Biology

Julie Ann Miller reports from the meeting in Boston, "Molecular Biology Now and Tomorrow: Thirty Years of DNA"

Faster fetal sex test

Determining the sex of a fetus is a key step in prenatal diagnosis of genetic disorders, such as hemophilia and Duchenne muscular dystrophy, that result from defective genes on the human X chromosome. In these cases if the fetus is female, it is extremely unlikely to suffer from the disorder, and no further tests are necessary. Currently, fetal sex is determined by analyzing the chromosomes of cells obtained by amniocentesis, the sampling of the fluid surrounding the fetus. This method of sex determination takes two to three weeks. Now Y.W. Kan of the University of California at San Francisco reports a new technique. It uses only a drop of amniotic fluid and takes just one to two days.

A piece of DNA found on the Y chromosome but not on the X chromosome is the key to the new technique. Similar DNA segments are repeated a few hundred times on the Y chromosome, Kan says. He and colleagues made copies of some of these segments. They found that some also bind to other chromosomes of the human cell. "We screened a number of them and found one very specific for Y," Kan says. "It is more than 1,000 times more efficient at binding to the Y chromosome than to the X." Thus, in his test, if the DNA segment binds to the DNA of the amniotic cells, the fetus is male. So far Kan has analyzed 65 pregnancies. "All the results agree with the chromosome tests," he reports.

Interferon: Recruiting more microbes

One of the undisputed triumphs of genetic engineering is the production in bacteria of human interferons. These natural substances have antiviral activity and are suspected of being anticancer agents. But animal interferons are not active in human cells, and human interferons are present in such low amounts in the body that sufficient material could not be isolated for clinical trials of potential therapeutic uses. Several of the genetic engineering companies now are attempting to increase the yield of human interferon produced by microorganisms.

The human interferon called IFN-*alpha*2 is being produced by the laboratory bacterium *Escherichia coli* for clinical trials. But only 1 to 2 grams of interferon can be extracted from a liter of suspended bacteria, says Charles Weissmann of Biogen, Inc., in Zurich. Theoretically that amount could be increased by a factor of 10 if the bacteria would excrete the foreign protein, he proposes. To investigate this possibility he and colleagues have attached to interferon the DNA segment that instructs another bacterium, *Bacillus subtilis,* to secrete a protein called *alpha*-amylase. With this hybrid gene, *B. subtilis* produced and excreted human interferon-*alpha*2, accurately cleaving off the stretch of amino acids that signal the cell to secrete the protein. But the yield was lower than expected. Perhaps *B. subtilis* enzymes break down the human interferon, Weissmann suggests.

Scientists at another company, Genentech in South San Francisco, are attempting to make human interferon in another microorganism — yeast. David Goeddel reports that he and colleagues have attached to the gene for the human interferon called IFN-*gamma* the yeast DNA sequence instructing the microorganism to make and excrete the yeast substance called *alpha*-factor. Goeddel reports that yeast containing the hybrid gene accurately produced human *gamma*-interferon and excreted about half of the interferon it produced. Goeddel says, "This shows the potential of yeast for interferon production."

Gamma-interferon is considered the most likely interferon to succeed as an anticancer drug. Biogen now has announced that it has just begun testing *gamma*-interferon (produced in bacteria) in human cancer patients in the Netherlands. Clinical tests are already underway on *alpha*-interferon (SN: 4/3/82, p. 231). Experiments on cells growing in the laboratory indicate *gamma*-interferon is more than 10 times more active against cancer cells than is *alpha*-interferon.

Earth Sciences

Hurricanes: Predictions and preparations

As anyone living along the Gulf or Atlantic coasts knows all too well, hurricane predictions are a chancy business. Even with improvements in regional forecasts and predictions issued by the National Hurricane Center (NHC) in Miami, it often is difficult for town officials and business owners to know whether to evacuate, and how to assess the probability that a hurricane will strike a specific location. Two research groups, independently of the NHC, are trying to improve the hurricane prediction, and prediction interpretation, game.

The NHC uses copious climatological data in its predictions, but William Lesso of the University of Texas at Austin uses only two bits of information — the storm's latitude and longitude — that he acquires at six hour intervals from the National Weather Service broadcasts. He then sits down at a microcomputer and adjusts the paths in which the storm is expected to move. The main advantage over the NHC approach, he says, is that "ours runs in seconds; theirs runs in hours," mostly because it takes longer to prepare the greater amount of data for the computer. "We seem to do as well or better most of the time," Lesso says. He and colleagues are in the process of verifying their results and comparing them to the NHC predictions. The computer model is designed for the Caribbean Basin, including the Gulf of Mexico. He says their record so far this year is fair: The prediction for where Alicia would strike land was off by only 30 miles. The motion of Hurricane Barry was far more complicated. The storm looked as though it was going to dissipate, but near Cape Canaveral, he says, it took an unexpected left turn "that no one could predict." Miles Lawrence, a meteorologist with the NHC, says, "I'm not inclined to be optimistic that he's got something new and better, but I'll be curious to see his results when they're published."

While others struggle to improve predictions, climatologist Bruce Hayden of the University of Virginia in Charlottesville and colleagues are trying to help municipalities deal with predictions once they are issued. The NHC does not have the resources or time to provide specific information for each municipality, he says, but each county has specific problems that must be considered in making a decision to evacuate. Barrier islands, for instance, are easy targets for hurricanes and may need more warning time because of traffic flow on limited roads and bridges connecting the islands to the mainland. The NHC issues the warnings and predictions, "and we put the probabilities into the perspective of the history of hurricanes that have tracked across a given area of coast," Hayden says. The project, co-sponsored by the state of Florida and the Federal Emergency Management Agency, focuses on 11 locations in Florida. The researchers also consider the likelihood that a town may over- or under-react to a hurricane threat. This is a critical point because needless evacuation is costly and because failure to evacuate can be tragic.

Earth science briefs

- The National Oceanic and Atmospheric Administration (NOAA) has come up with a new national network that gives federal, state, and private organizations access to about 13,000 files of environmental data. The National Environmental Data Referral Service is operated throughout the NOAA offices in Washington, D.C., and will perform searches for the user, and provide catalogs, indexes, and direct access through the user's computer terminal.
- Researchers from the Lawrence Berkeley Laboratory in Berkeley, Calif., have devised a new rock-cutting method that uses water jets within the drag bits. They say the technique makes it possible to cut rock that is twice as hard as has been possible until now. It also reduces two hazards of underground mining — explosions and lung diseases caused when workers inhale dust produced by drilling.