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**Title:** A Eulogy in Honour of Anders Johan Lexell, an 18th Century Finnish Mathematician

**Year:** 2016

**Version:**

**Please cite the original version:**

Ilmavirta, J., & Stén, J. C.-E. (2016). A Eulogy in Honour of Anders Johan Lexell, an 18th Century Finnish Mathematician. In E. Torrence, B. Torrence, C. H. Séquin, D. McKenna, K. Fenyvesi, & R. Sarhangi (Eds.), Proceedings of Bridges 2016 : Mathematics, Music, Art, Architecture, Education, Culture. Bridges Finland (pp. 545-548). Tessellations Publishing. Bridges Conference Proceedings.  
<http://archive.bridgesmathart.org/2016/bridges2016-545.pdf>

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## A Eulogy in Honour of Anders Johan Lexell, an 18th Century Finnish Mathematician

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### Abstract

We present a poem written in the honour of Anders Johan Lexell (1740–1784), a mathematician of Finnish origin, who became a collaborator and successor of Leonhard Euler. The poem was composed in Latin by Fredrik Pryss (1741–1767) in the honour of the 18-year-old promising young man in 1759. We discuss the poem itself and its connections to ancient poetic tradition as well as the foresight of Pryss in seeing the career that lay ahead of Lexell. We find that the poem is of excellent quality as a piece of art following ancient style in form, language and content. Discussing Lexell’s life in light of the poem reveals that Pryss did see that Lexell would rise to fame, but not how.

### Lexell, Pryss and the Poem

Anders Johan Lexell was born in 1740 in Åbo (Turku) in a well-off family of a goldsmith. Despite not coming from an academic family, he tried to pursue an academic career in the field of mathematics, but the lack of suitable open positions in the kingdom of Sweden (which Finland was part of at the time) forced him to look for a position abroad. In 1768 Lexell was invited to move to St. Petersburg, Russia, to assist Leonhard Euler, who had settled there in 1766. Lexell’s efforts were well received and he developed into one of the most skilled theoretical astronomers of his time. In particular his name is associated with the discovery that Uranus was a planet. In 1784 Lexell died from an illness in St. Petersburg. One of the two surviving portraits of Lexell is presented in Figure 1.

Unlike Lexell, Fredrik Pryss came from an academic family. Notably, his father Samuel Pryss was a professor of theology. He himself was clearly talented, as he was ranked first of his class of students in the graduation ceremony. In 1761 Pryss was appointed docent of history and politics. He was also a Freemason of the Swedish Rite. He died prematurely in 1767, before witnessing the boost of Lexell’s career.

Lexell defended a *pro exercitio* dissertation [1] in 1759, at the age of 18. After the title page and Lexell’s thanks and dedication to his father, a poem appears under the title “Auctori” (“To the author”). Congratulatory texts were often included in dissertations since the early days of the Academy of Turku (Regia Academia Aboensis), but they were rarely written in a foreign language.

Pryss, however, chose to praise Lexell in Latin. In this task he may have been assisted by Henric Hassel, professor of eloquence at the Academy and the teacher of Latin for both Pryss and Lexell, known for having corrected the Latin of numerous dissertations. We see the choice of Latin as an indication of two things:

- Lexell was not the average student and was worthy of a poem of higher standard, and
- the poet was a highly skilled young man in the ways of ancient poetry, language and mythology.

We will elaborate on these points in the following sections.

The original Latin version can be found in [1, 2] and an English prose translation by Per Pippin Aspaas in [2]. We present a new English translation of the poem, retaining the original metric structure. We acknowledge insights given to us by an unpublished Finnish translation by Teivas Oksala.

We have numbered every fifth line for the sake of easy references. In the discussion below, we will refer to specific lines of the poem by numbers in parentheses.

When shadows were thrown out from the sky by sweet red Aurora  
 and her purple face brought a new morning on Earth,  
 and when Flora filled fields by the sweetest smells of the flowers  
 and when a bird by her nest sang happy songs to us all,  
 I travelled Castilian woods, holy meadows and surroundings (5)  
 and by surprise in the cloud voice of Apollo declared:  
 “I was the king of the world with indisputable power,  
 by many people below always revered as a god.  
 Now when I let my light shine upon those people of these days,  
 they dare say I have birthmarks all over my skin! (10)  
 They say my sacred rays follow man-written laws and obey them.  
 For their god of light slavery they have decreed!”  
 Tortured and agonized, Phoebus was unable to speak more.  
 Then he decided against lighting a light for the day.  
 But then Pallas Athena descended the hillside of Pindus (15)  
 and criticized vain threats poured by Apollo the god:  
 “Leader of Muses, can you explain what madness has struck you?  
 Why does work of Lexell and his efforts bother you?  
 Lexell among all peers is worthy of deep admiration,  
 he who shines to us all for his ingenious work. (20)  
 Should he attempt to explain the interior structure of light rays,  
 show him mercy, for his action is hardly a crime.  
 Insight and skill can unveil our father’s sublime creations  
 and it is smart young men whose job it is to research.”  
 Anger of Phoebus was gone; wise words of Athena convinced him. (25)  
 Horses were then let run in the usual way.  
 My dear friend, it is now my duty to tell you about these  
 godly events that I saw, omens of great calibre.  
 Fama will skilfully add all rays of light to your glory,  
 rays that Thalia has bound as you have taught her to do. (30)  
 Do carry on your work and bind your Muses to science.  
 You shall receive the rewards that you will rightly deserve.

(English translation: Joonas Ilmavirta)

### The Poetic Context

The original poem was written in Latin, in elegiac couplet. This poetic form, consisting of alternating hexameter and pentameter lines, was used for many purposes, and it is a natural choice for a congratulatory poem. Pryss makes impeccable use of the meter and the Latin language. Fluent caesuras in the hexameter, no elisions across the strong pentameter caesuras and natural poetic use of language make the poem look like a genuine ancient piece of work—apart from references to Lexell and modern science.

The scene of the poem is set near Castalia, a fountain at Delphi that was sacred to Apollo and served as a source of poetic inspiration. In the poem “Castalian” (line 5) refers to the Muses and the site of Delphi in general, not merely the fountain. This is a clever implicit invocation; instead of calling the Muses directly to his help, the poet takes himself to a sacred fountain in inspiration. Aurora (1) and Flora (3), personified dawn and spring, set an idyllic scene for the poem and emphasize that the time of presenting the poem was the dawn and the spring in Lexell’s scientific life—and those of modern science in general. This theme returns later when Athena remarks that research is for the young (24).

Phoebus Apollo, the Greco-Roman god of light, appears in his sacred area and expresses his dissatisfaction with the modern time (6–12). (Apollo is a complex god and his reign extends far beyond light, but we shall not venture into his status in mythology.) Light is no longer holy, but people have tamed it to their use (11–12) and given laws to govern it (11). The birthmarks on Apollo (10) probably refer to sunspots, discovered in the 17th century. It is also possible—but not very likely—that this line was inspired by the forthcoming transit of Venus across the Sun’s disc in 1761. Apollo seems to consider science as hubris, an unsolicited human endeavour into the domain of the gods.

While Apollo was more of an artistic god, Pallas Athena (Roman Minerva) was—among other duties—a goddess of wisdom and reason. Having descended from Pindus (15), she explains to her half-brother that there is no reason for anger (17–24). Clever people should be let discover whatever they can (21–24), including the creations of Zeus, the father of both gods (23). In the original poem, Zeus is referred to as “Tonans” (“Thunderer”), but we have been unable to include this epithet in the metric translation. We therefore suspect that Pryss meant lightning when he referred to the creations of Zeus. Apollo agrees (25) and allows—contrary to his prior decision (14)—his horses to pull the Sun across the sky as usual (26).

This is not only a description of Enlightenment, the human reason taking over the realm of the previously mystical world, but also a praise of the cleverness and ability of Lexell.

People consulting the oracle of Apollo at Delphi were expected to wash themselves in the water of Castalia prior to entering the temple. Pindus (15) is a mountain range, not a single mountain. Pryss probably referred to Mount Parnassus, a mountain by the sacred site of Apollo where the events of the poem take place. All events are located in a single, well-chosen place that connects to light, poetry and prophecy.

Lexell’s research on optics reappears in the form of him guiding Thalia to bid rays of light together (30). It is unclear what Pryss exactly means with this, other than Lexell mastering optics. We do not know why Pryss chose Thalia, the muse of comedy and idyllic poetry, instead of Urania, the muse of astronomy, for this duty. Pryss predicts that fame, personified in the poem like in Roman mythology as “Fama”, will make Lexell well known (29). In the very end, Pryss encourages Lexell to continue his work and bring the Muses along (31–32). It was insightful of the 17-year-old poet to remind Lexell to keep inspiration and excitement with him at all times—these, as we know, underlie scientific progress.

### **On the Quality of Pryss’ Prophecy**

We now review Lexell’s life in light of the poem. For more details on his life and works, see [2, 3].

In St. Petersburg Lexell rapidly became world famous as a close collaborator of Leonhard Euler. In particular Euler’s appreciation gave him much confidence and inspiration, which he perhaps would not have received otherwise. Many of his research subjects in mathematics and astronomy were related to Euler’s topics. He did not hesitate to bring forward surprising results, nor to question those of others. For instance, he could foresee the disappearance of the comet of 1770 on its encounter with Jupiter in 1778, even when his European colleagues expressed their disbelief. He was the first to propound the idea that the celestial body, now known as Uranus, is actually a planet. Previously it had been considered a star or a comet.

Pryss correctly foresaw that Lexell would meet with fame (29–30). Close collaboration with Euler provided a constant source of inspiration. Comparing this with Pryss’ advice to keep inspired (31) would, however, be unjust, as it would downgrade Euler to a mere muse for Lexell. We would find Apollo to be a much more faithful mythological description of the kind of source of inspiration Euler was to Lexell.

In the poem, Apollo saw hubris in science (9–12), but Lexell had profound respect for the holy. Lexell preserved a simple Lutheran faith throughout his life. His personal library manifests a marked interest in religion. However, at the same time he was an amateur of ancient literature, as he owned a considerable amount of the works by the classics of Greek and Roman Antiquity. In spite of his religious faith, he could

appreciate and relate to the symbolism of Greek mythology.

Light and research on it is a recurring theme in the poem. It is both a metaphor for enlightenment and the physical phenomenon that is the topic of the dissertation, Lexell's first publication. In historical perspective, this makes the poem narrow-sighted: Lexell did not actually work much on the properties of light in his career. Only his two printed theses from 1759 and 1760 did in some way touch the geometrical properties of light. The thesis of 1759 concerned the Principle of Least Action—the principle that light follows the path of shortest possible optical length—in the form propounded by Leibniz, which the authors found insufficient in the case of concave mirrors. In the graduate thesis of 1760 Lexell points out that the trajectory of light as it bends at a material interface does not take a parabolic shape, thus questioning the conclusions of some of Newton's followers. Of course, without experiments Lexell was unable to foresee the oscillatory properties of light. They were properly discovered some 50 years later.

The only other subjects of research mentioned in the poem are the creations of Zeus the Thunderer (23); see the previous section about the epithet. Loosely interpreted, this can be seen as study of the heaven, and Lexell was indeed an apt astronomer. However, Lexell had no practical experience of astronomy before his move to St. Petersburg in 1768. Thanks to his freedom from prejudice, Lexell could actually conceive that the solar system is bigger than previously thought and that not nearly all of its greater constituents had yet been discovered. The recognition that Uranus was a planet marks what Thomas Kuhn would call a paradigm shift [4], in this case, between the Modern and the Ancient World View.

Other aspects of Lexell's work, mathematical and physical, receive no mention in the poem. His mathematical heritage includes differential geometry, differential equations, spherical geometry, polygonometry and mechanics. Due to lack of space we refer the reader to [2, Chapter 8] for more details.

Pryss did indeed correctly prophesize that Lexell would rise to fame. Pryss' clairvoyance ends there; details of Lexell's research topics, life and prestige are vague or absent in the poem. However, the purpose of the poem was not to see all that lay ahead of Lexell, but to congratulate and praise this rising young talent. This—as we hope the reader agrees—Pryss achieved wonderfully.



**Figure 1:** *Silhouette of Anders Johan Lexell, probably engraved by Johann Lorenz Haf in Berlin in 1780. [2, 5] Source: Universitätsbibliothek Basel, Johann III Bernoulli Briefe. Published with permission.*

## References

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