nature biotechnology
VOLUME 17 OCTOBER 1999

A common green ground

If the various environmental protection groups, who often appear hysterical about the use of recombinant DNA technologies to perpetrate a range of imagined ecological disasters, would acknowledge that these same tools are among the best means they have to achieve their enviable goals of habitat preservation and protection of the world's biological diversity, perhaps some of the polemical diatribe that has characterized the public debate on biotech biorisks might just turn to profitable dialog.

A case in point appears in this issue (p. 969), where Matz et al. report the discovery of six new homologs of green fluorescent protein. Originally isolated from the bioluminescent jellyfish *Aqueoria*, GFP has become an important tool in biology to monitor the real-time expression, subcellular localization, and interaction of proteins in living cells. These new fluorescent proteins expand the emission palette considerably, including a much sought after red-emitting protein, and so are of considerable interest to the world's biologists. But of particular significance is where—and how—they were found.

Until now, many thought that GFP-like proteins would only be found in other organisms that bioluminesce, or glow. But the authors of this new study hypothesized that the protein domain responsible for fluorescence could have cousins elsewhere in nature. The brightly colored and sometimes fluorescent fauna of the coral reef seemed a good place to look. Using primers based on structural features of GFP that they thought likely to be conserved, the workers used a nondestructive, non-invasive PCR-based method to isolate the novel genes from the colored body parts of the corals,. The discovery of these new fluorescent proteins is one more example of the still mostly untapped, valuable biochemical diversity of the world's rainforests and coral reefs.

The reefs from which these proteins were identified are among the most diverse ecosystems on the globe, and also among the most ancient. Although they occupy a mere 1% of the marine environment, they contain almost a quarter of all known marine species, leading to their distinction as the "rainforests of the marine world." Coral reef species offer particular promise because of the array of chemicals produced by many of these organisms for self-protection. A significant part of the search for new drugs against cancer and antibiotic-resistant bacteria now focuses on compounds from marine organisms such as these.

Alarmingly, however, almost 60% of the worlds reefs are under assault due to human activity, including overexploitation, coastal development, and runoff of pesticides and sediment from intensive inland farming activities. A report estimating the extent of this threat, entitled "Reefs at Risk: A Map-Based Indicator of Threats to the World's Coral Reefs" was released last year by the World Resources Institute (http://www.wri.org/indictrs/rr-data.htm) to only brief mention by the media. The irony is that while these risks are real and worsening, these same media are much more concerned with ill defined, potential risks posed by genetically modified organisms (GMOs). Unlike the controversy over GMOs, however, the preservation of biodiversity is an area where partnership between the proponents of biotechnology and conservationists is possible. It would be more than a shame if we did not take full advantage of this clear, common ground, and take it, now.

A green light for debate

If you want to move forward the debates surrounding genetic modification, consider sponsoring art. Novartis, the Basel-based agriculture and pharmaceutical multinational did—by supporting a life sciences theme that ran through this year's Ars Electronica. Ars Electronica is well-established and highly regarded week-long festival held every year in Linz, Austria. It usually explores the intersection of information technology, electronics and robotics with the arts. This year, its attention turned to the life sciences.

Perhaps the most startling thing about the life science-themed installations at Ars Electronica was their ability to preserve ambiguity. That has proved a difficult thing to do in biotechnology. Public discussions about genetically modification—whether of crops, animals, or humans—seems to hold little scope for uncertainty. Biotechnology has sunk into a political process. It is not seriously debated. It is not something about which one can securely hold delicately nuanced opinions. And it has become something to be voted in or rejected.

Compare that polarization and ossification with the impact of just one of the installations at Ars Electronica, Eduardo Kac's work-in-progress, GFP-K9—a dog expressing the gene for green fluorescent protein in its coat. GFP-K9 challenges people's current perceptions of transgenic animals. A scientific view might be that a glow-in-the-dark green dog is not, in intellectual terms, very different from a GFP mouse or a GFP human cell. GFP-K9 may trivialize transgenesis. But trivialization, in this instance, at least, creates room for discussion.

With man no longer a hunter in most societies, dogs are companions. Why would people not cherish these creatures just as they have cherished generations of specially bred cats and dogs?

Kac's work, even in its unrealized state, helps deconstruct issues that accrete around talismanic genetically modified seeds. GFP-K9 is a product of genetic modification that is not horribly utilitarian: thus any discussion of it may avoid, for instance, having to balance a benefit to humans against the indignities or sufferings of animals. (Measuring such entities have, in any case, proved largely beyond human efforts.) Neither is GFP-K9 ludicrously monstrous: so any discussion can be stripped both of visceral repugnance. This particular transgenic is also encumbered by connections to a particular part of the techno-industrial complex: distortions from corporate loyalties and profit motives can be removed from the discussion.

Kac's work shows some empathy with life science and biotechnology. Others artists exploring life science themes may be less charitable. But their work, too, will offer freedom for discussion. Art enters the debate as a third party. It is neither a moderator, nor an arbitrator, but a provider of a fresh perspective. It is capable of presenting with clarity that which entrenched parties find difficult to articulate.