"TOXICITY AT A LOWER DOSE"

DRUG AND PESTICIDE FROM PAW-PAW

CHICAGO, Ill.—During World War II, three-year-old Jerry McLaughlin ate a bunch of Indiana Bananas—the fruit of the shrub-like paw-paw—to satisfy his craving for the real McCoy, not available during war rationing. The tummy-troubling results of the young McLaughlin's zealous consumption of the ersatz tropical treat served as more than just an unpleasant memory; it prompted grown McLaughlin, a professor of pharmacognosy at Purdue University (W. Lafayette, IN), to investigate the paw-paw's bioactivity.

It sounds like a dream come true: a shrub, indigenous to the U.S., that yields powerful cancer drugs and pesticides.

"Pharmacology is toxicity at a lower dose" is McLaughlin's motto. To that end, he isolates toxic plant compounds to see if they could be valuable drugs, "or at least kill bugs," he says.

McLaughlin chooses to work with simple, inexpensive bioassays. The brine shrimp LC_{50} (lethal concentration 50 percent) test is one; McLaughlin simply places the compound in question in the brine shrimps' water, and sees what happens. What were the results when he added paw-paw extract? "The shrimp died," he says.

Powerful anti-cancer effects

It turns out that acetogenins—tetrahydrofuranoid fatty acid lactones—from the plant family *Annonacea*, which includes the paw-paw, have powerful anti-cancer, anti-malarial, and cytotoxic effects. In animal tests, bullaticin, an acetogenin extracted from an *Annonacea* plant growing in Miami, is more than 1 billion times as cytotoxic as the anti-tumor drug adriamycin and 300 times as potent as naturally occurring taxol. Also in animal tests, asimicin from the paw-paw has proven more effective than the drug cisplatin for treating ovarian cancer. The acetogenins work their magic by affecting electron transport in mitochondria, an important fuel source for energy-guzzling cancer cells.

Acetogenins are also potent insecticides. At the annual meeting of the American Association for the Advancement of Science held here in February, McLaughlin showed slides that testified to acetogenins' effectiveness against Mexican bean bugs. In a nutshell: The bugs devoured untreated bean plants and didn't touch plants treated with paw-paw bark extracts. Unlike some commercial pesticides, the paw-paw compounds don't break down in sunlight. McLaughlin estimates that, if sold as pesticides, an acre of the weedy shrubs would bring in $150-200 per year.

A dream come true?

It sounds like a dream come true: A shrub, indigenous to the Northeast and Midwest U.S. that yields a powerful anti-cancer compound and natural pesticide. Indeed, there are about 18 million plants in Indiana alone. So why is McLaughlin, as he puts it, "waiting for some big company to pick up" the dried, broken paw-paw twigs he has harvested from a test plot to start making money? One problem, he says, is that registration of the pesticide with the Environmental Protection Agency (Washington, DC) costs about $20 million—a prohibitive price for all but the largest companies, most of which produce synthetic compounds. And developing a pharmaceutical from the plant could cost up to $230 million.

McLaughlin also finds fault with the National Cancer Institute (NCI, Bethesda, MD), saying it has bureaucratized the "bioassay procedure until it's no longer efficient." He sites NCI's construction of expensive facilities devoted to *in vivo* bioassays, when $30 buys enough brine shrimp to do screening tests for two years. The NCI has also, he says, balked at using another of his cheap tests, which involves growing crown gall tumors on potato disks and then testing the anti-cancer ability of compounds on the disks. The test correlates well with mouse anti-leukemia tests and obviously is a lot less costly than animal tests.

—Julia Schulhof

Julia Schulhof is the managing editor of Lab Animal, *a Nature Publishing magazine.*

A SKILLS GAP

BLUE COLLARS NEEDED

SAN FRANCISCO—Where are the jobs? What skills do you need? For Northern California's growing biotechnology sector, there is an increasing need for "scientifically competent blue-collar workers," according to Fred Dorey, executive director of the Bay Area Bioscience Center (Oakland). As area biotech firms mature and expand, their need for qualified workers in production, manufacturing, and administration is soaring. In fact, of the 35,000-50,000 local biotech jobs that may be created over the next 10 years, 50-70 percent will require scientific and technical skills.

"Relatively few potential workers combine all three of the qualifications companies need for technician- and production-level employees—academic background, specialized lab skills, and motivation to stick with the job long enough to justify the firm's investment in their training." So states a recent report called *The Emerging Bioscience Skills Gap*, issued by the bioscience center and the Bay Area Council (San Francisco).

Look locally

Is there a potential solution? The report recommends that companies look to regional community and state colleges for employees. "With a solid bent towards teaching practical skills, the colleges are an often-overlooked source of job candidates who know their way around a lab," it says.

The Bay Area houses more than 315 bioscience companies, not to mention a wealth of academic institutions and government research laboratories. The companies currently employ about 39,000 people, while the nonprofit sector accounts for another 19,000. The expected addition over the next decade of up to 50,000 workers breaks down annually to an 8-10 percent jump in the diagnostics and therapeutics sector; a 6-8 percent rise in agriculture, medical devices, and instrumentation; and a 1-3 percent increase in the nonprofit area. These estimates are conservative, moreover. "Nobody was willing to stick his neck out," comments the bioscience center's Dorey.

Many technician slots are currently filled by overqualified personnel, though the slots don't always require a four-year college degree. The technicians tend to leave for greener pastures, contributing to an annual attrition rate of at least 5-10 percent and leaving companies holding the bag, says the report. Such jobs can really be per-