Opusculum
The Euler Society Newsletter
Spring 2011 Volume 3, Issue 1

The Euler Society invites interested parties to submit proposals for its annual meeting. Presentations pertaining to the work of Leonhard Euler or 18th century science are particularly encouraged.

Those interested in attending or presenting at the meeting should contact the conference co-organizers by postal mail or email:

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The deadline for abstracts is May 20th. Deadline for attendees is June 5th. Registration fee is $120; a reduced rate is available for those without institutional support.

Carthage College is located on the shores of Lake Michigan in Kenosha, Wisconsin. There is easy access from Milwaukee's General Mitchell Airport. Dormitory housing is available in *the Oaks*. Contact Erik Tou for dormitory room reservations, or for other lodging information.

The Omnipresent Savant

By Dominic Klyve

Euler's Letters to a German Princess: Betrayal and Translation

Traduttore traditore, as a sentence, is self-verifying; we traduce it by translating it. "The translator is a betrayer" may be true as a proposition, but the (English) sentence requires evidence, whereas the Italian one is grounded in a vowel change….

—Arthur C. Danto [Danto]

The Italian proverb "*traduttore traditore*" is an old one, and is often used to bypass a longer discussion about the inherent untranslatability of thoughts from one language to another. Differences in grammar, vocabulary, background, point of view, and larger cultural context do indeed put strong barriers before any would-be-translator, and these barriers are worth consideration by anyone who desires (for example) to render Euler's works in English. Most of the possible problems in translation, however, occur despite the best intentions to render the original author's thoughts faithfully in a target language. A much more insidious form of betrayal occurs when the translator replaces an author's words with new words, flagrantly ignoring the original intention. In its worst form, this alteration of the original text is hidden, and a reader who cannot

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access the original will be forever ignorant of the author's intended meaning. I have been surprised and disappointed to discover, over the last few months, the many examples of this last type of translation in several editions of Leonhard Euler's *Lettres a une Princesse d'Allemagne*.

The *Letters* in English

Readers of this column are likely familiar with Euler's *Lettres* (and if any are not, I happily refer them to my last column [Klyve] or Ron Calinger's article [Calinger]). Furthermore, many of us are familiar with the *Letters* in its English translation by Henry Hunter. Hunter, a Scottish minister who had just completed a translation of Johann Kaspar Lavater's *Essays on Physiognomy*, took upon himself the considerable task of translating the *Letters* in 1795. Believing that Euler's main goal was educating females, he considered himself to be faithfully following in the master's footsteps by doing the same, and targeted his work at British women. After a long discussion in his introduction of the remarkable progress that women's education had made in recent decades, Hunter expresses his hopes for his translation in the first English edition:

> The time, I trust, is at hand, when the Letters of Euler, or some such book, will be daily on the breakfasting table, in the parlour of every female academy in the kingdom; and when a young woman, while learning the useful arts of pastry and plain-work, may likewise be acquainting herself with the phases of the moon, and the flux and reflux of the tides. And I am persuaded she may thrum on the guitar, or touch the keys of the harpsichord, much more agreeably both to herself and others, by studying a little the theory of sound. I have put the means of this in her power; it will be at once her fault, and her folly, if she neglect it. [Hunter's preface, p. xiii]

Hunter, at first glance, seems to be upfront about his intentions (however paternalistic they may seem). Indeed, he plays the role of careful scholar, and tells the reader precisely which version of the *Letters* he translated:

> In translating the Work, I have followed the last Paris Edition, given by Mssrs. De Condorcet and de la Croix, in 1787, for the purpose of introducing the useful notes of these gentlemen; but I have taken the liberty to restore, from the original edition, that of Mietau and Leipsic, in 1770, several passages which the French Editor has thought proper to suppress.

(Note the curious reference to "suppressed" passages of Euler—we will return to these later. For now, however, we just consider Hunter's work.) Soon after demonstrating his careful attention to detail, however, he tells us that he has not, in fact, translated everything. In a passage containing a somewhat surprising theological digression, Hunter writes

> The frequent, tiresome, courtly address of YOUR HIGHNESS, except at the first setting out, I have entirely omitted; out of no disrespect to Princes [sic], but because it seemed to me a mere unnecessary waste of words, which only encumber and disfigure a work of science. The Princess and her instructor are both gone to that awful world, in which the distinctions of the present, those of virtue excepted, are for ever obliterated.

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The Euler Line

Euler on the Internet

Google Alerts are one of the more novel features that one can find online. The interested reader can arrange to have e-mails sent promptly when Google finds content involving any of his pre-selected keywords. For some time, I've subscribed to this service, using "Euler" as one of my keywords. Here are a few of the more interesting items that Google has uncovered for me recently:

- In December, a collection of 15 hand-colored maps, probably from the Atlas Geographicus, appeared for bids at the Clars Auction Gallery in Oakland, California. [http://bit.ly/gONjtp]
- As reported in The Villager: Tom Stoppard's play, *Hapgood*, debuted at the Phoenix Theatre Ensemble in New York City in December. Billed as a "staggeringly brainy play," this spy thriller incorporates a healthy dose of quantum mechanics, international espionage, and a hat tip to Leonhard Euler's solution of the Königsberg bridges problem. [http://bit.ly/fKjKEg]
- In an event that enjoyed widespread attention among mathematicians, Ken Ono (along with collaborators Jan Bruinier, Amanda Folsom, and Zachary Kent) announced the discovery of an algebraic formula for the partition function. Their paper (available here) uses observations from fractal theory to assemble the formula.

  The partition function was a topic of interest to Euler, who published multiple papers on the subject (for example, see E394). [http://bit.ly/eWkOZI]

— E. Tou

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Excising any words from one of Euler's works offends me, but this is not perhaps a terrible omission. I had intended to go on at this point to discuss my rather larger complaint that Hunter actually put his own words in for Euler's. Attentive and regular regulars will remember that in my last column, I noted "Euler's" list of the planets, which I took from the edition of the *Letters* sitting on the shelf in my office:

> Besides the *Earth*, there are ten other similar bodies, named planets, which revolve round the sun; two of them at smaller distances, *Mercury* and *Venus*; and eight at greater distances, namely, *Mars*, *Ceres*, *Pallas*, *Juno*, *Vesta*, *Jupiter*, *Saturn*, and the *Georgium Sidus*.

I asked in that column how Euler could predict the existence of asteroids (Ceres, Pallas, etc.) and the planet Uranus (Geogrium Sidus) decades before their discovery. My belief at the time was that Hunter updated the scientific information as he translated (reasoning, perhaps, that the goal of Euler's work was to teach the latest science), and I prepared to excoriate him for his anachronistic work.

With the help of the very diligent interlibrary loan librarian at Central Washington University, however, I have spent the last few months tracking down old versions of the *Letters*. I now have at least part of sixteen editions in half a dozen languages, and the sheer weight of information before me has led me to change my mind—to exonerate rather than excoriate. Hunter's original text (E343G in Eneström's Catalog) lists precisely those planets listed by Euler. The reprinting on my shelf (E343G[4]) includes the extra planets—they were added by a later editor (currently unknown to me). The decision about what to do with the list of planets seems to have been a vexing one for translators of the *Lettres*—the basic question being: If Euler's purpose was to give a list of all the planets, and now we know about more, should we put them in? The Spanish translator (in 1798) added a footnote describing the newly discovered planet Herschel. The German edition of 1847 (E343B[5]) is especially strange. In this edition, Uranus is inserted into the text. Then a footnote points out to the reader that Uranus hadn't actually been discovered when Euler wrote, before proceeding to mention Vesta, Juno, Ceres, and Pallas (naming them as planets), and then describing in some considerable detail the orbital dynamics of a fifth "planet", Astraea, between Mars and Jupiter, which had just been discovered by the German astronomer Hencke. The French editions of 1812 and 1829 (E343[5] and E343[6]) put Uranus and the four minor planets in a footnote, but the edition from the Belgian *Oeuvres Completes* (E343[7]), published ten years later, omits them completely. Things are, in short, a mess.

Nor is the list of planets the only thing to vary between editions and translations. Again looking only at Euler's letter, I found four different pieces which translators and editors seemed to feel free to change at will. They are, in order of appearance in the letter:

1. *The direct address to the princess.* This is simple and elegant, even in Euler's original (he writes simply "Madame"). Some editions, however, find this unnecessary, and cut it altogether.
2. *The units of distance*. For this I use Euler's stated distance from Berlin to Magdeburg, which he gave as 18 miles. His units, however, are German miles – each roughly 4.5 English miles. This question to me is more interesting: when translating the language, should the translator also translate units into those more familiar to the reader?
3. *The list of planets*. This issue is described above.
4. *The final sentence*. This is another thing I've discovered since my last column. When I quoted his first letter using the edition on my shelf (E343G[4]), I was unaware that the last clause of the final sentence had been excised. The last sentence in Euler's first version was actually

   > This immensity is the work of the Almighty, who governs the greatest bodies and the smallest, *and who is now crowning with success the arms in which we are so deeply interested*. (translation from a footnote in E343G[2]).

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Euler, Napoleon, and Artillery

In a recent conversation among Euler Society members on the Society's e-mail list uncovered a couple of interesting facts on Euler's *Neue Grundsätze Der Artillerie* (E77) that may be new to most readers of this newsletter.

- A scanned copy of the Opera Omnia's 1922 printing of this work is available online at Archiv.org.
- Benjamin Robins's French translation and commentary is available on Google Books.

The most interesting part of this particular thread is the fact that Napoleon Bonaparte (himself an artillery officer) owned a copy of the Robins/Euler *Nouveaux Principes d'Artillerie*. His notes on this work are available on Fred Rickey's website.

— E. Tou

Research Note: Euler and Resonance

By Jordan Bell

I am beginning a study of Euler's work that has to do with resonance, focusing on his 1739 paper E126, "De novo genere oscillationum"; Euler is inspired by the similarly titled paper of Krafft, "De novo oscillationum genere", which is a more usual way of writing the title in Latin; compare to "De rerum natura". My plan is to write a comprehensive paper along the lines of my summary of Euler's work on the pentagonal number theorem. After doing general reading, I'm going to start reading and translating relevant papers of Euler's, starting with E126, and also Krafft's paper. I expect this project will take about two years.

Truesdell writes in "The Rational Mechanics of Flexible Or Elastic Bodies 1638 - 1788": "By the accidental observation that a watch when hung up sets itself in vibration as a pendulum, Krafft reopened the problem of forced oscillations." (p. 174)

What relevant work was Euler doing at the time of E126? Apparently he was working on the vibrations of elastic bars, which led to the differential equation $ky'''' = y$. Was Euler looking at any other ordinary differential equations around 1739?

Did Euler write anything on the oscillations of pendulums or springs, and did he ever write about the mechanics of timekeeping devices? I think I've seen a paper having to do with the gearing of watches.

Sympathetic or acoustic resonance of strings in a musical instrument: there are certain frequencies of sound that excite a string. Did Euler say anything about acoustic resonance anywhere?

What is the history of our understanding of resonance? A ship sitting in a lake could start to rock back and forth depending on the rate that waves are hitting it. Did Euler ever think about this question in his naval work? That is, did Euler study the "rocking and rolling" of ships?

What about bell ringing? Clocks, bells (and children's swings), acoustics and rocking ships are the only natural examples of resonance I can think of now. I've read a little bit about Russian bell ringing and it seems like they keep the bell stationary and move the clapper, so I don't see how resonance would come up there, but if I want to get a big bell moving I have to pull the rope in sync with its swings.

Did Euler talk about the harmonic oscillator in any of his mechanics works, or the equation for the harmonic oscillator in any of his differential and integral calculus books?

If anyone knows people who would have something valuable to say about these questions I'd appreciate you talking with them and letting me know what you find out.

— **J. Bell** (jordan.bell@gmail.com)

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This last clause, written during a successful period for Prussia of the Seven Years' War, appears in italics in the Opera Omnia's printing of the original text. It is ignored by most translators, and derided by others (In E343G[2], Hunter points out that "philosophers, as well as other men, are under the dominion of local and temporary circumstances").

I am still missing several editions of the *Letters* known to Eneström. Some of these our library couldn't obtain. Others (the Russian, Swedish, and Danish) I didn't even seek for lack of ability to read them. Of the sixteen editions from which I now have front matter and the first letter, however, I have compiled a table showing how each handles the four issues above (Table 1, p. 27).

I'm more convinced than ever that the story of the translating the *Letters* has not been fully told. Among other things, the various translators' introductions make for fascinating reading. Before pursuing this story further, however, I became distracted by an issue even deeper than that of translation. There are several examples of textual betrayal in the French editions as well. In the most widely distributed edition of the *Lettres* (and the one from which Hunter did his translation), Euler's letters were systematically cut for political purpose.

Having run out of room for this essay, I find that my original plan to write about Euler's first *Letter* now expands to a trilogy. We will finish the story, and examine Euler's betrayal by his French editors, in the next issue of *Opusculum*.

— **D. Klyve** (klyved@cwu.edu)

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Ron Calinger, *Euler's "letters to a princess of Germany" as an expression of his mature scientific outlook*. Archive for History of Exact Sciences, 15:3 pp. 211-233, (1976).

Arthur C. Danto, *Translation and Betrayal*. RES: Anthropology and Aesthetics, No. 32, Autumn 1997, pp. 61-63 (1997).

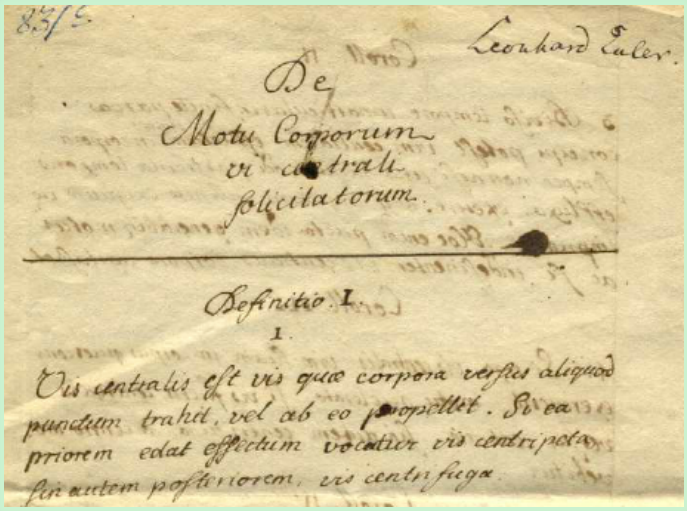
Dominic Klyve, *Euler as a master teacher in the "Letters to a German Princess"*. Opusculum 2:2, pp. 17-21 (2010).

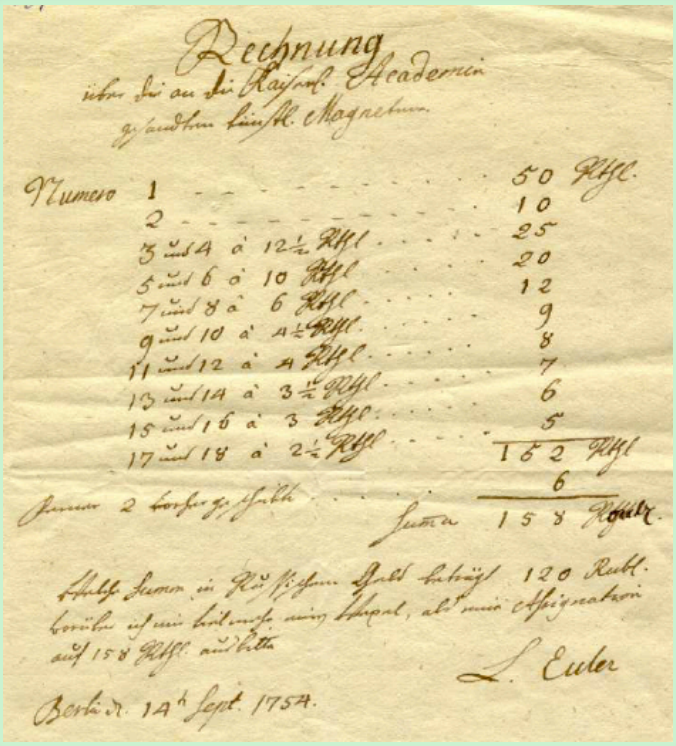
Euler Manuscripts Available Online

Tartu University in Tartu, Estonia has several of Euler's handwritten letters and manuscripts available on its DSpace digital depository. The link is here:

http://dspace.utlib.ee/dspace/

Simply search for Euler to find the available documents. Here are a few highlights from this collection.





Left: The first page of a manuscript on mechanics.
Right: A receipt written by Euler.

Discrepancies between translations of Euler's *Letters to a German Princess*, Letter #1.

Edition	Year	Language	Address	Planet List	Units (dist from Berlin to Magdeburg)	Last clause
E343		French	Madame	Stops at Saturn	18 miles	Present
E343[4]	1787	French	Madame	Stops at Saturn	18 miles	Missing
E343[5]	1812	French	Madame	Footnote mentions Uranus, Vesta, Juno, Ceres, and Pallas	18 miles	Present
E343[6]	1829	French	Madame	Footnote mentions Uranus, Vesta, Juno, Ceres, and Pallas	18 miles	Missing
E343[7]	1839	French	Madame	Stops at Saturn	18 miles	Missing
E343[8]	1842	French	Madame	Footnote mentions Uranus, Vesta, Juno, Ceres, and Pallas	18 miles	Present
E343B	1769	German	nothing	Stops at Saturn	18 miles	Missing
E343B[2]	1773	German	nothing	Stops at Saturn	18 miles	Missing
E343B[5]	1847	German	nothing	[1]	18 miles	Missing
E343B[6]	1853/4	German	nothing	[2]	18 miles	Missing
E343C	1785	Dutch	Mevrouwe	Stops at Saturn	18 miles	Missing
E343E	1787	Italian	nothing	Stops at Saturn	18 miles	Missing
E343G[2]	1802	English	Madam	Stops at Saturn	18 miles	Footnote
E343G[4]	1833/4	English	nothing	Includes "Ceres, Pallas, Juno, Vesta ... and the Georgium Sidus"	83 miles	Missing
E343H	1798	Spanish	Señora	Footnote mentions Herschell, and that it is also called Uranus	18 miles [3]	Missing

[1] Footnote mentions the big 5: Uranus, Vesta, Juno, Ceres, and Pallas, and one other (Astrea), with a lot of details about it.

[2] Uranus is part of the list in the text; Ceres, Palas, Juno, Vesta are listed as planets in the footnote; many the details about the orbit and discovery of the "planet" Astrea are given.

[3] A footnote also gives the distance in Castillian feet.

New Translation from the Euler-Krafft Correspondence

Jim Bisgard of Central Washington University has recently completed an English translation of a letter written by Euler to Georg Krafft in 1742. This letter, shown below in its entirety, was written during the early years of Euler's tenure at the Berlin Academy. It concerns the curvature of an idealized elastic rod undergoing oscillation. Any readers interested in corresponding with Dr. Bisgard on this topic, or on the Euler-Krafft correspondence, are encouraged to contact him at bisgardj@cwu.edu.

Euler to *Krafft*
Berlin, February 13, 1742

In order to determine the curve that a thin elastic rod forms under oscillation, Mr. Bernoulli's assumption is, to be sure, true. Namely, he is correct that the curvatures of the rod at different distances from the rest position don't differ from one another in any other way than that the ordinates everywhere maintain the same proportion as happens in the case of infinitely many parabolas, which have the same axis and vertex and only differ from one another in the ratio of their parameters. ([1]) However, I did not find it necessary to make this assumption, since this property followed from my calculations. The equation for the curve is

$$Af\ ddu = dx^2 \int dx \int udx, ([2])$$

or

$$Af\ d^4u = udx^4, ([3])$$

if dx is supposed to be constant. At the time, because I was unable to integrate this equation, I sought to find a series solution. To that end, I assumed that $u = \alpha + Ax + \beta x^4 + Bx^5 + \gamma x^8 + Cx^9 +$ etc. Note that many of the powers are left out, since I saw they would have no influence in the current case. From this assumption on u, I calculated d^4u and then determined the coefficients in order to get equality. Since this attempt, I have found a method to completely integrate $Af\ d^4u = u\ dx^4$, which I communicated to Mr. Bernoulli some time ago. Perhaps he has mentioned this in his paper. I find that

$$u = Ce^{x:\sqrt[4]{Af}} + D^{-x:\sqrt[4]{Af}} + E\sin A\frac{x}{\sqrt[4]{Af}} + F\cos A\frac{x}{\sqrt{Af}}.([4])$$

In order to apply this solution to the current case, it must be that

$$E = C - D, F = C + d, \text{ and } b = 2c + 2D.$$

If one sets $n = \sqrt[4]{Af}$ for the sake of brevity, the fourth condition of §37 of my work, page 116, volume VII yields the equation:

$$2 + \left(e^{\frac{a}{n}} + e^{-\frac{a}{n}}\right) cosA\frac{a}{n} = 0$$

which expresses a certain ratio between a and n. If it is assumed that $a = \mu n$ (where μ is constant), and consequently that $a = \mu\sqrt{Af}$, ([5]) it follows that the rod is isochronous with a simple pendulum of length $f = \frac{a^4}{\mu^4 A}$, as shown in §39. Finally, the number μ can be found from $2 + (e^{\mu} + e^{-\mu})\cos A\mu = 0$.

[1] In its original, this last sentence is a Mischung of German and Latin, and was only translated with the assistance of Dr. Stacy Langton and Dr. Dominic Klyve. Their help and comments have been invaluable.

[2] In more modern notation, this could be written $Af\frac{d^2u}{dx^2} = \int_0^x \int_0^s u(z)dzds$.

[3] In more modern notation, this would be $Af\frac{d^4u}{dx^4} = u$, which follows from the previous equation upon differentiating twice.

[4] There is a small typo in the transcription here, since there should be $\sqrt[4]{Af}$ in the denominator of the last term. This solution can be found by substituting $u(x) = e^{rx}$ in the differential equation, which . This leads to the characteristic equation of $Afr^4 - 1 = 0$, and so the solutions correspond to linear combinations of the fourth roots of Af. The complex roots are contained in the sine and cosine terms.

[5] Here there is again the small mistake, since this should read $\sqrt[4]{Af}$.

The Euler Archive staff is pleased to announce that the Archive has moved to the Mathematical Association of America (MAA). During the first few weeks of April, the content from this site has been transferred over to the MAA's servers. As of April 15th (Euler's 304th birthday), the site is live. All of the content—and much of the form—of the former site has been maintained.

In the next few months, the appearance of the site will be shaped to fit into the MAA's Digital Library (MathDL). The Archive will remain under the direction of Dominic Klyve, Lee Stemkoski, and Erik Tou.

To celebrate the relaunch of the Euler Archive, the MAA is offering a special discount on the five books it published for the Euler Tercentenary in 2007. Each book will be on sale for $20 each (plus shipping and handling). Check out the new Euler Archive front page for more information:

http://eulerarchive.maa.org

Translation and Archive Update

Rob Bradley of Adelphi University has completed a translation and summary of a letter Euler wrote to Gabriel Cramer in 1744. The contents of this letter have been examined in Ed Sandifer's *How Euler Did It* column for November 2009, and in "When Nine Points are Worth But Eight: Euler's Resolution of Cramer's Paradox," a paper soon-to-appear in the MAA's online journal, Convergence. Bradley's recent translation is currently available via the Euler Society's web site.

Ian Bruce has translated E26 and E54 into English:

http://www.17centurymaths.com/contents/euler/e026&54tr.pdf

He has also recently completed his translation of Euler's differential calculus text:

http://www.17centurymaths.com/contents/differentialcalculus.htm

Google Books continues the expansion of its digitized book collection.

- Benjamin Robins' translation/commentary on E77 is now available:
  http://books.google.com/books?id=dxYPAAAAQAAJ
- The original Latin version of Euler's *Tentamen Novae Theoriae Musicae* (E33) is now available:
  http://books.google.com/books?id=b8g9AAAAcAAJ
- The original Latin version of volume 2 of Euler's *Dioptricae* (E386) is also available:
  http://books.google.com/books?id=MmY_AAAAcAAJ

Opusculum is the official newsletter of the Euler Society. It is published on a quarterly basis.

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Letters, articles, and other contributions to the *Opusculum* are very welcome. Send any contributions, observations, or news items to Erik Tou at etou@carthage.edu.

The mission of *The Euler Society* is threefold: It encourages scholarly contributions examining the life, research, and influence of Euler. The Society also explores current studies in the mathematical sciences that build upon his thought, and it pro-motes English translations of selections from his writings, including correspondence and notebooks.