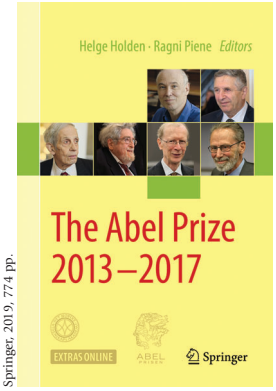
The Abel Prize 2013–2017

Reviewed by Kenneth A. Ribet



Springer, 2019, 774 pp.

The Abel Prize 2013–2017
By Helge Holden
and Ragni Piene (eds.)

On the occasion of his 60th birthday in January 1889, King Oscar II of Norway awarded a mathematics prize to Henri Poincaré. The King's prize may be considered as a precursor of the Abel Prize that we know today. News of the modern prize was unveiled at the Abel Bicentennial Conference at the University of Oslo in June 2002. At this conference, which was devoted to lectures on themes related to Abel's work, the organizers announced that a special Honorary Abel Prize would be awarded to Atle Selberg.[1] The first Abel Prize was presented to Jean-Pierre Serre in 2003. Prizes have been awarded annually since then; the most recent winners were Karen Uhlenbeck (2019), and Hillel Furstenberg and Grigory Margulis (2020).

The Abel Prize is the subject of three collections of essays, photos, and records of the annual Abel symposia: *The Abel Prize 2003–2007* [HP10], *The Abel Prize 2008–2012* [HP14], and *The Abel Prize 2013–2017* [HP19]. All three volumes can be freely downloaded from the Abel Prize page `https://www.abelprize.no`.

While these books focus on the lives and mathematics of the Abel laureates, they contain a wealth of supplemental information. For example, an essay by Arild Stubhaug [Stu10] in the first book explains how the King's prize was a precursor of the Abel Prize that we know today. A much longer essay, "The Abel Prize—The missing Nobel in mathematics?" [Hel14] by Kim G. Helsvig is included in the second of these three volumes.

Here's a quick history: an international Abel Prize was contemplated by scientists and politicians in Norway at the time of Abel's 100th birthday in 1902. Although a prize was on the threshold of being announced in 1904, plans for the prize were shelved because of the dissolution in 1905 of the union between Sweden and Norway (the "United Kingdoms"). Apparently there was little further discussion of an Abel Prize until the publication of the 1996 Abel biography [Stu00] by Stubhaug. After writing his book, Stubhaug met with a number of key Norwegian political figures and rallied support for a new prize.

This review concerns the third Abel volume [HP19], which covers the prizes given to Pierre Deligne (2013), Yakov Sinai (2014), John Nash and Louis Nirenberg (2015), Andrew Wiles (2016), and Yves Meyer (2017). For each prize year, there is a chapter (or "Part") of the book for the relevant laureate or laureates. For example, Part I, which corresponds to 2013, begins with a mathematical autobiography by Deligne and a 140-page report on Deligne's work by Luc Illusie, and concludes with Deligne's publication list and CV. By contrast, the analogous material for Yakov Sinai in Part II includes eight different articles about Sinai's work in place of a single appreciation.

Over the years, I have been unimpressed by the "coffee table books" about mathematical and nonmathematical prizes that publishers have sent my way. Accordingly, I was surprised to find myself becoming a fan of the book under review, which I can now recommend to both casual and committed readers. The volume is a pleasure to explore for a number of reasons that I will outline briefly below.

Kenneth A. Ribet is a professor of mathematics at UC Berkeley. His email address is `ribet@berkeley.edu`.

[1] *Selberg was unable to attend the conference.*

Communicated by Notices *Book Review Editor Stephan Ramon Garcia.*

DOI: https://doi.org/10.1090/noti2193

One thing that attracted me immediately to the book is the collection of wonderful photos of the laureates that are interspersed with the essays. For example, there are at least five photos of Pierre Deligne, beginning with a childhood photo and ranging through a photo of Deligne at his 61st birthday conference. Andrew Wiles is shown as a child on the beach; on his wedding day in 1988; and then at the conclusion of his lecture on June 23, 1993, during which he announced that he had elaborated a proof of Fermat's Last Theorem.[2]

The laureates were asked to write about their lives and the development of their work; colleagues of the laureates were asked to report on the mathematics of the winners. Both groups did an excellent job.

The stories written by the laureates are compelling and illuminating—and often deeply personal. A theme in several of the stories is one of setback and frustration. Y. G. Sinai provides one example:

> Once, when I was about 15 years old, my grandfather decided to teach me mathematics and gave me a lecture on quaternions. He then asked me to write a composition on them. I assume my results were unsuccessful because his attempts were never repeated. During my school year I participated in several Olympiads, always without success.

And here is Yves Meyer:

> [Jean-Pierre] Kahane thought that my findings were sufficient for a "thèse d'État." Elias Stein was on the way to publishing a much better theorem than the results of my thesis. I was destroyed. When I presented my dissertation I could not stop saying "I obtained this theorem but Elias Stein proved a much better result. . . ." Finally the probabilist Paul André Meyer who belonged to the committee said, "Yves, it is not your role to criticize your results, it is the role of the committee." My defense was a disaster.

While reading the testimonies of the Abel Prize winners, I thought of the recent book *Living Proof* [HLPT19], which teaches us that "people who succeed in mathematics, like people who learn a musical instrument or a new language, spend a lot of time not understanding and feeling frustration."[3] We learn from the Abel book that even our superstar colleagues do not glide without impediment from success to success.[4]

For many readers, the enduring value in the book will lie in the detailed analyses of the winners' work.

As mentioned before, Part I begins with a "mathematical autobiography" by Pierre Deligne and continues with a comprehensive 140-page survey of Pierre Deligne's work by Luc Illusie. The bibliography of Illusie's article contains 266 items and alone spans almost 11 pages. Despite the extraordinary breadth of Deligne's mathematics, Illusie's theme is that the theory of motives represents a tent big enough to cover it all:

> Grothendieck's philosophy of motives permeates Deligne's work. No one has made the multiple voices of arithmetic geometry sing in harmony better than Deligne. Almost every one of his articles echoes or corresponds to another one, sometimes far away. I have tried to make this counterpoint perceptible.

Because I have followed Andrew Wiles's work for almost 45 years, I was especially appreciative of Christopher Skinner's detailed article "The mathematical works of Andrew Wiles." Skinner, who began his graduate work at Princeton in the mid-1990s, writes knowledgeably about *all* of Wiles's articles, including those that Wiles coauthored with John Coates in the 1970s.

Skinner's report is divided into nine main sections, many of which conclude with a subsection on "Further Developments." In connection with Wiles's early work on explicit reciprocity laws, for example, Skinner explains what was known before Wiles and what Wiles proved in his articles—and then goes on to give examples and applications of Wiles's results and to discuss work by others (Coleman, de Shalit, Rubin, Perrin-Riou, Kato and Colmez) that leveraged Wiles's work. The seventh of the nine sections, "Modularity of Elliptic Curves and Fermat's Last Theorem," contains a "Further Developments" subsection that begins as follows: "Wiles's proof of his modularity lifting theorem opened the floodgates. . . ." There were quite a few developments to report on, but Skinner includes disclaimers like: "As of the preparation of this paper, the state of the art seems to be [30] and [68],[5] but that will almost surely have changed by the time it has gone to press!"

To my mind, this book has something for everyone: chronicles of the lives of distinguished contemporary mathematicians, descriptions of key results by their creators, and long thoughtful review articles by close colleagues of the Abel Prize laureates.[6] And, as suggested above, some of the photos are knockouts. If you like mathematics, mathematicians, photos, and stories, this book definitely belongs on your iPad—and perhaps even on your bookshelf.

[2] *In connection with his marriage, Wiles writes ". . . between 1986 and 1994, I was not quite the recluse in the attic that some accounts have portrayed."*

[3] *The quotation is from the book's preface by Stephen Kennedy. Like the Abel books,* Living Proof *can be downloaded for free—from the MAA web site.*

[4] *Terence Tao's contribution to* [HLPT19] *is entitled "A close call: How a near failure propelled me to succeed."*

[5] *The first of these articles is by T. Barnet-Lamb, T. Gee, D. Geraghty, and R. Taylor; the second is by S. Patrikis and R. Taylor.*

[6] *Each of the three books contains such supplemental information as the composition of the committees for each year's prize and the titles of lectures that were given at the annual Abel symposia. One learns, for example, that Nick Katz lectured in 2013 on "Life over finite fields."*

References

[Hel14] Kim G. Helsvig, *The Abel Prize: the missing Nobel in mathematics?*, The Abel Prize 2008–2012, Springer-Verlag, Berlin and Heidelberg, 2014, pp. 1–27, DOI 10.1007/978-3-642-39449-2.

[HLPT19] Allison K Henrich, Emille D. Lawrence, Matthew A. Pons, and David G. Taylor (eds.), *Living proof: stories of resilience along the mathematical journey*, Mathematical Association of America, 2019.

[HP10] Helge Holden and Ragni Piene (eds.), *The Abel Prize 2003–2007: The first five years*, Springer-Verlag, Berlin, 2010. With 1 DVD. MR2605604

[HP14] Helge Holden and Ragni Piene (eds.), *The Abel Prize 2008–2012*, Springer, Heidelberg, 2014. MR3185030

[HP19] Helge Holden and Ragni Piene (eds.), *The Abel Prize 2013–2017*, Springer, Cham, 2019. MR3930576

[Stu00] Arild Stubhaug, *Niels Henrik Abel and his times: Called too soon by flames afar*, Springer-Verlag, Berlin, 2000. Translated from the second Norwegian (1996) edition by Richard H. Daly. MR1762652

[Stu10] Arild Stubhaug, *The history of the Abel prize*, The Abel Prize 2003–2007 (Helge Holden and Ragni Piene, eds.), Springer-Verlag, Berlin, 2010, pp. 3–8.

Kenneth A. Ribet

Credits

Book cover is courtesy of SpringerNature.

Photo of Kenneth A. Ribet is courtesy of Jerry Fowler of the UC Berkeley Faculty Club.