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S U A N T E L I N D Q U I S T

CULTURES OF CREATIVITY

During the period 1901–2006, a total of 788 Nobel Prizes have been awarded for contributions in physics, chemistry, physiology or medicine, literature, peace and economics (thus including the Sveriges Riksbanks Prize in Economic Sciences to the Memory of Alfred Nobel, which was instituted in 1968). This fall, the first week of October, a new dozen will be added as the Laureates of 2007 are announced.

The centennial year 2001 saw the opening of the Nobel Foundation’s Centennial Exhibition “Cultures of Creativity.” This has been built in two identical copies, and one is on show in Stockholm at the old Stock Exchange Building in the Old Town. The second copy has been sent out on an international tour, and it has been shown in Tokyo, Seoul, Houston, Chicago, Kuala Lumpur, Florence, New York, San Francisco, London, Bangalore, Singapore and Sydney. The Centennial Exhibition will have its Grand Finale in the UAE: first in Abu Dhabi in late 2007 and then in Dubai in early 2008.

The Exhibition presents a selection of the 788 Laureates representing different prizes, different nationalities and different decades. The Exhibition is intended to illuminate the question “What is creativity and how can it best be promoted?” It also aims to encourage visitors to ponder on the question: “What is more important to the creative process: the individual or the milieu, that is, the environment in which the work is being done?”

The Exhibition does not provide any clear-cut answers to these

important questions, but it does provide food for thought. We want the visitor to come out confused — but at a higher level.

Well, that’s a good line, but perhaps too modest. You see, I seriously do think that the Exhibition does capture some general aspects of what it is that makes an individual or a milieu creative. In the Exhibition we deal with these questions in the two movie theatres which are the core of the exhibition.

One movie theatre is dedicated to individual creativity. Here you can see 32 different short films produced from archival footage. Here you may view, for example, films on Marie Curie, Nelson Mandela, Barbara McClintock, Wilhelm Conrad Röntgen, Amartya Sen and Isaac Bashevis Singer.

In the movie theatre dedicated to creative milieus, 10 longer movies on various creative milieus can be seen. They have been produced by students past and present at the Swedish University College of Film, Radio, Television and Theatre. Here you can see films on, for example, Cambridge University, England, or Cold Spring Harbor on Long Island.

In this article I will try to outline some of these general aspects, beginning with the individual.

Several aspects of individual creativity can be illustrated by the achievements of the Nobel Laureates. Many general preconditions for creative work are illustrated by — and are the same for — both scientists and writers and those working for peace. What is often involved is the courage to go one’s own way and explore new paths, for example to query an established scientific theory, to break with a literary tradition or to oppose a prevailing political doctrine. Radical creativity therefore requires a strong belief in oneself and a certain lack of disrespect for the predominant opinions of the day. You must even have the courage to challenge the theories and beliefs of your own teacher. (I could mention that the translation of the word “disrespect” caused us some problems in Japan and Korea. It’s very much against the Confucian tradition to question your teachers and

elders, and it was almost impossible to find words in Japanese and Korean which didn't also come with connotations of being rude and impolite.) An example of the courage needed is provided by the persistent work of Marie Curie, Laureate in both Physics and Chemistry, in a world dominated by men and conventions. Another is the stubborn struggle of the winner of the 1954 Chemistry Prize, Linus Pauling, against nuclear weapon tests. For this he received the Peace Prize in 1962, making him the only person in the first century of the Nobel Prize to win two prizes outright.

The courage to challenge established theories — and the persistency needed to continue your work and believe in your hypotheses regardless of what others think of it — is also illustrated by the work of Barbara McClintock, winner of the 1983 Medicine Prize. She preferred to study corn cobs, although they multiplied a good deal more slowly than the fruit flies used by today's geneticists, because this gave her time to reflect, time to study nature and time to reconsider her hypotheses.

Another aspect of the creativity of the individual that can be seen in the history of the Nobel Prize is the ability to combine knowledge and insights from different areas, to synthesize. The Swedish Chemistry Laureate Arne Tiselius' work on the application of physical methods in studying biochemical substances is a good example. Another is how Martin Luther King applied Mahatma Gandhi's non-violence principle in the American civil rights movement.

The ability to see an old problem or a well-known phenomenon in a new way is another quality. This is, for example, illustrated by the new interpretation of such concepts as poverty and resources by the Economics Prizewinner Amartya Sen and his studies on the Bengal countryside. Or by Dalai Lama's view of the significance of the Tibetan religious and cultural identity in a new era; his ability to see an old problem in a new way is being symbolized in the Exhibition by his glasses.

There is also often an element of play (“Homo Ludens”) in creative work, a pleasurable joy with no thought of utility. This had its importance when, just to amuse himself, the physicist Richard Feynman — known for his playfulness and extra-curricular activities, such as Bongo-drums — wondered how to describe in mathematical terms the wobble of a spinning plate that had been thrown into the air — which formed the basis of the theory of quantum electrodynamics for which he was awarded the Physics Prize in 1965.

Behind many great discoveries there is an element of chance. Such is the case in the discovery by the Physics Laureate Wilhelm Conrad Röntgen of x-rays; another is the discovery of penicillin by the Medicine Laureate, Alexander Fleming, a third example is the discovery of electrically conductive polymers by Hideki Shirakawa. The happy outcome of this game of chance is sometimes referred to as serendipity (from the Indian tale of the three princes of Serendip who all went out and found something other than what they were looking for, but something equally valuable).

But the random component should not be exaggerated. Behind most pioneering contributions lie years of dogged hard work. The French chemist and microbiologist Louis Pasteur (who would have been an obvious candidate for a Nobel Prize if he had not died as early as 1895) said that “chance favors only the prepared mind.” The American inventor Thomas Edison (who was nominated in the early twentieth century but never received the Nobel Prize) described genius as “1 percent inspiration and 99 percent perspiration.” This is illustrated by the stern daily self-discipline at the writing desk to which Ernest Hemingway, winner of the Literature Prize, subjected himself; or the almost two decades of exhaustive, and exhausting, experiments in X-ray crystallography — including an enormous amount of calculations in the early days of numerical computers, using punched paper ribbons — that were carried out by Max Perutz in order to ascertain the structure of the hemoglobin molecule before being awarded the Prize for Chemistry. Another example

is Jack Kilby's invention of the integrated circuit, the microchip. Kilby had been hired by Texas Instruments in the spring of 1958, and when the summer came most of his colleagues left for their summer holidays. The newly hired Kilby had no vacation time available, so he had plenty of quiet time to think and work at the company's North Dallas laboratory. After first sketching out his idea during the summer, Kilby had developed the first circuit by September 12, 1958.

In creative work there is often a "moment of insight," such as when the American physicist Charles Townes, sitting on a park bench in Washington, D.C., one day in 1951, was struck by the basic insight that was to result in the maser and the laser; or when the Swedish author Selma Lagerlöf as a young teacher in Stockholm suddenly saw the main outline of her most well-known novel *The Story of Gösta Berling* in her mind's eye as she was walking down the streets of the city.

It should also be pointed out that we stress the importance of early schooling in the Centennial Exhibition. Illustrated by, for example, the school Santiniketan, outside Calcutta in India, which was founded at the beginning of the last century by the Literature Laureate Rabindranath Tagore. The school, which still exists, applied original educational methods. It has fostered many of India's best-known politicians and cultural personalities, including the 1998 Economics Laureate, Amartya Sen. Another example: most Nobel Laureates and other famous scientists of Hungarian origin attended the same elite Gymnasium high schools in Budapest, and these, too, are schools which still exist. And yet another example: The Medicine Laureate Rita Levi-Montalcini and two other Italian Nobel Laureates all went to the same high school in Turin where they shared the same teacher. It is clear that early schooling and enthusiastic teachers on the high school level is very, very important. Another example: all three Japanese Physics Laureates — Yukawa, Tomonaga and Esaki — went to the same school, the Third High

School in Kyoto. A last example: Bronx High School of Science can boast of no less than five Nobel Laureates: Cooper, Glashow, Hulse, Schwartz and Weinberg.

To sum up, these are some of the aspects of individual creativity that the Exhibition deals with:

- Courage
- To challenge
- Persistence
- To combine /to synthesize
- To see in a new way
- Mobility
- Playfulness (“Homo Ludens”)
- Chance
- Work
- “Moment of insight”
- Early schooling

Interest in the personal circumstances of the individual doing creative work has in recent decades been supplemented by a growing interest in what have become known as creative milieus. In many parts of the world efforts are being made today to recreate, for example, the external circumstances that together led to the unique climate of innovation in the famous “Silicon Valley” in California or the “Route 128” outside Boston.

There are several milieus which have generated a remarkably large number of Nobel Prizes. Why, for example, has the University of Cambridge won some 80 percent of all the Nobel Prizes that have gone to Britain? It is, after all, a rather small place. During the inter-war years writers and artists gathered in Paris, among them future winners of the Literature Prize such as Samuel Beckett and Ernest Hemingway. There are individual laboratories which have been awarded many Nobel Prizes, such as Cold Spring Harbor Laboratory on Long Island, New York, where for example Nobel Laureates Barbara McClintock, Max Delbrück and James Watson

worked. Another example is the recently closed Basel Institute for Immunology in Switzerland which was built up by the Danish Nobel Laureate Niels K. Jerne, and where the Japanese Nobel Laureate Susumu Tonegawa worked.

Indeed, the examples are many and the history of the Nobel Prize may be said to illustrate several of the qualities that characterize creative milieus, whether they be regions, cities, universities or laboratories. These milieus are normally typified by a spatial concentration, a “high density” of individuals who together possess a diversity of competence in different fields and disciplines. For anything creative to happen, however, these people need to communicate, to belong to one or several networks where they can exchange knowledge, experience and ideas. The possibility of frequent meetings between individuals is therefore an important feature of these milieus. It also seems to be particularly relevant for there to be informal meeting places alongside the established structures, such as the cafeteria at the laboratory, where students and staff can meet as research colleagues outside the rigid hierarchy of the seminar situation where they meet as students and professors.

Another feature is the mobility of individuals between different creative milieus. As illustrated, for example, by Hideki Yukawa’s meetings with Albert Einstein when he visited Princeton University. Or when the British scientist Harold Kroto learned about the technique developed by Richard Smalley and Robert Curl in Houston and left his laboratory in Sussex to fly to Smalley’s laboratory at Rice University. He arrived on 1 September 1985, and after eleven hectic days of experiments their combined insights, knowledge and expertise had led to the discovery of a new form of carbon, buckminsterfullerene, “buckyballs.”

Yet another feature, witnessed by many creative milieus, is the careful balance between, on the one hand, resources to pursue your work and total freedom to choose your own problem and follow your

own ideas, and yet, on the other, a strong spirit of competitiveness in the milieu — why, even a strong pressure to perform. This careful balance between freedom and pressure — this contradiction of “freedom under pressure” — is perhaps one of the most characteristic features of a successful, productive creative milieu. Or, as the point is being made in one of the films in the Centennial Exhibition: “Sub pondere crescit palma” — the palm tree grows under pressure.

The competitiveness in science is a well-known phenomenon, i.e. the competition between individual scientists, research teams, laboratories, universities or even nations. The metaphor for this in the Centennial Exhibition is the annual rowing competitions, “the Bumps”, between various Cambridge colleges. This is also a reminder of the fact that if there are winners — like Nobel Prize Laureates — there are also losers. And as in the Olympics, and as in sports in general, there are always many more losers than there are winners — hence the prestige of the few.

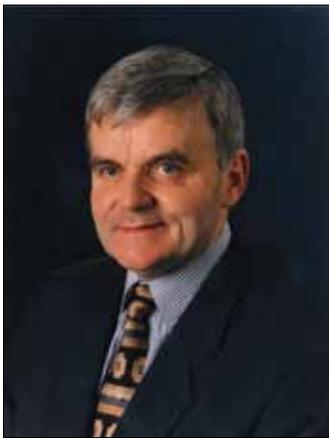
An interesting characteristic of many creative milieus is that they seem to flourish during a period of chaos, a time of “structural instability” when established institutional structures and hierarchies collapse, leaving room for the individual entrepreneur — whether he or she is a scientist, an artist or an author. One example of this is the vibrant milieu of new literary journals that arose in Tokyo after the Second World War. This was a situation where young authors, like the future Nobel Laureate Yasunari Kawabata, could publish and make their voices heard.

To sum up, these are some of the characteristics of creative milieus that the Exhibition deals with:

- Concentration (a “high density” of individuals)
- Diversity of competence
- Communication
- Networks
- Informal meeting places
- Mobility (between creative milieus)

- Resources
- Freedom
- Competitiveness (i.e. pressure ...)
- Chaos, “structural instability”

Finally, the center-piece of the Exhibition is a work of art, a web of optical fibres where the pattern and rhythm of the light are computer-guided. This work of art can be seen as a symbol of the central dichotomy of the Exhibition — that between individuals and milieus — since it can be interpreted in two different ways: both as a symbol of individual creativity and as a symbol of creative milieus. In one case you may read the flickering dots of light as the ideas, thoughts and experiences inside the brain of an individual — a mind in which insights from different fields clash and are combined in a new, innovative way. But you can also read all the flickering dots of light in this web as individuals connected in a network of communication, collaborating and exchanging ideas in the chaos which often constitutes a true creative milieu: here they interact in a network and share their different ideas and experiences with one another, the result being new, innovative ideas.



«Quality and the pursuit of excellence are embedded in the tradition of education in Ireland.»

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