Faster, Better, Cheaper

Former NASA Administrator Dan Goldin's mantra was *do it faster, better and cheaper*. The well-known retort is that you can have any two of the three, usually sacrificing quality for budget, but I believe there are cases when all three can be achieved. Much as we now use computers instead of bulky typewriters and manual graphing tools for producing this Annual Report, molecular biology holds similar promise for improving the methods we use to measure condition of our environment. That is why molecular biology, and the measurement of genetic material in particular, has become a focal point for SCCWRP's research.

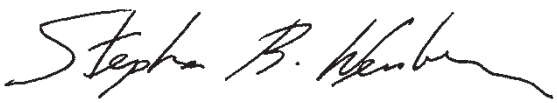
Our most advanced molecular initiative is development of rapid microbiological methods for monitoring beach water quality. Traditional techniques require 24 hours or more to culture bacteria before we count them, meaning that health warnings are out of date when they are issued. New genetic methods approved by EPA last month provide results in less than two hours. This Annual Report includes several articles highlighting SCCWRP's role in helping develop these methods and transition them to application. In addition, SCCWRP is extending the technology to measure pathogens that can't be easily measured using culture-based techniques, and to measure genetic signatures that differentiate bacteria originating from human versus other animal sources. Look to future Annual Reports to see how we automate these technologies for use in field deployments, something we couldn't have dreamed of using culturing methods.

A second research focus is the use of gene microarrays to pinpoint which contaminants are causing toxic responses in organisms. By experimentally exposing organisms to different chemicals and observing changes in gene expression, we gather the information that allows us to interpret causes of toxicity in organisms exposed to unknown samples. This is a huge advance over the traditional "kill 'em and count 'em" approach to toxicology. We are also working to incorporate gene microarrays into field screening programs as early warning indicators of contaminant stress before reproductive failure or death occurs.

A third molecular research focus is DNA barcoding, using genetic signatures to rapidly identify species. Scientists often examining biological community composition to determine environmental condition, manually sorting animals from their substrate (usually mud and debris) and providing them to taxonomic specialists for identification. This can take months, something that DNA barcoding holds promise for achieving in a day. Moreover, our work is already providing insights about morphologically similar specimens that appear to be genetically distinct species and, conversely, detecting organisms thought to be different species that are in fact genetically identical. These are exciting times in the world of taxonomy!

The cheaper part of the equation will take a while to realize, as equipment and supply manufacturers are only beginning to transition from serving the research community to the less expensive, higher volume, production mode. New technologies also present new challenges, such as developing the data storage and computational resources necessary to process the vast amount of data produced by genetic sequences. There are also infrastructure needs, as molecular analyses have a high potential for contamination and require special handling procedures. It wasn't cheaper, when SCCWRP retrofitted one of its laboratories this year to house special bench tops, airflow, flooring, and equipment to maintain a DNA-free "clean" environment.

While a computer costs more to purchase than a typewriter, it was definitely faster, better and cheaper to produce this Annual Report using a computer. My hope is that in a decade we will reflect on what we are able to achieve using molecular methods in the same way that we presently compare the computer to the typewriter.



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