is deemed acceptable and then use other factors that many people believe are equally relevant to success in science, including creativity, determination, and real-life experience, to choose the winners.

Tapia, who advocates such a threshold as a way to increase diversity without using set-asides, says such an approach would be a marked improvement over current practices. "The misuse of standardized tests has been the worst enemy of minorities," he says. Rice's freshman class contains a significant number of underrepresented minorities with "substantially lower SAT scores than the university at large," he says, who were chosen on the basis of other, race-neutral criteria. "But once admitted," Tapia says, "they are on a par in terms of retention rates and grade point average."

Applying the same policy to graduate admissions, he says, has allowed his colleagues to assemble a computer and applied mathematics department of some three dozen students that is one-third minority and more than half women. "And we graduate at those rates," he says proudly. Tapia currently receives funding from the Sloan program and is hoping to win NSF funding to replicate that success at a consortium of universities.

But administrators of other programs aimed at minorities worry that, whatever guidelines are used, the results may not make up for the loss of the minority fellowships. "[The settlement] could have a devastating effect," warns NIH's Ruffin. "These things are very competitive, and the people who make the decisions bring to the table their own sense of what makes someone most qualified. They may not be biased, but they may not know all the factors involving minority students."

Indeed, choosing the appropriate factors is so problematic that most federal agencies, including NIH, sidestep the issue by making grants to institutions, which are then free to use their own selection criteria. Through bridge and partnership programs with colleges and universities that have large numbers of minority students, majority universities also can tap a much larger pool of minority students than exists on their own campus.

At Johns Hopkins University, for example, that means linking up with two nearby historically black universities—Coppin State and Morgan State. A summer research fellowship program funded in part by the Howard Hughes Medical Institute, for instance, uses those connections to team up a dozen or so minority undergraduates with Hopkins's world-class faculty. "It happens that the program involves Coppin and Morgan State, whose student body happens to be more than 90% black," says Hopkins's Ostrander. "We will not take race and gender into consideration in the selection process. However, if it turned out that the top 10 applicants for the program were white males, we probably wouldn't run the program."

Granting sources like Hughes are also treading warily. The philanthropy is still a defendant in a suit brought by a white high school student denied entry to a summer science camp for minorities run by Texas A&M University, which U.S. officials agreed to settle last December (*Science*, 2 January, p. 22), and top officials declined to be interviewed on the subject. "There is a changing legal climate that raises questions we have to address," says Hughes spokesman David Jarmul. "But we think our commitment to supporting programs that increase participation by minorities and women is compatible with the law and consistent with our goal of training biomedical researchers."

NYU's Oppenheim also wants to do good science in an atmosphere that fosters diversity. And that requires a major commitment from "majority" institutions such as his. In 1990, he began a summer research program to attract minorities to NYU's graduate schools. It was through the program, which is now "color-blind" and currently 75% majority, that he befriended Savoy Brummer, an African-American graduate of Howard University.

Now a second-year medical student in the honors (research-oriented) program at the medical school, Brummer has spent the past three summers at NYU doing research. He says that Oppenheim, who is white, has been an immeasurable help as he takes his first steps into a career in medical research and that trust, not a desire to remove racial barriers, is the key to their close relationship. "I decided to come to NYU because Joel promised to stay here until I'm done," he says. "In a way, I've put my life in his hands. And he's always there for me."

—JEFFREY MERVIS

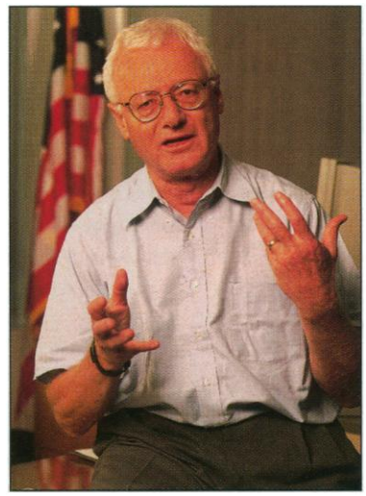
AIDS RESEARCH

NIH Concocts a Booster Shot for HIV Vaccines

After being criticized for moving too slowly on AIDS vaccine research, NIH is putting more urgency into the push to develop and test candidates

When the National Institutes of Health (NIH) decided 4 years ago not to fund large-scale efficacy trials of the leading AIDS vaccines then under development, the move underlined a stark and sobering message: A decade had passed since HIV had been unmasked as the cause of AIDS, yet researchers had not even found a vaccine promising enough to justify the expense of a full-scale test. The field lost what little momentum it had. Now, NIH is trying to give AIDS vaccine research a shot in the arm.

Neal Nathanson, a viral epidemiologist who in May left a long career at the University of Pennsylvania to take over NIH's Office of AIDS Research (OAR), says revitalizing the vaccine program is his top priority. "NIH money watered the basic science field, and we've let 100 flowers bloom," he says. "Now, we have to figure out some way of harvesting those and getting them eventually into [human] trials." In recent interviews with *Science*, Nathanson laid out how he and other NIH officials plan to speed vaccine development. The steps include boosting funding; creating a new peer-review study section to evaluate vaccine proposals; launching a set of standardized, comparative tests of candidate AIDS vaccines in monkeys; and trying to stimulate partnerships between U.S. investigators and colleagues in other countries. NIH even announced last week that it will collaborate in analyzing results from tests of one of the very vaccines it declined to sponsor 4 years ago—tests that are now being carried out by a private company.



SAM KITTNER

... it's time "to take an orderly, logical approach."

—Neal Nathanson

These changes come at a time when NIH has been under heavy criticism for not doing enough to speed the search for an AIDS vaccine. "Pretending to fill the leadership gap, marginally increasing public funds, and improving part of the grant evaluation and awards process does not add up to the full mobilization we need," the AIDS Vaccine Advocacy Coalition—an activist group that analyzes obstacles to vaccine development—complained in a stinging critique of the government's efforts that came out in May.

And NIH is having trouble making good on a pledge, announced by President Bill Clinton with great fanfare in May 1997, to establish a Vaccine Research Center on NIH's campus to speed the AIDS vaccine search by gathering intramural researchers from different disciplines under the same roof. Although a site has been selected for the center, a joint venture of the National Cancer Institute (NCI) and the National Institute of Allergy and Infectious Diseases (NIAID), a director has not yet been hired. "The Vaccine Research Center is something we hold tremendous hope for," says Nobel laureate David Baltimore, who heads an influential NIH advisory group known as the AIDS Vaccine Research Committee (AVRC). "But, frankly, it has been quite difficult to find a director who has the eminence and capabilities."

Baltimore says he's delighted at the new leadership of the AIDS vaccine effort, though. It includes not only Nathanson, a former AVRC member, but also Margaret Johnston, who as of next month will run NIAID's AIDS vaccine program. Johnston, who left NIAID in 1996 to work at the International AIDS Vaccine Initiative—a private organization that has been critical of NIH's efforts—says, "I wouldn't go back unless I was absolutely convinced that the NIH was taking AIDS vaccine development more seriously."

One indication that NIH is taking the problem more seriously is money: Next year's $1.73 billion AIDS budget calls for spending nearly $180 million on vaccines, a 79% jump from 4 years ago (see table). This increased funding has begun to lure researchers into the field. "Many of my colleagues never considered doing vaccine research before," says AVRC member Beatrice Hahn, a prominent AIDS researcher at the University of Alabama at Birmingham. "I didn't consider working in vaccine research, whereas now it's the focus of my lab." NIAID also is reaching out to exceptional researchers outside the United States, allowing them for the first time to be the principal investigators on NIAID-funded AIDS vaccine collaborations.

Asked whether this surge of money might support second-rate grants that decrease the average quality of AIDS vaccine research, Nathanson says he "won't lose a moment's sleep" if quality declines as more people are funded. "Speed and cost efficiency are totally different parameters, and you can't have both at the same time," he says. The crucial thing, he says, is to explore all promising ideas as quickly as possible. "The way this epidemic is going, any other approach would be intellectually absurd and ethically unconscionable."

Johnston points out that the traditional NIH peer review system has, in any case, often given vaccine proposals short shrift. The problem, she says, is that vaccine research tends to be empirical, and study sections favor more basic research. To correct this bias, NIH—after being prodded by OAR (pre-Nathanson)—plans to form a new study section in November, the Vaccines Special Emphasis Panel, to evaluate grant applications for AIDS and other diseases.

One problem the panel will face, however, is judging which approaches show the most promise. Researchers still are debating which immune responses a vaccine must trigger to provide protection. "It's really true that the road is unclear," says Baltimore. And empirical results from monkey tests that challenge vaccinated animals with SIV, HIV's simian cousin, have been confusing, too, because labs have used different reagents and protocols, making it difficult to compare results. Now, says Nathanson, it's

Coaxing Big Pharma Onto the Playing Field

The National Institutes of Health's efforts to inject new life into AIDS vaccine development are focused mostly on its traditional clients in academic science (see main text). But one key player is sitting largely on the sidelines: Big Pharma. Now, the World Bank is considering an initiative to coax more companies onto the playing field.

Pharmaceutical companies have not avoided AIDS vaccines altogether. Pasteur Mérieux Connaught has a significant AIDS vaccine program, and Merck says it's beefing up its efforts. Novartis has invested heavily in Chiron, a biotech that has a long-standing HIV vaccine program, and Wyeth-Lederle recently purchased a smaller biotech in the running, Apollon. But industry is cautious about potential returns from new vaccines, especially when the greatest demand for them is in poor countries, and it has mainly left the commercial field to small, cash-starved biotechs. "All along, the biggest problem has been how do you deal with the economic incentives for companies," says Seth Berkley, president of the International AIDS Vaccine Initiative (IAVI), a private group that has been holding workshops on the topic for the past 4 years. Enter the World Bank.

Building on an idea that came from an IAVI workshop, the World Bank has formed a task force (which includes Berkley) to plan a project called Innovative Financing Instruments for HIV/AIDS Vaccines, which would provide a guaranteed market for AIDS vaccines. "This project is considered a high priority within the bank and has generated quite a bit of excitement," says Amie Batson, a management consultant who co-chairs the task force and specializes in linking the vaccine industry to public health needs.

The task force is exploring the idea of creating a guaranteed purchase fund for AIDS vaccines. Under this plan, countries would secure either a loan or a gift—depending on their economic status—from the World Bank that they would promise to spend on a working AIDS vaccine. "If there were a large pot of gold at the end," says Batson, companies may be more willing to invest now in the science. Batson says the task force also is discussing other incentives, such as awarding a monetary prize to the discoverer of a working vaccine. With the blessing of the World Bank's board, these programs could be in place by next summer.

Berkley says without more involvement from industry, intriguing scientific leads will languish. "If you increased the NIH budget four times, that would be great—it would move the science forward," he says. "But ultimately, if the corporations aren't there to begin to take on that science and really put a serious effort into making vaccines … it's not going to happen." –J.C.

NIH'S AIDS RESEARCH BUDGET

Area of emphasis	FY 1995 actual	FY 1999 estimate	% increase 1995–99
Natural history and epidemiology	$192,624	$226,367	17
Etiology and pathogenesis	$344,303	$526,140	52
Therapeutics	$462,929	$481, 722	4.0
Vaccines	$100,399	$179,891	79
Behavioral research	$170,984	$232,737	36
Training and infrastructure	$46,483	$66,228	42
Information dissemination	$16,153	$17,711	9.6
Total	$1,333,875	$1,730,796	30

SOURCE: OAR

time "to take an orderly, logical approach."

Nathanson is advocating a large-scale, standardized comparison of dozens of vaccines in monkey tests. "We'd like to bracket the [candidates] from the very effective to the ineffective," says Nathanson, who is gambling that the monkey model will reflect what happens in humans. Human versions of the most promising vaccines then would move forward. Primate researcher Norman Letvin of Harvard Medical School is helping to organize these studies. "I am very excited," says Letvin. But he adds that "to do this is moving mountains because everyone sitting around the table has their own interests."

In parallel with the increased emphasis on monkey studies, NIH is more aggressively pursuing human trials. NIAID's new Integrated Preclinical/Clinical Program awards grants to academic researchers who promise to move candidate AIDS vaccines into human trials, and Nathanson says NCI has a plant in Frederick, Maryland, that academics could ask to manufacture vaccines for human studies. "In the past, NIH almost exclusively relied on companies to bring products into clinical trials," explains Johnston.

The drive to learn more from human studies even led NIH last week to announce that it would take part in tests of one of the vaccines it rejected 4 years ago. The vaccine—a preparation made from HIV's envelope protein, called gp120—is made by VaxGen of South San Francisco, which during the past few years raised private money to stage efficacy trials. The trials, the first of their kind, began in the United States this June. NIH will conduct laboratory studies of the immune mechanisms behind the vaccine's successes or failures. "Potentially valuable science will be captured because VaxGen itself will do limited studies with licensure as the goal, not scientific understanding," says Baltimore, who, interestingly, is one of the vaccine's many critics (*Science*, 30 January, p. 650).

Nathanson, who has been a prime player in the backroom negotiations with VaxGen, has worked hard to spread this pragmatic point of view. "Obviously, the VaxGen trial can make important contributions in a variety of different ways to developing a vaccine," he says. "That's all I really care about."

–JON COHEN

Jon Cohen is on leave from *Science*, writing a book about AIDS vaccines.

BIODIVERSITY TREATY

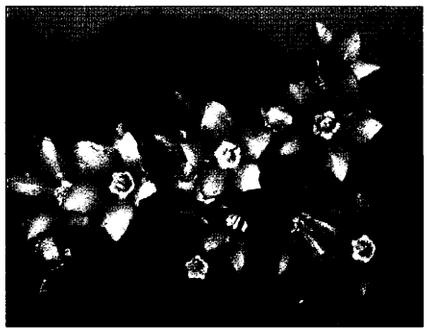
Botanical Gardens Cope With Bioprospecting Loophole

Experts will draft guidelines ensuring that indigenous peoples profit from specimens collected from their countries years ago

With thousands of species from around the world collected under one roof, a botanical garden may seem like a mother lode for drug companies and scientists interested in probing exotic plants or fungi for novel biochemicals and genes. Not only do botanical gardens and seed banks house up to a third of the world's vascular plant species, but the majority of an average garden's holdings may come with an economic bonus: Because they were collected before the biodiversity treaty was signed by 160 countries in Rio de Janeiro 5 years ago, they don't come under its protection. Thus, any company that struck botanical gold in a collection may not be obliged under the treaty to pay a cent to the country in which the specimen originated.

Alarmed by this prospect, watchdog groups and scientists worldwide are stepping up efforts to craft regulations to ensure that source countries are compensated for products derived from specimens gathered by botanical gardens. And representatives of gardens and arboreta themselves are also confronting the issue. They will meet in Kirstenbosch, South Africa, in September to hammer out a consistent, nonbinding policy that they hope to finalize within a year.

Although garden officials back such efforts, they argue that they are policing themselves effectively. "If we collect anything in a foreign country as a herbarium specimen or for cultivation, it's available for sampling [only with] permission from the country where we got it," says Peter Raven, director of the Missouri Botanical Garden in St. Louis, who says this policy is common at other botanical gardens. But some activists argue that general rules are needed to back up those assurances.



PORTER LOWRY/MISSOURI BOTANICAL GARDEN

Botanical gold. Guidelines could spell out who profits from garden holdings, such as this Gentianaceae *Exacum* from Madagascar.

Agreements between gardens and drug companies "are being put together in a very ad hoc way," asserts Edward Hammond, a program officer at the advocacy group Rural Advancement Foundation International in Winnipeg, Canada. Hammond points to an arrangement between the New York Botanical Garden (NYBG), the drug company Pfizer Central Research, and several Hawaiian botanical gardens, in which Pfizer pays an undisclosed sum for plant research in exchange for the right to license promising compounds. After investigating the agreement in 1995, Hammond claims it was "very clear" to him that the proposal "had nothing to do with compensating countries of origin or [the] people from whom these collections came."

Not so, say NYBG officials. The garden forges agreements only with those groups—including Pfizer—that pledge to return a fixed portion of future royalties from plant products to the source country, says Hans Beck, an NYBG botanist. Each specimen "has careful records that will allow us to identify, inform, and compensate the original collaborators, decades from now when a product might be developed," adds Michael Balick, director of NYBG's Institute of Economic Botany. The garden's official policy says that compensation would amount to half of all net royalties from any discovery.

The gardens' own efforts to craft fair guidelines at the Kirstenbosch meeting will be difficult, however—partly because it's often unclear where a plant came from. "How far back in time do you go in terms of how long people have lived in an area, and where do different genes originate?" asks Allan Stoner of the U.S. Department of Agriculture's National Germ Plasm Research Laboratory. Seed banks are already having problems working up guidelines compatible with the biodiversity treaty, Stoner says, because the United Nations Food and Agriculture Organization favors free exchange of agriculturally useful plants. "Many countries are still trying to figure this whole thing out."

Balick and others agree, however, that the time is ripe to tackle thorny ownership questions. Although, he says, "I don't know of any commercial drug that has come from a botanical garden collection," the gardens should be players in this debate. "If companies are interested in natural products such as plants," says Balick, "they come to where the botanists are—which is gardens."

–ALAN DOVE

Alan Dove is a writer based in New York City.