Vita Mathematica

Volume 17

Edited by
Martin Mattmüller

Johan C.-E. Stén

A Comet of the Enlightenment

Anders Johan Lexell's Life and Discoveries

Birkhäuser

Johan C.-E. Stén
Technical Research Center of Finland
VTT Espoo
Finland

ISBN 978-3-319-00617-8 ISBN 978-3-319-00618-5 (eBook)
DOI 10.1007/978-3-319-00618-5
Springer Cham Basel Heidelberg New York Dordrecht London

Library of Congress Control Number: 2014934306

Cover credit: Silhouette of Anders Johan Lexell cut by an engraver in Berlin in 1780. The signature "Haf" suggests that the artist was probably Johann Lorenz Haf (1737–1802). UBB (Basel). Published with permission.

Printed on acid-free paper

Springer International Publisher is part of Springer Science+Business Media
(www.birkhauser-science.com)

Contents

Preface

Multum adhuc restat operis, multumque restabit, nec ulli nato post mille saecula praecludetur occasio aliquid adhuc adjiciendi.
Seneca Epistulae ad Lucilium

Man sollte auf alles achten, denn man kann alles deuten.
Hermann Hesse Das Glasperlenspiel, 1943

La dernière démarche de la raison est de reconnaître qu'il y a une infinité de choses qui la surpassent. Elle n'est que faible si elle ne va jusqu'à connaître cela.
Blaise Pascal *Pensées, fr. 177 (éd. Gallimard)*

Background to This Biography

For the idea of this biography I am indebted first and foremost to Academician Professor Olli Lehto. After delivering a talk at the University of Helsinki on the occasion of the centenary of Lars Ahlfors in January 2007, he told me about the Finnish-born mathematician Anders Johan Lexell and the letters from his European journey in 1780–1781, which are preserved in Saint Petersburg, Russia [15, 106, 108]. Professor Lehto suggested that I should look for these letters and commemorate this little-known scientist and disciple of the great Leonhard Euler. Having made some preliminary inquiries at the Helsinki University Library, I found the material to be more ample and more interesting than I had imagined. I then realised that a biography of Lexell could, and indeed should, be written.

Prima facie it may seem strange that so far there exists no comprehensive biography of Anders Johan Lexell, who, after all, was among the most prominent mathematicians of his age [23]. To quote the Finnish historian of learning, Ivar Heikel (1861–1952), Lexell was [63] "[...] one of the foremost among the several talented scientists, who during the eighteenth century held a chair at the Academy of Åbo [the Finnish university]." According to the history of the Royal Academy of Åbo [80], Lexell was—besides the naturalists Pehr (Peter) Kalm and Peter Forsskål

and the chemist Johan Gadolin—the only eighteenth century Finnish scientist to meet with significant international acclaim. As has been noted in [94], these men are also the only eighteenth century Finnish scientists to have their own entries in the *Dictionary of Scientific Biography* [55].

Of course, this is not to say that nobody had ever aspired to write a biography of Lexell. According to Professor Lehto's biography of the mathematicians Lorenz and Ernst Lindelöf [92], father and son, a friend of the former, Professor Wilhelm Lagus at the University of Helsinki, had actually started to collect material connected with Lexell with the intention of writing a biography,[1] but for unknown reasons the project did not materialise. Except for short biographical entries in dictionaries, e.g. [57, 140], the biographical sketches and articles hitherto published in Finland [34, 66, 93, 94, 121, 123, 136, 153, 158], Sweden [62, 99, 101, 122, 130] and Russia [75, 106–109], being based mainly on national source material, are all somewhat biased and narrow in scope. In view of Lexell's cosmopolitan life and his vast scientific correspondence with learned men across Europe, this is neither fair nor adequate. Lexell was certainly Swedish by nationality and language, Finnish by descent, and Russian in that he had chosen to work in Saint Petersburg, but in spirit he was a scientist who knew no narrow national restrictions. Lexell's life and work are therefore clearly worthy of a wider, international contextualisation.

Methodology and Approach

In writing the history of exact sciences, it is natural also to reflect on the nature of the research as such. One of the main differences between historical and mathematical research is the fact that mathematics proceeds analytically, going from the general to the particular, whereas historical research proceeds synthetically, going from the particular to the general [29, 33].

With my background in engineering, historical research inevitably brings to mind a certain class of inverse problems in physics and engineering, where the objective is to determine the source function behind a certain effect. A biography is indeed an attempt to recreate someone's life in given circumstances (scientifically speaking "boundary conditions"), not only this person's actions, but also his thoughts and sentiments, as well as the dreams and ambitions which lay behind them. This is admittedly a difficult task, the more so as the answer will not be unique or exact: the result depends on the interpretation, the point of view and, ultimately, the interpreter himself. Thus, a certain degree of subjectivity is unavoidable.

[1] Lagus's *Lexelliana*, consisting mainly of copies of letters, are deposited at the library of Åbo Akademi, the Swedish university in Turku. Lagus used the material partly for writing the biography of another Finnish-born scientist at the Petersburg Academy of Sciences, the naturalist Erik Laxman (1737–1796) [87].

Another notable difference between the two sciences lies in the question of proof: to know something and to convey that knowledge convincingly to others, you have to be able to prove it. In the exact sciences, proofs are based on logical reasoning and mathematical rigour; in history, they are based on either verbal or written testimony. It stands to reason that in the latter, the credibility of the evidence must be judged from the reliability of the sources and an assessment of likelihoods.

In the historiography of science, explanations of historical events tend to be divided roughly into *external* and *internal*, depending on whether the impetus for the development comes from outside, or is determined by the central subject of the study itself. To achieve a balanced view, the historian of science should therefore follow at least three lines of inquiry simultaneously [147]: (1) the history of a special branch of science, (2) science during a specific period, and (3) the history of science of the relevant country or region. In the study at hand I have considered: (1) mathematics and celestial mechanics, (2) the science of the latter part of the eighteenth century, and (3) the general state of learning and science in Sweden and Russia. Like a set of co-ordinate axes, these three components will lead us to a thorough assessment of the person Anders Johan Lexell.

On the whole, it has been both a privilege and a challenge to study and describe the life of an exceptionally gifted person such as Lexell, living in an intellectually exciting era and surrounded by highly interesting personalities. I have been fortunate to have access to a rich store of letter material. Lexell was indeed prolific not only as a mathematician and astronomer, having been the author of more than a hundred publications during a life that lasted a mere 43 years (see the list of Lexell's publications in the index part of this volume). He was also a regular correspondent: his letters, written principally in Swedish and French, in an elegant style and neat handwriting, range from strictly formal scientific reports to personal thoughts and sheer gossip from the academic world. Lexell's descriptions of his famous contemporaries are precious not only because he was a clear-sighted observer, but because he inevitably brings to his descriptions his own opinions and prejudices. In their sincerity and candour the letters are also quite amusing. Whether or not these descriptions are reliable, Lexell is nevertheless an important witness of the European Enlightenment. Lexell's principal correspondents were the astronomer and Secretary of the Royal Swedish Academy of Sciences in Stockholm Pehr Wilhelm Wargentin (to whom Lexell wrote at least 112 letters), the Secretary of the Petersburg Academy of Sciences Johann Albrecht Euler (27 letters from Lexell have been recovered), the astronomers Johann III Bernoulli in Berlin (16 letters) and Anders Planman in Åbo (8 letters), as well as the naturalist Carl Linnaeus (von Linné) in Uppsala (7 letters). Moreover, he corresponded with the astronomers Joseph Jérôme de Lalande, Charles Messier, Christian Mayer, Nevil Maskelyne and the Secretary of the Royal Society of London, Charles Morton. Unfortunately, almost all letters received by Lexell are now lost. Nevertheless, it is clear that Lexell was well connected. Given the lack of previous biographical studies of Lexell, it is a deliberate choice by this author to let Lexell speak for himself, when appropriate, and in this way make as much use of the letter material as possible.

Formal Issues: Matters of Style

It is suitable at this point to adduce some formal issues that have changed since the eighteenth century. First of all, we note that scientists of old often used different orthography for their name depending on the language used in the context. The names could appear latinised, germanised, and gallicised, i.e. using French equivalents. In the case of Anders Johan Lexell these are, respectively, Andreas Ioannes Lexell, Andreas Johann Lexell and André Jean Lexell. In later Russian literature, his name sometimes appears russified as Андрей Иванович Лексель.[2] However, as a rule in this book, I have tried to preserve as far as possible the original form. In some of the letter citations, where Lexell uses a clearly different spelling of certain names from today, I have changed the spelling. However, especially in the citations, old forms such as de la Lande have been retained (for contemporary Lalande) as there seems no risk of confusion. As to the transliteration from Cyrillic to Roman script, I have followed current English practice. In cases where the transliterated name is not unambiguous, I have given the Russian spelling.

Lexell's main working languages were Swedish, French and Latin. His native language was Swedish, and although Finnish was spoken by most of the inhabitants of Åbo, Lexell's home town, it is not known to what extent he was able to communicate in Finnish. The same applies to Russian. Latin was obligatory at the university in Åbo, as were also German and French; the latter became Lexell's most important working language in Saint Petersburg. In this book, quotations in French are given in their original orthography, translated or summarised in English when necessary and occasionally corrected, with missing diacritical marks added, to facilitate understanding, while the citations in Swedish, German and Latin have been duly translated. In the process, many charming peculiarities of the eighteenth century writing style, such as addressing the recipient of the letter in the third person, have been sacrificed in favour of intelligibility and convenience.

The transition from the Julian (old style = o.s.) calendar to the Gregorian (new style = n.s.) calendar presently in use was still not complete in Lexell's times. When it started in 1582, the Julian calendar lagged 10 days behind the Gregorian. In the eighteenth century, the calendars differed by 11 days; to date, the difference has increased to 13 days. Among the last countries to put the new calendar system into practice were the Protestant countries of northern Europe (e.g. Sweden in 1753) as well as Orthodox Russia (in 1918), a fact which did not fail to cause much confusion in those days, as it was not always clear which calendar was implied. At the Petersburg Academy of Sciences, the minutes of the conferences were written using the old calendar, while in their international scientific correspondence, the new

[2]The Russian custom of using patronyms is unhistorical when applied a posteriori to Western names: Lexell's father was Jonas; thus, the artificial Иванович is misleading. By the same token, Leonhard Euler did not have a second Christian name, although his father's name Paul is sometimes (by confusion with the patronymic Павлович) attached to it in later Russian literature.

calendar was usually applied. In this book, new style dating is mainly used, but in citations and quotes, the original notation is maintained and marked in parenthesis.

Finally, a note is in order concerning the terminology and the names of the scientific disciplines used in this book. In the eighteenth century, the natural or physical sciences in particular—that is to say: biology, geology, geography, chemistry and physics, in the modern sense—were only just beginning to emerge. For those who applied themselves to these sciences, we use the general term *natural philosopher*. We refer to scientists of flora, fauna and minerals as *natural historians* or *naturalists*. Physics was then largely an experimental science—although steadily taking its first steps towards quantification—while rational mechanics and celestial mechanics were considered a part of mathematics.

Acknowledgement

This work would never have been realised without the help and guidance it has been my pleasure to receive. The Saint Petersburg Branch of the Archives of the Russian Academy of Sciences, the Centre for History of Science at the Royal Swedish Academy of Sciences in Stockholm, the Archives of the Académie des Sciences and the Bibliothèque de l'Observatoire in Paris, the library of St. John's College, Cambridge, as well as the University Libraries in Helsinki, Uppsala and Basel, have kindly supplied me with source material.

For all the help, advice and encouragement I have received, I am indebted to Tatiana Artemyeva, Per Pippin Aspaas, Simone Dumont, Emil Fellmann, Tore Frängsmyr, Carl-Fredrik Geust, Tapio Markkanen, Martin Mattmüller, Gleb Mikhailov, Eva Nyström, Vesa Oittinen, Osmo Pekonen, Jean-Nicolas Rieucau, Staffan Rodhe and Andreas Verdun. I am also grateful to Rod Sturdy for improving my English and to Andrei Nikitin for helping me out with Russian texts. My dear wife Päivi Koivisto has supported me through the process, for which I am infinitely grateful.

Financial support from the Finnish Society of Sciences and Letters is gratefully acknowledged.

Espoo, Finland
September 2013

Johan C.-E. Sten

Poem to Lexell

Cum modo disjectis tenebris Aurora rubebat,
Oreque purpureo jam dabat alma diem;
Floraque per campos suaves spirabat odores,
Nec procul a nido laeta canebat avis:
Castalidum subeo sylvas & amoena vireta,
Haec ubi vox Phoebi reddita nube fuit:
Ipse ego, qui fueram Rex inviolabilis orbis,
Quem coluit semper magna corona Deum:
Ipse ego, qui mitto cunctis mea lumina terris,
In terris naevos dicor habere meos.
Nempe meis audet radiis praescribere leges,
Me servire sibi caeca caterva cupit.
Plura locuturo vehemens dolor obserit ora,
Ergo cum tenebris hunc jubet ire diem.
Continuo at Pallas descendit culmine Pindi,
Sicque Dei vanas increpat alma minas.
Musarum Praeses, quae Te dementia cepit,
Cur Te Lexelli cura laborque coquit?
Lexell assiduos inter celebrandus alumnos,
Qui claret studiis ingenioque suo.
Visere si tentat tremulae penetralia lucis,
Da veniam placidus namque ea culpa levis.
Arte patent tali sublimia facta Tonantis,
Ingenuos juvenes hic labor usque decet.
Interea Phoebus commotam temperat iram,
Atque viam solitam currere mandat equos.

Complimentary poem to Lexell ("Auctori") written by classmate Fredrik Pryss (1741–1767) and published with Lexell's first thesis (1759). For the English translation, I am indebted to Per Pippin Aspaas.

Talibus auguriis ego ovans, perdulcis Amice,
Officium duxi visa referre Tibi.
Quos radiis addit radios Tua docta Thalia
Laudibus hos addet dextera Fama Tuis.
Perge Tuo studio, studiis obstringere Musas,
Sic tandem curis praemia digna feres.

Just as Aurora reddened the darkness-swept sky,
Gracefully bestowing a new day with her purple-red face;
And as the flowers in the fields began breathing out their delicious scents;
While close to her nest a bird began singing her joyful song;
That is when I entered the idyllic, green woods of the Muses
And all of a sudden the voice of Apollo[1] burst forth from a cloud:
"I, who once was the invulnerable King of the World,
Always revered as a God by a huge gathering;
I, who relentlessly bring my light to all lands of the Earth,
Am said to have spots[2] — by the Earthlings!
The blind heap of fools even dares to sanction laws for my rays
And wishes to see me serve as their slave!"[3]
Intending to continue his complaint, he was overwhelmed by the strength of his wrath.
Thus, he gave orders that this day was to end in darkness.
But at that very moment Athena descended from the heights of Pindus,[4]
criticising the meaningless threats of the God in the following manner:
"Head of the Muses, what madness has struck you?
Why are You provoked by Lexell's meticulous efforts?
Lexell should be praised as the one who among assiduous students
shines forth the brightest of all with his studies and intellect.
Should he attempt to venture into the holiest, awe-evoking woods,
Show him some mildness and mercy on account of the crime's insignificance.
The sublime creations of Zeus the Thunderer are exposed through such ingenuity;
Work of this kind is becoming for all youth of distinction".
Meanwhile, Apollo checked his agitated wrath,
Ordering his horses to continue their everyday path.
With omens of such magnitude I deemed it my duty, you Kindest of Friends,
To joyfully share my visions with You.
All the rays that Thalia,[5] Your erudite Muse, has added to the rays of light,
Will a favourable Fame soon add to Your laudable merits.
Persist with Your efforts to bind the Muses with studies,
Which will eventually yield the rewards You deserve for all Your painstaking labour.

[1] Phoebus Apollo, the Leader of the Muses in Greco-Roman mythology. He was occasionally identified as the Sun travelling across the sky with his chariot.

[2] Sunspots were discovered early in the seventeenth century.

[3] Apollo seems to consider science (here, the study of optics) as hubris.

[4] Pallas Athena (Minerva) was the goddess of wisdom and knowledge, and Mount Pindus the home of the Muses.

[5] Thalia is the muse associated with idyllic poetry and comedy, sometimes also with geometry and architecture.