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GENOME KNOW-HOW

This year marks the 15th anniversary of Milstein and Kohler's "Continuous cultures of fused cells secreting antibody of predefined specificity" (*Nature* 256:495-7, Aug. 7, 1975). That's why the Miami Bio/Technology Winter Symposium at the end of this month will be a birthday celebration of sorts.

Now, 15 years is not a very long time—not when it takes 10 years to approve a new drug, 11.5 years to develop and register a new chemical pesticide, and about four years to patent *anything* in biotechnology. Yet in that time, given these time constraints, monoclonal antibodies have become essential to basic research, to some commercial purifications, and some therapeutic strategies. And they completely dominate the market in new diagnostics. That's not bad for an adolescent.

But then again, nothing in biotech is very old.

"Construction of biologically functional bacterial plasmids *in vitro*" by Cohen, Chang, Boyer, and Helling (*PNAS* 70:3240-4, 1973) appeared just over 16 years ago. It is just 13 years since Maxam and Gilbert published "A new method for sequencing DNA," (*PNAS* 74:989-93, 1977). And it is less than five years since Mullis, Faloona, Scharf, Saiki, Horn, and Erlich presented "Specific enzymatic amplification of DNA *in vitro*: the polymerase chain reaction," at the 1986 Cold Spring Harbor meeting on Quantitative Biology.

By most standards, all of this is still brand new. Yet, biotechnology is the product of intellectual earthquakes that change things so completely that it is difficult, after the event, to remember that once the landscape was different. It is easy to forget that the change is recent, and that more change is just around the corner.

Which brings us to something that Charles Cantor, director of the Human Genome Center at Lawrence Berkeley National Laboratory, said at the beginning of last month, at another Florida meeting*: When the human genome is sequenced, it will probably not be by any of the technologies we now use for gene sequencing.

Think about that: Sometime over the next 10 to 15 years, we will discover, develop, refine, and use (some three-billion times) a technique that perhaps not even its inventor has yet heard of.

According to Cantor, the leading candidates are the new "scanning-tip" microscopies (most notably the scanning tunneling microscopy that yielded the first atom-by-atom photographs of the DNA molecule this past year), step-wise degradations (supported by new single-molecule sensing technology), and refinements of mass spectrometry. But he calls these only front runners. Only five to ten years of thought and experimentation will finally tell.

—Douglas McCormick

*The University of Florida's second international symposium, "Biotechnology: Science, Education, and Commercialization," Gainesville, FL, Dec. 3-6, 1989.