studied the *ecame obscura. He prepared meteorological catalogs comparing barometric and thermometric readings from various spots within the canton. In 1773 he examined Lambert's 'Universal-sonnenuhr'; in 1776 he investigated the principles of the hydrostatic balance and the megaphone. He assisted Volta with the visitor's demonstration of the electrophor. As a member of the "Astronomical Commission", he helped to station a new observatory within a tower of the Grossmunster. From 1778 to his death, he held the post of Society librarian.11

His scholarship rested foremost in political economy. An active member of the Economic Commission, Waser developed innovative

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* From 1767 to 1779, Pastor Waser read 82 major papers before the Neisen audience (14% of the total number of papers delivered during this period) compared to 88 papers by Johannes Gessner. Between 1775 and 1779 he was, in fact, the Society's most active performer; he delivered 44 presentations, or 4 more than did Gessner. See Table 15, p. 177.
statistical methods by which to study the relationships between population, food supply, craft wages, land prices, currency values, banking fluctuation, insurance costs, rural industry, and mechanization. He prepared dozens of "community tables" ("Gemeindetabellen") organizing and interpreting cantonal population and production statistics (some of which dated back to the Reformation era). An eclectic Swiss thinker, Waser mixed mercantile and physiocratic notions to fit the special circumstances of his homeland. He committed his research career to an enlightened program of "political arithmentic" ("die politische Rechenkunst"). He considered population as the truest form of wealth, but, like Quesnay, opposed "populationist" measures. A land could never have too many people, Waser felt, if government only encouraged more public study of economic resources and deficiencies. If politicians worked harder to discover (and then to maintain) wise economic practices, there would be enough food for all people to live. Political economics was mankind's surest vehicle to personal happiness and cultural improvement.12

Waser saw the key to Zurich political economy resting in the need to increase native food supply to end dependency upon imported grain and in wiser cantonal administration. In a 1771 work "Über das Fruchtwesen" and again in 1775's "Abhandlung über das Thermometer der Fruchtbarkeit und den Nahrungstand des Zürichgebiets", Waser identified famine as a social evil far worse than pestilence.13 (Zurich had suffered a terrible famine in 1770/71.) He provided statistical evidence that Zurich's
population had in the past closed several severe gaps caused by plague within as little as ten years. However, by analyzing the course of local grain prices over the centuries and the collections of the tithe in the districts of Embrach, Rüti, Kloten, and Knonsu, Waser concluded that starvation provoked far more serious, and lasting, misfortunes:

Despite the heavy death rate caused by epidemics, I evaluate the damages brought about by famine and starvation as at least as severe as the former, not only because of the loss of the people as such, but also as regards their effects. As soon as a pestilence is overcome, the survivors — like those who have escaped from a shipwreck — are cheerful and gay. The deceased have made room for the surviving people and left them considerable legacies. It is hard to find servants because there is so much open employment; the houses and estates are falling much below their real value; everybody is finding enough work as well as plenty of food; thus, whoever is able to marry will marry... We might, therefore, state that the losses caused by pestilence can be compensated within a decade. Damages brought by famine and starvation, however, have far more severe consequences, because after these catastrophies the impoverished, worn-out and discouraged people are in want of the dearest necessities of life and will need years to recover. Whoever is not in the highest degree careless will think twice before he gets married. And due to the fact that children will not be considered a blessing of God but rather a burden of married life, the population will increase very slowly. 14

Here, Waser's thought anticipates that of Malthus.

In some respects, Waser's economics suited the patrician outlook of the Economic Commission. His program embraced back-to-nature sentiment; it praised agriculture as man's most virtuous occupation. Waser made special trips to speak with Kleinjogg and participated vigorously in the Bauerngespräche. He corresponded
often with the brightest contributors to essay competitions. He advocated rational husbandry and agricultural intensification; he circulated reports of experiments with soil mixtures and fodder crops and promoted the potato as a new dietary staple. 15

Though Zurich generally recognized Waser's brilliance in the field of political economy, the community did not always appreciate it. Waser had an outspokenly critical attitude toward aristocratic government; he believed that economic matters involved political decisions to be made in public. At present too many local matters were being decided by uninformed councillors behind locked doors. State censors prevented the beneficial free exchange of ideas. His was the exceptional voice of the Economic Commission, however. "Gnadige Herren" disliked bold indictments of aristocratic rule.

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* Waser wrote in the "Abhandlung über die Grösse der ganzen loblichen Volkswirtschaft" (1775):

"muss man lesen und sammeln, dann rechnen und vergleichen, Parallelen und Subparallelen ziehen, messen, bestimmen, Schemata und Tabellen und Synchronismen richtig beobachten und schliesslich auf eine feine Art darüber philosophieren .... Was wir brauchen, sind nicht nur philosophische Bauern, sondern auch philosophische Politiker, Statistiker oder politischer Logiker.... Je freier ein jeder Burger über den Zustand seines Staates öffentlich reden und schreiben kann, desto mehr achter Patriotismus wird in selbigem entstehen.... Die genannte, ausgedehnte Kenntnis des Vaterlandes kann also niemals gefährlich, sondern immer nur nützlich sein".

Zurich Staatsarchiv, B X 26

** For instance, Waser made no blanket condemnation of rural industrialization as moral evil. He seems to have seen through the urban system of rural exploitation. Unlike Hirzel, he did not regard industry-stimulated population as 'artificial'; such population could tend to exceed the food supply, but proper government management would insure their sustenance.
In 1772, just two years after he had received his first pastoral appointment (to the communities "sum Kreus": Hottingen, Hirslanden, and Riesbach), Waser condemned two esteemed governors (Obergöge) in the Kussnacht region of malfeasance. A few years later he circulated written opinions against the Kornmeister: he charged that the director of the urban granary had so badly administered the food supply that he had aggravated the famine of 1770. In 1777 Waser distributed an inflammatory essay criticizing the Regime's unconstitutional handling of the decision to renew the mercenary alliance with France.

The progression of events from 1777 to his execution in May 1780 are too complex and controversial to narrate at any length here. Suffice to say that the city fathers stomached no more misbehavior from Waser. They took away his pastoral charge and reduced him, without compensation, to a private citizen. Waser grew progressively embittered; he strengthened his admonitions of public officials. Some biographers (who base their psychological profile of the man on biased accounts which surfaced during the trial or in apologia after the execution) relate that Waser grew pathological in his feelings toward the establishment. Recent historical literature leaves that question open. Two of Waser's most concerned and influential friends, Burgermeister Heidegger and Dr. Hans Caspar Hirzel, warned him to stop throwing stones at holy cows. In order to alleviate some of his desperation, the Physical Society voted him its librarian; the position paid no salary but it allowed him access to books and encouraged him to
continue his public scholarship. But, he continued to alienate and polarize the community; by 1779 few friends remained, even within the Physical Society.

In 1779 officers of the city council arrested Waser for apparently having pilfered certain precious state papers from the Staatsarchiv. (He had surreptitiously published them in foreign journals, particularly in Schlozer’s Briefwechsel.\(^{19}\)) A search of his house uncovered a number of valuable books and instruments belonging to the Physical Society. (Authorities established that they were wrongfully in his possession, but the Society seems never to have formally delivered its opinion.) No member of the fellowship spoke out to save him. Heidegger was now dead. Gessner held no political office and by then had retired from his public teaching. A desperate Waser tried to escape the canton, but police caught him and returned to trial. The court found him guilty. On 27 May 1780 the Regime — convinced that such an individual forfeited the right to live in society — had his head. The Physical Society apparently believed in the justice of the decision. The organization continued on into the 1780’s with no public comment on Waser’s fate. Its secretary simply penned a note in the minute-book stating the fact of his death.*

* Emil Walter wrote in “Der Pflege der exacten Wissenschaften in alten Zurich”, Vierteljahrschrift der NOZ (19 ), 87, 103 n.110:

"Johann Heinrich Waser wagte den Schritt von der wissenschaftlichen Aufklärung zur sozialen und politischen Kritik und musste diese Tat seinem Leben büssen.... So übermächtig war der seelische, politische und wirtschaftliche Druck der gnädige Herren in alten Zürich.... Das schwerste politische Vergehen Waser's bestand in der Umgehung der politischen Zensur bei der Veröffentlichung von Angaben über den Finanzbehalt der städtischen Verwaltung".
Postscript to Enlightenment

The rest of this paper serves best if understood as a postscript. With the execution of Waser in 1780, the Zurich Enlightenment showed itself as a dying movement. A watershed in the history of the community had been reached. A brilliant professional scholar — economic historian Eugen Böhler ranks Waser as an economic thinker in the company of Rousseau, Iselin, and Necker — had been stopped dead in his tracks at age 38 by a tough-minded oligarchy. From this point on, middle citizen/patrician agreement was no longer so routine. The generation of burgers born after mid-century in the hey-day of the Economic Commission began to go more separate ways than had its parents. Young intellectuals embraced liberalism. Only 13 men entered the Society of Ordinarii in the last 18 years of the Old Regime.

On 6 May 1790 Johannes Gessner died (he was 81). After his retirement from public teaching in 1778, he had performed little research and rarely presided over the Physical Society. His health was poor; grief for the loss of loved ones dominated his thoughts; in 1778 his best friends Heidegger, Haller, and Lambert had died; the execution of his prized pupil Waser in 1780 haunted him; in 1784 Salomon Schinz (his beloved nephew and hand-picked successor to the canonicate) died (he was 50); finally, in 1788 his wife Katarina died. They had had no children.

On 5 July 1790 the Physical Society gathered to honor the accomplishments of its founder and president. In a great public
ceremony, the new president of the Society, Hans Caspar Hirzel, eulogized Gessner. Pastor-physiognomist Johann Caspar Lavater composed a song to accompany 'Trauermusik'. The fellowship recognized that it owed a great debt to the deceased naturalist.

As an "Erdensohn" (see Lavater's text below) Gessner had understood

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* Erdensohn! wie gross du seyst!
Wahrheit nur sey deines Speise!
Allumfassend sey dein Geist,
Weiser, als zehntausend Weise—
Demnoch ist dein Ziel und Loos
Sterblichkeit, und Erdeschooel!

Grösser Jüngling, Mann und Greisl!
Lichtgeist, ohne seines gleichen!
Du auch misstest dem Geheiss,
Das den Dichter vegrief, weichens!
Ach! das niemal satte Grab
Gessner, schlang auch Dich herab!

Dich, der Weisheit Lieblingssohn!
Der Natur vertrauter Kenner!
Ehrer der Religion!
Freund und Lehrer grösster Manner!
Dich auch, unsern Führer, riss
Weg des Grabes Finstemiss!

Mit der Liebe Leidenschaft
Sammettest Du Wunderschatze!
Mit der Rühe Heldenkraft
Forschtest Du Naturgesetze—
All! Dein Wesen lebte ganz
In der Kenntnis reinster Glanz'!

Lichtgestirne, Berg' und Thael,
Felsen, Flissen, Stein und Pflanzen
Thiere, Volker ohne Zahl
Schaffest Du Dir zum schönsten Ganzen
Ordnung, Plan, und Harmonie
Fehlte Deinem Wissen nie!

Tag und Nachte forschtest Du!
Lerntest täglich mehr im Lehren!
Arbeit war Dir Lust und Rüh'!
Lust war's Weisen, Dich zu hören;
Und des Wissens Herrlichkeit
Kronte die Bescheidenheit.

Mude nie war Deine Hand:
Und Dein Wissen lauter Helle!
Unermüdbar Dein Verstand!
Weisheit suchtest Du beym Quelle!
Und der Wahrheit gienget Du nur
Nach auf der Erfahrung Spühr!

Was vor Dir ergründet war,
Durch Natur- und Grössenlehre.
Alles machtest Du Dir klar;
Muschelsand und Sternenheere,
Heilkunst, Thatenkunde: Nichts
Floh dem Strahle Deines Lichts!

Wer hat mehr, als Du gestrebt
Nach der Wahrheit? Mehr gefunden?
So der Wissenschaft gelebt?
So mit Weisheit sich verbunden?
Mehr auf einmal überschmut?
So harmonisch war gebaut?

Auf der Weisheit höchsten Hoh'n
Standst Du mit der Dehmuth Miene!
Bulers, Hallers, und Linnèn
Boerhavens und Albine—
Sahst Du — strahlend über Dir
Sah'n an deiner Seite Wir!

Stets ist Wahrheitliebe kindlich;
Stets vereint mit Huld und Licht;
Weiser wird die Weisheit stündlich,
Oder, sie ist Weisheit nicht —
Gessner! Jüngling, Mann und Greisl!
Wer ist dass, wie Du, Beweis?

Licht eins unserer Vaterstadt!
Licht eins unserer ersten Lichter!
Wird in deinem Lob' nicht matt
Kunst der Redner und der Dichter?
Unser Haupt und Stifter, Dir,
Singen und verstummen wir.
that the character of Canton Zurich called for an organization of scientific activity meeting local needs. Though he belonged to a network of Enlightened scholarship including "Eulers, Hallers, und Linnein, Boerhavens und Albinen", Gessner had shed most of his brilliance on the public situation of the hometown naturalist ("Licht einst unserer Vaterstadt! Licht einst unserer ersten Lichter!"), he had excelled as a teacher of young burgers ("Was vor Dir ergründet war, Durch Natur- und Grossenlehre. Alles machtest Du Dir klar"). and had exemplified the indefatigable professional researcher ("Tag und Nachte forschtest Du! Lerntest täglich mehr im Lehren! Arbeit war Dir Lust und Ruh!"). Through his efforts, the city achieved its first botanical garden and astronomical observatory and possessed several impressive physical cabinets ("Felsen, Flüsse, Stein, und Pflanzen, Thiere, Völker ohne Zahl; Schuffest Du Dir zum schonsten Ganzen, Ordnung, Plan und Harmonie"). For 44 years he loomed as the regent of Zurich science ("Allumfassend sey dein Geist, Weiser als zehntausend Weise"). Civic science may have developed in eighteenth century Zurich without Gessner, but it is hard to imagine.

In the 1790's the life of the Physical Society was exposed to events which more seriously affected local scientific discourse than had Gessner's death. News of the French Revolution did not immediately worry the Old Regime of Zurich; it did not move the ruling elite to question its future hold on the countryside. Old thoughts persisted; Subjects were by nature free of pride and corruption; They would not embrace revolution without massive
foreign inducement. Economic Commissioners remained committed to the government policy of patriarchal benevolence and to the ideal of Kleinjogg; they failed to address industrialization in its real terms.

In 1794/95 a local crisis forced Zurich's "Gnadige Herren" for the first time to seriously ponder the chances of a revolution in the canton. Leaders of the industrialized, lakeshore village of Stafa sent a "Memorial" to the city in which they deferentially recommended a number of rural reforms: a rural constitution; the end to urban economic monopolies; the right of rural folk to attend urban schools, to hold office in the State Church, and to become military officers; the abolition of feudal dues and their replacement by a direct tax; and the restoration of lost community rights. In addition, the reformers (principally industrial entrepreneurs, wine-growers, and rural surgeons) asked for permission to examine the ancient documents on which the legal heritage of the city-country relationship was based.

Zurich's city fathers responded forcefully to the challenge of the Stafa Memorial. They arrested the leaders of the movement, tried them, and fretted long over the proper punishment of "disobedient children". The majority of councillors called for harsh punishment. Dr. Paul Usteri, a young liberal (and Physical Society Ordinaria), recorded on 28 July 1795 that "public opinion is to have their heads". The government decided to admonish the "conspirators" severely, to fine them huge sums of money, and to exile a few of them. When this decision provoked greater unrest along Lake Zurich,
the city sent an army to occupy Stafa. It condemned one Stafa official to death, though eventually it reduced the sentence to perpetual exile.22

The Stafa Affair ("Ständerhandel") launched the city into the era of European Revolution. Rural malcontent intensified and spread even into agricultural regions. Violent urban debate shattered the long-prevalent feeling of community. Censorship tightened and factions developed. For the most part, patricians misunderstood what was happening in the countryside. They believed the Memorial to be a shrewd, demagogical lure designed by greedy rural industrialists (Fabrikanten) to further exploit naive cottage bumpkins. The "reign of terror" in France under Robespierre and the Committee of Public Safety mortified their position further. Some younger burgers rightfully perceived the Memorial as an opportunity to accommodate changes in the countryside and to work out problems before revolution hit home. They discussed "free trade" (the end to urban economic monopolies) as the key to soothing rural feeling. Meaningful opposition to the Regime could not organize, however. "Republican" intellectuals could only stand ready to meet newly-enfranchised rural folk as equals and friends when the inevitable happened.23

If political discussion occurred within the Physical Society during this period, it was not recorded. Certainly most of the public debate took place in smaller bodies, especially in literary and historical clubs. Clearly some of the younger members of the scientific fellowship believed that the old order was dying. Among
the "republicans" and "Volksfreunde", one can count Dr. Paul Usteri (1768-1831), Ludwig Meyer "von Knossa" (1769-1841), and Hans Conrad Escher "von der Linth" (1767-1823). All three men later served in the Helvetic Senate. Their circle of Ordinaria was perhaps split over the issue of rural reform; however, the audience of Honoraria sided strongly with the Regime. The financial records of the Society suggest that patrician support of the scientific organization remained firm to the end of the Old Regime. Between 1794 and 1797, the Society spent nearly 6,300 guilders, over 1,150 guilders just on instruments. These amounts of expenditure exceeded those of any other four year period of the fellowship.24

By late 1797 the end of the Old Confederation was at hand. French troops occupied the Vaud and the bishopric of Basel. In January 1798 Canton Basel declared its revolutionary rights. A French army demanded the surrender of the government of Berne. In Zurich, the Regime tried in vain to diffuse its ticking bomb. The councils granted amnesty to a leading Stafa rebel, but they would not give away any of the dear urban Treedoms. Burgermeister Wyss argued that the answer to restoring order rested in moral regeneration of the patriarchate, a notion echoing the already failed Enlightenment idea of reform.25 Other officials recommended that the city needed to simply grant a few rural folks citizenship; they believed that the goal of cantonal reformers was to become part of the system of urban privilege.

* Johann Caspar Pfenninger, a surgeon trained by Dr. Johann Heinrich Rahn in the city's Medico-Surgical Institute. Rural surgeons played an important role in rural leadership.
On 6 February 1798 a revolutionary Landeskommission dissolved the centuries old Zurich constitution and pronounced full and equal rights for all cantonal residents. In early March Berne (the bastion of aristocratic rule) fell. On 29 March Zurich’s ruling councils finally submitted to a new constitution dictated by France. Zurich was now an administrative district of the "Helvetic Republic". The urban guilds were dissolved and their property redistributed. By late spring the canton had become a major theatre of war. An Austrian army under Archduke Charles defeated Massena’s French army and occupied the city. A Russian army commanded by Korsakof relieved the Austrians in late summer. His Cossacks encamped within the Physical Society botanical garden in Wiedikon; they destroyed its fences and irrigation system, grazed their horses on its rare plants and shrubbery, and used its flower pots for cooking. By autumn 1799 the French had recaptured the city and imposed their version of Cossack plunder: they demanded a payment of three million francs, two-fifths of which had to be paid by the burgers immediately in cash. Several families were forced to sell most of their possessions to meet the payment. Many patricians went into exile.

Needless to say, such sad times discouraged scientific activity. The flame of the Physical Society flickered and nearly died. Discourse continued in the small group of middle citizen Ordinarii, but its pace slowed considerably. Members read only 26 papers in 1800, one-half of which concerned medicine, chemistry, or physics. Between 1798 and 1802 they spent nothing on instruments.
or collections. Nearly all of the financial records until 1813 showed deficits. The local organization of Naturforscher did not recoup its strength until after the reconstruction of Europe in 1815. By then, Zurich belonged to a modern industrial world. The Physical Society changed its name to the Natural Science Society (Die Naturforschende Gesellschaft) and participated in a network of cantonal scientific organizations headed by the Swiss Natural Science Society (Die Schweizerische Naturforschende Gesellschaft; founded in 1815). Scientific forms of cognition would play far different social roles than what they had played during the Old Regime.
EPILGUE

Switzerland resembles a Chinese box. Into it history has nested cantons, towns, villages and communes, sovereign cloisters and monasteries, and free valley associations. Because of the mosaic surface of the country, it is very difficult to say anything general about "Swiss science" of any century. What can be said of Swiss cognition of their physical environment when it is so often claimed that Swiss are only Swiss when outside of their country; within it, where loyalties are directed toward the canton or even to the city or village? The principle of local autonomy dates back to the earliest days of the confederation; few powers have ever been given up by home authorities. Ethnic and linguistic particularism further complicates the picture: What have Swiss Italian, Swiss French, and Swiss German scientists in common? What can be said about the organization of Swiss scientific curricula when each canton controls its own educational structure?

In the opening address to the 1934 meeting of the Swiss Natural Science Society, Paul Karrer, Nobel laureate and president of Zurich's Natural Science Society, noted the overriding practical flavor of Swiss science. It dated, he suggested, from the eighteenth century Enlightenment-influenced decision to support science as socially useful knowledge. To support his criticism of the resulting predominance of applied science at the expense of more theoretical studies, Karrer recalled the correspondence of an earlier Swiss Natural Science Society president, Andreas von Planta, with Polytechnical Institute professor

197
Viktor Meyer. In 1873 Von Planta had pointed out that:

In Switzerland, a single discovery in the chemistry of cheese-making is more likely to make you immortal than a thousand studies of the finest examples of isomerism in organic chemistry.28

This association of science with practical, locally-determined needs compliments the standard characterization of the Swiss population as a thoroughly skillful, efficient, and entrepreneurial people, but a people with little feeling for sensuality or for the "ideal". In the movie The Third Man, Orson Welles (playing character Harry Lime) observed in an emotional outburst: "The Italian Renaissance was full of crimes and excesses, and yet it gave us the greatest masterpieces of art.... Switzerland has lived in peace for three centuries, and what has she given us? The cuckoo clock?". And, André Gide remarked in his journals: "I am constantly reminded as I walk through Zurich how much more conducive to art is sensuality than sentimentality. Really I am quite at sea here; I feel more alien to these people, and they to me, than I would among Zulus or Caribbeans". A Swiss stereotype persists.

The focus of this work has been the eighteenth century ancestor of Paul Karrer's organization — Zurich's Physical Society. From at least the time of Johannes Gessner to the time of Karrer, organized Zurich science appears to have tended toward local application. In the eighteenth century, the ruling class vision of a harmonious territorial organism directed Naturforschung into a study of the regional ecology. Thought for the economic uses of natural knowledge prevailed over theoretical curiosity. Though they made no discoveries
In the chemistry of cheese-making, Economic Commissioners explored the utility of the potato in relieving famine, experimented with wild chestnuts as fodder, and found ways to more efficiently spread manure. Discourse related more to concrete socio-political issues than to any positivistic body of scientific ideas.

In trying to explain this tendency of the Physical Society, one hopes to avoid invoking the influence of "Swiss national character". References to the industry and sobriety of the peasants and merchants of the population do not go very far to illuminate the social meanings of Swiss science. National character, after all, should be relatively approximate between a Züricher and an Appenzeller, but every Swiss knows there is a world of difference between the two.

A compartmentalized cultural environment required a compart-minded historian. Links between Zurich scientists and the broad European scientific community that no doubt existed were here unexplored. Links between the Physical Society and the scientific organizations of other Swiss towns must still be explored. Despite the particularism of the country, Switzerland flourishes. As Francis Bacon noted in the seventeenth century (in "Of Nobility"): "We see the Switzers last well, notwithstanding their diversity of religion, and of canton. For utility is their bond, and not respects". By comparing the outlook of the various scientific societies within the Old Confederation, it should be possible to say something more meaningful about the general character of Swiss science during the Enlightenment.
NOTES

I. INTRODUCTION


7. Cited in Steinberg, 182.


9. Candolle, 186.


In the 1940's and 1950's, Walter had combined his skill in sociology with historical research into the rich archives of Zurich's Naturforschende Gesellschaft. Most of his early analysis focused on social and economic statistics collected by the eighteenth century Economic Commission (a branch of the scientific society). In 1945 he published an article "Johannes Gessner und die Gründung der zürcher Naturforschende Gesellschaft" in the journal Volkshochschule. He first broached comparative study of Swiss science in a lecture at the University of Zurich entitled (in translation) "Berne, Zurich, and Basel as Centers of Scientific Research: A Comparison". In the September 1951 volume of the Vierteljahreschrift der Naturforschende Gesellschaft in Zurich, his article "Die Pflege der exakten Wissenschaften (Astronomie, Mathematik, Kartenkunde, Physik, und Chemie) im alten Zürich" appeared.

14. Walter did not strictly align his conclusions with those of Candolle, or with the Weber-Merton thesis, but he did find that Swiss science flourished in Protestant cities where industry and commerce was strong. In Catholic Switzerland, the Church-tied ruling classes supported the arts but inhibited science, he argued.

15. This table compiled from Walter's "Anhang, Schweizer Naturforscher vom 15. bis zum 18. Jahrhundert" (366-374) suggests something of Walter's statistical comparison of "significant" scientists in Swiss towns of the early modern period:

<table>
<thead>
<tr>
<th>Town</th>
<th>1500-1599</th>
<th>1600-1699</th>
<th>1700-1799</th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td>Geneva</td>
<td>1</td>
<td>5</td>
<td>43</td>
<td>49</td>
</tr>
<tr>
<td>Basel</td>
<td>4</td>
<td>8</td>
<td>23</td>
<td>35</td>
</tr>
<tr>
<td>ZURICH</td>
<td>6</td>
<td>10</td>
<td>14</td>
<td>30</td>
</tr>
<tr>
<td>Berne</td>
<td>3</td>
<td>2</td>
<td>13</td>
<td>18</td>
</tr>
<tr>
<td>Schaffhausen</td>
<td>1</td>
<td>5</td>
<td>2</td>
<td>8</td>
</tr>
<tr>
<td>Neuchatel</td>
<td>0</td>
<td>0</td>
<td>8</td>
<td>8</td>
</tr>
<tr>
<td>Lausanne</td>
<td>0</td>
<td>1</td>
<td>4</td>
<td>5</td>
</tr>
<tr>
<td>Lucerne</td>
<td>0</td>
<td>1</td>
<td>3</td>
<td>4</td>
</tr>
<tr>
<td>Freiburg</td>
<td>0</td>
<td>2</td>
<td>2</td>
<td>4</td>
</tr>
</tbody>
</table>


17. Walter, "Die Pflege der exakten Wissenschaften ..."; on Zingg: 6, 10, 25, 32ff; on Waser: 6, 64, 81ff, 87.
18. Candolle, 165-166.
20. Shapin and Thackray, 8.


22. Earlier attempts to unify Swiss scientific work had occurred but failed. In the late seventeenth century Swiss members of Germany's "Accademia Leopoldina" in Suseinfurt (founded 1652) proposed to bring together Swiss physicians and naturalists within one learned society. However, Johann Conrad Peyer of Schaffhausen (1653-1712) and Johann Jakob Harder of Basel (1656-1711), the leaders of the movement, failed to realize the dream. In the 1790s, Joseph Samuel Wytenbach (1748-1830), a Berne professor, corresponded with Henri-Albert Gosse (1753-1816), a Genoves apothecary, over a plan to unite the local scientific groups of Switzerland already organized. The day's political turmoil prevented immediate fulfillment of their goal; Both Wytenbach and Gosse helped to found the Swiss Natural Science Society in 1815.


Eduard Feuter, Grosse Schweizer Forscher (Zurich, 1939); Geschichte der exakten Wissenschaften in der schweizerischen Aufklärung (1680-1780) (Aarau, 1941).


NOTES FOR INTRODUCTION

Bernhard Hilt, "Johann Jakob Scheuchzer und seine Reise in Land Utopia", in Vierteljahrschrift der NOZ 21 (1946);
"Johannes Gessner (1709-1790)", Gessnerus 3 (1946), 103-124;


Rudolf Steiger, "Johann Jakob Scheuchzer, 1672-1733", in Schweizer Studien zur Geschichtswissenschaft 15 (1927);
"Verzeichnis des wissenschaftlichen Nachlasses von J.J. Scheuchzer", in Vierteljahrschrift der NOZ 78 (1933), 1-75.

Rudolf Wolf, Geschichte der Vermessungen in der Schweiz als historische Einleitung zu den Arbeiten der schweizerischen geodatischen Kommission (Zurich, 1879).

Ferdinand Rudolf, Die Naturforschende Gesellschaft in Zurich, 1746-1896 (Zurich, 1896).

Eduard Rubel (see end of note 22).

This bibliography is far from comprehensive. Any student interested in the internal history of Swiss science should start by examining the contents of Gessnerus, Vierteljahrschrift, herausgegeben von der Schweizerischen Gesellschaft für Geschichte der Medizin und der Naturwissenschaften, 1943- present (Aarau: Verlag H.R. Sauerlander & Co.)

II. WHICH ENLIGHTENMENT?


2. Robert Darnton, "In Search of the Enlightenment: Recent Attempts to Create a Social History of Ideas", Journal of Modern History 43 (1971), 113. He argues that historians of eighteenth century thought should come down from the intellectual peaks to concentrate on the problem of situating the Enlightenment within more precise social contexts. In particular, he focuses criticism on Peter Gay's two-volume study of the Enlightenment. Gay answers Darnton in his "Why was the Enlightenment?", in Eighteenth Century Studies. Presented to Arthur M. Wilson (ed. Peter Gay; Hanover, New Hampshire, 1975), 59-73. These two articles can be read together as valuable polemical pieces in the on-going debate over the interpretation of the Enlightenment as a social phenomenon and the value of a sociological method in intellectual history.

4. Though Reill contented himself in this work with a rather traditional history of ideas examination of "secondary figures", he noted that a volume on the sociology of the German Enlightenment could perhaps better differentiate Aufklärung from the western Enlightenment.

5. German historians have questioned the standard "western" interpretation of the Enlightenment for a long time. In 1945 Max Wundt remarked that "Enlightenment" was in fact a very unenlightening term by which to conceive the history of the eighteenth century (Die Deutsche Schilphilosophie im Zeitalter der Aufklärung; Tubingen). Georg Lukacs in Goethe and His Age (translated by Robert Anchor; London, 1968) asserted that the German Enlightenment was not a poor imitation of the French and British Enlightenment but a form distinct and in some ways in advance of the western movement. In an article for the Lessing Yearbook (entitled "Scholarship on the German Enlightenment as Cultural History: An Essay", 6, (1974), 139-149), Thomas Sains related that positive German developments have been wrongfully studied in opposition to Aufklärung: "It is time to be militant and to retake the territory that has been sliced away from the Enlightenment by such salami tactics. It makes more sense to see Lessing, Klopstock, the Sturm und Drang, and even aspects of Classicism and Romanticism in the context of the Enlightenment than to see in them heralds and anticipators of some nebulous Deutachtum(146). Like Sains, Reill argues that cliches, questionable value judgements, and Franco-British bias have diverted attention from the real German Enlightenment; he questions those who see the Enlightenment as essentially cosmopolitan, those who demean the contributions made to it by the Germans, or those who oppose its German form to superior national traditions of thought" (ix).

6. "Stände, roughly translated, refers to the orders, corporations, and estates derived from medieval and early modern European social and political practice. It carries with it the connotation of a specific social and legal mentality associated with one order (Stand) or with the complex of all. A Ständestaat is a state where corporate orders, constituted bodies, and a juridical system postulated upon the Stände predominate".

Reill, (Berkeley, 1975), 221 n. 6.

7. Reill pointedly criticized a too uniform generational scheme linking western and German Enlightenment figures: "Too often we find thinkers such as Christian Wolff and Voltaire bracketed together. They were contemporaries, but they did not share the same set of basic experiences, nor did they attempt to answer
the same set of vital questions.... Wolff and his generation were still part of the great age of speculation that preceded the Enlightenment.... Only when Wolff's immediate influence waned can we detect a dominant conjunction of intellectual forces that paralleled those of the Enlightenment. This conjunction occurred around 1740".

Reill, 7.

8. One of these positivistic critics was Karl Popper. His works include: Logik der Forschung (Vienna, 1934-35); The Poverty of Historicism (London, 1944, 1957). For an excellent short discussion of Popper's influence on the sociology of knowledge, see Robert K. Merton, "The Sociology of Science: An Episodic Memoir", in The Sociology of Knowledge in Europe, edited by Merton and Jerry Gaston (Carbondale and Edwardsville; London; 1977).


10. Reill's final chapter has the title "Structure of Development and Appreciation of the Unique". Bodmer is the subject of more than half the chapter. Reill related that "despite his wide contacts and his acknowledged learning, Bodmer remains one of the shadowy figures in most histories of eighteenth century German thought. At best he is recognized for his role in the reformation of eighteenth century aesthetics, but even in that he is often viewed as an un system atic precursor to Baumgarten, Lessing, Herder, and the Sturm und Drang. Except by a small number of writers, Bodmer's role in shaping a new German historical awareness has gone unmentioned. Yet in interests and in disposition Bodmer was, as the historian Fritz Ernst observed, 'a born critical historian'.

Reill, 200.


12. For another opinion on Bodmer's significance and on the nature of the Bodmer-Gottsched debate, see Ernst Cassirer, The Philosophy of the Enlightenment (translated by Fritz A. Koelln and James P. Pettegrave; Boston, 1951), 333-337; also Carlo Antoni, Der Kampf wider die Vernunft: Zur Entstehungsgeschichte des deutschen Freiheitsgedankens (translated from Italian by Walter Goetz; Stuttgart, 1951), 37-54.


15. Reill; 8.

16. Regarding Muller, see Reill, 87. Readers should also be aware of the following published works: Edgar Bonjour (ed.), Johannes von Muller, Briefe in Auswahl (Basel, 1953), and J.H. Fussli (ed.) Johann Muller's Briefe an seinen ältesten Freund in der Schweiz (Zurich, 1812).

Regarding Iselin, see Reill, 65-66. Iselin's greatest scholarly work was Über die Geschichte der Menschheit (Basel, 1786).

17. Reill argued that Göttingen became more important for Aufklärung than did Berlin because the "Berlin of Frederick the Great was, despite certain notable exceptions, influenced by those amenable to French absolutistic thinking", 8.

18. E. Ziehen discussed Germany's enthusiasm for Switzerland in Die deutsche Schweizerbegeisterung in den Jahren 1750-1815 (Frankfurt am Main, 1922).

19. For a discussion of Schlözer's attitude toward the Swiss, see Reill, 54, 143-144, and 238 n. 71.

20. J.J. Wilhelm Heinse: "Man zählt an die 800 am Leben, die etwas drücken lassen". Cited by Sigmund Widmer, Zürich, Eine Kulturgeschichte (Zurich, 1979), VII: 46.


23. Four good histories of Switzerland in English should be identified: Raphael Armattoe, The Swiss Contribution to Western Civilization, with a foreword by Julian S. Huxley (Dundol, 1944); Hans Kohn, Nationalism and Liberty: The Swiss Example (London, 1956); Georg Thurer, Free and Swiss: The Story of Switzerland (London, 1970); and Christopher Hughes, Switzerland (London, 1975).

24. R.E. Keller examined Swiss German language in German Dialects (Manchester, 1961). See also scattered discussion of Swiss German literary figures in Eric A. Blackall, The Emergence of German as a Literary Language, 1700-1775 (Cambridge, 1959).

25. One should not casually dismiss the idea of a Swiss German literary unity. In 1845 Jakob Burckhardt, the great Renaissance historian, wrote:
"Among better educated thinking, German-speaking Swiss, if only quietly for the moment, the feeling of belonging to Germany, of our inner, original unity, is spreading as they are less and less able to convince themselves sincerely of the existence of Swiss nationality. They consider themselves lucky that no dialect raised to the dignity of a written language separates them from Germany as the Dutch are... Are we really one nation with the Genevese or Ticinese as is repeatedly asserted?". Cited by Jonathon Steinberg, Why Switzerland, 105-106.

Twentieth century Swiss Germans have often felt this attraction uncomfortable. During the Second World War, their language could not be used outside of the Confederation without the risk of people jumping to the wrong conclusion about their nationality. Today the maxim seems to be that Swiss Germans should not use High German too well or too badly.


27. Ulrich Im Hof, Aufklärung in der Schweiz (Bern, 1970); Hans Hubschmid, Mensch und Welt in der schweizerischen Aufklärung (Affoltern am Albis, 1950).

28. Several historical works deal with the relationship of the Alpine landscape to Swiss mentality, including: W.A.B. Coolidge, The Alps in Nature and History (London, 1908); A. Gunther, Die Alpenländischen Gesellschaft als sozialer, politischer, und kultureller Lebenskreis (Jena, 1930); Heinrich Decker, Barockplastik in den Alpenländern (Vienna, 1943); and Hermann Alfred Schmid, Die Entzauberung der Welt in der Schweizer Landeskunde: Ein Beitrag zur Geschichte der Aufklärung in der Schweiz (Basel, 1942). Schmid's work is especially enlightening on Scheuchzer, 106ff. See also Im Hof, 84-85.


33. Heinz Balmer discussed Alpine aesthetics in Albrecht von Haller (Bern, 1977), a compact, nicely illustrated work which is one of a series of "homeland-conservation" publications similar to those issued by the Sierra Club in the United States. In particular, see the short essay on Haller as poet, 37ff.

34. Translated by Hendrik Betlem in The Mountains of Switzerland, 89-91.


36. Sigmund Widmer, Zürich, Eine Kulturgeschichte, VII: 46.


38. Im Hof, Aufklärung, 50-52. See also Hans Nabholz, Die Helvetische Gesellschaft 1761-1848 (Horgen, 1961).


III. THE SOCIAL OUTLOOK OF THE CANTONAL ENLIGHTENMENT

1. Gay, "Why was the Enlightenment?", 71. He went on to say that:

"an effective social history of ideas cannot stop with merely tinkering with the sociology of knowledge. It must go further and abolish it. I agree with sociologists like Raymond Aron who have said that there is, and can be, no sociology of knowledge.... we must abandon the confident automatic claim to the primacy of the social. It may be the social dimension that has primacy, it may be the status of technology, or the internal history of the intellectual tradition. It all depends."


3. Ibid.

5. Robert E. Schofield offers a general review of scientific societies and their historiography in "Histories of scientific societies: needs and opportunities for research", History of science 2 (1963), 70-83.


7. On the Guild Revolution, see Anton Largiader, Bürgermeister Rudolf Brun und die Zürcher Revolution von 1336 (Zurich, 1936); and H. Zeller-Werdmüller, "Zur Geschichte der Zürcher Verfassungsänderung von 1336", Zürcher Taschenbuch (1898). On the Old Regime constitution, the most comprehensive sources are: Leo Weiss, Verfassung und Stände des alten Zürich (Zurich, 1938); and Paul Guyer, Verfassungszustände der Stadt Zürich im 16., 17. und 18. Jahrhundert unter Einwirkung der sozialen Umschichtung der Bevölkerung (Zurich, 1945).


9. Historical work on Zurich guilds is extensive. For sources see Werner Schwyzer, Quellen zur zürcher Zunftgeschichte (Zurich, 1936), 2 vols., and Salomon Oyr, Zürcher Zunft Historien: Schilderungen aus der Geschichte Zürichs (Zurich, 1929). For general interpretations of the guilds, use Hans Schulthess, Die politische Bedeutung der Zunfte im zürcherischen Staatswesen (Zurich, 1926) and Rene Schoop, Rechtstellung, politische und wirtschaftliche Bedeutung der Zürcher Zunfte, besonders in Zeitraum von 1498 bis 1798 (Zurich, 1955). References to work on the individual guilds can be found in these books.

10. David von Wyss, Politisches Handbuch für die erwachsene Jugend der Stadt und Landschaft Zürich (Zurich, 1796), 209.

11. Johann Caspar Fässl, Versuch eines Handbuches der schweizerischen Staatskunde (Zurich, 1796), 209.


17. In the major constitutional revision of the 1490's, the guilds had lost much of their insular craft nature. Tradesmen in gold, glass, salt, iron, and textiles — previously limited to the Constabulary — were permitted free election into any of the guilds.


22. Steinberg, 24.


28. Johann Heinrich Hottinger (1620-1667); Johann Jakob (1652-1735); Heinrich (1647-1692); Conrad (1688-1727); and Johann Jakob (1750-1819).


30. Bodmer's contemporary Jakob Rudolf Schinz evaluated Bodmer's local influence in Was Bodmer seinem Zürich gewesen (Zürich, 1783).


32. Von Wartburg, 73-74.

33. Anton Largiader, Geschichte der Stadt und Landschaft Zürich II: 8-12. See also Ernst Saxer, Die zürcherische Verfassungsreform von Jahre 1713 mit besonderer Berücksichtigung ihres ideengeschichtlichen Inhaltes (Zürich, 1938).

34. Largiader, II: 23; Finsler, 53-55.

35. Leo Weiss, Die politische Erziehung im alten Zürich (Zürich, 1940), 163; Finsler, 55-57.


37. See chapter seven of this dissertation, 182-188.


IV. JOHANNES GESSNER AND THE BIRTH OF CIVIC SCIENCE


2. E. Walter, "Die Pflege der exacten Wissenschaften", 30-32.


4. Hans Hubschmid distinguished four generations of the Swiss Enlightenment in Gott, Mensch und Welt in die schweizerischen Aufklärung (Bern, 1950). Historians frequently discuss Enlightenment thought in terms of generational representatives. We should, however, be more familiar with sociological theories of development based on the formation and interaction of generations; we could start by reading Julian Marias Aguilera, Generations: A Historical Method, translated by Harold C. Raley (Tuscaloosa, 1970). Aguilera was a student of Ortega y Gasset.


7. Gessner's academic memberships included: Upsala (1742); the Academia naturae curiosorum (1746) as 'Arcanus II'; Stockholm (1747); the botanical society of Florence (1748); Göttingen (1755); St. Petersburg (1761); the Societas Georgica at Pavia (1773); the Gesellschaft der Naturforschenden Freunde in Berlin (1776); and the Böhmische Gesellschaft der Wissenschaften (1785). His correspondents included: Boerhave in Leyden; Linnaeus in Upsala; Jussieu in Paris; Gmelin in Tübingen; Gronov in Leyden; Brander in Augsburg; Jallabert in Geneva; Johann II Bernouilli in Basel; Sulzer in Berlin; Van Royen in Leyden; Schreiber in Peters burg; Bertram in Pennsylvania; Ehrhard in Memmingen; Ludwig in Leipzig; König in Bern; Stahelin in Basel; and Lambert in Mulhausen.


8. Gessner rarely left the canton after he returned from university study. A bright-eyed scholar with a long, broad nose and small pursed mouth who in later years grew heavy-jowled, Gessner seems to have exhibited intense personality traits. Hypochondria apparently helped to turn him into a homebody; however, he made good impressions upon his students. One of his students, Paul Ustari (the fourth Physical Society president) wrote about Gessner:

"Pendant les ames qu'il a rempili les fonctionnes de ses places il a rendu des services essentielles et durable a sa patrie en propageant le gout des sciences exactes en formant un nombre considerable de disciples qui le reveraient et qui l'ont honore par leur merites"

In Biographic Universelle (1816), 124.

9. In October 1732 Gessner wrote to Haller:

"D. Poliatrum Muraltem juniiorem praterito mense obisse, te forsan non latet. Vices Poliatri jan tenet Cel. Scheuchzerus, stipendio vero medico auctus est D. Landolt, medicus omnium nostrorum natu minimus. Vides inde, quanum spes praemii aut honoris animos excitat".


10. In his eulogy of Gessner before the Physical Society on 5 July 1790, Dr. Hans Caspar Hirzel explained why so few of Gessner's papers had been published:

"Gessner machte sich zweytens wichtig durch seine in den Druck ausgegeben Schriften. Es ist aber zu bedauern, dass deren nach dem Verhältniss seines weitumfassenden Gelehrsamkeit nur wenige an der Zahl sind. Aber dazto grosser ist ihr Gewicht. Gessner hatte bey seinen holländischen Lehrern, die nicht nötig hatten dem Geldgewinn zum Endzweck ihrer Bucher zu machen, die Maxime angenommen,
NOTES FOR "JOHANNES GESSNER..."

lange zu sammeln, wohl zu verdauen und nichts herauszugeben, das
nicht ganz durchgedacht und vollkommen ausgearbeitet wäre. Hierzu
kam eine ihm angebohrene Schuchternheit und beynahe übertriebene
Bescheidenheit. Er glaubte, ein Schriftsteller musste Ehrfurcht
für das Publikum haben, und nichts unreifes demselben mittheilen.
Die Werke mussten also lange in dem Pult liegen bleiben, und oft
übersehen, und von neuem überdacht werden. Man musste sich vorerst
das Vorhandne vollständig bekannt machen, und nicht eher die Presse
gebrauchen, bis man etwas Wichtiges und Neues, oder das Bekannte in
hellern Lichte und mit mehr Genauigkeit mitzuteilen im Stand
ware. Bey seinem Fleisse, alles Neue kennen zu lernen und in seine
Schriften einzutragen, und bey der unpartheyischen Prüfung, weit
entfernt, in Buchern Stoff zum tadeln zu suchen, sondern seine
Begriffe zu prüfen, zu berichtigen und vollständiger zu machen,
fand er immer neues Licht, und verschob die Ausarbeitung einer
Anfangnen Werks".

Ferdinand Rudio cites this long passage from Hirzel’s Denkrede
auf Johannes Gessner in Die Naturforschende Gesellschaft in Zürich
1746-1896 (Zurich, 1896), 62.

Christoph Salomon Schinz (1764-1847) worked to publish Gessner’s
manuscripts after Gessner’s death in 1790. His greatest accom­
plishment was Tabulae phytographicae analysis generum plantarum
exhibentag, with commentary and edited by C.S. Schinz (Zurich,
1795-1826).

11. Sections 5-10 of the "Statutenentwurf 1746, von der Hand des
späteren Burgermeisters Hs. Cd. Heidegger", Zurich Staatsarchiv
B IX 207 (A-1).

12. Bernhard Milt, "Die Entwicklung der zürcher Naturwissenschaften",
13-15; F. Schwerz, "Die Anfange einer naturforschenden Gesellschaft
in Zürich im 17. Jahrhundert. Gründungen und Statuten der ersten
wissenschaftlichen Gesellschaften", in Zürcher Monats-Chronik
15 (1946), 99-105.

13. Gottfried Escher von Luchs, "Verzeichnisse der Officianten und
Mitglieder der Gesellschaft", B IX 207.

The original membership roll with the signatures and seals of
the Society members are found in B IX 209 (121-128) and B IX
210 (75-79).

14. Collective biographical history of Physical Society members is
very difficult since most or them did not perform publishable
scientific work. The standard dictionaries of scientists
(the DSB; J.C. Poggendorff’s Biographisch-Literarisches
Handworterbuch zur Geschichte der exakten Wissenschaften
[Leipzig, 1861]; August Hirsch’s Biographisches Lexicon der
hervorragenden Ärzte aller Zeiten und Völker, second edition
[Berlin, 1929-1935]) help to identify only a few of the members.
NOTES FOR "JOHANNES GESSNER..." 215

I accomplished satisfactory identification of 303 members of the eighteenth century fellowship only after examining a great volume of diverse sources. I collected a good deal of biographical data from the Dictionnaire Historique et Biographique de la Suisse (Neuchatel, 1921-), from local histories of Zurich families (detailed in my attached bibliography), and from secondary sources on Zurich history. The following bio-bibliographical guides and prosopographical aids were also helpful: Genealogisches Handbuch zur Schweizer Geschichte, 3 vols. (Zurich, 1900-1916); Der Schweizer Familienforscher (Zurich, 1938-); Allgemeine deutsche Biographie, 56 vols (Leipzig, 1875-1912).


See also Bruno Barbatti, Das 'Refuge' in Zürich (Zurich, 1957), and Leonhard von Muralt, Gedanken zur Geschichte der Familien von Orelli und von Muralt (Zurich, 1939).

17. The fourth president of the NOZ, Paul Usteri, discussed his family's history in Leonhard Usteri, Denkreden von Paul Usteri auf seinen Vater. Kleine gesammelte Schriften (Aarau, 1832). See also H. Peter, Leonhard Usteri (Zurich, 1965).

18. C. Keller-Escher, Familie Escher vom Glas (Zurich, 1885).


20. Emil Walter analyzed the work of Arduser, "Der Pflege der exacten Wissenschaften", 19-29.

21. From 1706 to 1723 Wolff (1679-1754) taught mathematics and natural philosophy at Halle. In 1721 he delivered a lecture citing the adages of Confucius as proof that reason can attain moral truth by its own efforts. Incensed colleagues reported him to the Prussian government. Frederick William I ordered him to leave the country within 48 hours on pain of death. Wolff fled to Hesse; there, from 1723 to 1740, he taught at Marburg. Frederick II recalled him to Halle. By 1743 Wolff presided as the university's vice-chancellor and his textbooks soon replaced those in the tradition of Philip Melanchthon.

22. Abhandlung der Naturforschenden Gesellschaft in Zürich (Zürich, 1766) III: 3-4.

23. Ibid., 15.


The course of Gessner's early addresses before the Society can be followed in "Abhandlungen der Naturforschenden Gesellschaft", B IX 242 (1747) and B IX 243 (1748-1754).


26. Downs and Dadd Stea defined 'cognitive mapping' as a "process composed of a series of psychological transformations by which an individual acquirees, codes, stores, recalls and decodes information about the relative locations and attributes of phenomena in his everyday spatial environment".


Historical geography seldomly has done more than summarize lessons of demographic history. Historical understanding of spatial behavior is perhaps another field of knowledge fertilized by the discipline of geography.

27. Abhandlungen der NGZ (1761) I: 79.

28. There are several works to consult on Old Zurich medicine, among them: Otto Bucher, "Die Anfänge der wissenschaftlichen Anatomie in Zürich", Gesnerus 2 (1945), 131-141; Edgar Frenk, Johann Rudolf Burkhards "Syllogae Phainomenon Anatomikon", ein Einblick in das Krankengut des Zürcher Spitals vor 200 Jahren (Aarau, 1958); Bernhard Milt, Geschichte des Zürcher Spitals (Zurich, 1951); and G.A. Wehrli, Die Wundaerzte und Bader Zürichs als zunftige Organisation (Zurich, 1931).
NOTES FOR "JOHANNES GESSNER..." 217


Mesmerism helped to shape the ideas of the pastor-physiognomist Johann Caspar Lavater, but the influence of Lavater's Mesmerism on the Physical Society appears to have been slight. The issue of Mesmer's influence on Zurich's scientific community perhaps deserved research within the archive of the NOZ. Lavater's papers are housed within the Zentralbibliothek Zurich: ZBZ Ms. 149.

31. Abhandlung der NOZ (1766) III: 22.


V. SCIENTIFIC ENTERPRISE IN PATRICIAN SOCIETY, 1747-1759

1. The banking firms were:
   
   Bank Leu & Co.
Pestalozzi zum weissen Thurm
Caspar Schulthess und Co. im Rechberg
Usteri, Ott, Escher, und Co.
Tauenstein zum steinernen Erker
Usteri und Co. auf den Hirschengraben
Johann Wirth auf den Munsterhof
Hans Caspar Escher im Stadelhofen

The best economic history of eighteenth century Zurich is Hans Conrad Payer, Von Handel und Bank im alten Zürich (Zurich, 1968).

S. Widmer related the episode involving De Rocairol in Zurich. Eine Kulturgeschichte (1979) VII: 76.


5. B IX 225. The records remain in their original report booklets. On the Zinskommission, see Finsler, 50.
6. Rudolf Schinz' plan for the greenhouse (30 August 1779) with sketches by J.H. Baumert rest within B IX 255. See also "Jahresberichte der Naturf. Gesellschaft, 1779-80", B IX 167; and "Akten und Rechnungen betr. den Botanischen Garten", B IX 222.

7. F. Rudio, 46-47.


9. Ibid., 18.

10. "General-Calcul über die Summarias aus denen jährlich abgelegten Rechnungen einer Lobl.-Physikalischen Gesellschaft in Zurich von derselben verordnet-befindlichen Quaestorat", B IX 224. This includes accounts for the purchases of books, instruments, machines, cabinet pieces, engravings, and for the payment of rent on the meeting hall and on the property of the botanical garden.


12. Heidegger's "Statuten" read:

"Bey besetzung der Stellen eines Praesidis, quaestoris und Beyder Secretariorum, sollte weder anmeldung noch namsung vorgehen, sondern ein volliges Scrutinium beobachtet werden, und kleiner zu diesen stellen gelangen mogen, Er habe denn wenigstens 2/3 vota. Ein jeder der eine von diesen 4 stellen bekleidet, solle dabey 1 Jahr lang zu bleiben verpflichtet seyn, nach verfluss desselben aber, dieselbe wohl aufgeben, und dann für das nächst folgende Jahr nicht damit belegt werden mogen. Uebrigens bleibt ein jeder bey seiner stelle, lebenslang, oder bis er sie selbst aufgibt. Die wiederbesetzung dieser 4 stellen solle bei Erster Zusammenkunft nach vorgefallener vacantz geschehen". B IX 207 (A-1). See also F. Rudio, 21.


14. An early inventory of Society instruments placed within the Zunfthaus zur Meise before 1759 exists: "Inventarium aller Mobilien an Hausrath, Instrumenten, Mahlersyen etc. wie solche ... auf dem Zunfthaus zur Meise befinden worden den 23. April 1759". B IX 150 (-4).
15. "De motibus variatis" (1749); "De motibus variatis supplementum in quo vires centrales exponentur" (1750); "De hydroscopis constantis measurement" (1754); "De triangulorum resolution, primario Metheseos ad Physicam applicatae fundamento, I. II." (1757-58).

S. Walter analyzed the contents of these works, 'Die Pflege', 68-71.


18. Some of Gessner's works, including the catalog of his herbarium, are now available on microfilm. For example, see Tractatus physicus de petrificatis (Leyden, 1758), microfilm 15-81, no. 59, List 81.

VI. THE SOCIAL PROGRAM OF THE ECONOMIC COMMISSION
1760-1779

1. "Seit 1778 wurde (die ökonomische Gesellschaft) darin durch die offizielle landwirtschaftliche Kommission unterstützt".

Von Wartburg, 35.

See also Alexandra Kraus, Die Einflüsse der physiokratischen Bewegung in Literatur und Gesetzgebung und ihre praktische Auswirkung in der Landwirtschaft der Schweiz (Vienna, 1928), 75.

See Archivkatalog 343: 35, 148 (Zürich Staatsarchiv) for Physical Society listings on the state economic commissions. On the role of sub-groups in the society, see B IX 208; 35a.


3. Ibid., 72.
4. Rousseau, D'Alembert, Condorcet, Mirabeau, Lagrange, Kant, and Herder all responded to essay competition. Basel's Leonhard Euler earned approximately 30,000 Livres (or 8,000 Taler) for 12 prize-winners at Paris, and the Bernouillis (Daniel, Jean, and Johann) won in excess of that amount in 16 Paris contests.


7. A number of these societies published collections of their economic writings; see Hans-Heinrich Muller, Akademie und Wirtschaft im 18. Jahrhundert, 287, 291.


The Commission made annual reports, or "Relationen", to the general Society; B IX 54 (1766-1779) and B IX 55 (1780-1793).


11. Johann Jakob Ott (1715-1769), a charter member of the Physical Society, was the son of a prosperous silk merchant and one of Johannes Gessner's first pupils in his class at the Carolinum. Ott left the family business to relatives and devoted his adult years to political office — he was a 'Twelver' of the Zimmerleuten guild — and to academic interests. He published in 1763
The Physical Society planned to include Ott's "Die Vertheilung der Sonnenwarme in der Erde" in a fourth volume of Abhandlungen, but the issue never went to press. (J.H. Lambert included Ott's geothermal observations in his posthumously published *Pyrometrie oder vom Masse des Feuers und der Warme* (1779).)

Ott worked to improve the state of cantonal forests. In 1767 he won public financing for an Economic Commission plan to establish an experimental tree nursery (the first in Switzerland). By the mid-1770s this woods -- known as the "Sihlholzli" for its location along the Sihl River -- included nearly 20,000 young trees. See Arnold Hauser, "Der erste schweizerische Versuchswald im Zürcher Sihlholzli 1768-1808", Schweizerischen Zeitschrift für Forstwesen 2 (September 1963), 505-516. See also Heinrich Grossmann, *Der Einfluss der ökonomischen Gesellschaften auf die Entstehung einer eigentlichen Forstwirtschaft in der Schweiz* (Bern, 1932), 43-67.

Ott and the Economic Commission attributed the widespread cantonal wood scarcity, and resulting high cost of wood for fuel and construction, to the false prejudice prevalent among peasants that regarded woods as wild spots which required no other attention than cutting them down at a proper age. To improve the care of its woods, the Commission undertook several measures. First of all, it asked peasants to respond to several essay competitions involving the success of experimental seeds, the best time for seeding, whether leaves should be collected or left to decay into the soil, whether trees should grow unregulated or whether they should be trimmed and cropped, and the extent of damage caused by cattle feeding in the woods. The Commission collected the responses, edited them according to the ruling point of view, and circulated "Instructions" (Anleitungen) recommending techniques and procedures. In July 1769 Economic Commissioners joined with delegates from government to revise the "Waldungsmandat" of 1717. Four years later the city council passed a 16-article "Erneuerte Waldungsmandat". See Grossmann, *Forstwirtschaft*, 64-67.


16. Ibid.

17. Ibid., 440.

18. Ibid., 484. See also Hirzel's letter to the editor of the second French edition of Le socrate rustique (Lausanne, 1764), translated into English by Arthur Young, The Rural Socrates, Or, a Description of the Oeconomical and Moral Conduct of a Country Philosopher. Written in German by Mr. Hirzel, President of the Physical Society at Zurich (London, 1800), 107-108.

Young's translation is available as an "Early American Imprint" [microfiche] of the American Antiquarian Society (Evans # 15226).


20. Ibid., 440-441.

21. Ibid., 442.

22. Ibid., 338. The moral education of the peasant was Hirzel's central idea. See his letter to Baron von Tschudi of Glarus in Hirzel's Auserlesene Schriften zur Beforderung der Landwirtschaft und des hauslichen und burgerlichen Wohlfahrt (Zurich, 1792) I: 316.

The Economic Commission's interest in rural education is evident in several records of the Physical Society, for instance: "Relation von den Verrichtungen der Oecon. Comm.", B IX 55, 199-200, 275. These reports to the general fellowship date from years 1770 and 1771.


25. A. Young, 84.


29. In 1782 the price for a "Mutt" of grain was 5.32 guilders; it had been 6.7 guilders in 1778. The Commission estimated that each person required an average of 2 1/2 "Mutt" of grain annually. Annemarie Custer, *Die Zürcher Untertanen*, 9.

See B IX 17, Nr. 42-46 for papers evaluating the state of the regional corn market, 1779-1782.


32. See "Vermischte ökon. Abhandlungen", B IX 16, nr. 25, letter from an Obervogt to the Commission on rural industry.

Also see Archivkatalog 343 for NG2 archive listings of papers concerning rural industry and poverty.


The Commission's recommendations for the countryside came in the form of "Berichte und Vorschläge an die Gemeinden", commonly known in the proceedings of the Society as "Reskripte".

B IX 86-91 holds "economic tables" for numerous cantonal communities. B IX 106 surveys agricultural experiments conducted over a 12-year period (1782-1793) under the supervision of the Economic Commission.


The Economic Commission reported to the Society on the matter of enclosure of common pasture many times. For the period of the village controversies discussed here (p.160), see "Relation von den Verrlichungen der Oecon. Comm.", B IX 55, 25ff (1768), 20 (1769), and 17-18 (1770).


37. Arthur Young, The Rural Socrates, 86.

38. Ibid., 87.

39. A number of these rural correspondents joined together to create a branch commission of the Economic Commission; they called it the "Freiwillige ökonomische Kommission von Landleuten im Ausseren Amt der Grafschaft Kyburg", "Relation über den Verrichtungen der ökonomischen Commission", B IX 55, 18 (1768).

See Appendix for list of contributors to the Economic Commission essay competitions.

The life-history of one of these rural economists, Heinrich Bosshard, is available: Heinrich Bosshard, eines schweizerischen Landmanns Lebensgeschichte (Winterthur, 1804-1810).

40. A. Young, 98.

41. Ibid., 94-95. See also G.C.L. Schmidt, Der schweizer Bauer im Zeitalter des Frühkapitalismus, II: 269, and A. Stiefel-Bianca, 44-45.

42. Young, 139-140. The Commission over the years kept fairly close to Kleinjogg's status:

"Bey Unterredungen mit Landleuten". B IX 59: 42, 240;
B IX 60: 34; B IX 67: 6, 15, 31, 76, 94.

"Vermischung der Erdarten. Unterredung". B IX 60: 148-150;
B IX 67a: 366, 416; B IX 59: 287.

"Sandgrube und Anwendung des Sands aufs Felder". B IX 61: 8, 32, 42, 73, 84.

"Hochzeit seines Sohns". B IX 60: 41-42.


See also Fritz Ernst, Kleinjogg, der Musterbauer (Zurich, 1935).


44. B IX 70: 89. For the Commission's attitude toward rural industry in the period 1785-1787, see "Vermischte Papiere", B IX 264.

45. Von Wartburg, 71-88.

NOTES FOR "ECONOMIC COMMISSION:..." 225


48. Ibid., 475. Hirzel elaborated this position in his letter of 4 October 1779 in the Auserlesene Schriften zur Beförderung der Landwirtschaft und das haußlichen und burgerlichen Wohlfahrt (1792) I: 408.

49. The council mandate rests within the Zurich Staatsarchiv, III AA bl.

50. Hirzel, Hirtenbrief (Zurich, 1777), 47. See also R. Braun, "Protoindustrialization", 320-333.

VII. TWILIGHT OF FELLOWSHIP 1780-1798


2. Escher von Luchs, "Geschichte der Instrumentensammlung", B IX 207 (B-11). See also "Verzeichnis von Instrumenten", B IX 149; and F. Rudio, 179-180.


4. Salomon Schinz, Reflexionen über die Strahlableiter (Zurich, 1776), and De electricitate. Cum Suplemento (Zurich, 1777).

5. David Breitinger, Reflexionen ob es wohl gethan ware, Strahlableiter in unserer Stadt Zurich einzuführen (Zurich, 1776), and Nachricht von dem Einschlagen des Blitzes in einen Wetterableiter, nebst Berichtigung einiger Begriffe über die Wirkung der Ableiter (Zurich, 1786).

A brief historical examination of the controversy was printed "Wie Zurich seine Blitzableiter bekam", in Neue Zürcher Zeitung, Nr. 4229, 18 October 1963.


9. Reill, 54, 143-144.


11. One of Waser's population tables is in B IX 127: 2.

12. See floral arrangement in B IX 208: 60-61. Gottfried Escher vom Luchs organized Waser's later manuscripts for his essay "Die wichtigsten Momente aus der Geschichte der Naturforschende Gesellschaft von ihrer Gründung an bis zur Feier ihres 100-jahr. Jubiläums", in Denkschrift zur Feier des 100-jahr. Stiftungsfestes (Zurich, 1846). His manuscripts on Waser rest within B IX 207 (B-17).

See also R. Braun, "Protoindustrialization", 324 n. 18.

14. Ibid.


16. Ibid., 44.


A copy of this publication rests within B X 26 (2-b)

18. Emil Walter, "Die Pflege der exacten Wissenschaften", 6, 64, 87. In note 110, page 103, Walter remarked:


20. Wolfgang von Wartburg, 245-258. Details of the Stäfa affair are explored in Otto Hunziker, Der Memorial- und Stäfnerhandel (Stafa, 1895).

21. Cited Von Wartburg, 293. Other contemporary opinions from Physical Society members are on record within the NGZ archive; see, for instance, Hans Jakob Escher (1734-1800, Ordinary member), "Kurze Beschreibung der entstandenen Unruhen in unserm Lande 1794-1795", B IX 111. Annemarie Custer analyzed this manuscript fully, Untertanen, 95-96. See also B IX 111a for a typescript of this manuscript made by Dr. Custer in September 1964. B IX 111a also includes "Joh. Kasp. Lavater an seine Landesvater vor dem Strafursehul über die Hauptschuldigen an den inlandischen Unruhen".

There is in addition an excellent volume of Quellen zur Schweizer Geschichte, 17 (Basel, 1897) devoted to sources on the Stäfa affair.
22. A. Custer, Untertanen, 72-74.


26. Martin, History of Switzerland, 186-188. Martin recognized the Helvetic Revolution as a consequence of social tension between city and country:

"If the Revolution found an echo in the subject districts when it was brought to us in the baggage trains of the French army, if here and there it secured some sentimental support, it was not because it proclaimed liberty, fraternity, or unity. The Swiss had no desire whatever to be one and indivisible; a practical race, they had no belief in fraternity; while as to liberty, they had it, or thought they had it, already.

What attracted the Swiss peasantry to the Revolution was the abolition of feudal obligations and the breaking of the bonds of servitude. They were impressed by the sentence, almost monumentally hypocritical from his mouth, but full of explosive force, which Bonaparte used when he annexed the Valtellina: 'It is not right that any people should be subject to another people'. They were moved also by the hope, naturally dear to tillers of the soil, of exemption from feudal dues. The Swiss Revolution was an agrarian revolution because the Swiss people were a people of peasants", 173.

27. B IX 229

APPENDIX A

CHRONOLOGY OF MAJOR EVENTS IN PHYSICAL SOCIETY HISTORY

<table>
<thead>
<tr>
<th>Year</th>
<th>Event</th>
</tr>
</thead>
<tbody>
<tr>
<td>1745</td>
<td>Johannes Gessner's preparatory course</td>
</tr>
<tr>
<td>1746</td>
<td>Formal foundation of the Physical Society in August</td>
</tr>
<tr>
<td>1747</td>
<td>Gessner outlines a scientific agenda before a meeting in the Limmatburg; by the end of the year, 82 Zurich citizens belong to the fellowship.</td>
</tr>
<tr>
<td>1748</td>
<td>The Society purchases an azimuthal quadrant from the mechanic Brander in Augsburg; the botanical and lottery commissions are formed.</td>
</tr>
<tr>
<td>1749</td>
<td>Three new performing members join the Ordinarii: Johann Jakob Koechlin, Heinrich Rahn, and Salomon Hirzel.</td>
</tr>
<tr>
<td>1750</td>
<td>Johannes Verdmuller carries a volume of Voltaire under his arm into the Grossmunster; the Society spends only 750 guilders for the year.</td>
</tr>
<tr>
<td>1751</td>
<td>President Gessner suggests that the organization move from the Limmatburg into the Zunfthaus zur Meise (then under construction); membership stands at 87 members.</td>
</tr>
<tr>
<td>1752</td>
<td>The lottery commission completes its series of public drawings in March.</td>
</tr>
<tr>
<td>1753</td>
<td>Two Ordinary members die: Hans Jakob Schulthess and Pastor Hans Heinrich Gossweiler; news of the publication of Linnaeus' <em>Species Plantarum</em>.</td>
</tr>
<tr>
<td>1754</td>
<td>Gessner completes &quot;De Hydroscoapis Constantis Mensurae, Disquisitiones Phys.-Math.&quot;; in Germany, Christian Wolff dies.</td>
</tr>
<tr>
<td>1755</td>
<td>Membership plummets to its lowest level in the century, 72 members.</td>
</tr>
<tr>
<td>1756</td>
<td>Late in the year the fellowship moves its belongings into the Meisen guildhall.</td>
</tr>
<tr>
<td>1757</td>
<td>Dr. Hans Caspar Hirzel commemorates the Society's move into the Meisen in his 10 January address entitled &quot;Von dem Einfluss der gesellschaftlichen Verbindungen&quot;.</td>
</tr>
</tbody>
</table>
Gessner's protege Dr. Salomon Schinz is elected an Ordinary member; in Bern, the Economic Society is created.

A second historical period of the Physical Society begins with the establishment of the Economic Commission.

Astronomical observatory in the attic of the Meisen operates for its first year.

Hirzel's "Die Wirtschaft eines philosophischen Bauers" is published within the first volume of Physical Society Abhandlungen.

Members deliver 100 papers; a new membership class of Swiss 'EHrenmitglieder' is initiated with the election of 15 men from outside of Zurich; 27 members of the Society contribute 109 guilders to purchase a 'Theatrum machinarum' from Seuffert in Augsburg.

The first 'Bauerngesprache' is held.

Heinrich Schinz's economic history of the city and canton of Zurich is published within volume II of the Abhandlungen; Leonhard Usteri becomes an Ordinaria and Daniel Bernouilli an 'Ehrenmitglieder'.

Gessner completes the fourth part of his "Phytophraphiae Sacrae Generalis"; Heidegger begins a movement to reform the city schools.

A third volume of Abhandlungen is published.

The Society adopts an official escutcheon under the title "Sigilum Soc. Phys. Turicensis"; a new botanical garden is begun on property in Wiedikon.

The Economic Commission hears enclosure disputes.

Johann Jakob Ott, charter member and original director of the Economic Commission, dies; membership expands to over 100 men.

Arthur Young first translates Hirzel's essay, "The Rural Socrates".

Economic Commission sponsors first "Instructions" ('Anleitungen') to the peasantry; Johann Heinrich Waser is elected an Ordinary member.
1772
Ordinarii elect first corresponding members; Society makes gift of barometer to Capucin monks of the St. Gotthard hospice.

1773
Ordinary member David Breitinger becomes professor of mathematics at Zurich's new Künstschule; Robert Strange becomes a corresponding member; Gessner completes his *Phytographia Sacra*.

1774
Volta sends the Society an electrophorus; Arthur Young is elected to be a correspondent; Pastor Waser publically criticizes government officers.

1775
Goethe visits.

1776
Society studies lightning rod; Volta and Abbe Jean Rozier are selected as corresponding members.

1777
Community crisis over Regime's handling of renewal of mercenary alliance with France; Albrecht von Haller dies.

1778
Heidegger dies and leaves a 200 guilder legacy to the Society for the promotion of cantonal agriculture; membership hits its eighteenth century peak: 130 men.

1779
Waser arrested; Lessing publishes *Nathan der Weise*.

1780
Waser executed; historical period of the Zurich Enlightenment appears to be ending.

1781
Engineer Johannes Feer is elected as Ordinarius.

1782
A greenhouse is constructed at the botanical garden.

1783
Senator Dr. Rahn presents Economic Commission with a gift of 100 guilders.

1784
Economic Commission completes a population table for the city of Zurich. (See B IX 84)

1785
Johann Heinrich Orell, charter member and burgermeister, dies and leaves the Society a legacy of 200 guilders; the Society purchases a large cabinet of precious metals from Landvogt Zoller.

1786
Membership stands at 114.

1787
Three new Ordinarii are added: Christoph Salomon Schinz, David Breitinger, jr., and Johann Jakob Romer.
1788 Dr. Paul Usteri becomes an Ordinaria; Sir Charles Bladgen visits.

1789 Instrument Commission established and in the next nine years spends over 2,500 guilders on instruments. Zurich remains unaffected by French Revolution.

1790 Johannes Gesaner, president of the Physical Society from its inception, dies at age 81; succeeded in his office by Dr. Hans Caspar Hirzel.

1791 Chur's Carl Ulysses von Salis Marschlin is elected an 'Ehrenmitglieder'.

1792 Hirzel publishes Auserlesene Schriften zur Beforderung der Landwirtschaft und des baurlichen und buergerlichen Wohlfahrt.

1793 Junker Hans Ulrich Blaarer, charter member, dies.

1794 Rural unrest at Stafa begins; Hans Conrad Escher 'von der Linth' becomes Ordinaria.

1795 Membership stands at 110; city suppresses Stafa Memorial.

1796 Last two performing members elected during the eighteenth century: Hans Jakob Cramer and Johann Caspar Fassi; David Rahn becomes the Society's secretary.

1797 City councils pass hasty rural reforms in hopes of averting revolution; political divisions seem to affect the spirit of the Physical Society.

1798 Activity of the scientific fellowship comes to a standstill as Zurich's Old Regime ends; yet, the Society publishes its first "Neujahrsblatt an die zürcherische Jugend"; botanical garden virtually destroyed by Cossacks.
APPENDIX B
PERFORMING MEMBERS (ORDINARII) OF THE PHYSICAL SOCIETY, 1746-1798

CHARTER MEMBERS:

1. Dr. Johannes Gessner 1709-1790
2. Dr. Johann Heinrich Rahn 1709-1786
3. Dr. Hans Jakob Schulthess 'zum oberen Hammerstein' 1706-1753
4. Dr. Hans Jakob Gessner 1711-1787
5. Hans Heinrich Escher 1713-1777
6. Hans Conrad Meyer 1693-1766
7. Johann Conrad Heidigger 1710-1778
8. Johann Jakob Ott 'in der Schipfe' 1715-1769
9. Hans Ulrich Friess 1716-1786
10. Hans Ulrich Blaarer 1717-1793
11. Hans Ludwig Steiner 1711-1779

JOINING BETWEEN 31 AUGUST 1746 AND 9 JANUARY 1747:

12. Dr. Hans Conrad Meyer 'zum Felsenegg' 1715-1788
13. Dr. Hans Caspar Hirzel 1725-1803
14. Professor Johann Jakob Cramer 1714-1769
15. Professor Johann Jakob Gessner 1704-1787
16. Pastor Hans Jakob Gessner 1694-1754
17. Pastor Hans Heinrich Gossweiler 1717-1753
18. Johann Jakob Wirz 1705-1764
19. Hans Felix Corrodi 1722-1772

20. Johann Heinrich Schulthess 'zur Limmatburg' 1707-1782

10 JANUARY 1747-1749

21. Hartmann Rahn 1721-1795 (1747)
22. Ludwig Steiner 1688-1761 (1748)
23. Johann Caspar Scheuchzer 1719-1788 (1747)
24. Johann Jakob Koechlin 1721-1788 (1749)
25. Heinrich Rahn 1716-1785 (1749)
26. Salomon Hirzel 1727-1818 (1749)

1750-1759

27. Rudolf Freytag 1728-1786 (1754)
28. Hans Jakob Escher 1734-1800 (1756)
29. Heinrich Lavater 1731-1818 (1756)
30. Johann Heinrich Schinz 1727-1792 (1757)
31. Dr. Salomon Schinz 1734-1784 (1758)

1760-1769

32. Dr. Hans Conrad Rahn 1737-1787 (1760)
33. Johann Martin Usteri 1738-1790 (1761)
34. Rudolf Burkhard 1721-1784 (1761)
35. Hans Conrad Vogeli 1729-1791 (1761)
36. Pastor Johann Heinrich Ziegler 1738-1818 (1761)
37. Johann Heinrich Schinz 1725-1800 (1761)
38. Captain Johannes Beyel unknown (1761)
39. Hans Caspar Füssli 1728-1769 (1763)
40. Leonhard Usteri 1741-1789 (1764)
41. Dr. Hans Georg Locher 1739-1787 (1766)
42. David Breitinger 1737-1817 (1767)
43. Diethelm Lavater 1743-1826 (1768)
44. Salomon Landolt 1741-1818 (1768)
45. Wilhelm Schweizer died 1775 (1768)
46. Johannes Scheuchzer 1738-1815 (1769)
47. Hans Conrad Römer 1724-1779 (1769)
48. Johann Caspar Lavater 1741-1801 (1769)

1770-1785
49. Johann Jakob Pestalozzi 1749-1831 (1770)
50. Hans Caspar Brunner 1738-1790 (1770)
51. Hans Conrad Lochmann 1742-1780 (1770)
52. Johann Heinrich Waser 1742-1780 (1770)
53. Dr. Johann Heinrich Rahn 1749-1812 (1771)
54. Johann Conrad Heidegger 1748-1808 (1774)
55. Salomon Pestalozzi 1753-1840 (1775)
56. Hans Rudolf Schinz 1745-1790 (1775)
57. Johann Heinrich Orell 'im Grabenhof' 1757-1799 (1776)
58. Johann Conrad Nuscheler 'im Neusgg' 1759-1856 (1778)
59. Johannes Feer 1763-1823 (1781)
60. Johann Jakob Scheuchzer 1734-1810 (1784)

1786-1798
61. Dr. Christoph Salomon Schinz 1764-1847 (1787)
<table>
<thead>
<tr>
<th>No.</th>
<th>Name</th>
<th>Years</th>
<th>Year</th>
</tr>
</thead>
<tbody>
<tr>
<td>62</td>
<td>David Breitinger</td>
<td>1763-1834</td>
<td>(1787)</td>
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<tr>
<td>63</td>
<td>Johann Jakob Römer</td>
<td>1763-1819</td>
<td>(1787)</td>
</tr>
<tr>
<td>64</td>
<td>Dr. Paul Usteri</td>
<td>1768-1831</td>
<td>(1788)</td>
</tr>
<tr>
<td>65</td>
<td>Ludwig Meyer 'von Knobau'</td>
<td>1769-1841</td>
<td>(1792)</td>
</tr>
<tr>
<td>66</td>
<td>Leonhard Schulthess 'im Lindengarten'</td>
<td>1775-1841</td>
<td>(1792)</td>
</tr>
<tr>
<td>67</td>
<td>Dr. David Rahn</td>
<td>1769-1848</td>
<td>(1793)</td>
</tr>
<tr>
<td>68</td>
<td>Hans Conrad Escher 'von der Linth'</td>
<td>1767-1834</td>
<td>(1794)</td>
</tr>
<tr>
<td>69</td>
<td>Johann Caspar Horner</td>
<td>1774-1834</td>
<td>(1795)</td>
</tr>
<tr>
<td>70</td>
<td>Hans Jakob Cramer</td>
<td>1771-1855</td>
<td>(1796)</td>
</tr>
<tr>
<td>71</td>
<td>Johann Caspar Faesi</td>
<td>1769-1849</td>
<td>(1796)</td>
</tr>
</tbody>
</table>
APPENDIX C

SWISS 'EHRENMITGLIEDER' OF THE PHYSICAL SOCIETY, 1762-1798

<table>
<thead>
<tr>
<th>Honor member</th>
<th>Residence</th>
<th>Dates</th>
<th>Year elected</th>
</tr>
</thead>
<tbody>
<tr>
<td>Aepli, Jean-Melchior</td>
<td>Diesenofen</td>
<td>1707-1787</td>
<td>1774</td>
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<tr>
<td>Alibert, Johannes</td>
<td>Bern</td>
<td>unknown</td>
<td>1765</td>
</tr>
<tr>
<td>Ammann, Johann Conrad</td>
<td>Schaffhausen</td>
<td>1724-1811</td>
<td>1762</td>
</tr>
<tr>
<td>Bansi, Heinrich</td>
<td>Flasch (Grisons)</td>
<td>1754-1800</td>
<td>1778</td>
</tr>
<tr>
<td>Bernouilli, Daniel</td>
<td>Basel</td>
<td>1700-1782</td>
<td>1764</td>
</tr>
<tr>
<td>Beroldingen, Joseph von</td>
<td>Speier</td>
<td>1738-1816</td>
<td>1764</td>
</tr>
<tr>
<td>Biedermann, Johann Jakob</td>
<td>Winterthur</td>
<td>1721-1794</td>
<td>1774</td>
</tr>
<tr>
<td>Dick, Johann Jakob</td>
<td>Lusslingen (Ct. Bern)</td>
<td>1714-1779</td>
<td>1773</td>
</tr>
<tr>
<td>Egg, Rudolf</td>
<td>Ellikon (Ct. Zurich)</td>
<td>unknown</td>
<td>1793</td>
</tr>
<tr>
<td>Engel, Samuel</td>
<td>Bern</td>
<td>1702-1784</td>
<td>1762</td>
</tr>
<tr>
<td>Escher, Johann Heinrich</td>
<td>Berg (Ct. Zurich)</td>
<td>1713-1777</td>
<td>1764</td>
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<tr>
<td>Frey, Johann-Rudolf</td>
<td>Basel</td>
<td>1727-1799</td>
<td>1764</td>
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<td>Glutz, Johann-Karl</td>
<td>Solothurn</td>
<td>1731-1795</td>
<td>1772</td>
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<tr>
<td>Grafenried, Emanuel von</td>
<td>Ct. Bern</td>
<td>1726-1787</td>
<td>1762</td>
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<tr>
<td>'Herr von Carouge'</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Grafenried, Jean-Rudolphe</td>
<td>Ct. Bern</td>
<td>1729-1790</td>
<td>1762</td>
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<tr>
<td>von 'Herr von Worb'</td>
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<tr>
<td>Haller, Albrecht von.</td>
<td>Bern</td>
<td>1708-1777</td>
<td>1762</td>
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<tr>
<td>Haller, Gottlieb</td>
<td>Bern</td>
<td>1735-1786</td>
<td>1765</td>
</tr>
<tr>
<td>Emanuel von</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Name</td>
<td>Place</td>
<td>Years</td>
<td>Death Year</td>
</tr>
<tr>
<td>---------------------------</td>
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<tr>
<td>Hermann, Franz-Jakob 'Abbé'</td>
<td>Solothurn</td>
<td>1717-1786</td>
<td>1766</td>
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<tr>
<td>Hettlinger, Johann Jakob</td>
<td>Winterthur</td>
<td>1734-1803</td>
<td>1777</td>
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<td>Hoepfner, Johann-Georg</td>
<td>Biel</td>
<td>1759-1813</td>
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<td>1766</td>
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<tr>
<td>Jetzler, Christoph</td>
<td>Schaffhausen</td>
<td>1734-1791</td>
<td>1766</td>
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<tr>
<td>Kappeler, Moritz Anton</td>
<td>Lucerne</td>
<td>1685-1769</td>
<td>1762</td>
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<tr>
<td>Koch, Johann Heinrich</td>
<td>Thun (Ct. Bern)</td>
<td>unknown</td>
<td>1774</td>
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<tr>
<td>Lambert, Johann Heinrich</td>
<td>Mulhausen</td>
<td>1728-1777</td>
<td>1762</td>
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<td>Meyer, Hans Jakob</td>
<td>Pfungen (Ct. Thurgau)</td>
<td>1731-1792</td>
<td>1774</td>
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<td>Mieg, Achilles</td>
<td>Basel</td>
<td>1731-1799</td>
<td>1762</td>
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<tr>
<td>Pictet, Marc-Auguste</td>
<td>Geneva</td>
<td>1752-1825</td>
<td>1770</td>
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<tr>
<td>Razoumowsky, Gregory 'Comte de'</td>
<td>Lausanne</td>
<td>died 1837</td>
<td>1785</td>
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<tr>
<td>Rudilz, Prince 'von'</td>
<td>Ct. Uri</td>
<td>unknown</td>
<td>1782</td>
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<td>Rutschmann, Johann Hch.</td>
<td>Eglisau</td>
<td>1768-1819</td>
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<td>Salis-Marschlins, Karl Ullyses von</td>
<td>Chur</td>
<td>1760-1818</td>
<td>1791</td>
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<td>Scherb, Jakob-Christoph</td>
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<td>1748-1798</td>
<td>1778</td>
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<td>1735-1814</td>
<td>1762</td>
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<tr>
<td>Name</td>
<td>Location</td>
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</tr>
<tr>
<td>---------------------------</td>
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<td>Sulzer, Johann Caspar</td>
<td>Winterthur</td>
<td>1716-1799</td>
<td>1766</td>
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<td>Sulzer, Johann Georg</td>
<td>Winterthur</td>
<td>1720-1779</td>
<td>1763</td>
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<td>Thormann, Franz</td>
<td>Bern</td>
<td>1715-1779</td>
<td>1769</td>
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<td>Tschärmann, Niklaus-Emmanuel</td>
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<td>1767</td>
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<td>1764</td>
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<td>Verdeil, Francois</td>
<td>Lausanne</td>
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<td>Werndli, Johannes</td>
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<td>1773</td>
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<tr>
<td></td>
<td>[surgeon in Surinam]</td>
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APPENDIX D

CONTRIBUTORS TO ESSAY COMPETITIONS OF THE ECONOMIC COMMISSION FROM 1762-1798

Very few of these contributors can be fully identified. For many of these men, I have simply recorded their last name, occupation, and village of residence.

Ammann from Obermeilen
Hans Rudolf Bachofen, bailliwick of Freudwil
Johannes Baenninger, schoolmaster at Ober-Embrach
Peter Baenninger, 'Landrichter' at Embrach
Coppersmith Baer from Ober-Rifferswil
Heinrich Bans, pastor at Flasch
Conrad Bleuler of Herrliberg
David Bodmer of Trullikon
Hans Ulrich Boelsterli of Wiesendangen
Heinrich Bosshart (1748-1815), land surveyor at Rumikon
Heinrich Braendli of Martahlen
Heinrich Brunner of Erlenbach
'Alt Ehegaumer' Hans Jakob Buchmann of Maschwanden
Schoolmaster Hans Heinrich Daendliker of Hombrechtikon
Hans Ulrich Derrer of Oberglatt
Hans Dubendorfer of Dubendorf
'Gerichtsvogt' Hans Caspar Egg (d. 1792) of Ellikon
Conrad Egli of Herrliberg
Felix Aerni (or Erni) of Pfaffikon
Hans Ulrich Ernst of Veltheim
'Untervogt' Johannes Farner of Stammheim
Heinrich Frank of Fluntern
Hans Conrad and Salomon Freihof of Veltheim
'Amtmann' and schoolmaster Hans Jakob Frey of Ober-Urdorf
'Kirchenpfleger' Jacob Frey (1754-1828) of Ober-Uster, later pastor at Feuerthalen
Hans Rudolf Furrer of Pfaffikon

240
Jakob Furrer of Unterschlatt
"Kufer" and 'Bannwart' Heinrich Goetschi (d. 1783) of Oberrieden
Heinrich Gross of Brutten
Schoolmaster Jonas Hagenbuch of Andelfingen
"Untervogt" Hans Jakob Hauser of Wadenswil (born 1744; received Zurich citizenship in 1795 in reward for his loyalty to the Regime during the Stafa Affair)
Hans Jacob Hertzschweiler of Wetzwil
Carpenter Jacob Hitz of Langnau
Hans Rudolf Hotze, member of the "Waldunskommission" (died 1794), of Oerlikon
Hans Jakob Hotze of Hottingen
Caspar Hotze of Oberrieden
Schoolmaster Hans Jacob Hurter of Urzlikon (near Cappel)
Schoolmaster Mattheus Keller of Trullikon
Hans Heinrich Keller of Unterreich
Jacob and Johann Knecht of Hinwil
Miller Rudolf Koch of Schoflisdorf
Johannes Koelliker, shipbuilder and tanner at Thalwil
Captain Hans Heinrich Kramer of Buch am Irdel
Schoolmaster Johann Krebser of Wollissellen
Salomon Kuhn of Grafschaft Lindau
Johannes Manz (or Mantz) of Glattfeld
Schoolmaster Hans Martin Meyer of Rumlang
'Schlosser' Kaspar Meyer
Heinrich Meyer of Nanikon
Adam Moetteli of Andelfingen
Georg Morf of Nider-Iltnau
Heinrich Morf of Trullikon
Heinrich Muller of Rudolfingen
Hans Rudolf Naegeli of Hottingen
Jacob Naegeli of Munschof
Fire-captain Hans Rudolf Notz of Cappel
'Gerber' Jakob Rudolf Notz of Pfaffikon
Jacob Ottiker of Wetzikon (Ruti)
Heinrich Peter of Ellikon
Matthaeus Pfister of Luftingen
Postal carrier Ulrich Reich (1766-1834) of Sennwald (Ct. St. Gallen)
Schoolmaster Rosell of Ruschlikon
Jakob Ruegg of Neubrunn-Turbenthal
Junker Schmid of Uster (submits his essay under the pseudonym 'Mesagrocius')
Johannes Schneebeli of Affoltern am Albis
Schoolmaster Abraham Schollenberger of Buch
Schoolmaster Schutz of Bachs
Felix Schweizer of Oberglatt
'Untervogt' Conrad Sigrist at Rafz
Schoolmaster Spalinger of Marthalen
'Gerichtsvogt' Jakob Spiess (died 1775)
Spoerri of Embrach
Andreas and Jacob Staub of Thalwil
'Alt Weibel' Hans Heinrich Steiger of Uetikon
Heinrich Steiner of Veltheim
Schoolmaster Steinmann
Rudolf Suss of Wisendangen
Johannes Thomann (1720-1805) of Zollikon
Captain Hans Jacob Toggenburger of Marthalen
Heinrich Walder of Unter-Wetzikon
Schoolmaster Jacob Weber of Runlang
'Gerichtsvogt' Jacob Weidmann of Nieder-Weiningen
'Untervogt' Hans Georg Wipf of Kybourg (Also given burger status in 1795 for supporting Regime during Stafa affair.
'Amtmann' Heinrich Wirz of Erlenbach
Schoolmaster Hans Heinrich Wolfensberger of Ettenhausen
Hans Martin and Rudolf Zangger of Nossikon
Schoolmaster Caspar Zweifel of Hongg
'Seckelmeister' Hans Ulrich Zoebeli of Ober-Weiningen
'Untervogt' Daniel Zollinger of Watt

The major contributors and correspondents to the Economic Commission from the countryside were: Pastor David Wieser of Wisendangen, pastor David Klint of Rickenbach, Joh. Jak. Meyer of Weisslingen, Ulrich

See Albert Hauser, "Johann Heinrich Waser", 50.

This catalog of Preisfragen contributors was compiled by the author from B IX 18-24 ("Preisanhandlung von Landleuten: Beantwortung landwirtschaftlicher Preisfragen, mit wenigen eingestreuten Drucken"), and from B IX 27-31 ("Briefe an die ökonomische Kommission", 1768-1793).
APPENDIX E

BUDGETARY ACCOUNT OF THE PHYSICAL SOCIETY, 1747-98

Compiled from "Rechnung der: Haupt Cassa", B IX 229, Zurich Staats-archiv. Figures have been rounded off to the guilder.

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## APPENDIX F

**ABHANDLUNGEN DER NATURFORSCHENDEN GESELLSCHAFT IN ZÜRICH**

| 1. Title page of the first volume of Abhandlungen published in 1761 by 'Heidegger und Compagnie'. | Page 247 |
| 2. Table of Contents. Volume I (1761). | 248-249 |
| 3. Table of Contents. Volume II (1764). | 250 |
| 4. Table of Contents. Volume III (1766). | 251 |
Naturforscherinnen und Gesellschaft

Zürich

1. Band

1761

[Image of a scene with a group of people]
Inhalt.


IV. Abhandlung von einer neuen Weise, das Getreide lange Jahre ohne Verderbung und Verfall zu erhalten, und wie dieselbe zum Nutzen unseres Vaterlands besonders angewendet wäre, von Heinrich Schüpf, hinger. p. 133.

Inhalt.

V. Bemerkungen von der Börse der Fischerei und verschiedener Krankheiten. pag. 119.


IX. Anleitung wie man durch Verbesserung der nassen Wärmespannen, und vernünftige Ordnung im Handel, der Belebung und Gebrauch des Bischofs den Wechseln vorzubeugen könne. p. 349.

Die
2. (continued)

Inhalts.

X. Die Wirthschaft eines Philosophischen Hauses, entworfen von H. C. Hertz, M. D. und Stadtarzt. pag. 171.

XI. Vorschlag einiger durch die Erfahrung bewährter Hilfsmittel gegen den Brand im Korn, von Johann Heinrich Schultheiß, zur Erinnerung, Quartierhauptmann. p. 497.


Der Leser betriebe die eingestellten Fehler als zu verbessern.

pag. 178. L. s. dele nicht.

pag. 179. L. s. leges anstatt ungefähr 600 Lieber, nicht 300 Centner.
Inhalt.


II. Über dem Erfolg der Einführung der Posten an einigen Orten in unserer Schweiz.


IV. Anleitung für die Landleute in Abicht auf die Pflege der Bäder.

V. Versuch über den Bergkristall.

VI. Von der Untersuchung der Mineralwaßer. Von Dottore Conrado Ceitro.


VIII. Kurze Beschreibung des Pfifferfer-Mineralwaßer, und Dr. Conrad Kühn, A. D. zu Rheinberg, der berühmten Brettschiff gesungen.

IX. Beschreibung eines bequemen Reise-Bartometers, von Christoph Jostler von Schaffhausen, Mitglied der Gesellschaft.


XI. Beschreibung einer Maschine, vermittels welcher eine Masse, der in kurzer Zeit eine große Menge Wasse in die Höhe ran geboben werden. Von J. Jacob Witz, Obrmann der Kupferschmieden.


Der
Inhalt.

I. Versuch einer Geschichte der Handelschaft der Stadt und Landschaft Zürich; von Hans Heinrich Schinz; 251

II. Beschreibung einer Wasserflucht und daraus erfolgten Schlafstiche, mit Epileptischen Convulsionen und Blindheit, und der Art wie dieselben gebildet worden; von D. Johann Georg Zimmermann. 187

III. Abhandlung von der Leich-Wirtschaft, und derselben Vorteilhaftigkeit und vorzüglichem Nutzen; von Johann Heinrich Küfer von Berg. 219

IV. Entwurf allgemeiner politischer Gemeindes-Tabellen; von Mr. Blaarer. 277

V. Versuch einiger physischer und medizinischer Betrachtungen; von Laurentius Zellweger. 309

VI. Aufstellung für die Landbeute, in Abicht auf die Zünte; zusammengetragen von Leonhard Usteri. 361

VII. Beschreibung zweier Postenkrankheiten, die teils ein kalter Brand, teils nach einer vorhergegangen aussehenden Brustkrankheit andere geéértliche Züchte begleitet, und der Art wie dieselben Krankheiten gebildet worden; von D. Johann Georg Zimmermann. 381

VIII. Bemerkungen von der Mäcfung des Schilings in verschiedenen Krankheiten; zusammengetragen von D. Johann Heinrich Kahn. 415
APPENDIX G

The 'Sigilum Soc. Phys. Turicensis' over a Photograph of the 'Zunfthaus zur Meise'
BIBLIOGRAPHY

Primary Sources: Manuscripts

The manuscript sources used in this study are deposited at the State Archives of the Canton of Zurich. Serial numbers of manuscripts cited in the text and notes correspond to those in the catalog completed in March 1964 by Dr. Ulrich Helfenstein, State Archivist of the Canton Zurich.

Archiv der Naturforschenden Gesellschaft in Zurich, B IX 1-265

Primary Sources: Printed Material

Breitinger, David. Reflexionen ob es wohl gethan waere, Strahlableiter in unserer Stadt Zürich einzuführen. Zurich, 1776.


---------. Tabulae phytographicae analysis generum plantarum exhibentes. With commentary and editions by Christoph Salomon Schinz. Zurich, 1795-1826.


---------. Der philosophische Kaufmann. Zurich, 1775.


---------. Auserlesene Schriften zur Beförderung der Landwirtschaft und des haußlichen und bürgerlichen Wohlfahrt. Zurich, 1792.


Schinz, Salomon. Reflexionen über die Strahlableiter. Zurich, 1776.

---------. De electricitate. Cum supplemento. Zurich, 1777.

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