BIOLOGY

Gene-splicing for undergrads

The coming-of-age for a scientific technique might be considered its appearance among the laboratory courses listed in a college catalog. Ray Rodriguez of the University of California at Davis is currently teaching what he believes to be the first lab course for undergraduates that focuses on recombinant DNA. "We are using the new technology, including about ten different procedures," Rodriguez says. "The techniques accelerate genetic analysis. In ten weeks we can do what a number of geneticists had done in 10 years."

The students in the course will analyze the structure and activity of two groups of bacterial genes, specifically the histidine and arabinose operons of *Escherichia coli*. "The purpose of the course is not so much to learn the techniques, but to understand how to apply them to problems," Rodriguez says. "All the students plan to go into the health sciences professions, so they should at least have first-hand knowledge of what recombinant DNA techniques involve and how to use them."

What of the safety of letting undergraduates loose with the technique that has, in the past, unleashed fears of novel epidemics? Rodriguez says the closely supervised experiments the students will perform are generally considered so safe that the National Institutes of Health requires no special physical containment procedures. In the course, however, the students will fulfill the requirements for the first level of containment (P1), Rodriguez says. The students, actually seven undergraduates and seven graduate students, were selected for their previous training in microbiology, biochemistry and genetics. Rodriguez says he met with encouragement and no resistance to the course within his department and the administration, although he says that some other universities have shunned the idea of such research for undergraduate students. "The potential danger argument can't be used anymore to regulate recombinant DNA research at all the levels," he says.

Interferon in the offing for U.S.

To treat 150 cancer patients in a clinical trial, the American Cancer Society last year bought 40 billion units of interferon from a Finnish laboratory for about $2 million. Next year a New York company, National Patent Development Corp., plans to turn out enough interferon at a pilot plant in New Jersey to meet that research demand.

Interferon is an animal cell protein that inhibits virus reproduction. Experiments have indicated that the substance may be a general body defense against disease, including viral and bacterial diseases and certain cancers (SN: 10/28/78, p. 295). A shortage of interferon has limited investigations of that promising compound, so the research has not yet proved that interferon can serve as a medicine.

The Finnish laboratory that is currently the major supplier of interferon isolates the substance from white blood cells cultured in the laboratory and infected with a virus to trigger production. National Patent Development Corp. plans to use that technique with a modification devised by their consultant, Alexander Yabrov. The company predicts their method will yield more interferon from each white blood cell.

Bacteria get another day in court

The Supreme Court has agreed to decide whether organisms can be patented. In 1977 the U.S. Court of Customs and Patent Appeals ruled that two microorganisms, one that "eats" oil and one that makes an antibiotic, could be patented. The Justice Department charges that the ruling significantly extends the coverage of the patent laws without legislative authorization.

TECHNOLOGY

Doing what the carburetor can't

If its carburetor were replaced with Enoch Durbin's "ionic fuel-control system," a Pinto-sized car could expect to get 40 miles to the gallon, a standard-sized auto 33 miles to the gallon — all the while emitting less than half the pollution associated with conventional gasoline-powered cars. Or so claims the Princeton mechanical engineer of his brainchild.

Emissions are the product of incomplete combustion. Durbin reasoned that the way to reduce them was to increase a car's efficiency in terms of how much of the fuel that's delivered to the engine gets burned. Maximum efficiency, he says, requires a steady, lean ratio in the fuel-to-air mix delivered to an auto's pistons. But the carburetor, which in conventional cars determines the changing fuel-to-air mix, requires time to effect changes that compensate for a moving vehicle's constant series of accelerations and decelerations. "Typically," Durbin says, "a car runs rich [in the ratio of fuel to air necessary for optimum combustion] whenever it decelerates and lean when it accelerates, with a three- to 10-second lag before the mixture adjusts to its new value." This lag, he says, means that the fuel-to-air mix is only *approximately* — and *never exactly* — right.

Durbin has replaced a Toyota's carburetor with a system that continuously measures the number of air molecules sucked into each piston — "gulp by gulp" — and then modifies fuel flow accordingly. At its heart is a flowmeter that injects ions into passing air and then monitors their drift downstream. Durbin patented the flowmeter for other applications, but has revamped it, he says, to withstand the harsh temperatures and "wild environment you find under the hood of a car." Although Toyota, Ford and two British firms are following his work closely, Volkswagen will soon begin tests of the fuel system — using a model he's preparing — linked to a turbo-charged engine.

Traction for high speed drives

Gears, the work horse of mechanical-power transmissions, become an expensive and unreliable option for small-size, high-speed applications such as industrial grinders and millers, or the gas turbines used to drive turboprop planes, helicopters and cars. The reason, explains Douglas Rohn at NASA's Lewis Research Center in Cleveland, is that without precise machining, imperfections in small-gear teeth will show up as noisy vibrations when teeth mesh at high power and speeds (on the order of 150 horsepower and 75,000 or more revolutions per minute). The result can be a thunderous environment for workers and, all too often, broken gear teeth.

But NASA sees a possible near-vibrationless solution with the Nasvytis traction-drive transmission. Patented by a private inventor and refined by Lewis engineers, it resembles a stepped, planetary-gear train with rollers substituted for gears.

In much the same way that gravity holds a car's wheels in contact with the road, a planetary ring squeezes in on planet rollers, engaging them in a friction/traction grip with the central "sun" roller. Adapted from other traction-drive systems developed over the past 90 years, it employs two or three rows of fixed-axis planets — instead of a single row — wedged, pyramid fashion, between the sun and outer ring.

Tests show the system to be as efficient as gears and capable of reducing drive speeds by ratios in excess of 15 to 1. The latter is necessary in gas-turbine auto engines in which turbine-shaft speeds must be stepped down, Rohn says, from about 100,000 rpm to 6,000 rpm — a speed the car's transmission can handle. Among its advantages over gears in high-speed applications, the Nasvytis traction drive system is expected to cost less, weigh less, be more reliable and, of course, produce far less noise.

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