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Educating the Best and Employing Them

The education of scientists at the college and university level in the United States is the focus of this issue of Science. From a period of rapid growth in funding and a good supply of jobs, science has moved into a period of little growth and more students than job opportunities. This change has precipitated much discussion of the teaching and advising programs and whether they are preparing students for the current realities or for an imagined past of unlimited funding and countless job prospects.

The higher education system in the United States has, to a large extent, been the most flourishing in the world. A higher percentage of high school students go on to college here than in any other developed country, and the system of research and teaching occurs in a marvelous symbiotic, albeit not perfect, harmony. Both self-selection and mentor selection occur at every new level, so that, in general, the most interested and the most able emerge at each new stage.

As the current funding for higher education and the job opportunities for graduate students decrease relatively, the system must now reappraise itself. There is serious question whether or not cuts at these levels are wise for a nation that wishes to maintain a competitive edge in a global economy, but that is not the focus in this issue of Science; instead, our coverage rests on the assumption that the funding and job levels will stay more or less constant at a time when the system can produce many more scientists. Thus, to function well, the system must have a mid-course correction to adjust to new conditions. That suggests evolution, not revolution.

Any impetus for soul-searching and reexamination has positive aspects, but haphazard suggestions and shoot-from-the-hip “reforms” can cause more harm than good. For example, the inadequate training of high school students is a real problem, but should not lead to colleges becoming high schools. Remedial courses may be needed temporarily, but they should be called “remedial” and not given for college credit. That keeps the pressure on high schools to reform and maintains colleges at the right intellectual level.

“Teaching students to be prepared for the real world” is not achieved by turning a university into an industrial pilot plant. A graduate training program should be used to instill in students the disciplines of rigorous thinking, originality, and versatility that the Ph.D. has always been supposed to require. With expanding funding and plentiful job prospects in the past, both college-level and graduate-level standards tended to decline to allow admission of more students. That trend created false expectations, both on the part of the students and on the part of the universities that train them and the industries, universities, and other institutions that hire them. Calls to expect students to think more creatively and learn how to be flexible and resourceful are well taken. Calls to Ph.D. programs to become job training courses for specialized professions sound less appropriate. The Policy Forum of Mary Lowe Good and Neal Lane discusses some of these issues.

Educational training is like DNA: it tends to protect itself in order to transmit information with fidelity and integrity. Like DNA, education can be improved by mutation, but also degraded. Like DNA, changes should be subject to selection so that the good changes survive and the bad changes are discarded. The educational system of the United States has some built-in inertias that first rejects mutations and then becomes unwilling to discard bad ideas even when they are not working. In the current era of change it will be good if sociology recapitulates biology by welcoming change but applying selective pressures to maintain the survival of the fittest.

Most important, the major goals—a system that produces the best and most able scientists and a number of scientists that is enough to put a dent in the gargantuan problems of the present—should never be abandoned. Governments that talk about “creating” jobs and supporting research, and then put their money elsewhere, are the most in need of reform.

In the future, Science will discuss the changes in education outside the United States, as Ellis Rubinstein mentions in his introduction to our Special Section. In the meantime, we relate some of the first ideas on how to improve a system in the United States that is functioning well, but must adjust to a new environment.

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**LETTERS**

**Conservation Research and the Legal Status of PCR Products**

The challenge of obtaining biological material for conservation genetic research has always been daunting. There was some justification for tight regulatory control when genetic analysis required that a few organisms be killed to provide samples for the study of threatened or endangered populations. Polymerase chain reaction (PCR)-based genetic assays, however, can be performed with a single drop of blood, a scrap of skin, or a dried fragment of muscle. The forensic identification of whale products in commercial Japanese markets (C. S. Baker and S. R. Palumbi, Policy Forum, 9 Sept., p. 1538) is an example of molecular genetic analysis used in the service of conservation. But even as this new era in conservation biology unfolds, developments of a bureaucratic nature have cast a troubling shadow across the field.

Ironically, the first development stems from the 1993 Convention on Biological Diversity. One of its more controversial passages endorses financial compensation to developing nations for genetic resources. This initiative was aimed primarily at pharmaceutical companies prospecting for biological resources on foreign territory, but unfortunately it also has been applied to nonprofit conservation efforts. For example, two developing nations recently rejected our requests to export scientific samples (typically a few drops of blood) for genetic analysis, citing the compensation principle of the biodiversity convention.

The second development involves a mid-1994 decision by the Office of Management Authority (OMA, a branch of the U.S. Fish and Wildlife Service) to include PCR products within its jurisdiction over material from endangered species. If enforced, this new policy would place synthetic DNA under the same restrictions as apply to rhinoceros horns and elephant tusks, but the tiny synthetic pieces of DNA produced by the PCR themselves do not have monetary or aesthetic value that might invoke commercial abuse. Furthermore, because PCR methodology requires preexisting knowledge of portions of the target sequence, there is little possibility that the technique could be improperly used to somehow purloin genetic resources. Instead, synthetic copies of DNA may be likened to a biological microfilm. The OMA might just as reasonably seek control over photographs or other likenesses of endangered species. To regulate this form of biological data serves only to further extend the reach of OMA into scientific arenas, at draconian cost to conservation efforts (1). If DNA products for scientific research were allowed to cross political boundaries freely, without cumbersome regulations being imposed by the Convention on International Trade in Endangered Species or the U.S. Endangered Species Act, the resulting genetic information highway would undoubtedly increase the pace of critically important conservation genetic research.

**Free Electron Lasers Fettered?**

As managers of two leading research programs that use free electron lasers (FELs), we are disturbed by the factual inaccuracies and conservative philosophy of the recently released National Research Council (NRC) report on FELs (Eliot Marshall, News & Comment, 16 Sept., p. 1651). The NRC report (1) reflects a political agenda rather than an evaluation of the real situation. It is disturbing for one of us (G.M.) to be listed as a contributor to a report that states, for example, that “valence transitions of chemical bonds fall in the visible and ultraviolet, and band gaps of solids fall in the visible or near infrared” (1, p. 3). We suggest that Donald Levy and his co-authors act consistently with this opinion by publicizing for ever the use of kitchen salt, windows, and eyeglasses.

On a more serious note; the NRC report mixes the analysis of three different energy ranges—visible, ultraviolet, and near infrared. Not surprisingly, its corresponding findings and recommendations...
are misleading. For example, it does not mention the active materials research in the near infrared range at Vanderbilt University, notably with semiconductor interfaces and nonlinear optics, which would be simply impossible without the Vanderbilt FEL’s capabilities.

More specifically, the report does not mention the fact that no tunable broadband source exists over the entire near infrared range (1 to 10 micrometers) covered by the Vanderbilt facility. This range includes fundamental material science parameters such as semiconductor band discontinuities, interface energy barriers, and energies of artificial nanostructures (2).

As for the x-ray region, the NRC report mentions the importance of x-ray microscopy and holography, but states that “one must compare these techniques with recent advances in tunneling, atomic force, and near field optical microscopy” (1, p. 5). However, no such comparison is evident from the report, which is unfortunate because such techniques are complementary: those based on the FEL have capabilities not available in the others (and vice-versa).

Marshall states that “the Levy panel says that none [of the nine active FELs in the United States] has picosecond capability. . . .” Is the panel familiar with the basic performance characteristics of the Stanford, Duke, and Vanderbilt FELs? Did its members even visit such facilities?

Levy is credited with saying that “none of them is truly open to all comers; instead they are controlled by universities or government labs where, the management occasionally allows people to come in.” This is not correct, witness the Vanderbilt users’ program.

In our view, the most disturbing aspect of the NRC report is its conservatism: rather than presenting a vision of the future in FELs, its main preoccupation appears to be a defense of the status quo. If adopted, its recommendations would condemn the United States to a secondary role in a vital field of scientific research.

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Department of Physics and Astronomy, Vanderbilt University, Nashville, TN 37235, USA

References

Treating Brain Cancers

Faye Flam’s article “Will history repeat for boron capture therapy?” (News & Comment, 22 July, p. 468) presents boron neutron capture therapy (BNCT) as a one-shot gamble aimed at a single tumor—malignant glioma—which uses a single new boronated (and one old) chemical, and a single method to deliver the thermal neutrons to the target region, that is, the nuclear reactor. While the nuclear reactor is often presented as the only way in which the neutrons could be delivered, research has identified new ways to deliver the neutrons without engaging the brain or scalp. New, improved boron compounds have been developed that can be better localized in the brain tumor. The concentrations of these compounds remain lower in blood and in normal brain tissue. Other tumors, such as malignant melanoma, have been identified where BNCT may also be useful. There are also other neutron sources.

One new method for delivering neutrons is by using small pellets or “seeds” of the radioactive transplutonium radioisotope Californium-252 (Cf). Californium can be produced in a highly radioactive form that can be implanted directly into the brain tumor without traversing the brain or scalp, as is necessary in the case of beam therapy. Neurosurgeons and radiation oncologists perform these treatments routinely in medical centers using other radioactive isotopes. As Cf-252 neutrons (which are already of low energy) interact with tumor tissue, they lose further energy and become thermalized (1). BNCT can thus further enhance the efficiency of Cf therapy.

Experimental studies (2) have shown that when a human brain tumor is implanted into the brain of nude rats and treated with Cf-252 alone or Cf and boronophenylamine, lifespans are much longer than those of untreated, tumor-bearing mice. Earlier human studies (3) had already shown that Cf alone can eradicate glioblastoma from the brain.

The Department of Energy has focused on the reactor as the only way to produce neutrons. But if neutrons and boron neutron capture enhancement prove to be effective, alternative low-cost, safe, and practical sources of neutrons need to be made available on a large scale quickly.

Yosh Maruyama
James Fontanesi
Arthur T. Porter
Jacek G. Wierzchicki
Laurie Gaspar
Kevin Padian (Letters, 19 Aug., p. 1017) refers to “Darwinian” and “Linnaean” classifications as if they were the same, and criticizes me for supporting this view. Actually, I have consistently pointed out the total difference between the Darwinian (traditional) and the Linnaean system of classifying. Padian, by implying that the Linnaean and Darwinian systems are the same, ignores the history of taxonomy. It must therefore be stated in a few words.

From Cesalpino (1583) up to and including Linnaeus, taxonomists applied the downward method of classification, actually a system of identification, as we now realize. In the last third of the 18th century (beginning with M. Adanson), the method of upward classification came into ever greater use and, by the end of the first third of the 19th century, it was the standard method (1). Its weaknesses were that it had no properly articulated method, that it still relied too much on single characters, and that it did not provide an explanation for the grouping of organisms into nearer and more distant relatives. These deficiencies were repaired by Darwin in the brilliant 13th chapter of his On the Origin of Species. Here Darwin showed that all classifications must be genealogical in order to reflect his theory of common descent. Furthermore, Darwin strongly emphasized that a second criterion was needed to achieve a sound classification, that of representing degree of similarity (2). Again and again Darwin stated “genealogy alone does not give a classification.”

Darwin’s advice to base classifications on two criteria, genealogical relationship and degree of similarity, was more or less followed by all good taxonomists in the next 90 years. There was no need to designate this method as Darwinian because it was the only properly presented method of classifying.

After 1950, two new methodologies were proposed, both attempting to base their classifications on only one of Darwin’s criteria. The numerical pheneticists (3) said that similarity alone was sufficient. The
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- specific Serine endoproteinase
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- for cleavage of fusion proteins expressed by MoBiTec's pAX-Vector-System

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Serious shortcomings of this approach have since been frequently pointed out (4). The other proposed method was that of Hennig (5) who said that one should not classify by establishing groups of organisms by similarity but that one should simply recognize branches of the phylogenetic tree. Again and again in his writings, Hennig warns against using degrees of similarity or difference. Hence, he clearly based his ordering system on one criterion only, that of being on the same branch of the phylogenetic tree. Naturally, species on a given branch have certain characters in common, so-called synapomorphies, and are similar to each other in that respect. However, most branches are highly heterogeneous, and the stem groups of such branches are often far more similar to stem groups of sister taxa than to the crown groups of their own particular branch (clade). Thus Hennig's scheme clearly violates the second of Darwin's criteria. In order to discriminate the methodology which uses two criteria from the newly proposed phenetic and Hennigian systems, it is now necessary to refer to the two-criteria methodology as Darwinian classification. It has, of course, Padian notwithstanding, nothing to do with Linnaean downward classification.

Both Darwinian classifications and Hennigian systems are valid approaches to ordering. If one is only interested in phylogeny, then, by all means, one should use the Hennigian system. But, as Darwin has said so rightly, phylogeny alone does not provide a classification. The Darwinian approach which groups together similar organisms is indispensable for ecological researches, and furthermore, as pointed out by several recent authors (6), it provides more information than the Hennigian ordering system.

**Ernst Mayr**

*Museum of Comparative Zoology, Harvard University, Cambridge, MA 02138, USA*

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**References**


Padian makes the valuable points that Linnaeans' system of classification (1) has nothing to do with Darwin's systematic efforts and therefore that "Hennigian (cladistic)" systems of classification should not be contrasted with something called "Darwinian (Linnaean)." The record needs to be set straight, however, regarding Padian's argument that Linnaean classification is a vapid formalization of Aristotelian taxonomy with no underlying philosophy. Although Linnaeaus' system had long been replaced by better ones by the time Darwin did his taxonomic work (which was much more limited in scope than Linnaeus'), Linnaeaus, like Darwin, was interested in the origin of new forms, which is why he became fascinated with hybridization. The problem of finding a natural system, reflecting affinities of genera and orders, occupied Linnaeus already in the 1730s (2). In his *Philosophia botanica* (3), Linnaeus proposed 63 "natural orders" of seed plants, largely corresponding to our families. A diagram [reproduced in (2)] based on lecture notes by one of Linnaeus' pupils depicts the affinities among these orders as perceived by Linnaeus. It is remarkably similar to the phylogenetic trees in cross section popularized by R. Dahlgren and his students in the mid-1970s [for example, (4)]. In the spirit of Aristotelian logic, Linnaeus searched for the essence of a species, for example, in its flower characters, instead of using overall similarity; yet there was room for variation, as we can perceive from the breadth of his species concept and through statements in the *Philosophia botanica* (2). As B. Jonsell has suggested (2), Linnaeus may even have had some influence on the development of modern ideas on evolution through his work on the Economy of Nature (5), which discusses warfare (competition) between species. Darwin read Linnaeus, and while Homo sapiens L. heads the table in the *Systema Naturae*, he is immediately followed by the monkey.

**Susanne Renner**

*Institut für Spezielle Botanik, Universität Mainz, D-55099 Mainz, Germany*

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**Corrections and Clarifications**

In the article "Genetic testing set for takeoff" by Rachel Nowak (News & Comment, 22 July, p. 464), Helix was cited as the source of information for the accompanying table describing genetic testing (p. 466). The information in the table regarding mutational mechanism, cost, and market size came from sources identified by Helix who were contacted separately.
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Amplification of Genomic DNA Fragments

#1 Genomic DNA fragments of various lengths in the 0-2.4 min region of *E. coli* K12 chromosome were efficiently amplified with this LA PCR Kit.

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<th>Lane</th>
<th>Marker/Size</th>
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<tbody>
<tr>
<td>1</td>
<td>λDNA/Hind III marker</td>
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<td>2</td>
<td>2.0 kb</td>
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<td>11</td>
<td>High MW marker</td>
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#2 Genomic DNA fragment of 6.8 kb was specifically and efficiently amplified by genome walking on the *E. coli* chromosome with this LA PCR Kit employing Single Specific Primer PCR and Nested PCR.

<table>
<thead>
<tr>
<th>Lane</th>
<th>Marker/Size</th>
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<td>2</td>
<td>Conventional PCR kit</td>
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<tr>
<td>3</td>
<td>LA PCR Kit</td>
</tr>
</tbody>
</table>

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Iggo, W. et al.: Selective amplification of DNA sequence from total RNA by cassette-ligation mediated polymerase chain reaction (PCR): Application to sequencing of 0.5 kb genome segment of hantavirus strain B-1. *Molecular and Cellular Probes* 6 (1992) 467-475

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Acculturation to Science

Becoming a Scientist in Mexico. The Challenge of Creating a Scientific Community in an Underdeveloped Country. JACQUELINE FORTES and LARISSA ADLER LOMNITZ. Pennsylvania State University Press, University Park, 1994. x, 225 pp., illus. $35 or £32. Translated from the Spanish by Alan P. Hynds.

Research scientists are in short supply in Mexico. There were about 3000 full-time researchers at the National University of Mexico (UNAM) in 1979 and even fewer in 1990. The educational system is set up to turn out professionals such as doctors, lawyers, and engineers, who use knowledge but do not create it. Fortes and Lomnitz have written an ethnographic account of a bold approach to increase the number of scientists in Mexico by inculcating a select group of undergraduates with the scientific "ethos."

The UNAM is an "university of the masses" with a total enrollment of over 300,000, where students are taught in large sections in an authoritarian fashion by part-time teachers who do little research. Research is carried out in research institutes by full-time researchers. A group at one of these institutes, the Institute of Biomedical Research, began a program in 1974 to train small numbers of selected undergraduates with a completely different approach. During all four undergraduate years, they taught laboratories and seminars using only the discovery approach, with a minimum of lectures. The students were immersed in the Institute, given an extremely heavy work load, and encouraged to question and think critically.

A key goal of the faculty was to transmit and inculcate into the students the model of an ideal scientist as combining hard work, discipline, and creativity. This model was repeatedly emphasized in seminars, in the laboratory, and by example with the explicit aim of socializing students into a research culture. The program enrolled 100 students between 1974 and 1987 and graduated 65, most of whom went on to higher degrees. The program was very labor-intensive. It involved three full-time teachers and 14 researchers, in varying degrees, of whom 13 had Ph.D.'s, which is a very high proportion of doctorates for an undergraduate program in Mexico.

Fortes and Lomnitz argue that the transmission of a scientific ethos was the key component of the program because the cultural setting in the Third World, and in Mexico in particular, is not supportive of science. They argue that science did not develop naturally in countries that had been Spanish colonies, because these countries followed for centuries the anti-science ideas of the Counter-Reformation. Additionally, after independence the promoters of science in Mexico in the 1890s were the Comtean positivists, who had leadership roles in the Díaz dictatorship that was overthrown in the Mexican Revolution of 1910. The revulsion against the Díaz dictatorship also produced, as an unintended consequence, an anti-science bias in society. Beyond that, the lower middle classes are not aware of research degrees and do not see them as a means of social mobility. Fortes and Lomnitz cite a survey of 2000 university students in which fewer than 1 percent expressed interest in pursuing a research degree while almost all were interested in the traditional professional degrees.

The experiences in this program are quite interesting because it resembles the effort to increase the number of minority members in science in this country. Minorities here also do not envision science
Vignettes: Studying Science

I was thinking of whether I could graduate from high school if for the second year in a row I failed biology. I was surprised to be failing it, because I loved it; I'd loved it the first time I'd failed it too. My favorite part was gene-recession charts. I liked working out the sequence of blue eyes in families that had no characteristics except blue eyes and brown eyes. My family had a lot of characteristics—achievements, ambitions, talents, expectations—that all seemed to be recessive in me.
—Susanna Kaysen, in Girl, Interrupted (Random House)

A postlab discussion of an activity called "Experimenting with Mixtures" provided a forum for identifying the activity's successes and difficulties. Students expressed frustration over my expectation that they could inductively derive a distinction between homogeneous and heterogeneous mixtures. Students' preconceptions of mixtures were far richer and more complex than the scientific dichotomy of homogeneous/heterogeneous. "Why couldn't we just read about it before the activity?" they asked.
—Glen Aikenhead, in STS Education: International Perspectives on Reform (Joan Solomon and Glen Aikenhead, Eds.; Teachers College Press)

I think I got in [MIT] by being a nerd and getting good grades.
—Bill Gosper, in More Mathematical People (Donald J. Albers, Gerald L. Alexanderson, and Constance Reid, Eds.; Academic Press)

as a career, and programs like the Minority Biomedical Research Support (MBRS) and Minority Access to Research Careers (MARC) have the same aims as the program of the Institute of Biomedical Research and use some of the same approaches. All try to instill the scientific ethos by having the students actually do research and discover both that hard work is necessary to do science and that the rewards of science are not only in the results but in the search itself. A key component in both programs is mentoring by senior scientists and the feeling of belonging to the scientific community. An important difference is that the students at the Institute in Mexico were a select upper-middle-class group with professional parents, whereas most students in the MBRS program are first-generation college students who come from a lower socioeconomic level. Remarkably, despite this, the graduation rate of these minority students is in some programs exceeds that of the Institute (MBRS 88 percent, MARC 99 percent at Wayne State University, according to Joseph Dunbar of the Medical School). Another difference is that whereas most of the Institute graduates went on to graduate degrees in science, there is a significant (45 percent) diversion of MBRS graduates to medical school, with only about 30 percent continuing in science. This is probably due to the much greater financial differential between M.D.'s and Ph.D.'s in the United States than in Mexico. A surprising difference was that female students in the Institute outnumbered male students by two to one.

Fortes and Lomnitz's book provides a number of illuminating views of the process and difficulties of socializing students into science. It will be of interest to those concerned with increasing the proportion of scientists in traditionally underrepresented groups.

Bernard Ortiz de Montellano
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Books Received


paper. $34.95.


Clusters and Colloids. From Theory to Applications. G. G. Schatz. VCH, New York, 1984, xvii, 555 pp., illus. $145.00.


Energy-Efficient Electric Motors and Their Applications. 2nd ed. Howard E. Jordan. Plenum, New York, 1994, x, 188 pp., illus. $49.50.


Transition Metal Chemistry. The Valence Shell in d-Block Chemistry. Malcolm Gerloch and Edwin C. Constable. VCH, New York, 1994, xii, 211 pp., illus. $75.00; paper, $35.00.

William Harvey’s Natural Philosophy. Roger French. Cambridge University Press, New York, 1994, xii, 385 pp., illus. $75.00.

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Join these and other members of the scientific community at Pfizer Central Research in seaside Connecticut. You will be part of an R&D organization with a budget of $1 billion. Aside from enjoying the professional resources of our Fortune 100 company, you will appreciate the many cultural, recreational and educational advantages easily accessible to our scenic location. Relocation assistance is available. For confidential attention, send your resume to: Employee Resources, Pfizer Inc, Central Research, Eastern Point Road, Groton, CT 06340.

We are an equal opportunity employer M/F/D/V.
In the Department of Molecular Biology at The Scripps Research Institute (TSRI), postdoctoral fellow Bruce S. Duncan, Ph.D., is developing new computational methods to represent molecular structures and model their interactions. This research is important for gaining new insights into biological processes and for the development of medical applications such as computer-aided drug design.

For more than three decades, TSRI has maintained its position at the forefront of science and focuses its efforts in molecular biology, cell biology, chemistry, immunology, molecular and experimental medicine, neuropharmacology and neurobiology.

"Because of its extensive resources and scientific talent, TSRI is an ideal place for people with ability and motivation," Duncan believes. These include a staff of more than 2000, with 200 principal scientific investigators and 500 postdoctoral fellows; a collaborative intellectual environment; and superior experimental and computational facilities. The Institute's proximity to the University of California at San Diego, The Salk Institute, the San Diego Supercomputer Center, and a biotechnology community that ranks as the fourth largest in the nation provides even more research opportunities for its scientists.

For postdoctoral fellows looking for a unique and stimulating environment, The Scripps Research Institute announces:

The TSRI Postdoctoral Fellowship Program for Minority Candidates.

Two fellowships are available for research in molecular biology and related fields. They are open to those with training in biology, chemistry, immunology, biochemistry, neurobiology, mathematics, physics, and computer science. Qualified underrepresented minority candidates are encouraged to apply.
The People behind our Science

Bristol-Myers Squibb Pharmaceutical Research Institute, the R&D division of Bristol-Myers Squibb, is proud of the many talented and diversified scientists behind our scientific endeavors.

“Our group is very proud to be part of a team effort in developing new and exciting therapeutic approaches for treating viral hepatitis. It is both exciting and rewarding as scientists and individuals to know that you are part of a company dedicated to research aimed at understanding and curing viral diseases.”

“We find it gratifying to be able to pursue the development of biological therapeutics in a well equipped and supported state-of-the-art facility.”

If you would like to apply for available R&D positions, please forward your resume to: Dept. BM-900, Bristol-Myers Squibb Pharmaceutical Research Institute, Human Resources, P.O. Box 4000, Princeton, NJ 08543-4000. Equal Opportunity Employer, M/F/D/V

Bristol-Myers Squibb
Pharmaceutical Research Institute
Committed To Training Of Scientists And C...

The National Institutes of Health is the world's largest institution dedicated to biomedical research. The NIH intramural research program, which includes more than 4,000 doctoral level scientists and a clinical center that is home to half of all research beds in the country, has traditionally provided exceptional postdoctoral training opportunities in both the basic and clinical biomedical sciences. In addition, the NIH is fully committed to helping prepare the upcoming generation of scientists by providing programs for graduate, medical, and college students.

The NIH also seeks to ensure that the next generation of scientists reflects the rich diversity of this Nation's citizenry. The NIH is committed to achieving this goal and enhancing the training experience and career development of all postdoctoral fellows.

The following descriptions introduce the various postdoctoral and other educational opportunities available at the NIH. Minorities are especially encouraged to explore the many research training opportunities described below and to contact the Office of Education for additional information.

Postdoctoral Training Programs

Laboratory Research Training

At the NIH, postdoctoral fellowships are available to conduct basic biomedical research in a wide variety of disciplines. Initial appointments are usually for two to three years. Candidates should have either a doctoral degree (e.g., PhD, MD/PhD, MD, DO, DDS, DMD, or DVM) accompanied by previous laboratory research experience. Current postdoctoral openings are posted on the NIH EDNET Bulletin Board's POSTDOC conference which is available via modem. In addition, the NIH welcomes applications for anticipated openings from nine months to a year in advance. A catalog featuring the research descriptions of NIH scientists may be obtained by contacting the NIH Office of Education. Research descriptions may also be accessed on the NIH Gopher server on Internet (see below for instructions). Individuals interested in pursuing research training through the Clinical Investigator Pathway of the American Board of Internal Medicine may also contact the NIH Office of Education for additional information.

Clinical Research and Subspecialty Training

Subspecialty training at the NIH allows physicians to become board-certified specialists who are also prepared for careers in academic medicine. In-depth training in clinical and/or basic research complements the fellow's clinical training in the following programs which are accredited by the Accreditation Council on Graduate Medical or by boards in their respective disciplines: Allergy and Immunology, Anatomic Pathology, Blood Banking/Transfusion Medicine, Clinical Laboratory Immunology, Critical Care Medicine, Dermatology (third year), Endocrinology and Metabolism, Gastroenterology, Hematology, Infectious Diseases, Internal Medicine (third year), Medical Genetics, Medical Oncology, Oral Medicine, Pediatric Endocrinology, Pediatric Hematology/Oncology, Psychiatry (fourth year), Radiation Oncology, Reproductive Endocrinology, and Rheumatology. Programs in Clinical Chemistry, Clinical Hematology and Clinical Microbiology offer credit toward board certification on an individual basis. In addition, the Clinical Neurosciences Program offers neurologists advanced training towards Added Qualifications in Clinical Neurophysiology under the American Board of Psychiatry and Neurology.

Loan Repayment Programs

The NIH AIDS Research and Clinical Research Loan Repayment Programs (LRP) provide educational loan repayments to highly qualified physicians and scientists who agree to conduct qualified research activities as NIH employees. Individuals may receive a maximum of $20,000 annually in loan repayments, in addition to attractive salaries and benefits, and must sign an initial, two-year contract. Contracts are awarded on a competitive basis, and priority in funding is given to qualified health professionals who are underrepresented in biomedical/behavioral research including members of minority groups, disabled individuals, and women. Interested individuals should contact the LRP for an application at 1-800-528-7689.

Accessing Information on Postdoctoral Training Electronically

The NIH EDNET Bulletin Board POSTDOC conference may be accessed via Internet (wyibur.cu.nih.gov) or modem (1,301-402-2221 or 1,800-358-2221) with parameters set at "7, Even, 1". When connected to NIH, type in "F100" for terminal emulation, "FSE" for initials, and "AJL" for account number. An electronic version of the Post-
doctoral Research Fellowship Opportunities catalog may be accessed via the Internet using either the Gopher Information System (gopher.nih.gov) or the World Wide Web (http://www.nih.gov). When connected, select Research Opportunities at the NIH Office of Education.

Graduate Student Programs

Students interested in doctoral training in genetics are encouraged to consider the NIH-George Washington University (GWU) Graduate Program in Genetics. NIH and GWU faculty provide didactic instruction and dissertation research is conducted in NIH laboratories. Full tuition and stipend support are provided.

NIH Predoctoral Intramural Research Training Awards are granted to support doctoral students who wish to conduct their research in NIH intramural laboratories or to students who have been accepted into graduate school but wish to delay matriculation for a year in order to pursue a research experience in an NIH intramural laboratory.

Medical and Dental Student Programs

The Summer Research Fellowship Program provides eight to ten weeks of basic research training for students in the summer following their first or second year. In addition, the Clinical Electives Program provides rotations in 20 clinical subspecialties for third and fourth year students, providing clinical and research experiences unduplicated elsewhere.

NIH Predoctoral Intramural Research Training Awards are granted to provide a one year research experience for students currently enrolled in medical school who seek an interim research experience before completing their medical education or for students who have been accepted into medical school but wish to delay matriculation in order to pursue research training in an NIH intramural laboratory.

Post Baccalaureate Programs

The NIH Predoctoral Intramural Research Training Award Program also provides opportunities for recent college graduates who wish to pursue biomedical research in NIH intramural laboratories for one year while applying for graduate or medical school.

Undergraduate Student Programs

Students can participate in state-of-the-art biomedical research through the Summer Internship Program in Biomedical Research. This program also provides workshops on career pathways and strategies for a successful scientific career, as well as a weekly seminar series and brown-bag luncheons where students can interact informally with NIH scientists.

The Undergraduate Scholarship Program supports undergraduates pursuing academic programs which prepare them for careers in professions needed by the NIH. These individuals may receive up to $20,000 annually in scholarship support for tuition and qualified educational and living expenses. In addition, as participants in the Undergraduate Scholarship Program, recipients will be provided a variety of summer employment opportunities on the NIH campus. Contracts are awarded on a competitive basis with priority in funding given to students from underrepresented minority groups, disabled individuals and women. This program is scheduled to begin in September 1995. For more information, call the Loan Repayment Program at 1-800-528-7669.

To find out how the NIH can play a role in your research training, please contact the NIH Office of Education for information on any of these programs.
Oak Ridge National Laboratory is making major contributions every day to solving the energy and environmental problems of the nation and the world through science and technology. Because of recent retirements, we are now seeking outstanding professionals to join us in this essential endeavor. You will work with leading scientists and engineers using state-of-the-art equipment in an environment of challenge and achievement. Among the many exciting programs at ORNL are:

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- Environmental science, technology & engineering
- Energy technologies & systems
- Instrumentation & controls
- Solid state physics
- Atomic & nuclear physics
- Advanced materials
- Biotechnology
- Robotics

ORNL offers competitive compensation and benefits, including a relocation package. For additional information or consideration for open positions, including BS, MS, PhD and post doctoral opportunities, contact: ORNL Staffing, Dept. SC, P.O. Box 2008, Oak Ridge, TN 37831-6216.

ORNL is an equal opportunity employer committed to building and maintaining a diverse workforce. Some positions may require U.S. citizenship for consideration.
The Howard Hughes Medical Institute announces the 1995 competitions for fellowship programs that support training in fundamental biological and biomedical research. Awards, based on international competitions, focus on research directed to understanding basic biological processes and disease mechanisms. Fellowships may be held at academic or nonprofit research institutions.

**Predoctoral Fellowships in Biological Sciences**
Up to five years of support for full-time graduate study toward a Ph.D. degree in biostatistics, cell biology and regulation, epidemiology, genetics, immunology, neuroscience, or structural biology. Applicants must not have completed the first year of postbaccalaureate graduate study in biology. *Application deadline: early November.*

**Postdoctoral Research Fellowships for Physicians**
Three years of support for training in fundamental research subsequent to at least two years of postgraduate clinical training and no more than two years of postdoctoral research training. *Application deadline: early January.*

**Research Training Fellowships for Medical Students**
An opportunity for medical students in the United States to explore a burgeoning interest in fundamental research. Support is awarded for one year of full-time fundamental research in a laboratory at the student's medical school or another institution (except NIH in Bethesda, Maryland). *Application deadline: early December.*

**Research Scholars at the National Institutes of Health**
Under this joint HHMI–NIH program, medical students in the United States spend an intensive year in research in the intramural program at NIH in Bethesda, Maryland. Residence is provided at the Cloister on the NIH campus. *Application deadline: early January.*

**1995 Program Announcements and Applications**

*For Predoctoral Fellowships:*
Hughes Fellowship Program  
The Fellowship Office  
National Research Council  
2101 Constitution Avenue  
Washington, DC 20418  
United States of America  
Telephone: (202) 334-2872  
Fax: (202) 334-3419  
E-mail: infofell@nas.edu

*For Other Programs:*
Howard Hughes Medical Institute  
Office of Grants and Special Programs  
Department AL95  
4000 Jones Bridge Road  
Chevy Chase MD 20815-6789  
United States of America  
Telephone: (301) 215-8889  
Fax: (301) 215-8888  
Internet: fellows@hhmi.org

The Howard Hughes Medical Institute, an Equal Opportunity Employer, welcomes applications from all qualified candidates and encourages women and members of minority groups to apply.
The Office of Placement Services has been reorganized and renamed FASEB Career Resources Office - - - Specializing in Biomedical and Biological Career Advancement. Our services have been enhanced and expanded to provide applicants and employers a worldwide computerized resource for seeking and matching the right person with the right position. The FASEB Career Resources Office will provide year-round services focusing in four areas.

CAREERS OnLine - a global network for the biomedical professional over the Internet.
CAREERS OnLine is designed to provide applicants at ALL stages of their professional careers with available positions in academe, government and industry.
CAREERS OnLine, because of its international reach, should be the core of an employer's job search to satisfy obligations to recruit a diversified work force under equal employment guidelines. FREE applicant listings
will be accepted between January 1 through June 30, 1995. Watch for further details in The FASEB Journal. E-mail: careers@faseb.org

Career Resources Classified - Matching the Professionals, a special monthly bulletin for employment opportunities and positions desired devoted solely to the life sciences and biomedical professions. This new publication will reach over 42,000 scientists worldwide beginning January 1995. Reserve space now by calling 1-800-43-FASEB, ext. 7103. E-mail: adnet@faseb.org.

Outplacement Services - Organizations that are restructuring or downsizing their operation now can provide their staff with opportunities and options for seeking new employment. This service will provide prospective employers with access to resumes of potential applicants.

FACEB Announces....

Biophysical Society Meeting February 12-16, 1995 San Francisco
Experimental Biology '95 April 9-13, 1995 Atlanta
ASEMB/DBC-ACS Joint Meeting May 21-25, 1995 San Francisco
Protein Society Annual Symposium July 8-12, 1995 Boston

MINORITY ACCESS TO RESEARCH CAREERS (MARC)

FASEB's Life Sciences Research Office administers three programs funded by the Minority Access to Research Careers (MARC) Program of the National Institute of General Medical Sciences (NIGMS).

The Visiting Scientists for Minority Institutions program provides opportunity for visits by distinguished research investigators from the FASEB Societies at minority institutions for periods of 3 to 5 days. Visiting Scientists present lectures and demonstrations, interact with faculty and students, discuss research career opportunities, explore curriculum improvements, and assist with research grant preparation. A roster of visiting scientists is available on request.

Scholarships are awarded competitively to faculty and students at minority institutions for attendance at annual meetings of the nine FASEB Member Societies.

For more information contact:
LSRO, Rose Marie Soulé, Executive Secretary, 301-530-7030 or FAX 301-571-1876
E-mail: marc@lsro.faseb.org

For more information:
1-800-43-FASEB
Fax: 301-530-7001
9650 Rockville Pike
Bethesda, MD 20814-3998
It's not "WHAT" has brought us where we are today. It's "WHO".

Miles Inc., Pharmaceutical Division does business from a unique vantage point. We define our values and our vision not by "what" will make us a premier healthcare corporation, but rather "who" will. We believe it's the combined talent, motivation and insight of our highly skilled staff that ultimately inspire and commit us to achieve excellence. Which is why we open the lines of communication among employees with comprehensive internal diversity training.

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Our Medical Affairs area is not merely statistics, analyses, tracking and regulations; it's the blending of people from different backgrounds — cross-functional teamwork in an entrepreneurial environment. Join this innovative, creative company — after all, it's not what you are that matters, it's who you are.

Director - Professional Services
M.D. with experience in the pharmaceutical industry. Must have in-depth knowledge of professional services management. Directs all activities on investigation of adverse effects and complaints and supports marketing in providing advice and guidance for medically and scientifically accurate programs.

Associate Director - Regulatory Affairs
Requires Ph.D. or equivalent with at least 4 years' FDA regulatory experience. Demonstrated knowledge of all aspects of regulatory affairs and extensive experience with FDA divisions and concepts.

Associate Director - Anti-Infective
M.D. preferably trained in infectious disease and board eligible. Requires clinical trial experience in AIDS drug development.

Clinical Data Coordinator
B.S. in a scientific area or equivalent and 2 years' experience in data management. Thorough knowledge of medical terminology and basic SAS computer programming for data processing, proofing and display.

Statistician
Requires a Ph.D. in Statistics. Must possess thorough knowledge of statistical methodology, including experimental design and linear models.

Clinical Programmer Analyst
Candidate must possess a B.S. with scientific emphasis or equivalent and minimal experience. Requires knowledge of SAS, IBM/OS/MVS JCL, and ISPF experience is desired.

Medical Research Associate
B.S. in Biomedical Sciences or equivalent with 3-4 years' experience monitoring clinical trials. Requires a working knowledge of medical terminology, biology, pharmacology, trial methodology and clinical pharmacology.

All positions require effective interpersonal, verbal and written communications skills and the ability to work successfully with individuals at all levels of management.

Located on the Connecticut seashore, Miles is close to the New York City and Boston metropolitan areas. We offer a highly competitive salary and comprehensive benefits package, including tuition reimbursement, 401(k), relocation assistance and more. For immediate consideration, please send your resume, including salary requirements, to: Miles Inc., Pharmaceutical Division, Dept. KPS, 400 Morgan Lane, West Haven, CT 06516.

Miles values the strength diversity adds to the workplace and is committed to being an equal opportunity employer M/F/D/V.

Diversity Equals Strength.
ADVANCED GENOME SEQUENCING & ANALYSIS
March 14 - 27
Ellison Y. Chen, Perkin Elmer Corporation
Richard Gibbs, Baylor College of Medicine
W. Richard McCombie, Cold Spring Harbor Laboratory
Richard K. Wilson, Washington University

Recent advances in the automation of DNA sequencing have opened new possibilities for the analysis of complex genomes at the DNA sequence level. This two week course will provide intensive training in this rapidly evolving field. The course will emphasize techniques and strategies for using automated sequencers to sequence large, contiguous genomic regions. Students will carry out all of the steps in the sequencing process from preparing cosmid DNA to computer analysis of the finished sequence. Topics will include subclone library generation, large-scale template purification, sequencing reactions, gel analysis on automated sequencers, sequence assembly, gap filling and conflict resolution. Students will work in groups to sequence a large region of DNA and through this process be trained in crucial project and data management techniques. A series of lecturers will discuss their applications of these techniques as well as alternate strategies for high speed automated DNA sequencing.

PROTEIN PURIFICATION & CHARACTERIZATION
March 30 - April 12
Richard Burgess, University of Wisconsin, Madison
James Kadonaga, University of California, San Diego
Sue-Hwa Lin, M.D. Anderson Cancer Center, University of Texas
Daniel R. Marshak, Cold Spring Harbor Laboratory

This course is intended for scientists who are not familiar with techniques of protein isolation and characterization. It is a rigorous program that includes laboratory work all day and a lecture with discussion session every evening. Each student will become familiar with each of the major techniques in protein purification by actually performing four separate isolations including: (i) a regulatory protein from muscle tissue; (ii) a sequence-specific, DNA-binding protein; (iii) a recombinant protein overexpressed in E. coli; and (iv) a membrane-bound receptor. A variety of bulk fractionation, electrophoretic, and chromatographic techniques will be employed including: precipitation by salts, pH, and ionic polymers; ion exchange, gel filtration, hydrophobic interaction, and reverse phase chromatography; lectin affinity, oligonucleotide affinity, and immunoadfinity chromatography; polyacrylamide gel electrophoresis, and electroblotting; and high performance liquid chromatography. Procedures will be presented for solubilizing proteins from inclusion bodies and refolding them into active monomeric forms. Methods of protein characterization will be utilized including immunological and biochemical assays, peptide mapping, amino acid analysis, protein sequencing, and mass spectrometry. Emphasis will be placed on strategies of protein purification and characterization rather than on automated instrumental analysis. Guest lecturers will discuss protein structure, modifications of proteins, methodologies for protein purification and characterization, and applications of protein biochemistry to cell and molecular biology. Guest lecturers have included: R. Aebersold, L. Giersch, G. Hart, A. Komberg, N. Pace, Y. Paterson, G. Rose, J. Rothman, B. Stillman, and N. Tonks.

CLONING & ANALYSIS OF LARGE DNA MOLECULES
March 30 - April 12
Hadi Abderrahim, Cell Genesys, Inc.
Bruce Birren, Whitehead / MIT Center for Genome Research
Douglas Vollrath, Stanford University

This course will cover the theory and practice of manipulating and cloning high molecular weight DNA. The course will focus on the use of yeast artificial chromosome (YAC), bacterial artificial chromosome (BAC) and bacteriophage P1 cloning systems for library construction and techniques of pulsed field gel electrophoresis (PFGE). Lectures and laboratory work will include an introduction to yeast genetics, the isolation and manipulation of high molecular weight DNA from a variety of sources, and preparative and analytical PFGE. Clones will be produced and characterized by several approaches, including library screening, contig assembly, long range restriction mapping, and recovery of YAC ends. Lectures by outside speakers on topics of current interest will supplement the laboratory work.

EARLY DEVELOPMENT OF XENOPUS LAEVIS
April 4 - 13
Robert Grainger, University of Virginia
Hazel Sive, Whitehead Institute

This course will provide extensive laboratory exposure to the biology, manipulation and use of embryos from the frog, Xenopus laevis. The course is suited both for investigators who have had no experience with Xenopus, as well as those who have worked with Xenopus and wish to expand their repertoire of techniques. All students should have a current training in molecular biology and some knowledge of developmental biology. The course consists of intensive laboratory sessions, supplemented by daily lectures and demonstrations from experts in both experimental and molecular embryology. Six areas will be covered: (i) care and handling of adults and embryo isolation; (ii) stages of embryonic development and anatomy; (iii) whole mount in situ hybridization and immunocytochemistry; (iv) microinjection of eggs and oocytes, including mRNA and antisense oligonucleotides; (v) micromanipulation of embryos, including induction and transplantation assays; and (vi) preparation and use of cell cycle extracts. Lecturers and co-instructors will include: Enrique Amaya, Rick Elinson, Janet Heasman, John Gurdon, Richard Harland, Ray Kelley, John Newport, and Nancy Papalopulu.

Application Deadline: January 15, 1995
Tuition Room and Board:
Ten day course $ 1,460
Two week course $ 1,720
Scholarship funds are available for qualified applicants

Applications can be obtained from:
Course Registrar SM
Cold Spring Harbor Laboratory
1 Bungtown Road, Cold Spring Harbor, New York 11724-2213
Tel: 516-367-8345 Fax: 516-367-8845 Email: meetings@cshl.org
Additional information on Meetings, Courses, and Publications: World Wide Web site http://www.cshl.org/
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**Chemists**
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- Formulation
- Pharmaceutical
- QA/QC
- Simulation Production
- Synthetic Organic
- Validation

**Compliance Specialists**
- Diagnostics/Software
- Audit

**Associate Medical Directors**

**Clinical Data Associates**

**Clinical Research Associates**
- Pharmaceutical Experience

**Nurse Practitioners**
- Occupational Health

**Regulatory Managers**
- Pharmaceutical Experience

**Research Scientists—PhDs**
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- Immunology
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announces

INTERDISCIPLINARY GRADUATE TRAINING in MOLECULAR MEDICINE

The Cornell University Graduate School of Medical Sciences, composed of faculty from Cornell University Medical College and Memorial-Sloan Kettering Cancer Center, has established a training program in Molecular Medicine leading to the Ph.D. degree.

Students will matriculate as members of the Graduate School of Medical Sciences and complete a core curriculum, courses bridging basic and clinical science, and a series of laboratory rotations designed to expose the student to the many research opportunities at the participating institutions. Training will focus on the molecular and cellular basis of human disease, inform students of the major unresolved questions of pathogenesis and therapeutics, and how molecular medicine might address these issues in the future. Graduates will be laboratory scientists whose expertise will be in fundamental biomedical research but who can interface productively with clinical investigators.

The Cornell University Medical College/Graduate School of Medical Sciences constitutes the New York City Campus of Cornell University at Ithaca, New York. It is part of a large biomedical research complex extending along York Avenue on Manhattan’s East Side, including The Memorial-Sloan Kettering Cancer Center, The Hospital for Special Surgery, and The Rockefeller University.

The Cornell University Medical College is committed to the successful recruitment and training of qualified women and members of underrepresented minority groups, including, but not limited to, African Americans, Alaskan Natives, American Indians, hispanic Americans, and Pacific Islanders.

Cornell University is an Equal Opportunity/Affirmative Action Employer

To receive additional information and an application kit, call or write to:

Cornell University Graduate School of Medical Sciences  
445 East 69th Street  
New York, NY 10021, USA  
Tel: (212) 746-6565  
Fax: (212) 746-8906
The Center for Biologics Evaluation and Research is searching for outstanding physicians and scientists interested in a challenge by participating in the development and approval process for new biological products. The Center's mission is to regulate blood, vaccines, biological therapeutics and related products according to statutory authorities in order to protect and enhance the public health. The regulation of these products is founded on science and law to ensure their purity, potency, safety, efficacy, and availability. In conjunction with regulatory and research responsibilities, the Center statistically evaluates clinical and preclinical studies of human biological products and vaccines and epidemiologically evaluates post-marketing studies and adverse biologics reactions. As members of a multidisciplinary team of scientists, the incumbents will work as reviewers in the approval process for new biological products. Some positions offer the unique opportunity to conduct biomedical research at the post doctoral level in combination with review responsibilities. These positions offer a high degree of independence and involve complex medical, scientific, and regulatory issues. Opportunities for professional development may include further training, attendance at scientific meetings and conferences, and clinical activities.

Qualifications: Physicians must have completed all requirements for a Doctor of Medicine or Osteopathy Degree from an accredited institution. Graduates of foreign medical schools must submit a copy of their permanent Educational Commission for Foreign Medical Graduates (ECFMG) certification. Physicians should be board eligible or certified in a primary specialty or have completed at least four years of residency training or possess equivalent experience. For scientists, doctoral level degrees in biological or physical sciences, pharmacology, toxicology, or related disciplines, along with advanced training and/or experience in the development, manufacture or testing of biologics is desirable.

In addition, candidates should have highly developed analytical, written and oral skills, as well as the ability to research problems and issues and to use mature judgment in problem solving.

Candidates for Civil Service or Commissioned Corps appointments must be U.S. citizens. Candidates for fellowships may be either U.S. citizens or resident aliens eligible for citizenship within four years.

Location: Offices and laboratories are strategically located on the campus of the National Institutes of Health in Bethesda, Maryland, or in close proximity to the campus.

Salary: For physicians, the 1994 Civil Service salary range for GS-13 through GS-15 is $59,099 to $91,029. In addition, some positions may include a Physicians' Comparability Allowance. For scientists (other than M.D.), the 1994 Civil Service salary range for GS-11 through GS-15 is $35,045 to $90,252. Salary, benefits, research support, and level of responsibility are commensurate with education and experience. Also, positions may be filled by appointment in the U.S. Public Health Service, Commissioned Corps, or in the Fellowship Program, with commensurate salary and benefits.

How To Apply: Applications are accepted throughout the year, and candidates should indicate when they will be available for employment. Interested candidates should send an Application for Federal Employment (SF-171) and/or current detailed Curriculum Vitae along with bibliography, statement of regulatory/research interest, transcripts, and names of three references to:

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Penn trains investigators at every level:
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  Ten weeks of hands-on laboratory research.
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  Combines Ph.D. training in biomedical science with a professional degree from Penn’s School of Medicine, Dental Medicine, Veterinary Medicine, Law, or The Wharton School.
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  For minority undergraduates, graduate students, and faculty in research laboratories around the world.
- **Postdoctoral Training in Research**
  In all leading areas of modern health science.

The University of Pennsylvania Medical Center actively promotes diversity in its community. Students, faculty, and staff are selected without regard to race, color, sex, sexual or affectional preference, religion, national or ethnic origin, handicap, or disability.

For information contact:
Biomedical Graduate Studies
240 John Morgan Building
University of Pennsylvania
Philadelphia, PA 19104-6064
215-898-1030
email:BGS@mscf.upenn.edu

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The mission of the NIEHS is to reduce the burden of human illness and dysfunction from environmental exposures by understanding each of these elements and how they interrelate through multidisciplinary biomedical research programs, prevention and intervention efforts, and communication strategies that encompass training, education, technology transfer, and community outreach.

EMPLOYMENT OPPORTUNITIES AVAILABLE:
Postdoctoral fellowships and Senior Scientist positions are available for applicants in the physical and life sciences interested in applying a multidisciplinary approach to research in environmental health. Salaries for permanent positions range from $47,920 to $86,589. The stipend range for postdoctoral fellowships is $28,000 to $73,472. The detailed compensation and benefit package will be outlined once the appointment mechanism is determined by the Institute.

NIEHS scientists, working with researchers in Utah, recently isolated the breast cancer gene. Dr. Martin Rodbell won the Nobel prize in Medicine this month for his research that led to the discovery of cellular chemical messengers called G-proteins. NIEHS cosponsored a national Environmental Justice symposium this year to focus on research issues and strategies central to environmental justice, and to examine community and government actions needed to confront this important health challenge.

LOCATION:
The headquarters and intramural research programs of NIEHS are located in Research Triangle Park, North Carolina. Its proximity to four major universities - The University of North Carolina in Chapel Hill, Duke University and NC Central University in Durham, and North Carolina State University in Raleigh - facilities the close working relationships between the staff of the universities and the Institute.

QUALIFICATIONS REQUIRED:
Applicants for postdoctoral fellowships must possess a Ph.D., M.D., D.V.M., or equivalent degree and less than 7 years of postdoctoral experience. Other positions are also available.

HOW TO APPLY:
Submit the following to the address listed below:
1. A cover letter describing the types of research position(s) of interest and date available for employment.
2. Curriculum vitae and bibliography.
3. Three letters of reference
4. A statement regarding citizenship status (U.S. citizen, permanent resident, or type of visa held or sought).

NIEHS Personnel Office (HNV93)
P.O. Box 12233
Research Triangle Park, NC 27709
Here, people make all the difference.

At Chiron, our enthusiasm for biotechnology goes beyond looking for solutions to serious diseases. Our sights are set on helping people be their best. Whether they’re the patients who benefit from our breakthrough diagnostics, therapeutics, vaccines or ophthalmic devices ... or the Chiron professionals who make it happen.

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- *Manufacturing*
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- *Research & Development*
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Write us at Chiron Corporation, Human Resources, 4560 Horton Street, Emeryville, CA 94608. Expand your opportunities to advance your career and to transform the practice of medicine. We welcome applications from all individuals. Women, veterans, minorities and disabled individuals are encouraged to apply.
Be At The Forefront Of Drug Discovery & Development

...with The DuPont Merck Pharmaceutical Company. We are focused on meeting unmet medical needs through the discovery and development of innovative compounds leading to novel pharmaceuticals. We currently have immediate openings at our Wilmington, DE facilities for:

**Associate Director-CNS New Neurobiology**
This Senior Molecular Biologist will assist in guiding 5 Ph.D. and 16 Associate Scientists in gene cloning, transfection/expression, transgenic animal and antisense programs in a broadly based CNS Drug Discovery Department. This researcher must be recognized for significant contributions in Molecular Biology applied to the Nervous System. Proven project and Ph.D. leadership skills a must as is familiarity with CNS Pharmacology. Refer to #KBD-AD-CNS

**Senior/Principal Research Scientist-CNS**
This Neuroscientist/Pharmacologist will be a member of a broadly based CNS Department emphasizing molecular approaches to drug design. This position requires an accomplished researcher in the general fields of G-Protein-Coupled Receptors and their Downstream Targets and/or Second Messenger Systems from a Molecular and Biochemical perspective. While directing a group of Associate Scientists, this Research Scientist will be responsible for both theoretical and laboratory aspects of Radioligand Binding and Second Messenger Assays. Consideration will be given to both Senior Researchers and recent Postdoctoral Scientists. Refer to #KBD-SPR-CNS

**Associate/Staff Scientist-Molecular Neurobiology**
This individual will be responsible for carrying out experiments requiring skills in molecular biology, such as DNA cloning, PCR, DNA sequencing, in-situ hybridization, Northern, RNA protection assays, transfections) and tissue culture (cell lines as well as primary cultures). Experience with receptor binding assays, a basic understanding of chemistry or same experience with chemical DNA synthesis methods would be a plus. Several years of experience in an academic or industrial lab is ideal. Refer to #KBD-AS-MN-CNS

**Associate/Staff Scientist-CNS**
This Scientist will be responsible for carrying out experiments requiring skills in molecular biology (such as PCR, DNA and RNA sequencing, in-situ hybridization, Northern, RNA protection assays, transfections) and tissue culture (cell lines as well as primary cultures). Experience with receptor binding assays, a basic understanding of chemistry or same experience with chemical DNA synthesis methods would be a plus. Several years of experience in an academic or industrial lab is a must. Refer to #KBD-AS-CNS

**Associate Director-Clinical Pharmacology**
An experienced MD with residency training in a clinical specialty. Specific training or experience in clinical pharmacology obtained either in a fellowship program, or in a prior academic, government or industrial position is required. An interest in and experience with basic research and an ability to interact with basic scientists is desirable. Refer to #KBD-AD-CP

**Ph.D. Macrophage Cell Biologist**
This individual will have primary responsibility for discovering and developing new drugs for therapeutic targets distinctive to the human macrophage. The successful candidate must have a Ph.D. with at least two years postdoctoral experience, specifically related to the study of macrophage cell biology or biochemistry, and possess a wide range of knowledge and interest in macrophage biology in terms of cell activation and differentiation. Refer to #EPG-S-1DR-D

**Ph.D. Molecular Biologist**
We are seeking a Ph.D. level scientist with expertise in molecular biology that could be applied to the study of vascular biology. Specific research experience in one of the following areas is preferred: molecular, cellular and/or biochemical aspects of vascular biology; macrophage cell biology, integrin biology and intracellular signaling. The preferred candidate would also have a general knowledge of arteriosclerosis and some understanding of the drug discovery process. The candidate's background and experience should enable him/her to interface between arteriosclerosis and thrombosis within CVS, and with discovery groups outside of CVS, for example, a vascular biologist with a strong background in macrophage biology. Prefer candidate with 2-4 years postdoctoral experience. Refer to #EPG-S-CVS-D

**Associate Scientist-Drug Metabolism and Pharmacokinetics**
This Associate Scientist will assay biological samples from nonclinical studies. A BS in Chemistry or related science is required. Experience with HPLC or GC assays is desirable. Refer to #LL-AS-DMP

**Staff Scientist-Drug Metabolism and Pharmacokinetics**
This individual will develop assays for biological samples using LC-MS instrumentation and interpret LC-MS data. BS and/or MS in Chemistry or related science and experience with LC-MS instrumentation is required. Refer to #LL-SS-DMP

DuPont Merck offers competitive salaries and benefits and encourages female and minority candidates to apply. Our company is dedicated to the continued growth and development of our most important resource, the people of DuPont Merck.

Please send a letter of introduction and resume, indicating position number, to: Human Resources, The DuPont Merck Pharmaceutical Company, E400/2413, P.O. Box 80400, Wilmington, DE 19880-0400. An equal opportunity employer M/F/D/V.

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The DuPont Merck Pharmaceutical Company
UCI's School of Biological Sciences has 70 full-time faculty doing innovative work in a broad range of research areas including cellular, developmental, evolutionary and molecular biology, biochemistry, ecology, and neurobiology. In conjunction with the basic science departments of the UCI College of Medicine, we operate several respected graduate programs. We currently have five positions available which will require selected candidates to develop and maintain an active research program, and to participate in both our undergraduate and graduate teaching programs. Curriculum vitae, a description of research and teaching backgrounds, and names and addresses of three referees should be submitted by January 6, 1995 to the appropriate Search Committee Chair.

**DEPARTMENT OF MOLECULAR BIOLOGY AND BIOCHEMISTRY**

**ASSISTANT PROFESSOR - TENURE TRACK**

The successful applicant will have broad training in immunology and research interest in the field of immunopathogenesis. Departmental research interests cover a wide range of topics in molecular biology, molecular genetics, biochemistry, immunology, structural biology and cellular biology. Additionally, we have strong interdepartmental research units in virology and cancer as well as an expanding program in molecular pathogenesis in conjunction with the College of Medicine. Send materials to: Dr. Anthony James, Department of Molecular Biology and Biochemistry, UCI, Irvine, CA 92717-3900.

**DEPARTMENT OF PSYCHOBIOLOGY**

**ASSISTANT PROFESSORS (2) - TENURE TRACK**

Current departmental research emphasizes plasticity with a focus on problems within the areas of learning and memory, integrative neuroscience and aging/neurodegeneration. The successful candidates will be neurobiologists working at the molecular, cellular, systems or behavioral levels. We anticipate that candidates' research will complement current Departmental research programs and have a manifest relationship to some behavioral endpoint. Send materials to: Dr. H.P. Killackey, Department of Psychobiology, UCI, Irvine, CA 92717-4550.

**DEPARTMENT OF DEVELOPMENTAL AND CELL BIOLOGY**

**ASSISTANT PROFESSOR - TENURE TRACK**

The successful candidate will be using innovative approaches, preferably molecular and genetic, to investigate fundamental problems in the development of animals or plants. Research interests in the Department include the molecular genetics and cell biology of pattern formation, growth control and cell signaling in animals and plants, as well as development of the nervous system. Send materials to: Dr. Susan V. Bryant, Department of Developmental and Cell Biology, UCI, Irvine, CA 92717-2300.

**SCHOOL OF BIOLOGICAL SCIENCES - STRUCTURAL BIOLOGIST**

**ASSISTANT/ASSOCIATE PROFESSOR - TENURE TRACK**

The successful candidate will have a background in the area of macromolecular crystallography, NMR spectroscopy or computational/theoretical approaches to fundamental biological problems. Facilities at UCI include high field NMR spectrometers, state-of-the-art x-ray diffraction equipment, and excellent computing facilities including access to the UCSD Super Computing Center. Send materials to: Dr. Thomas Poulos, Department of Molecular Biology and Biochemistry, UCI, Irvine, CA 92717-3900.

Discover UCI's perfect climate for thriving careers. As one of nine University of California campuses, UCI is among the most respected institutions of higher education in the nation and is known for its commitment to and celebration of diversity. Located in the heart of Irvine, a flourishing high technology and cultural center just five miles from the Pacific Ocean, we promote growth and accomplishment for faculty and staff as well as students. Selected candidates will enjoy an excellent salary and benefits package along with the opportunity to participate in our continuing successes.
Providing Leadership in Health Care Through Change, Innovation and Growth

Baxter Biotech Gene Therapy Unit, a Baxter Healthcare Corporation R&D group, is continuing in an established tradition of individual commitment emphasizing a conscious desire to excel. We at Baxter Biotech Gene Therapy Unit, Santa Ana, CA are committed to pioneering the creation of novel therapies based on engineered immunity that will minimize pain and suffering in achieving a cure for cancer. We seek talented individuals motivated to deliver new technologies to patients through studying the processes of gene therapy in T cells.

CELL IMMUNOLOGY

In this position you will be responsible for evaluating function and growth of genetically engineered T lymphocytes using standard immunological assays, as well as developing and evaluating processes for gene delivery. You will also be responsible for the development of prototype cell processing systems, and manufacturing processes to evaluate culture components and T lymphocyte function in the production of genetically modified cells for clinical trials.

The successful candidate will have a Ph.D. in Immunology or a related field with 0-3 years extensive experience in evaluating T lymphocyte activity, cell manipulation and culturing. Knowledge of animal models for tumor immunity, analysis by flow cytometry, and protein analysis is a strong asset. Industrial work experience, and previous supervisory experience are beneficial. Familiarity with cell processing instrumentation devices e.g. CS3000 is preferred.

CELL BIOLOGY

In this position you will assist in the analysis of genetically engineered T lymphocytes as well as in the development of lymphocyte cell processing systems. Developing manufacturing processes and components evaluation in the production of genetically modified T cells for clinical trials will also be a major focus.

Applicants must possess a strong background in Immunology, Cell Biology, or Industrial Biotechnology, and a M.S. with 3-5 years related experience or B.S. with 5-7 years related experience. Knowledge of QC documentation, establishing/validating processes under GLP for GMP, and cell culturing experience are desired. Familiarity with flow cytometry, T cell analysis, cell processing instrumentation/devices e.g. CS3000 is highly recommended.

Strong written and oral communication skills, organizational ability, and team orientation are required for all positions.

The name Baxter Healthcare Corporation is synonymous with products, systems and services devoted to improving health care throughout the world. We are a Fortune 100 company providing a smoke-free environment, competitive compensation and benefits. Please send your resume in confidence to: Baxter Biotech, Gene Therapy Unit, Human Resources Department, 9 Parker, Irvine, CA 92718. An Affirmative Action/Equal Opportunity Employer.

Gene Therapy Division

Baxter
A decade ago, Jim Wyngaarden, then director of NIH, characterized clinical investigators as "an endangered species."

In today's world of biomedical research a gap is widening between technically proficient basic scientific researchers and clinical practitioners in daily contact with patients. In a recent article published in Science, the need for dual degree researchers to fill a void in biomedical research was emphasized: "physician-scientists are the major conduit for the application of basic science to human disease."

The Picower Institute for Medical Research has initiated a Ph.D. degree granting program in Molecular Medicine for a highly select group of young M.D.s who are committed to a career in biomedical research.

Molecular Medicine
- a new and exciting field which integrates molecular and structural biology, biochemistry and immunology
- focuses on elucidating the fundamental mechanisms of disease
- develops molecular means of diagnosing, treating and preventing disease

The Picower Institute for Medical Research
- is located on Long Island's North Shore, 45 minutes from Manhattan
- in a dedicated research building at North Shore University Hospital, which is affiliated with New York University School of Medicine
- contains 14 outstanding groups working on chronic and infectious diseases
- founded by Anthony Cerami, previously Professor of Medical Biochemistry and Dean of Rockefeller University

The Picower Graduate School of Molecular Medicine
- offers a Ph.D. degree for M.D.'s, chartered by the University of the State of New York: Tuition fees--none; Stipend--$35,000; Time--3 years; Focus--laboratory research; Teaching--tutorials, seminars, courses
- Applications: Letter--research interests, clinical experience, goals; Curriculum vitae; 3 recommendations; Transcripts
- To: Dr. Annette Lee
  Director of Educational Programs
  The Picower Institute for Medical Research
  350 Community Drive
  Manhasset, NY 11030 USA
ABL Basic Research Program

POSTDOCTORAL FELLOWSHIPS

at the National Cancer Institute-Frederick Cancer Research and Development Center

Molecular Mechanisms of Carcinogenesis

George F. Vande Woude, Ph.D., Program Director molecular basis of neoplastic transformation; role of proto-oncogenes in cell cycle regulation

Stephen H. Hughes, Ph.D. structure and function of HIV reverse transcriptase; src oncogene; expression of cytoskeletal genes; retroviral vectors; transgenic birds and mammals

George N. Pavlakis, M.D., Ph.D. eukaryotic gene regulation; molecular biology of HIV and pathogenesis of AIDS

Barbara K. Felber, Ph.D. molecular biology of human retroviruses; posttranscriptional mechanisms of gene regulation

Peter F. Johnson, Ph.D. mammalian bZIP transcription factors; protein structure, dimeric interactions, mechanisms of transcriptional activation, and regulatory functions during cell differentiation and development

Deborah Morrison, Ph.D. role of the proto-oncogene c-ras in mitogenesis and developmental pathways; structure/function analysis of c-ras; identification of signal-transducing molecules

David Kaplan, Ph.D. signal-transducing molecules in mitogenesis, oncogenesis, and development; identification and characterization of substrates of receptor and nonreceptor tyrosine kinases; function of trk genes

Chemistry of Carcinogenesis

Anthony Dipple, Ph.D. polycyclic aromatic hydrocarbon carcinogenesis and mutational specificity; chemical carcinogen-DNA interactions

Robert C. Moschel, Ph.D. chemical synthesis of carcinogen-modified DNA; physical chemistry of carcinogen-DNA interactions; DNA adduct-induced mutagenesis in bacteria and mammalian cells; chemotherapy adjuvants

Chromosome Biology

Stuart J. Austin, Ph.D. chromosome stability in bacteria; regulation of plasmid replication and distribution of copies to daughter cells

Donald Court, Ph.D. regulation of gene expression by transcription initiation, transcription termination, and RNA processing

Eukaryotic Gene Expression

Jeffrey N. Stratthern, Ph.D. recombination; pseudogene formation; DNA repair in yeast; cell type regulation; gene expression

David J. Gartinkel, Ph.D. molecular biology of the retrotranspon Ty; genome rearrangement; insertional mutagenesis; gene regulation

Amar J.S. Klar, Ph.D. mating-type switching of fission and budding yeast; genetics and molecular biology of recombination; gene regulation

Molecular Virology and Carcinogenesis

Stephen Orozlan, Ph.D. immunoochemistry and protein chemistry of retroviruses; structure and function of retroviral gene products; viral proteases

Alan R. Rein, Ph.D. retroviral genetics; functional analysis of retroviral genes using natural and synthetic mutants; viral pathogenicity

Nancy R. Rice, Ph.D. study of the rel oncogene and the related NF-kB family of transcription factors

Mammalian Genetics

Neal G. Copeland, Ph.D. development of mouse models of human disease; neurofibromatosis; gene targeting in ES cells

Nancy A. Jenkins, Ph.D. molecular genetics of mouse development; transgenic mice; receptor ligand interactions and their role in development

Peter J. Donovan, Ph.D. development of the mouse germ line; germ cell gene expression; sterile mutants; cell adhesion molecules

Macromolecular Structure

Alexander Wlodaver, Ph.D. structure of enzymes and cytokines studied by X-ray diffraction

Christopher J. Michejda, Ph.D. antineoplastic and antiviral drug design; biochemical and molecular pharmacology

R. Andrew Byrd, Ph.D. structure of proteins and carbohydrates studied by macromolecular NMR techniques

The ABL Basic Research Program is dedicated to basic research in molecular biology, biochemistry, crystallography, genetics, virology, and organic chemistry. The scope of current projects is indicated by the research interests of the senior scientists listed above. Senior staff members enjoy complete independence in their choice of research problems and are accorded excellent facilities to accomplish their goals. A vigorous seminar program, implemented by formal and informal arrangements with the National Institutes of Health, Johns Hopkins University, University of Maryland, and other research and academic institutions, provides opportunities for extensive interaction within the scientific community.

The FCRDC is located in Frederick, Maryland, which with its proximity to Washington, D.C., and Baltimore offers a rich scientific and cultural environment, as well as a quiet country setting.

Fellowships are awarded on an equal opportunity basis to recent recipients of an M.D., a Ph.D., or an equivalent degree in the biological or biochemical sciences. Postdoctoral training opportunities are available with the staff members listed above as well as other scientists associated with the Program.

Appointments are made for one to three years. Annual stipends generally range from $25,000 to $31,000, depending upon experience.

Interested individuals are encouraged to apply well in advance of their availability date. The ABL Basic Research Program does not discriminate in employment on the grounds of sex, race, color, age, religion, disability, or national origin.

To apply, send a letter describing your research interests, a curriculum vitae, and the names and addresses of three references to the investigator(s) of interest, c/o ABL Basic Research Program, Personnel Department/Scl, NCI-FCRDC, P.O. Box 6, Bldg. 428, Frederick, Maryland 21702-1201.

The Basic Research Program is operated by Advanced BioScience Laboratories, Inc., under contract with the National Cancer Institute. EOE M/F/D/V