

OPPORTUNITIES IN THE UNITED STATES FOR TRAINING IN BIOTECHNOLOGY FOR PARASITIC DISEASE INVESTIGATIONS

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ABSTRACT

In the United States there are academic, governmental and industrial training opportunities in biotechnology that are applicable to the study of parasitic disease.

Academic opportunities are the most plentiful. At least 130 universities in the United States have training programs in which current biotechnologies are being used to investigate parasites of economic or public health importance. Further, there are at least 70 centers of biotechnology in the United States. In these centers, many of which are located on university campuses, new biological techniques are being applied to both basic and applied research projects.

The United States government administers more than 20 research programs that utilize current biotechnology to conduct parasitic disease research programs. These programs are conducted in or supported with resources of the following agencies: the Departments of Agriculture, Health and Human Services, Defense, and Interior, the Agency for International Development, the National Science Foundation, the National Academy of Sciences, and the Environmental Protection Agency.

Commercial firms using biotechnological methods for production of biologicals and other reagents, provide an opportunity for on-the-job training and experience in the application of these new technologies to parasites diseases of major economic or public health importance.

INTRODUCTION

In the United States, scientists and can obtain training in biotechnologies, applicable to parasitic diseases of economic and health importance to Indonesia, in universities, government laboratories and industrial firms.

ACADEMIC TRAINING OPPORTUNITIES

Six directories of academic institutions in the United States provide listings of

programs available at universities in the United States.

The American Society of Parasitologists Directory, entitled "Opportunities for Graduate Training in Parasitology", identifies universities with programs in immunoparasitology and molecular biology. This directory can be requested from :

Secretary-treasurer
American Society of Parasitologists
1041 New Hampshire St.
P.O. Box 368
Lawrence, Kansas 66044, U.S.A.

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Bethesda, Maryland 20814-4799 U.S.A.

The 1989 edition of Peterson's Graduate Programs in Biological, Agricultural and Health Sciences reviews 5,500 research and applied professional programs in the United States and Canada. The current edition lists 12 universities with programs in biotechnology, 130 universities with programs in cellular and molecular biology programs, and numerous universities with basic immunology programs. Peterson's guide is a valuable source of information that, if used in combination with the directory provided by the American Society of Parasitologists, identifies universities with solid parasitology programs and in-dept educational opportunities in biotechnology. The current edition can be ordered from :

Peterson's Guides
P.O. Box 2123
Princeton, New Jersey, 08540 U.S.A.

A Directory of Graduate Programs in Agriculture, Biological Sciences, Psychology, Health Sciences and Home Economics can be ordered from :

Graduate Record Examinations
Educational Testing Services
Princeton, New Jersey, 08541-6014
U.S.A.

A report on **The US Capacity to Address Tropical Infectious Disease Problems** was published in 1987. This report identified 150 US Universities with tropical infectious disease experts, 15 universities with program in tropical infectious diseases and 8 centers of expertise in tropical infectious diseases. This publication can be ordered from :

Board on Science and Technology
for International Development
National Research Council
2101 Constitution Ave, NW
Washington, DC 20418 USA

A Directory of U.S. Courses in Biotechnology for Developing Country Scientists was published in 1984. Although this directory is now five years old, it is still a useful listing of various courses in biotechnology offered in United States universities. A copy can be requested from :

Board on Science and Technology
for International Development
National Research Council
2101 Constitution Avenue, N.W.
Washington, D.C. 20418 USA

A more recent development in the United States has been the creation of centers of biotechnology. More than seventy such centers are listed in a **Directory of Biotechnology Centers 1989**. These centers organize groups of faculty with expertise in a variety of biotechnologies into a single unit. They provide resources and services in technologies that economically can not be duplicated in each department. In addition, they provide a bridge between the basic science interests of the faculty and the mushrooming applied interests of the industrial sector. A copy of this directory can be ordered from :

Information Program
North Carolina Biotechnology Center
P.O. Box 13547
Research Triangle Park
North Carolina 27709-3547 USA

GOVERNMENT TRAINING OPPORTUNITIES

Government agencies fund training programs in their own laboratories and in universities, and they provide sites where scientists and students with their own support can obtain research experience. Training opportunities available to foreign students in federal agencies investigating parasitic dis-

ease problems are reviewed here in and the requirements for participation are summarized.

UNITED STATES DEPARTMENT OF AGRICULTURE (USDA)

Animal Parasitology Institute

The USDA provides training opportunities for pre- and postdoctoral fellows in immunogenetics, immunology, biochemistry, endocrinology and molecular biology. Fellows can be supported by USDA or provide their own source of support at the institute. Candidates for fellowships simply must possess the technical qualifications for the research project. Further information can be obtained from :

Director, Animal Parasitology Institute
U.S. Department of Agriculture
Beltsville, Maryland 20705 USA

International Training Programs

Training programs are conducted by the USDA at land grant universities throughout the country, Resources from other agencies such as USAID are used to support collaborative international training programs at land grant universities. Further information is available from :

Office of International Cooperation and Development
International Training Division
U.S. Department of Agriculture
Room 4118, Auditors Bldg.
14 th & Independence West
Washington, D.C. 20250 USA

International Research Division

The office of International Cooperation and Development funds research projects of

interest to the USDA in countries other than the United States. Training in an U.S. institution that is germane to the project can be undertaken in the United States and funded with USDA project resources. Additional information can be obtained from :

Office of International Cooperation and Development
International Research Division
U.S. Department of Agriculture
Room 4200, Auditors Bldg.
210 14th Street, N.W.
Washington, D.C. 20250 USA

DEPARTMENT OF HEALTH AND HUMAN SERVICES

National Institutes of Health (NIH)

The NIH Visiting Program offers talented scientists the opportunity to receive further training in a variety of biomedical specialties including parasitology. An appointment to the Visiting Program is requested through a senior investigator at NIH who will serve as the applicant's sponsor. Each participant in the Visiting Program at NIH will work closely with a senior investigator at NIH. Anyone interested in the Visiting Program at NIH should send his or her resume' to a senior scientist at NIH who is working in the applicant's field of interest. Senior investigators are listed in the **Scientific Directory and Annual Bibliography** published by NIH.

A copy can be requested from :

Office of Communications & Public Inquiries
National Institutes of Health
Building 31, Room 2B10
Bethesda, Maryland 20205 USA

In addition to the Visiting Program, the NIH sponsors pre- and postdoctoral fellowships, guest workers and tropical diseases fellowships.

Pre- and Postdoctoral Fellowships from NIH are available through the NIH extramural research program, e.g., grants that NIH awards to scientists in universities throughout the United States. Candidates for these fellowships must apply directly to a scientist who has been awarded a grant from the NIH.

Guest Workers at NIH area scientists or students who work under the sponsorship of a NIH scientist but with personal support from a source other than NIH. Anyone interested in the Guest Worker program should send a resume to a senior scientist at NIH in the field of his or her interest. A list of senior scientists at NIH is found in the **Scientific Directory and Annual Bibliography** which is published by NIH.

The Tropical Diseases Fellowships program at NIH is a special postdoctoral research program that is available to non-United States citizens. This program is administered through the John P. Fogarty International Center for Advanced Study in the Health Sciences at NIH. Further information on this program should be requested from :

John P. Fogarty International Center
for Advanced
Study in the Health Sciences
National Institutes of Health
Bethesda, Maryland 20205 USA

Center for Disease Control (CDC)

The CDC has four programs to support training in the application of biotechnologies to investigation of parasitic disease problems:

Visiting Scientist program at CDC employs foreign scientists as members of the CDC staff.

Guest Research program provides foreign scientists who are sponsored by a CDC scientist with the facilities to conduct research. However, guest Researchers are responsible for their own personal support.

International Epidemiology Fellowships are available. These fellowships are usually awarded to foreign doctoral scientists who are employees of their respective Ministry of Health. Fellows receive a stipend from CDC while they conduct the program of epidemiological research outlined in their application. Postdoctoral and Senior Research Associateships are available in the Center for Infectious Diseases at CDC. Candidates must possess a doctoral degree and demonstrate ability for creative research.

Further information regarding the Visiting Scientist, Guest researcher and International Epidemiology Fellowship programs can be requested from :

Office of the Director for
International Health
Centers for Disease Control
Atlanta, Georgia 30333 USA

DEPARTMENT OF DEFENCE

Naval Medical Research Institute (NMRI)

Resident Research Associateships in Parasitology are available at NMRI. Currently, parasitological research at NMRI is focused on development and evaluation of a malaria vaccine. Further information can be requested from :

Scientific Director
Building 17B, Room 123
Naval Medical Research Institute
National Naval Medical Command
Bethesda, Maryland 20814 USA

**Walter Reed Army Institute of Research
(WRAIR)**

Resident Research Associateships in Parasitology are available in three divisions of WRAIR. The Division of Biochemistry has programs in biochemical and molecular parasitology; programs in the Division of Communicable Diseases and Immunology emphasize immune responses to parasites, development of field applicable diagnostic tests for parasites in their arthropod vectors, and defining the role of nonspecific immunity to parasitic disease agents; and the Division of Experimental Therapeutics conducts extensive investigations on the chemotherapy and chemoprophylaxis of parasitic diseases. Further inquiries should be directed to :

Associate Director for Research
Management
Walter Reed Army Institute of
Research
Washington, D.C. 20307-5100

**Uniformed Services University of Health
Sciences (USUHS)**

The USUHS offers a doctoral degree in Medical Zoology (Medical Parasitology and Vector Biology) and advanced courses in biochemistry, cellular and molecular biology, and immunology are also available. The university is also an United States center for tropical infectious disease research. This concentration of tropical infectious disease expertise and a strong basic science program using current biotechnology, provide an ex-

cellent opportunity for applying new technology to classical parasitic and vector borne diseases.

Additional information can be requested from:

Associated Dean for Continuing and
Graduate Education
Uniformed Services University of the
Health Sciences
4301 Jones Bridge Road
Bethesda, Maryland 20814 USA

**UNITED STATES AGENCY FOR IN-
TERNATIONAL DEVELOPMENT
(USAID)**

**Program for Science and Technology
Cooperation**

This USAID program supports who apply state-of-the-art technology to problems of international or regional interest. Research topics of special emphasis are : (1) biotechnology and immunology in human and/or animal system, including recombinant DNA technology, hybridoma technology and related immunological techniques for better and more rapid diagnosis, immunotherapy, vaccine development; and (2) biological control of human schostosomes and their snail vectors, emphasizing ecologically acceptable interruption of disease transmission based on microorganisms-host-vector relationships, genetics, biochemistry, immunology, natural predation, and pathobiology. Additional information is available from :

Office of the Scientific Advisor
Agency for International
Development
Washington, D.C. 20523 USA

NATIONAL SCIENCE FOUNDATION (NSF)

Division of International Programs

The NSF supports U.S. scientists who collaborate with scientists from abroad through its Division of International Programs. The U.S. scientist submits the proposal and select qualified candidates from abroad to participate in the project.

The National Science Foundation also published a selected list of fellowship opportunities and aids to advanced education in the United States for foreign nationals. This listing can be requested from :

The Publication Office
National Science Foundation
100 G Street, N.W.
Washington, D.C. 20550 USA

DEPARTMENT OF INTERIOR (DOI)

Two division of DOI conduct research programs involving parasitic diseases of wildlife and fish. The National Wildlife Health Laboratory sponsors research of pre- and postdoctoral students whose parasitological research is pertinent to Wildlife Division's own research programs. Further inquiries should be directed to :

Training Officer
National Wildlife Health Laboratory
Madison, Wisconsin USA

The National Fish Disease Laboratory sponsors pre- or postdoctoral students whose parasitological research programs are compatible with the facilities and interests of the laboratory. In addition, the Fisheries Academy offers intensive courses on diseases of fish. Students provide their own support or

are supported by other sponsoring institutions. Additional information of the National Fish Disease Laboratory and Fisheries Academy is available from :

Superintendent
Leetown National Fisheries Center
Leetown, West Virginia USA

Fish and Wildlife Cooperative Research Units

There are 38 Cooperative Research Centers situated at universities throughout the United States. These units are devoted to wildlife or fisheries research, including parasitic disease investigation, and they offer programs leading to Master or Doctoral Degree. Funding for graduate students can come from a variety of sources. Additional information on these units may be obtained from :

Department of Cooperative Units
Fish and Wildlife Service
Mactomic Room 527
Washington, D.C. 20240 USA

ENVIRONMENTAL PROTECTION AGENCY (EPA)

Postdoctoral and Senior Research Associateships

EPA's office of Research and Development supports research efforts in parasitology at its Health Effects Research Laboratory. Associateships offered for research of parasitic contaminants of water systems with primary interest directed toward recovery of *Giardia lamblia* cysts from drinking water and *Ascaris ova* survival in sludge-amended soils. Further inquiries regarding parasitological research opportunities in this laboratory is available from :

Microbiology Division
Health Effects Laboratory
Environmental Protection Agency
Cincinnati, Ohio 45268 USA

NATIONAL ACADEMY OF SCIENCES

National Research Council(NRC)

The NRC's Office of scientific and Engineering Personnel is charged with administering Resident Research Associateship programs. Four of these programs that provide advanced training in the application of new biotechnologies to parasitic diseases are located in the following government laboratories: the Naval Medical Research Institute, the Walter Reed Research Institute, the Centers for Disease Control and the Environmental Protection Agency. Further information is available from :

Associateship Program
National Research Council
2101 Constitution Avenue, N.W.
Washington, D.C. 20418 USA

Howard Hughes Medical Institute, Doctoral Fellowships in Biological Sciences

The Howard Hughes fellowship program is for graduate work in research based doctoral programs in biological sciences: biochemistry, cell biology and cell regulation, developmental biology, genetics, microbiology and virology, and molecular biology, etc. Further information may be obtained from :

The Fellowship Office
National Research Council
2101 Constitution Avenue, N.W.
Washington, D.C. 20250 USA

COMMERCIAL OPPORTUNITIES

There are at least 400 commercial firms in the United States utilizing biotechnology. Companies, developing and marketing products for the diagnosis, treatment and prevention of parasitic disease, seek qualified technical and professional employees, especially those with strong backgrounds in biochemistry and immunology. These firms provide excellent on-the-job sites for training in the application of new biotechnologies.

Genetic Engineering News published an annual **Gen Guide to Biotechnology Companies in the United States**. This guide, which provide the names, addresses, technologies employed, markets, major products and technologies available, can be ordered from :

Genetic Engineering News
1651 3rd Ave
New York, New York, 10128 USA

Genetic Engineering and Biotechnology Related Firms, Worldwide Directory - Technical Highlights and Funding Sources is another annual directory of biotechnology firms. This directory is available from :

Sitting & Noyes
P.O. Box 592
Kingston, New Jersey 08528 USA

Scientists interested in on-the-job exposure to the front wave of biotechnology, as it applies to the development of human and animal health related products in an industrial atmosphere, should initiate correspondence with those commercial companies currently applying biotechnology of interest to them.

SUMMARY

In the United States there are academic, governmental and industrial training oppor-

tunities in biotechnology. Academic opportunities are by far most plentiful. At least 130 universities in the United States have training programs applicable to the study of animal and human parasitoses in Indonesia. Further, there are at least 70 centers of biotechnology located on university campuses where a variety of biotechnologies are being applied to a wide range of research projects. The government administer 20 programs through its own institutions. Government institutions conducting or supporting parasitic disease re-

search programs are : the Departments of Agriculture, Health and Human Services, Defense, and Interior, the Agency for International Development, the National Sciences Foundation, the National Academy of Sciences, and the Environmental Protection Agency. Commercial firms, applying biotechnology for production of biologicals, can provide on-the-job training and experience in the application of these new biotechnologies to applied parasitic disease problems of relevance to scientists in Indonesia.

QUESTIONS AND ANSWERS :

1. Question: Could you explain more about the requirements and qualifications for a "guest-worker" ?
 Answer : You must be sponsored by a government scientist and a government laboratory. You must provide your own support while you work in that laboratory. Qualification vary, most would possibly be MD or PhD scientists with the same interests as the US government sponsor.

2. Question: 1. Would you like to give us guidance, how to get USDA/NIH/USAID/ and other outer fellowships successfully.
 2. Among the persons of the US Team of this meeting, is there any person who act as "strong man" in USAID, NIH, USDA, and other supporting centres, that could sponsor us to get the sponsorship.
 Thank you.
 Answer : 1. Determine first your own training goal with specific objectives. Then find out where that type of training can be obtained, e.g. in which government organizations or universities are there active research programme that are focused on your training goal.
 2. The US Team is comprised of members from the Department of Defense and from a variety of Universities. Any member of the team could serve as a "point of contact" or "strong man" in his or her institution.
 You can find "strong man" in organization like NIH or USDA through review of current parasitological journals. Find individuals whose professional interests match yours.

3. Question: Could you mention which of the Academic, Government, agencies for training, that the arrangements or applications should be through governmental, or university/institution.
 Answer : **Academic:** You must apply to the scientist you wish to ask for sponsorship whether or not you have your own source of support.
Government: You have to apply through official channels but you better establish a personal linkage with scientists in the government agencies to which you apply.