Good Science Needs Time to Mature and Ripen!

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Do you ever have the impression that the system of scientific research is getting out of control? That you don't have time to keep up with constant demands to publish more, write more grant applications, perform administrative duties, produce 'economic value' and yet still, incidentally, do some meaningful research? You're not alone! Nourished on Slow Food, Slow Science calls for a healthy rethinking of research. Jeremy Garwood investigates its spreading influence.

A spate of recent articles have examined the loss of traditional scientific values at public universities and research institutions in favour of new management ideas, based on notions of economic efficiency and quantitative evaluation.

In "Slow science: an alternative to macdonaldization of the academic lifestyle" Finland's Petri Salo and Hannu Heikkinen, for example, show clear similarities between the industrialisation of food production and universities (*Tieteessä Tapahtuu* 2010, 28:6, English translation available at *slowscience.fr*). In their abstract they write: "Though built historically on quite different aims, prerequisites and conditions of knowledge production, academia seem to have fully embraced the McDonald's service and delivery practices. Fast food and fast science – quick and dirty!"

Slow means more, not less

As far back as 1995, Martin Parker and David Jary described the creation in the UK of "The McUniversity" (*Organization* 2: 319): "Changes in the political, institutional and funding environment have produced forms of Higher Education organization that increase the power of management and diminish the autonomy of professional academics. These new forms of organization, which are increasingly bureaucratic and utilize sophisticated systems of surveillance, will make academics increasingly instrumental in their attitudes and behaviour."

Derived from the doctrine of 'New Public Management', many of these practices have since spread worldwide. They include new criteria for accountability, cost-effectiveness, efficiency and engaging in income-generating activities. Applied to universities, it is said to have resulted in "an academic assembly line" where academics are now treated as 'managed professionals' or 'state-subsidised entrepreneurs'. Researchers are faced with increasing demands to conform to policies based on the slogan, 'excellence', whose priorities are now defined by the equally vague criteria of 'competitivity' and 'productivity'.

The term Slow Science is, in fact, inspired by the Slow Movement, an expanding list of alternative approaches to everything from 'Cities' to 'Parenting', 'Gardening' to 'Travel'. All of which themselves owe homage to Slow Food.

This began in 1986, when Carlo Petrini formed an association to resist the opening of Italy's first McDonald's in Rome. By 1989, its momentum gave rise to the international Slow Food movement and the Slow Food manifesto. Currently, the movement has expanded to include more than 100,000 members in over 150 countries.

The manifesto itself calls for a rethink about the direction that Fast Food and industrial agricultural practices have been taking our food habits. To see how this has inspired Slow Science, you need only look at the (slightly modified) Slow Food manifesto (see text box on p22.).

Real science is not so fast

Although he makes no mention of Slow Food, the first published reference to Slow Science came in 1990 from Eugene Garfield: "Fast science vs. slow science, or slow and steady wins race" (*The Scientist* 4:14). Here, Garfield complains that the public has the wrong idea about the speed at which research progresses. Encouraged by journalists, they believe it "is achieved primarily in sudden flashes of genius or serendipity by scientists shouting 'Eureka!'" But in reality "most scientific advances depend on long-term, persistent, methodical research".

He points at how important breakthroughs more often came from decades of research by individuals "who doggedly plug along in a field that is ripe for discovery and who are intellectually prepared to recognise and exploit unexpected results".

Garfield was concerned that public opinion was putting increasing pressure on researchers via funding policies that expected immediate results in 'hot' fields – "highly publicized, hyperdramatized research areas in which pursuit of funding is wildly competitive and change is quick".

"Taking time to savour the rewards"

The big irony is that Eugene Garfield is the father of bibliometrics and the journal impact factor. In 1955, he founded the Institute of Scientific Information (ISI) to develop a comprehensive citation index to show "the propagation of scientific knowledge". This led to the Science Citation Index (SCI) which made it possible to calculate 'impact factors' (IF) for research papers. These, in turn, have been used as numerical values when evaluating a researcher's scientific productivity, one of the key factors in the cut-throat competition to place research papers in high IF journals and, perversely, to identify the latest 'hot' fields in research!

We then jump forward 16 years to a letter in *Nature* (2006, 443:271) by Lisa Alleva, an Australian biochemist, who Petri Salo designates as the 'mother' of slow science.

Alleva describes how, as an older postdoc, she found herself looking at her younger colleagues "experimenting themselves into oblivion". At this point, she chose to accept the 'here and now' rather than working 100 hours a week to try to "attain the elusive goals of my own grant, my own lab, perhaps even tenure".

It was only then that she discovered a secret, that "science, slow science, is perhaps the most rewarding and pleasurable pastime one could ever hope for".

"My supervisor's lab is small – two postdocs only, with no teaching responsibilities. We are free to read the literature, formulate ideas and carefully plan our experiments so as to execute thoughtful strategies. We do not plough through genomes hoping to discover something interesting; we formulate a theory, and then we go in and test it.

"Perhaps we are old-fashioned but I feel my education as a scientist has benefited far more from my five years of slow science than the preceding five years of fast science. What's more, we are on the brink of something big, exciting and wonderful that spurs my slow science forever onwards."

Multiple gears and slow speeds

But what are researchers actually calling for in Slow Science? How do they propose to achieve their aims? This is where matters get a bit more complex. It requires a lot of thought to encapsulate the whole range of public research activity in all universities and research institutions. What are the problems? Where are the causes?

To give you an idea of possible solutions, we'll look at three contemporary calls for a slow science movement – each has a different focus.

▸ The Ostrich

From the Slow Science Academy in Berlin, Germany, we have an anonymous 'Slow Science Manifesto' (*slow-science.org*): "We are scientists. We don't blog. We don't twitter. We take our time."

Most of the manifesto is a long appeal for more time to do research, "Science needs time to think. Science needs time to

read, and time to fail. Science does not always know what it might be at right now. Science develops unsteadily, with jerky moves and unpredictable leaps forward – at the same time, however, it creeps about on a very slow time scale, for which there must be room and to which justice must be done."

Unfortunately, though, this manifesto appears self-defeating. Like an ostrich with its head buried in the sand, it does not want to look at its real predator. "Don't get us wrong," it says at the beginning, "we do say 'yes' to the accelerated science of the early 21st century. We say 'yes' to the constant flow of peer-review publications and their impact; we say 'yes' to science blogs and media and PR necessities; we say 'yes' to increasing specialization and diversification in all disciplines. We also say 'yes' to research feeding back into health care and future prosperity. All of us are in this game, too."

▸ The Fox

From France, we have a petition, calling "For a Slow Science movement" (*slowscience.fr);* in French, English, Spanish, Portuguese and Esperanto). Written by Joel Candau, Professor of Ethnology at the University of Nice, this petition identifies specific problems and suggests five immediate solutions. "Researchers, teachers, we urgently need to slow down! Stop wanting to run faster and faster. Following Slow Food, Slow City and Slow Travel, we call for the creation of the Slow Science movement." Candau also stresses the need to take more time, "Looking, thinking, reading, writing and teaching all take time. We have less and less of this time, if we have not lost it completely. Within our institutions and beyond, social pressure promotes a culture of imme-

Slow ~~Food~~ Science Manifesto

(slightly adapted from the original at *www.slowfood.com)*

"Born and nurtured under the sign of Industrialization, this century first invented the machine and then modelled its lifestyle after it. Speed became our shackles. We fell prey to the same virus: 'the fast life' that fractures our customs and assails us even in our own homes, forcing us to ingest 'fast-~~food~~ science'.

Homo sapiens must regain wisdom and liberate itself from the 'velocity' that is propelling it on the road to extinction. Let us defend ourselves against the universal madness of 'the fast life' with tranquil material pleasure. Against those – or, rather, the vast majority – who confuse efficiency with frenzy, we propose the vaccine of an adequate portion of ~~sensual gourmandise~~ intellectual pleasures, to be taken with slow and prolonged enjoyment.

Appropriately, we will start in the ~~kitchen~~ laboratory, with Slow ~~Food~~ Science. To escape the tediousness of 'fast-~~food~~ science', let us rediscover the rich varieties and aromas of local ~~cuisines~~ research. In the name of productivity, the 'fast life' has changed our lifestyle and now threatens our environment and our ~~land (and city)~~ lab-scapes. Slow ~~Food~~ Science is the alternative, the avant-garde's riposte.

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Real culture is here to be found. First of all, we can begin by cultivating ~~taste~~ thinking, rather than impoverishing it, by stimulating progress, by encouraging international exchange programmes, by endorsing worthwhile projects, by advocating historical ~~food~~ scientific culture and by defending old-fashioned ~~food~~ scientific traditions.

Slow ~~Food~~ Science assures us of a better quality lifestyle."

The manifesto's last sentence is less obvious: "With a snail purposely chosen as its patron and symbol, it is an idea and a way of life that needs much sure but steady support." Unfortunately, the snail is already a trademark for Slow Food. What might best symbolise Slow Science?

Now, some of you might feel that the Slow Food movement is not on the same level as science. However, let us not forget that although many people could probably live without science, the same cannot be said of food!

Does the analogy also work with Fast Food? Are there certain striking similarities to Fast Science? Well, there's the 'McJob' for a start. Originating with McDonald's fast-food shops, it is now a recognised term used to describe any low-status job, regardless of the employer, where little training is required, staff turnover is high, and workers' activities are tightly regulated by managers. Graduate students and postdocs would probably dispute 'little training' but 'staff turnover'? Another dictionary definition has "a low-paying, low-prestige dead end job that offers very little chance of intracompany advancement". Sound more familiar? A McPhD?

'McJob' entered the Oxford English Dictionary (OED) in 2001 with the definition "an unstimulating, low-paid job with few prospects, especially one created by the expansion of the service sector". In 2007, McDonald's said it would like to see a 'McJob' redefined as "a job that is stimulating, rewarding and offers genuine opportunities for career progression and skills that last a lifetime". To which the OED replied that it is not the job of a dictionary to alter the meanings of words to reflect how certain interested parties would like the world to appear.

Is Fast ~~Food~~ Science healthy? Questions have been posed about the consequences for human health of the industrialised fast food diet, linking the ingestion of large quantities of salt, sugar and saturated fats to heart disease, diabetes and obesity. Does Fast Science affect the 'health' of the research and higher education system? Again, there may be analogies, for example, Peter Lawrence's observation that 'The heart of research is sick' (see his interview in *Lab Times* 02/11: 24-31). Setting aside questions about the health of overstressed researchers (which in itself is a growing problem), what are the long-term systemic effects on the 'body' of science?

diacy and urgency. With real-time, just-in-time production, projects come and go at an ever-increasing pace. Our professional lives are not the only victims of this pressure – a colleague who is not overworked and stressed out passes for eccentric, apathetic or lazy – but also to the detriment of science. Fast Science, like Fast Food, favours quantity over quality."

Quality over quantity

Since 2007, French research has been subjected to a barrage of destructive reforms, largely inspired by the doctrine of New Public Management. As such, Candau has no difficulties identifying specific problems.

The search for money: "We multiply the research projects to fund our laboratories, which are often poverty-stricken. In consequence, as soon as we have finished developing one program and, by merit or by luck, got a grant, we must immediately consider meeting the next tender, rather than devoting ourselves to the first project."

Publication pressures: "Because the appraisers and other experts are always in a hurry too, our CVs are often solely evaluated by their length: how many publications, how many presentations, how many projects? This phenomenon creates an obsession with quantity in scientific production. One result is that it is impossible to read everything, even within a narrow speciality. Thus, many articles are never cited and they may not even be read. In this context, it is increasingly difficult to identify publications and presentations that really matter – those that a colleague has spent months, sometimes years, perfecting – among the thousands of others that are duplicated, sliced and recycled, or even more or less 'borrowed'."

A frantic race to 'adapt'

McUniversity: "Of course, the training that we offer must be 'innovative', obviously 'high performance', 'structuring' and adapted to 'changes in the business world'. But it is hard to identify the appropriate changes in a world in perpetual motion. As a result of this frantic race to 'adapt', the issue of selecting the fundamental knowledge to pass on – knowledge which, by definition, is unchanging – is no longer on the agenda. What matters is to be in tune with the times, and especially to change constantly, to keep the hot air blowing."

Managed professionals: "If we accept managerial responsibilities (university councils, departmental or laboratory management), as we are all required to do during an academic career, we are immediately forced to fill out endless forms, often giving the same information over and over again. Much more serious, the result of invasive bureaucracy and 'meetingitis' – the latter to maintain the appearance of collegiality, while generally emptying it of its essence – is that no one has time for anything: we must comment on the application received today for implementation tomorrow!"

Candau vehemently assures us, "Resisting Fast Science is possible. We can build a Slow Science, giving priority to values and principles." He proposes five points:

- "Research is the motor of education, despite the repeated attacks of those who dream of eliminating research from French universities." Therefore, "at least 50% of our time must be reserved for research" by rejecting any task that encroaches on this 50%.


Photo: Fotolia/ Eric Isselée

More time for high quality research, family and mouse hunting...

- To have enough time to produce high quality research and publications "we must have regular periods without managerial responsibility or training", e.g. to have six months exclusively for research every four years.

- To stop the obsession with quantity in the CV "we must decide, in a collegial and transparent way, how to assess scientists by the quality of their scientific production, not just its quantity", e.g. list just five publications in the CV.

- If the job of university scientists is to teach acquired knowledge then they must be given time to teach properly. "How much time is wasted solving practical, often trivial, problems that are outside their job definitions?" E.g. stop unnecessarily reformulating the teaching programmes every four or five years.

- It's also important to understand administrative changes. "Insist on enough time to study the issues. In the interest of all, critically analyze the content. There is no reason to accept the ideology of urgency, repeated ad nauseam by the Ministry and its 'managers'."

And finally, "We must not forget that there is life outside the university. We need time for our families, our friends, our leisure … for the pleasure of doing absolutely nothing!"

▸ The Philosophical Hot Potato

From Belgium, there is a "plea for slow science" by Isabelle Stengers, professor in science philosophy at the Université Libre de Bruxelles: "Another science is possible!" (transcript of the lecture at *threerottenpotatoes.wordpress.com*). She notes that Belgian universities have also fallen prey to the "general imperative of benchmark evaluation in the competitive academic market" but her vision looks beyond the stresses and strains of individual researchers to the very foundations of modern science itself.

For Stengers, we must look back to the 19th century, to the origins of fast science and modern universities in order to understand the future threat posed by the 'knowledge economy' and its new politics of public research. The slow science she proposes depends upon understanding how fast science has developed and why it has become 'unsustainable' in the context of society's future needs. In particular, because it is not equipped to resist the changes that are being imposed on it.

Fast Science – Origins

Fast science arose from a new method for training scientists as professionals during the 19th century. Stengers, who herself trained in chemistry, gives the example of chemists. Previously, a chemist "might take a lifetime to acquire the practical knowledge and ability to master the wide variety of subtle, complex and often dangerous chemical operations pertaining to the many

arts or crafts of chemistry, from perfumers to metallurgists to pharmacists". But the great German chemist, Justus von Liebig (1803-73), changed this. In his laboratory at the University of Giessen, students were now able to obtain a doctoral degree after four years of intensive training. His students had become 'professional scientists', a model that rapidly spread.

Fast Science = academic science

However, students of professional science learned nothing of traditional crafts and recipes. In effect, Liebig's invention divides "the whole continent of chemical crafts on the one side, and, on the other, both academic research and the new network of industrial chemistry".

Liebig then went on to define the relationship between industrial chemistry and university research. He became a passionate promoter of the need for pure, autonomous academic research and used the 'Goose with Golden Eggs' argument to justify this freedom. He maintained that it was in industry's best interest to keep its distance from academic research. Industry's best chance of getting Golden Eggs would come from leaving the scientific community free to determine its research questions because "only scientists can tell, at each step, which questions are fruitful ones that will lead to fast cumulative development" rather than those that will only result "in some empirical gathering of facts leading nowhere".

Basically, academic scientists worked best when left alone but eventually, they would produce knowledge to help industrial development. However, this academic autonomy also implied that the researchers left industry a free hand with their discoveries and were not responsible for any 'misuse'.

Today, there are academics who talk of returning to a Golden Age, often situated in the 1960s. But Stengers insists that many scientists completely fail to realise that this Golden Age of academic research depended on Liebig's division "between scientists who work on protected academic grounds and those who sell their labour force to industry, and who are usually denied autonomy and the freedom to contribute to public knowledge".

Photo: iStockphoto/pkruger

Slow and steady wins the 'race'.

Fast Science has a narrow focus

Furthermore, fast science poses some inherent problems because it relies on professionals who, highly specialised in particular regions of thought, are progressively adding to the sum of knowledge within limited subject areas.

Obviously, researchers can resist this tendency and look outside their specific domain but what happens when the priorities of fast science discourage or prevent such curiosity? For example, when time pressures become so great that "for many scientific researchers, to slow down and lose one's time with questions that do not directly contribute to the immediate and valuable progress of their field is something akin to a sin – to a temptation a true scientist knows he has to resist".

She suggests that this restricted image of scientific creativity is deeply ingrained in fast science education, especially when it comes to questions that "concern the wider world". Fast scientists learn to consider these issues as "non scientific", even if such questions are the object of a lot of scientific work in other departments, dealing with cultural, social or economic problems. "They learn that for a fast science researcher to lose his time with these questions is a very bad sign, a weakness suggesting he is not completely committed to the advancement of true science."

As a consequence, although the autonomy of fast science has protected the reliability of scientific claims, it has not asked whether the mode of development followed by human society as a whole is similarly sustainable. This is by no means an accident, says Stengers, because "the reliability of fast science's results is relative to experimentally purified, well-controlled laboratory experiments. And competent objections are competent only with regards to such controlled environments". But fast science has now fallen prey to industry. It has lost its historical freedom. "Our universities, once so proud of their autonomy, have accepted, in the name of the market, the imperative of competition and benchmarking evaluation." Stengers also laments, "Researchers have accepted, without too much resistance, the redefinition of research by the knowledge economy. Whatever the explanations we can offer, they all testify of the deep vulnerability of what we were so proud of. The arrangement which promoted fast, disembedding and disembedded science as a model for scientific research made us too sick to defend it."

The 'promise economy'

However, instead of a 'knowledge economy', there are many signs that we are instead generating a 'promise economy'. Because, as countless researchers now know, evaluations of scientific research activity based on quantity, rather than quality, encourage the generation of unreliable science. Previously, trustworthy scientific results were ensured because they were openly exposed to the "demanding objections of competent colleagues" who wanted to confirm their validity.

But look what happens when this shared concern for truth is compromised by the need to keep commercial partners happy. To attract such partners, we must make promises. Yet, in order to maintain these promises, we may now be tempted to apply less rigour when objecting to weaknesses in research claims, especially if such objections might lead to a general weakening of a whole field's promises.

"Dissenting voices will then be disqualified as minority views that need not to be taken into account, as they spell unnecessary trouble." This is the 'promise economy' when "what holds protagonists together are no longer reliable scientific eggs that may turn golden for industry, but glimmering possibilities nobody is interested to assess any longer". As a direct result, the 'knowledge economy' has annexed the production of scientific knowledge for the speculative "bubble and crash economy".

Slow Science – Creating the future

Stengers' definition of Slow Science seeks to address the failings of Fast Science. For a start, she says, it should create the future. In this respect, she quotes Alfred North Whitehead, the mathematician-philosopher, who in 1935 described the task of universities as "the creation of the future, so far as rational thought and civilised modes of appreciation can affect the issue. The fu-

ture is big, with every possibility of achievement and tragedy".

In Slow Science, 'rational thought' would mean "active lucidity about what is actually known, avoiding any confusion between the questions that are actually answered and the questions that will arise in the wider and inevitably messy environment". While a 'civilized mode of appreciation' would imply never identifying "what is well-controlled and clean with some truth transcending what is messy".

Accept that life is 'messy'

Unfortunately, fast science considers as 'messy' all the "irreducible and always embedded interplay of processes, practices, experiences, ways of knowledge and values that make up our common world". Which is quite a lot!

She maintains that the symbiosis of fast science and industry has privileged knowledge and strategies that are "abstracted from the messy complications of this world. But messiness is returning with a vengeance! Ignoring it, dreaming of its eradication, we discover that we have messed up our world".

In this respect, in Stengers' Slow Science, scientists accept that what is 'messy' by the criteria of fast science is not a 'defect' but rather something that "we have to learn to live and think in and with".

Active participation

But how do slow scientists address these issues? For a start, Stengers says we could definitely improve our modes of communication. Out with those PowerPoint presentations that appear so striking, authoritative and schematised, "Just think of the boredom we are so used to, silently and patiently half-listening to a dear colleague speaking for an hour."

Instead, we might try 'slow meetings' – meetings organised in such a way that participation is not simply formal; or 'slow talks' – reading and discussing beforehand so that it is not reduced to the ritual of attending a prepared talk ending with some questions. And, yes, she knows that fast science is horrified by such suggestions because "they all mean a loss of time". However, she also suggests that we get into "the habit of demanding that when colleagues speak about issues that are beyond their field of expertise, they present the information, learning and collaborations that allow them to do so". Or that when an issue of common concern is presented (especially 'messy' ones), an effort be made to have the presence of co-experts, such that people are aware of the many dimensions involved.

Utopia or dystopia?

Isabelle Stengers admits that her plea for slow science may sound utopian in the present situation. "No university today is free to escape the rules that make fast, competitive science a matter of life and death." But perhaps we should accept that "the very idea that our future may escape the worse is also utopia".

In this respect, she insists we have to learn how to cultivate Slow Science because the task and responsibility of public researchers and universities lies in the creation of a future that is worth living. -JG-