Passion versus fear as the emotion driving scientists

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The pressures on the scientific community, both in industry and in academia, to succeed in an environment of competition, short time-lines and high expectation has taken its toll on the altruistic ideals of 'science'. The author describes how the motivation for scientists has changed in the light of increasing pressures and what effect this may have if it continues.

There once was a time when politicians were called statesmen, a time when golf was a gentleman's game, a time when strangers treated each other with respect and a time when scientists were thought to pursue knowledge for altruistic purposes. The times, they have changed.

Since Henry Ford ushered in the industrial revolution, the pace of society has accelerated at logarithmic rates. In every aspect of life, the rules of acceptable conduct continue to change. No longer are people content with things as they are. Instead, 'it' must be faster, better and cheaper at any cost. While 'cheaper at any cost' may sound like an oxymoron, cost cannot be measured solely in monetary terms but must also include other factors such as the sweat equity involved in accomplishing the goal.

Mail is a simple metaphor of how technology has changed our expectations. At one time, sending documents via the post office was sufficient and people realized that many days had to be allowed for document transit. With the advent of FedEx, one-day turn-around has become a standard, with the only decision being early or late morning delivery. Similarly, a heavy reliance on facsimile transmission of documents evolved. Now, use of e-mail allows rapid dissemination of information to an individual no matter where they are located or traveling. I recently realized how we have taken these new technologies for granted when I told a friend that my favorite performer, Mary Blankemeir, wrote a letter to me and the response was 'Oh yeah, what's her e-mail address?'

Science is an art

Scientists view their craft to be like painters. The resulting masterpieces are artistic contributions, not static but constantly evolving over time. Like the impressionist painters of the 19th century, most scientists follow trendy topics. While only a few can be like Monet and set the trends, there is sufficient room for important contributions by many investigators.

Regardless of whether they are setting trends or popularizing previous concepts, scientists require that their environment fosters creative energies so they may perform at an appropriate level. Using Maslow's 'Need Hierarchy', research support can be thought of as the basic 'physiological' motivator, but many other needs including freedom, self-esteem and personal identity combined with collegiality all play important roles. Taken together, fulfillment of these needs allows for creativity and, thereby, increases the chances of success.

How it was

In a simpler time, academic scientists received continued grant support and ascended, with confidence, through the

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  1359-6446/98/$19.00. PII: S1359-6446(98)01233-1

accepted career stages. Similarly, their colleagues in the pharmaceutical sector were given multi-year time frames to identify novel drug prototypes for eventual optimization to marketable drugs. At some point, however, things changed.

One may blame the academic deflection point on the access to funds. The absolute sum of funds available from federal agencies has not kept up with inflation over the past two decades. In addition, the number of scientists competing for funds has dramatically increased (i.e. the actual number of grants submitted over the years). As a result of governmental control of grant allocation, specifically the requirement for a fixed number of grants being funded, there is less money per grant.

In the pharmaceutical sector, new expectations for blockbuster drugs led to continual 15–20% annual increases in corporate profits. While the increases took place in large companies during the 1980s, it was often the result of increasing profit margins on existing drugs rather than bringing new drugs to market. The first two companies (Squibb and SmithKline French) to achieve billion dollar annual sales on individual drugs failed to continue their initial successes and were each consumed by other companies.

How it is

As a result of such pressures in both the academic and industrial sectors, today's environment is different. Those responsible for allocating funds see the scientist as a transient resource that can be bought, influenced, deployed and discarded in the name of maximization of profit. Creativity is difficult to muster when guessing whether you are one of the 10,000 employees that may be laid off as a result of a new corporate merger or if venture capitalists will actually provide another round of private financing to your biotech company. This change in the corporate mindset has had a dramatic impact on the conduct of science. The emotion guiding the researcher has changed from passion to fear.

- Passion is a bright, positive emotion that lures a scientist towards the path of enlightenment, a path that the scientist is seduced along as a voluntary participant. This emotion is self-generated. With passion, the scientist is an eager driver on a road that has many hills and valleys. Through each change in altitude, the scientist gains experience that helps increase the chance of future successes.
- Fear, on the other hand, is a dark taskmaster that pushes the victim towards an externally driven goal. In this case, the scientist is an unwilling passenger on a very bumpy road; whether this road has hills or valleys is irrelevant because it is not a very enjoyable journey and less will be learned as a result of the distractions along the way.

Creativity demanded

The corporate world guiding scientists now demands that investigators be both creative and successful in very short time-frames giving new meaning to the phrase 'performance anxiety'. In most cases, creativity and corporate responsibility simply don't mix. The concept became clear to me in the 1980s when a colleague informed our vice president that one of the drugs he discovered had cumulative sales exceeding $1 billion and the response was 'That's great, but what have you done lately?'

The relationship between creativity and productivity has been known for a long time. For example, in *Walden* by Henry David Thoreau it was stated:

> 'The aim of the laborer should be, not to get his living, to get a job, but to perform well a certain job and, even in a pecuniary sense, it would be economized for a town to pay its laborers so well that they would not feel that they were working for low ends, as for a livelihood merely, but for scientific, or even moral ends. Do not hire a man who does work for money but him who does it for the love of it.'

The cost of failure in science has become very high and there is little tolerance for 'downtime'. As a result, investigators are hesitant to assume new and risky challenges. Instead, it has become safer to take the homogeneous, copy-cat approach. Unlike the production of widgets, however, scientific output cannot be easily quantified or tuned up. When the product requires brute intelligence and creativity as key ingredients, fear and intimidation will not make the successful completion of the task any easier. As Edison clearly demonstrated, scientists require the luxury of failure on their path to success.

It is well recognized from hundreds of medical studies that stressful work environments induce ailments. In his short essay *Life Without Principle* Thoreau has summarized these studies:

> 'Why should we not meet, not always as dyspeptics, to tell our bad dreams, but sometimes as eupeptics, to congratulate each other on the ever glorious morning? I do not make an exorbitant demand, surely?'

Shrewd science

Some academic researchers still believe their role is solely one of attaining knowledge to benefit society. Many, however, have demonstrated that they understand the financial rewards of maintaining close contacts with the industrial sector. It is not uncommon in major academic labs for federal research funds to be supplemented by industrial grants. A recent survey has suggested that in the USA life science companies support more than 1500 research projects with $340 million annually[1].

In addition to six-digit research funds, the research directors also accept money and stock as 'consulting fees' for their efforts. These scientific founders of many biotech companies, who typically assign away the rights of their federally-funded research discoveries, have the ability to benefit rather handsomely. One scientist I know transferred exclusive rights to his patented assay technologies to a biotech company. Since 1988, he has been granted over 283,920 shares of stock (accumulated market value >$4 million) and has received monthly consulting fees over $8500.

While it is logical that academics and their institutions should benefit when discoveries are commercialized, this expectation has caused intense secrecy and competition within individual laboratories and reluctance to disseminate data rapidly to the scientific community. Laboratory members are hesitant to discuss data in group meetings to prevent coworkers from sharing in a potential financially rewarding discovery. Laboratory heads are hesitant to share data with colleagues in other groups and departments. Before submitting publications, patent issues are reviewed with university officials and attempts to out-license the research are initiated.

Harsh reality

Subterranean examination of the corporate world reveals a different picture from that presented at the surface. Every employee is told by Human Resources (HR) that the corporate culture is one of teamwork and cooperation to maximize success. They are expected to tout this 'kum ba yah' philosophy in written and oral communications. However, in the laboratories and offices where HR is not invited, a very competitive, individualistic society exists. In these daily interactions, the reality is that each person must fight for their personal survival as well as for the survival of their research groups. This culture is emotional, small-minded and ruthless, with the real philosophy being kill-or-be-killed. Many of those who are successful find a way to exude the bland, lobotomized behavior yet practice the warrior nature.

Winston Churchill once stated that 'You can't run a war as if you were in a laboratory'. Unfortunately, I have found the corollary is also true: you can't run a laboratory as if you were in a war. Such behavior types detract from success by reducing the creative processes and concentration of scientists. Even when competition is thought to exist quietly between individuals, the impact on colleagues is obvious and counterproductive.

Over the centuries, many artists have painted their versions of 'The Rape of the Sabines'. In Picasso's work, a soldier's horse is actually stepping on a person he is attempting to defend. This is meant to symbolize that war hurts those it is supposed to protect. The same conclusion can be drawn from battles in the laboratory. Unfortunately, not only do the warring groups suffer but so does humanity.

Winners and losers

Who are the people that are making the rules in this new corporate culture? Often, they are either 'successful' business people or former scientists who have played the game well enough to leave the laboratory for greater responsibilities and salaries. Their rewards are based upon maximizing profit, which may be in direct conflict with scientific progress. Like bureaucrats in other fields, such people have assumed control over those they should be assisting.

A particularly painful aspect of science controlled by bureaucrats is the attempt to fit creativity into a simple Gannt chart. George deStevens, the inventor of hydrochlorthiazide at Ciba, recently lamented[2]:

> 'It was meaningless to develop a five-year plan for the discovery of a new anti-inflammatory drug, or a substance to treat atherosclerosis. Creativity cannot be put into a management plan dominated by target dates, network control of research decisions, and cost versus result analyses.'

While this may seem obvious to every scientist, it somehow does not make sense to those at the top. As a result, scientists are constantly compromising their belief systems to meet unrealistic, externally assigned goals.

As the scientist begins to comprehend life in modern society – that they have become slaves to the demands and needs of someone else's reality – the innate values driving that person must be re-evaluated. This self-examination,

however, is not easy as the person often has many accumulated expectations. These expectations are the result of years of education and training, the historical observations from previous generations, the innate desire to be successful combined with many years of hard work and personal/family sacrifices. Too much emotional energy has been accumulated to just change, yet the sad reality is that there does not appear to be an alternative.

'I am a gun for hire, I am a saint, I am a liar
Because there are no facts, there is no truth
Just data to be manipulated
I can get you any result you like
What's it worth to ya
Because there is no wrong, there is no right
And I sleep very well at night
No shame, no solution
No remorse, no retribution
Just people selling T-shirts
Just opportunity to participate in the pathetic little circus
And winning, winning, winning'

Excerpt from *In the Garden of Allah*,
Henley, D. *et al.* (1995) Wisteria Music

When I first heard these lyrics, I assumed the song was about life in a pharmaceutical company (T-shirts being a metaphor for products). Much to my initial surprise, the song is actually about the devil visiting a city in Southern California and finding that he has become obsolete. As I pondered my initial reaction, I realized that my observation was not very far off.

Managing with emotions

As with other occupations that require creativity, scientists are bound to be emotional. When scientists are able to show their enjoyment of their work, that emotion is observed as passion. The excitement associated with a novel scientific finding is as great as completing a work of art or an opera. This emotion pushes the scientist harder. As long as the emotional aspects are positive the scientist and the institution will have a great chance to be successful.

In the pharmaceutical sector, there are many other factors that induce emotion. These include the increasing collaborative nature of research, the impressive financial rewards and the expectation of longer work hours. As long as these factors keep the science moving in a positive direction, they are helpful. But as the factors induce intra-company competition, they breed fear and hurt the company. In the long run, a company cannot be successful if its scientists are fearful about their personal value to the organization. Company-induced fear results in withholding of data, reduced team efforts and paranoia leading to reduced chances of success.

Each company's management must understand that the negative emotions hurt the company. As long as the company is playing tug-of-war with itself, everyone loses. Rather than just giving HR-speak, real changes must take place. Projects and budgets should be determined at the research level, with assistance from the financial groups. As success milestones are reached, the researchers should be rewarded as a team. Those individuals that cannot be part of the team efforts should not be part of the company.

Glimmer of hope?

Jürgen Drews, former head of R&D for Hoffmann-La Roche has offered a proposal to attract and retain top scientists[3]. Accordingly, semi-autonomous 'research centers' comprising hundreds of scientists should be formed. Each center would be responsible for forming and implementing its own research plan with help from corporate management.

Will the result be that scientists will be able to embrace their passion or will they just give up and lose all emotion becoming assembly line worker bees? Seeing how the Internet, a tool that has largely removed emotion from communication has become indispensable, I fear the latter. Yet, in spite of the reality of life in modern science, I truly believe that scientists still crave the desire to make a positive impact on society and will continue to do so in defiance to attempts to be controlled.

REFERENCES

1 Jacobs, M. (1996) *Chem. Eng. News* 74 (8), 5
2 deStevens, G. (1995) *Med. Res. Rev.* 15, 261–275
3 Drews, J. (1997) *Drug Discovery Today* 2, 72–78

In short...

In July this year, Packard BioScience Company (Meriden, CT, USA) announced the acquisition of the Canadian-based biotechnology company BioSignal. Packard, which owned 19% of BioSignal's shares, paid ~$8.5 million for the remaining 81% interest in the company. The acquisition will enable Packard's subsidiary, Packard Instrument Company, to unite BioSignal's gene cloning expertise with advanced biochip techniques to develop integrated products and services for application in high-throughput screening and functional genomics. For further information visit Packard's Website at http://www.packardinst.com