

THE HAMMING EXPERIENCE

Hans Petter Langtangen and Olav Lysne

Many scientists frequently wonder about the answers to questions, such as *What characterizes high-quality scientific research?*, *How does it differ from that which is more routine in nature?*, and *What steps must I, as a scientist, take to improve myself, so that I might reach the top of my field?*

Very often we recall world-class, renowned scientists or personal mentors whom we revere when we ponder such questions. However, deducing the methods behind the work, the nature of their day-to-day duties and responsibilities, and how they achieved their greatest triumphs can be a difficult proposition. Research is a fuzzy, often nebulous process that can be difficult to describe in words. One such researcher, Richard Hamming, was once asked to give a talk about being a first-class scientist. Fortunately, his words were recorded and transcribed. In his talk, Hamming addressed our questions above and many others of major importance in a very inspiring manner that explains in explicit detail what it takes to do first-class scientific research and which failures are likely to occur. We find Hamming's words so inspiring and useful that we have decided to include them in this book.

One aspect of Hamming's talk is of particular significance to this book. Those who built Simula wanted to create a research laboratory that, over time, could host top scientists and be an inspiration to those who aspired to do first-class research. Gleaning the answers to the questions posed above is thus of the outmost importance. After reading the transcription of Hamming's talk, we found that it—in a remarkable way—distilled our attitudes, thoughts, and insight into what research actually is and what being a researcher is really about. The ideas and messages from his talk have inspired and guided us in the process of building Simula. We want Simula to

Hans Petter Langtangen · Olav Lysne
Simula Research Laboratory

be an institution that actively implements Hamming's ideas for achieving success in research and avoids the potential for failure.

Hamming was speaking to researchers desirous of doing work of the very highest calibre, the type that can lead to awards comparable to the Nobel prize. While such work is a noble undertaking, we believe the audience for his words should be broadened to include all those who would study science. For example, most of his descriptions and recommendations apply to all kinds of scientific work, including that undertaken by students. This is why we wanted to include his famous talk in this book and let it serve as an inspiration for everyone who appreciates the pleasure of doing high-quality scientific work.

Many of the critical topics for success in science are brought up by Hamming. First, he says, you must drop modesty—you must believe in yourself and explicitly express it, for example, by stating, *Yes, I want to achieve something significant*. To achieve something significant, you must work on an important problem. He asserts that too many scientists work on what, at heart, they believe to be unimportant problems. Therefore, to achieve significant results, you (or your institutions) must discover sufficiently important problems as prerequisites for performing research that stands a chance of making an impact.

Exhibiting a tremendous drive is a necessary condition for a researcher's success. Hamming's formulation is: *Knowledge and productivity are like compound interest. Given two people with exactly the same ability, the one person who manages day in and day out to get in one more hour of thinking will be tremendously more productive over a lifetime*. In addition, if you have a problem for which you seek a solution, you need to be truly committed to your problem, so that your subconscious mind can work on the problem, too. But working hard and being deeply immersed in a topic are not enough—you must also be sensible, both in your approach to the work and in your thinking.

Along with the qualities of sheer confidence, tremendous drive, and a fresh perspective, looking back over their careers, many scientists feel that their achievements occurred as a result of luck. Hamming warns against waiting for the lucky moments, citing Pasteur's words: "Luck favours the prepared mind." This means that the more you know about a subject, the more you think about it; and also, the greater the amount of courage you feel as you pursue your ideas, the more "luck" will come your way. Great achievements also often stem from being able to both believe and doubt a hypothesis at the same time: you must believe it enough to go forward with it, but doubt it enough to realize its deficiencies and from them, devise improvements that eventually could lead to great work.

In the above paragraphs, we have noted a few of Hamming's views. Still, Hamming approaches these questions from the standpoint of a researcher, not from that of an institution. Therefore, in the formation of Simula, we felt a need to address the relationship between the successful researcher and the successful institution. One way of formulating this is *How can we create an environment in which people like Hamming could thrive and be productive?* Simula's answer to this question is formulated by Aslak Tveito and Morten Dæhlen in chapter 1, and is further elaborated in the description of the Simula culture in chapter 3.

The full value of Hamming's thoughts on these matters can only be appreciated by reading the transcript yourself. Many of us who have had the pleasure of participating in Simula's formation have done so, time and time again. If you have not read it before, we can assure you that it is well worth your while.

Enjoy!