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STRATEGIC OR BLUE SKY RESEARCH?

The Execution of Serendipity

Susan Stipp

As an academic scientist, I share concerns with colleagues about decreasing support for basic research. Governments are putting increasing pressure on research funding agencies to favour projects that promise to solve specific problems, to produce a product or a process that has economic value. Whether explicitly announced or subtly understated, the concept “from idea to invoice” rings from calls for proposals. From discussions with colleagues and from my own experience, I know this to be true in the US and Japan, at the European Commission, in the British funding bodies, for several Danish agencies, in other Scandinavian countries, in Switzerland, in Germany, and so on. Applications require scientists to put the right words in the box for economic impact. And we, as academic researchers, who have students to support, instruments to acquire and keep running, and H-indexes to nurture, are under increasing pressure to either learn the applied research funding rules as the game changes, or perish.

Basic research, where the aim is to discover the fundamental principles of how the world works, is driven by curiosity. There is a passion at the base that motivates the scientist, and the results that come out are often very different than those sought at the outset. In the past 20 years, basic research has become unpopular. Academia, “the ivory tower”, has gained the reputation of being cut off from “the real world”, a place where researchers selfishly follow tangents to esoteric ends. Politicians claim that tax payers have a right to research results that can be directly applied, to give an economic advantage or to solve society’s problems. Of course there is truth in this, but many of the most important discoveries of the last centuries, discoveries that have moved society forward to what it is today, have come out of curiosity-driven research. For example, during its lifetime, CERN, the largest and most fundamental science activity in the world, has not only provided understanding about how the universe was born, but has also parented inventions such as medical scanners, the World Wide Web and supercomputing (Llewellyn Smith 1997). H. C. Ørsted discovered the electromagnetic effect because he was curious about how nature works. Such a discovery could never have been driven by earmarked funding because no one knew that such an effect existed. Funding dedicated for topics recognised as strategic by governments requires that politicians have insight into what natural phenomena remain to be discovered and how to use them. Physicists curious about the internal

structure of the atomic nucleus in the 1930s answered their need for counting nuclear particles by developing circuits, which then led to electronics and the silicon revolution that has changed the way our world functions. There was no strategic funding that kick-started the electronics revolution. Think how it would have been without computers. What about the colossal developments in genetics? In modelling and simulation at all scales? In communication and transport? Strategic research can encourage improvements and developments, but curiosity-driven research is essential for the big breakthroughs.

The theme of this *Elements* issue is an excellent example of the value of fundamental science in our own discipline. Metamorphic petrology is seen by some as a field where it is hard to make

a case for its worth to society. That could not be further from the truth! How can we forget the importance of metamorphic processes in concentrating the metals that have been essential for the advancement of society and culture as far back as the Bronze Age – and our growing concern now as resources become scarce? But metamorphic geology has important contributions to offer society from the fundamental side as well. Although one of the first lessons in geology is: “The present is the key

to the past”, modern geologists have realised that rocks are the textbook where one can learn the fundamental principles of global change, a critical issue today. The articles in this issue of *Elements* tell us how we can read exciting chapters of Earth’s history from the textures and composition of metamorphic rocks.

The current funding system, where research ought to have a direct link to application, has been with us for at least 20 years. It is interesting that as society has in general become wealthier, where the standard of living has increased, governments have decreased the relative funding for higher education and academic research. In the years after World War II, when Europe was struggling to get back on its feet and North Americans were far less affluent than now, scientists were highly respected and tax payers provided research budgets that were proportionally much larger.

Unfortunately, it does not appear that politicians will lose their love of applications-driven research in the near future. Can we adapt? Of course we can. Students are often eager to work on topics where the goal is clear, where their results will be “used for something”. The public is often excited to hear about projects where one can easily understand the end product. Industry representatives are often willing to support the basic research that is necessary to underpin developments, provided they can clearly see the pathway from the fundamental new knowledge to their application.

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THANKING SUSAN STIPP

Reluctantly, we bid farewell to Susan Stipp as principal editor of *Elements*. Susan joined the team in 2007 and has the distinction of being both the first woman to serve as principal editor and the first person appointed from outside the USA or the UK.

Susan has been instrumental in developing the magazine, following on from the founding editors. She worked at a critical time, helping to firmly establish a new journal in a highly competitive environment. She contributed great energy and enthusiasm to all aspects of the tasks. She was often the person with a new insight or a novel perspective on an issue. This was reflected by her editorial contributions on topics such as who should decide on how research funding should be spent, the need for much more interdisciplinary research, the ethical issues associated with our diminishing Earth resources, and the gender bias that still damages the career prospects of many women working in science. Susan will be missed for her energy, insights, integrity, and honesty, and for adding that spark that brought life to many of our debates.

Susan was in charge of the following issues: Critical Zone (v3n5), Phosphates (v4n2), Carbon Dioxide Sequestration (v4n5), Bentonites (v5n2), Metal Stable Isotopes (v5n6), and Fluids in Metamorphism (v6n3). Susan has also encouraged and nurtured a number of topics that will be featured in upcoming issues of *Elements*. We thank Susan for her outstanding contributions; she will be greatly missed by the editorial team.

David Vaughan, on behalf of the editorial team

THIS ISSUE

An issue on metamorphism has been on the wish list of the *Elements* editorial team for several years, and Bruce Watson, during his time as principal editor, worked hard to bring it to reality. Now, finally, here it is.

Imagine a collection of papers on metamorphic petrology without a single P - T - t diagram! And serpentinization of ultramafic rocks at mid-ocean ridges is not what first comes to mind when one thinks of metamorphism. Guest editor Bjørn Jamtveit chose to highlight the continuum between diagenesis, contact metamorphism, and regional metamorphism. So we hope you will enjoy this different perspective on the role of fluids in shaping the Earth's crust. I was especially intrigued by the final article on the potential impact of the metamorphism of carbonate rocks on global climate change.

Among the other offerings in this issue is a very interesting article about Linus Pauling's participation in the 1993 CMS meeting (page 188). And in Parting Shots, Ian Parsons surprises us once again, this time with the origin of the name *Calgary* (page 199).

EDITORIAL MEETING

Elements' editors will hold their annual meeting just prior to the Goldschmidt Conference in Knoxville, Tennessee. We will welcome incoming principal editor Georges Calas, who will officially start his term of office in 2011. During this invaluable day-long meeting, the editors will plan the upcoming year, discuss any issue developing on the horizon, and plan *Elements'* thematic content for the second half of 2011 and part of 2012.

VINCENT BOIVIN 1983–2010



Vincent Boivin, the young graphic artist who has been typesetting *Elements* since 2006 and who was *Elements'* webmaster, died on March 30, at the age of 27. I introduced Vincent and Michel Guay in volume 4, number 2

(page 78) as the magicians who take unformatted text and turn it into *Elements'* colorful layout. Each time I took an issue to press, I spent a day with Michel and Vincent to do final corrections, and over the years, we developed a real camaraderie. I appreciated Vincent's appetite for life, his cheerful disposition, his wonderful sense of humor, and his courage.

Vincent was a cancer survivor from childhood, and a little over one year ago, he was diagnosed with lung cancer, a potential side effect of the medications he took as a child. He cheerfully worked through major surgery and aggressive chemotherapy. For a few months, it seemed like he had beaten the beast. But in November, he learned that the cancer had returned and that medicine could not do anything more for him. Michel and I visited him just a few days before he died. Even then, he was interested in catching up on our news, and we had no inkling the end would come so fast. We will miss him so much!

Pierrette Tremblay, Managing Editor

EDITORIAL *Cont'd from page 139*

Funding bodies that " earmark " or "cigar-box" sums of money for topics that are labelled "strategic" are often happy to fund proposals where a promised development is solidly founded on a set of experiments to establish basic understanding. Unfortunately however, if one strictly follows the rules for applications-driven research, one should not pursue even a single interesting tangent. In principle, the funding is given only for research that is directed toward reaching the contracted goal. This is a shame because the unexpected phenomena and the spin-offs can be more valuable than the promised product. It is a shame for the researcher who misses the satisfaction of following his/her insight to an exciting end, but it is even more of a shame for the funding body and society, who will undoubtedly miss many benefits from today's generation of Ørstedts.

* Susan Stipp was the principal editor in charge of this issue.

George Whitesides, well known for his work in many branches of chemistry and materials and who has the highest H-index of all living chemists, gave the plenary lecture at a recent meeting. A young fellow, referring to the frustrating lack of funding for basic research in the current science landscape, asked how he got the funding to do what he really wanted to do. Professor Whitesides did not hesitate for an instant before he answered, "Lie, cheat and steal". With goal-directed research, there is little room for serendipity and few resources to follow a flash of inspiration. Perhaps George Whitesides has a point. As academic researchers, we can choose to bootleg experiments to follow promising tangents on the side of projects intended to deliver a product or process. Or we can hope that our politicians soon realise the huge risk of lost opportunities and swing the funding pendulum back to a system where curiosity-driven, blue sky research is offered a fairer share of the cake. We can hope.

Sincere thanks to the guest editors and authors I have worked with over the past three years. Warm wishes to Pierrette and the editorial team for the wonderful experience of working with you. It has been very rewarding to help *Elements* grow from a fledgling publication, when we were still a little worried about the long run, to a mature periodical with a respectable and growing citation index. I wish *Elements* continued success in producing issues that bring the excitement and drama felt by the specialists of each theme to a more general readership! Congratulations *Elements* on your fifth birthday!

Susan L. S. Stipp*

Llewellyn Smith CH (1997) The Use of Basic Science. CERN, <http://public.web.cern.ch/public/en/About/BasicScience1-en.html>