Lymphology 21 (1988) 203-211

SCIENCE, DREAMS AND POETRY

M. Bessis

Institut de Pathologie Cellulaire, Hôpital de Bicetre, Paris, France

One of Bede Morris' favorite subjects was the role of science, its place in a more visionary and humane society, and who among us should be doing it. He often expressed the view that it was difficult and sometimes impossible to judge "good" ideas from "bad ones" as the distinction was often arbitrary or fashionable and could only be fully justified in retrospect. For Bede, if you enjoyed the challenge of ignorance, the insecurity of uncertainty, had a burning desire to tackle nature's inner secrets, and were possessed with commitment and boundless energy, you had the necessary ingredients to be a scientist; and any governmental agency would be well advised to invest in your future success. Once, when I asked him to define the nature of scientific activity, Bede submitted the following essay by Marcel Bessis for publication in Lymphology, *here reprinted with permission from the Nouvelle Revue Francaise d'Hematologie (18:415, 1977). In a world of galloping "conspicuous consumption", "big science", "press releases", and "marketing", this eloquent essay was for Bede a delightful breath of fresh air. It is well worth our scrutiny (CLW).*

I do not know the name of the scholar who defined science as "merely that which is measurable". Whoever he was his definition is imprecise and too restrictive. Of course, measurements are necessary for scientific research and as a consequence people who measure things for a living are a byproduct of science. Multitudes of measurers, under the direction of entrepreneurs, measure everything that can be measured. The scientific literature is filled with the measurements of scientists who work solely on the techniques of measurement (with isotopes, with electrophoresis, with chromatography, with enzymes, with antibodies). Their tasks are almost mechanical, almost routine, as they cross the t's and dot the i's of established fact.

We all know that the vast expansion in the numbers of research workers and in the amount of money given to them has not been accompanied by commensurate increases in discoveries. To a large degree this is because today there are many young researchers working solely in the realm of measurement techniques merely adding a greater degree of precision to discoveries that have already been made. Assuredly scientific research needs good measurements to make such judgments but what science crucially needs, is a perceptive insight of what to measure. Those people who have this perceptiveness are the creators, the artists of science.

Artistic creation and scientific creation, I believe, have as their bases precisely the same mechanisms. With development, a difference becomes manifest: a work of art needs not to be proven, and cannot be measured by any objective criteria. It needs only to please; to please a certain audience, placed within a certain social and cultured setting. There can be no assurance of its persistence, and unlike a natural law, its very nature is ephemeral. A work of science in contrast, is universal and sublime; it has as its basis reproducibility and thus once it is enunciated it can be given to those who measure to add detail and refinement.

Among scientists, there are neither "pure" measurers, nor "pure" creators. Scientists are, in fact, both. Nevertheless, the trend today is toward encouraging mensuration and discouraging creativity. The social destinies of the measurers and the creators are quite different. Nothing threatens the measurer. His career is assured; he will always be needed to provide his latest set of figures and society will acknowledge the virtue of his figures and provide him with security. He will never be confronted with a problem that he cannot solve for there is nothing that cannot be measured. The career of the creator, on the other hand, is profoundly uncertain. He can never fulfil the expectations of everyone and more importantly he can never know exactly what he wants, or know in any precise way how to attain it. He remains, of necessity, in a miasma of uncertainty. He makes errors, falls into traps, takes enormous risks, and may produce nothing definitive for months or years on end. His intellectual talents may dignify him as an enlightened man and yet finally he must contend with the feelings of guilt associated with his unproductive effort when he is judged by the measurers, the administrators, and the contractors of research. My late friend Eric Ponder, author of a splendid but little known work included in the preface this quote from APPOLLINAIRE:

Have pity on us, who fight always at the frontiers of the unlimited end of the future

Have pity for our errors, pity for our sins...

While the measurer presents problems for science he has no personal problems, and the survival of his species is assured. For this reason I shall speak only about the creators--or to that part within each of us which is concerned with the creative act. As I have said, many of us are at once a mixture of creator and measurer. Many having once been creative, end up in the more comfortable position of a measurer, or in the more seductive position of an administrator or entrepreneur. For the administrators and the entrepreneurs who more and more direct the course of contemporary scientific research and also for the young scientists who stray into mensuration, I should like to analyze some aspects of the creative process. The starting point of my analysis is in the dream.

The dream-time

Dreams can be many things and occur in many circumstances. They may occur while sleeping, they may be the delirium of fever or they may be irrational or vague thoughts or distractions. They may represent thoughts seen as in dreams or the passionate desire for something yet unattained. We all know of significant discoveries which have originated with each of these various states of mind and I shall not bother to recount such well-known anecdotes here. All who have made discoveries, however miniscule, know that many, if not all of them, have either been born of dreams, or have been nourished by them.

I want to write only about two aspects of dreaming: about thoughts seen as in dreams and about dreams that embrace a passionate idea. It may seem a paradox but I believe that the second aspect of dreams is the more important. Without enthusiasm for an idea, without passion for it, there is no creation. It is passion that distinguishes those who create from those who measure. Creative researchers cannot be structured intellectually; they are not like physicians, lawyers or garbage contractors; such people are turned out to be professionally competent but not necessarily creative. Any young man who wishes to devote himself to research and who wonders whether he has the vocation, should read what Rainer Maria Rilke wrote to

a young man who wished to know if he could become a poet: "There is only one way: go down into yourself and search out the need that makes you write; see if this need has its roots in the deepest part of your heart; own up to yourself: would you die if you were forbidden to write?

Above all: ask yourself at the most silent hour of your night, must I really write? Dig down for the deepest response. If this response is affirmative, you may then face an even more serious question with a strong and simple "I must". Then, construct your life around this necessity."

And what should a young man with this passion see in his dream? Rilke gives the advice: "Use that which is all around you, the images of your dreams, the objects of your memories. If your daily life seems poor, do not blame it. Blame yourself for not being poet enough to call forth its riches to you. For the creator, nothing is poor."

The creative researcher like the poet must find his inspiration in himself and in the emotions that he himself has experienced. The experiences of others or a formulated intent to make a specific discovery, cannot be relied upon to help, they may in fact obfuscate the creative dream whose images must come from personal experiences, emotions and observations. These may have occurred years previously, perhaps during a romantic interlude of his early youth which remained dormant in his memory. These fleeting visions may appear in a disordered fashion coupled with unexpected new associations. They may be shocking or pleasant but they are the stuff of which creation is made.

Ardent desire and appropriate dreams are, however, not enough: the subconscious must be given expression: the shadow, substance; the vague thought, precision. This happens by a mental process involving trials and errors, the process Paul Valery called "Poiesis".

The poietic-time

It seems evident to me that poets and scientists create in much the same way. Both find their inspiration in dreams and both transform the stuff of dreams; the poet into poems, the scientist into hypotheses. However, the analogies end here. The creations of poets and scientists will be judged differently: the poet must formulate his poem to please, the scientist must formulate his hypothesis and then have it accepted.

There is an inane cliche that art is universal. Nothing could be more false than this. The pleasure that a work of art evokes depends on the country, the time, the fashions and the culture of those who judge the work and on their own experience in life, their likes, their dislikes and their desires. By contrast a proven natural law has a universal and timeless value. All things being equal it will have no limitations or restrictions in terms of culture or time; it will be true on Mars on on the moon. Scientific theory establishes relationships between facts by objective means independent of the observer; art on the other hand establishes its reality in emotions which are uniquely those of the observer.

I quite recognize that there has always been an audience for scientific works and particularly today this audience plays a considerable part in the establishment of scientific fashion by judgments that are often not objective. The scientific audience always has assigned much importance to those discoveries which it sees as essential to the development of intellectual commitments already made. These discoveries are predicated because contemporary science has given to the measurers the responsibility of making them; it would be unacceptable if this were not to follow as a natural consequence of the way science is now structured. Today the behavioral patterns of scientific audiences are conditioned by the domi-

nance of the administrators, the entrepreneurs and measurers. They reject a brillant hypothesis that does not conform to scientific fashion while they acknowledge and applaud some dubious scientific proposition on the basis of the necessity to have it so. We need not go back as far as Galileo and Mesmer; there are fine examples in the second half of the twentieth century.

Like artists, researchers see in their dreams the realities they wish to create. Images and emotions are subconsciously rearranged in a thousand ways and from these vague outlines a miracle is born: a new idea. The idea has no detailed development, it is merely an intuitive creation that requires organization within an experimental framework. As with the poet the dream must be arranged into structured thought. The dream is a phantom, the poem a reality. Poems and scientific hypotheses are the objective choices creators make from unstructured dreams.

Just how *new* an artistic creation or a scientific hypothesis actually is determines how long it will take to be understood. It will be readily accepted only if there is an appropriate audience that recognizes the aesthetic value of the work of art or the perceptiveness of the hypothesis. Recognition of the virtue of a creation may not occur for years, not until the end of the creator's life, after his death or never.

The value of a work of art or of a scientific hypothesis depends very much upon the law of supply and demand and upon the prevailing social structure; the more original the work, the more indifferent, the more wary or the more hostile will be the people who judge it.

In science much more than in art, the acceptance of a new idea depends on contemporary fashion. What is it that drives researchers to put in so much effort and trouble to create new ideas; are their motivations the same as those of artists? As I have said, creative scientists have a passion to understand the "I must" of Rilke. There are other motivations less intangible; the desire to be useful, to have a satisfying career, to be appreciated and to be honored by one's scientific peers. These motivations are largely venal, they do not encourage creativity but they incite researchers and artists to advertise and distribute the results of their creative work.

The passion of the creative urge may be followed by the pleasure that is felt when a new idea arrives. Such an experience is its own reward even before it is transmogrified into a scientific or poetic form. For once I disagree with P. Valery when he said:

"O recompense, apres une pensee qu'un long regard sur le calme des dieux",
It is sufficient to say:
"O what a reward is a thought"...

Some have experienced this fleeting and delicious sensation. Some will pursue it all their lives.

WAYS TO MAKE DISCOVERIES

The conditions that I have just discussed as being the necessary prelude and succession to a scientific discovery do not contain any formal advice on the way to go about making discoveries. Examples come to mind of important discoveries that have changed the destinies of many people without having their origins in burning passion, in creative insight or in dreams. Many discoveries are created without suffering and accepted by science and society without anguish or rancor.

It has occurred to certain philosophers that by studying the various conditions of scientific and artistic creation, it may be possible to discover laws under which creative thought can be programmed towards the desired end. It may not be possible to produce creators, but at least it may be possible to produce creations. If enthusiasm and dreams are essential components of cre-

ation it may be possible to generate or control them and so relieve the suffering that often goes with creation, while at the same time, fashion a ready acceptance in the community to these new discoveries.

There are many books which deal with creativity--the process of invention, of making discoveries. Most of them begin by recording the progress of invention throughout history in the works of great innovators of the past--Descartes, Darwin, Bacon, Claude Bernard. They proceed with an analysis of the history of discoveries, and finish with an analysis of recent studies of intuitive thought and psychology of creativity. They recognize the role of the dream and of imagination and strive to find the psychological conditions in which fertile ideas will flourish.

As an exercise I think it may be instructive to look more precisely into a proposition that creative research may be amenable to a methodical and well-formulated approach. I will examine briefly some of the propositions mentioned in books concerned with creativity and compare them with my own ideas. I shall offer a series of recipes, which like all recipes may or may not give the desired results.

RECIPES FOR DREAMING

One of the best recipes can be found in the writing of Leonardo da Vinci; he said that: "In walls covered with stains, or made of different kinds of rock, the artist can see landscapes, mountains, rivers, boulders, trees, plains, great valleys, hills; he discovers battles, strange faces, exotic costumes..." I doubt, however, that da Vinci used to contemplate walls to stimulate his dreams or that he indulged in dreaming, as some "experts" on creativity advise, with the intention of creating. Some of our great poets, partook of absinthe or opium, and while certain dreams may have resulted from these indulgences, it is more likely that the effects of these substances made life more easy to bear than to write poems. There is a certain naivete in thinking that the simple induction of dreams or their current equivalents will induce the creation of masterpieces in all mortals. "A butcher-boy will always have butcher-boy's dreams," said Baudelaire. There are, however, some recommendations about dreaming that we need to consider in relation to some of the different meanings that the process of dreaming may have.

Dreaming while sleeping

Psychoanalysts tell us that many dreams involve suppressed fears and desires and that we may later use them productively. Surrealists create strange images from banal forms seen in their dreams; a chemist may see cyclopentenoperhydrophenanthrene rings in them and from these images create a new sex hormone; a composer may find the score of a new sonata. Much of this may have happened in the past, but now something new has been added; by placing small electrodes on the skulls of sleeping people, physiologists have observed periods of intense electrical activity in the brain which last about ninety minutes during the night and indicate the time during which dreams are actually occurring. Sleepers awakened during these periods can easily remember the content of their dreams. By attaching the electrical recorder to a simple apparatus, the sleeper can now wake himself and record his dreams for future use.

Using the delirium of fever

The use of drugs and stimulants has for many centuries been part of the bohemian cultural tradition and a variety of pharmacological stimulants, tranquilizers, alcohol, opium and hallucinogenic mushrooms have been used to attain a state of creative delirium. While it is forbidden in sporting activ-

ities to use drugs which affect the muscles, drugging the mind, some say, is recommended for intellectual pursuits. Chemists now have at their disposal a whole pharmacopoeia for inducing dreams. Statistics are available to define the average number of dreams recorded by volunteers after they have taken increasing doses of opium, alcohol or marijuana and these statistics could be used to estimate the creative spin-off from drug taking.

Saying irrational things

Another approach to discovery through dreams is to indulge in irrational discourse. Turn the world upside down to see whether the view from the underside might allow for revision of the old ideas. In order that confirmed intellectual habits do not obscure original ideas, that which is known must be unlearned. In particular, common sense must be abolished (the sense that makes one believe that the earth is flat or that if it is round, antipodeans must walk with their heads down).

Day-dreaming

Vague thinking represents another approach to the creative process. There are moments when the mind wanders; in an airplane, during a walk or when one is tired and thinking of nothing in particular. Imagination, however, is subconsciously directed by the unfocused, vacant mind. Advantages must be taken of mental meanderings lest their creative force be lost and imaginative discoveries overlooked.

Being distracted

The same can be said for periods of distraction. When one's mental application to a problem is intense, creative thoughts may be obliterated. No new ideas come forth and the creator may become discouraged and ready to abandon his efforts even when they have occupied weeks of work. Intense indulgence as opposed to intense concentration, is a completely legitimate approach to creativity. Forgetting the original problem entirely, sometimes allows for solutions to emerge.

Thus, two contrary attitudes are recommended in these recipes which are mentally exclusive: on the one hand, it is suggested that one's thoughts should be given a total release from the inhibition of one's personal and intellectual past and from conformist ideas, however common-sensical these may be. On the other hand, it is suggested that the mind should be alert, trained and ready to capture the serendipitous clue to reach the next stage, the poietic-time.

RECIPES FOR "POIESIS"

These recipes will make "poiesis" more efficient, more rapid and less painful.

To have a watchful mind

After allowing the mind total freedom for subconscious and conscious thought and for evoking fantasies, one must then begin to sort out the fertile ideas from those that are barren; the jargon of creativity describes this as the preparation of the mind for the emergence of an "association of meaningful incongruities".

For the creator this process is in a sense, self-deceptive, for it requires the formulation of images, without any reason, self-criticism or logic. The task of selecting useful ideas from these disjointed images makes the creator at once, the hunter and the hunted.

To recognize a new idea

A rough guide of a good idea is the pleasure or the reward which it may generate. Many researchers, years after they described the discoveries that made them famous, have told of the absolute certainty they had of the virtue of their idea, because of the

euphoria they felt when it first emerged. However, it must be said that the virtues of good ideas are not always confirmed and for this reason sensations of pleasure and euphoria can only be regarded as having some indicative value.

A new idea may also be recognized by the effect it has upon the "experts". A really good idea should be found by the experts to be incoherent or inappropriate. All ideas that seem incoherent are not necessarily new or good but genuinely new ideas have always appeared irreverent at first.

Using a note book

Many great inventors have recorded ideas that came to them while out walking, travelling on a train or lying in bed. Fleeting thoughts, the glimmers of ideas, vaguely perceived, can be recorded and subsequently referred to for further elaboration. But one must work fast to capture a fleeting inspiration. Said Pascal: "I wanted to write it down, instead I write that it escaped me." However even if the thought is captured in a note book it sometimes happens that it proves to be less brilliant when reread at a later time.

The obligation to create

A very effective recipe for creativity is compulsion. When the great French novelist Colette could not furnish enough copy to her publisher, her husband locked her in her room, giving her food only when she had written a certain number of pages; it is even said that for good measure he beat her to ensure that a productive output was sustained.

Some great masterpieces have been produced to order under the pressure of a deadline. Painters of the past produced many of their greatest works as commissions. Many scientific articles, even some important ones, have been written because a commitment had been made to deliver them to a meeting on a specific date.

Continually thinking about the subject

The content and value of a poem or a theory often depend upon the time spent in dreaming about them and on the time spent in selecting the appropriate material for their composition. Rilke said: "Verses mean so little when one writes them in youth. One should wait, gathering material throughout an entire lifetime; then finally, very late, one might perhaps be able to write ten good lines. For verses are not, as some would have it, feelings: they are experiences.." When someone asked Newton how he had made his discoveries, he replied, "by always thinking about them!"--perhaps being Newton was also important.

Trying everything

Scientific research can be compared to the solution of a jig-saw puzzle. Minor discoveries correctly locate a few pieces and, with patience and perserverance, there is no doubt that eventually many small discoveries will complete the puzzle. A genius however immediately grasps how many of the pieces fit together. Genius saves us time, but since geniuses are rare and their activities unpredictable, it has been suggested that others who are less gifted should adopt a statistical approach to research and try everything. If we are interested in the effects of Carbon compounds on a certain type of cancer why not try all of the 850,000 of such compounds. Only one contractor would be needed to assign 850,000 researchers to this problem for one year. This example may seem a little extreme but it must be recognized that this recipe, when used with a certain amount of intuition and intelligence, has given results. The famous 606, the first effective treatment for syphilis, was the 606th substance in a series of compounds tried against the

disease. It is true, unfortunately for this example, that it was tried by a genius.

Recipe for feeling secure while creating

A recent variation in research method has been the development of group research. Many books have recently been devoted to this approach. The method depends on information obtained by coteries of scientists, working together for mutual security. The group dreams, and then selects the ideas that appear to them to be significant. In order to give the dreams direction, a group "dream-leader" ensures that certain recipies are followed faithfully: words are played with, their meanings transformed, irrational approaches considered, unusual incidents provoked: although it is acknowledged that the unpredictable is unforeseeable, this approach at least provides conditions in which the unpredictable may emerge.

Specialized members of the group sort out any new ideas from the tapes upon which the dreams and ramblings have been recorded. Their selections are reported back to the group, which decides which ones to retain and to develop to the stage of publication and future use.

Is group research more productive and better than individual research? According to some, there is no doubt; collective genius must be a great deal better than individual genius; this is how the scientific research of tomorrow will be directed. It must be said, however, that up to the present time, such group research has given results only in the applications of science to technology; to my knowledge, the group approach has not yet brought forth any great fundamental discovery. We will wait however and hope.

Is group research easier to do than individual research? It certainly is. To be told by a group leader what to do and knowing that there is a distribution of labor, makes research similar to a well organized expedition which sets out to explore an unknown country. Such planned activity in research should be pleasant: everyone feels secure, for failure cannot be blamed on any individual. The isolated researcher, on the other hand, believes he stands alone in a hostile world which waits to identify his failures.

When one thinks about it, solitude is the only reason for the suffering of the scientists. In his dreams, in his creative acts and even in the communication of his results, he is alone. The humorous phases of Muench, "everyone talks too much/everyone writes too much/nobody pays any attention," describe, in fact, the poignancy of solitude in science.

The researcher, perhaps like all humans, lives for only two things, which my friend George Grecher summarizes as follows: "(1) to contribute and (2) to be acknowledged."

The cry of the lone researcher has already been heard in the quotation from Apollinaire: "Have pity for us, have pity for our errors, pity for our sins.."; such a cry will never be heard from an organized group of dreamers.

EPILOGUE

In any scientific article, the conclusion should follow as the necessary consequence of the experimental results, and these should be reproducible by anyone. In an essay, one can say what one likes and end with an epilogue. I have written about the processes of discovery, the pleasure and the pain of creation, and about recipes for creativity. I would have wished to write also about recipes which would ensure non-discovery (like the recipes for dreaming and creating, they can be studied only in retrospect through an examination of the reasons why nothing was discovered) but there would be too many of these to include in this essay.

It often happens that in a symposium when I play the thankless role of moderator, I interrupt a lengthy report and say: "This is all very interesting, but we would like you to deliver your message; we would like you to tell us in a few sentences what *you* think." The speaker may remain silent for a few seconds, but then he says what he really wanted to say. Here then is the intent of my essay.

It is entirely possible that in the near future works of art, poems and scientific hypotheses will be produced by well-organized armies of orangutangs trained to dream and versify on command. This possibility must be considered with the utmost seriousness. There are already examples of paintings, done collectively and of poems and scientific creations done in the same way that have met with great success. Personally, I am disconcerted by this approach. It does not provide the feeling of exhilaration that advises me that I am on the right track. I cannot free myself from my old taboos. I cannot believe that creations of the mind either in art or science can be born other than in solitude.

ACKNOWLEDGEMENTS

Original essay dedicated to Professor Jean Bernard on the occasion of his 70th birthday. Translated from the French by Lynn Kari Petrich, and with the help of some of the author's friends (including B.M.).