# FINAL WORD/

by David Padwa

# THE SOCIOBIOLOGY OF BIOTECHNOLOGY

Genetic arrangements become cultural artifacts. Professor E. O. Wilson calls these "culturgens". Consider how the hard-wired physiology of the fight-or-flight response interacts with external events, forming genotype-by-environment interactions. Are there genomes for cooperation and collaboration akin to ones for combat and escape? Would they provide evolutionary fitness in a complex and shifting economic/technological climate?

Consider the elaborate tribal sub-cultures of biotechnology competing furiously for limited resources. Assembled within the envelope of a particular enterprise, the combining "fitness" of these differing constituencies becomes a cultural phenomenon. Analyzing corporate cultures is now in vogue. An anthropological perspective may be a modern tool in shaping the success of an enterprise, and the behavior of motley individuals and assorted disciplines in attempting to organize themselves is fascinating and instructive. If they can negotiate successfully the hundreds of minor treaties of turf and time, or "get their acts together", it may even be valuable.

Since biotechnology is a relatively new culture, many constituent roles are untested and uncertain, conflicts abound, and traditions are scarce. How then does an enterprise contain and direct the shearing and centrifugal forces at work? How does an organizational memory and learning curve develop? In a wider framework, how does a culture of mutual respect and collaboration form, where participants enthusiastically behave as consenting adults rather than as antagonists? Most professionals actually love to work. The question is whether they can do so in concert.

I am interested in these issues because I am the CEO of a growing and energetic company and because of certain unproductive behaviors I see throughout the biotechnology community, both within and without my organization (mostly without).

Unlike settled mature cultures, biotechnology is barely approaching puberty; its traditions are still weak in the rites of transformation and initiation. Successful organizations can execute strategies requiring long lead-times and continuous commitment. Such cultures have achieved sufficient depth and complexity to transcend the comings and goings of individuals; they permit flexible adaptations and the absorption of stress that is constantly testing the "fitness" of the enterprise. This is the acid test of maturation.

Language, the heart of culture, becomes a storehouse of value ("the learning curve") and a medium of exchange ("information"); for it allows the discovery of trading-chips which evolve into useful rites and habits. When language becomes widely shared, all parts of an organization begin to communicate.

The development of shared language is the foremost event binding individuals into a cultural unit and is the principal tool for purging superstitious behaviors. Initially this is largely a matter of exchanging and learning basic vocabularies. In time the working "pidgins" evolve into "creoles," and if successful, into the rich and precise language which forms the foundation for a vigorous culture.

In this regard I am frequently surprised at the prideful illiteracy of many biologists about business concepts and categories. While it is a commonplace that non-scientists connected with biotechnology work hard to develop their pidgins, too many scientists screw up their noses at the vocabularies of accounting, marketing, and corporate finance. While the scientist turned entrepreneur is the exception to the rule, the researcher who can discourse knowledgeably on marathon running, academic or sexual politics, French wine, trout fishing, and a dozen other realms, is all too frequently tongue-tied when it comes down to analyzing economic utility. Perhaps this deliberate naivete is a self-serving pose, maintaining a holier-than-thou theology of science as secular religion and constituting a rationale against having to change one's "choice of problem." Some who play the game of knowledge in its purest form may claim to be indifferent to the utility of their work and see no need to learn any language outside their own. In this day and age that attitude symbolizes the vanity of intellectual voluptuaries. And if utility is to be valued by more than mere lip-service, one is quickly confronted by the importance of understanding the mechanisms, the "system," whereby utility is translated to where it is needed. And it is needed.

Ironically, the stand-offishness of some biological scientists towards commercial utility occasionally leads to a prurient fascination with money. What is one to make of leading scientific journals running cockeyed biostock-indexes with financial narratives bordering on the comic? Perhaps this is a hopeful sign since it too is a form of pidgin which, though it makes us smile, should be encouraged and refined.

In Aristotle's view the "polity" is the higher form of democracy—it is the active collegial organization of consenting citizens rather than the weary compromises of a culture's inhabitants. The polity involves a cultural integration of skills, intentions, commitment, and courage, transcending the provincial fashions and conflicts of a mob. Can the biotechnology community develop its polity?

Natural selection favors the heterozygous individual, and in populations, phenotypic and genotypic diversity is equated with stability and fitness. Conversely, at the cultural level it is a com-

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encouraged.

As biotechnology's commercialization becomes increasingly linked to public scrutiny, it is in the self-interest of researchers to actively promote direct public education in biotechnology: a public with technological savvy is more likely to support innovative research. As citizens, researchers may feel compelled to participate because improved education in science and engineering is necessary for an effective modern democracy. To borrow a term from science educator Mary Budd Rowe, fate control—the sense that people can know about and influence the direction of society as it affects their lives—is essential for participatory democracy. The current tendency for students (and future citizens) to believe or disbelieve the textbook or verbal scientific instruction—based upon the authority of Science—works against fate control. As new technologies play an increasingly important part in rapidly transforming occupational and personal roles, scientists and engineers must accept the burden of informing future citizens directly to ensure the effectiveness of participatory government. **—Christopher Edwards**



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tic acid, acetic acid, ammonia, ethyl alcohol, and biochemical oxygen demand probes used for these purposes in Japan. The commercially promising models listed by Dr. Anthony Turner of Cranfield Institute of Technology detect substances ranging from lactic acid (for use in sports medicine) to TNT (for use in anti-terrorist work). My guess is that an equal dividend from this burgeoning technology could be the insight it provides into organic–inorganic interrelations. This is essential groundwork if the dizzy goal of true bioelectronics is to be achieved. ◪

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monplace to observe the inbreeding depression of time serving "cover your rear" bureaucracies and of gridlocked administrators who unwittingly shield the "deleterious recessives" from too much exposure to selection pressure. While this was the Lysenko story, private organizations can suffer similar fates.

Building a polity in the biotechnology community, at any level, means keeping the heterogeneous nature of the culture in a healthy balance. A culture of collective sameness (which usually develops mimicry into its principal survival skill) creates little that is new. The trick is to keep our heterogeneous community from flying apart or disemboweling itself. Just think of all the short sighted investors, greedy brokers, closet Marxists, threatened hacks, over-reaching egotists, cheap-shot competitors, ambitious politicians, and idiotic fantasy mongers swimming in the pond. (This is the short list). But after all, it is in part the chaotic nature of capitalism that is responsible for its creative vigor. Personally, I think it's coming together beautifully. ◪