

UNLAWFUL COMMUNICATION

Department of HEALTH, EDUCATION, AND WELFARE PUBLIC HEALTH SERVICE APPLICATION FOR GRADUATE TRAINING GRANT UNDER THE PUBLIC HEALTH SERVICE ACT

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23-295 GRTC (1) March '59 Council

ATTENTION:

NOV 20 1958

Date November 1, 1958

- NATIONAL INSTITUTE OF ARTHRITIS AND METABOLIC DISEASES
NATIONAL HEART INSTITUTE
NATIONAL INSTITUTE OF NEUROLOGICAL DISEASES AND BLINDNESS
DIVISION OF RESEARCH GRANTS
NATIONAL INSTITUTE OF ALLERGY AND INFECTIOUS DISEASES

- NATIONAL CANCER INSTITUTE
NATIONAL INSTITUTE OF DENTAL RESEARCH
DIVISION OF NURSING RESOURCES PHS
Div Gen Med Sci

AREA (see Instruction Sheet)

GENETICS

Application for a training grant is hereby made by the institution named below for the subject and purpose indicated. The amount requested is based on estimated requirements for a one year period, but not limited in availability to such period. (See Instructions.)

Table with 2 columns: PERIOD (April 1, 1958 through March 31, 1960) and AMOUNT REQUESTED (\$113,616)

- PURPOSE (check appropriate SINGLE item)
A [X] Establishing new training program
B [] Expanding present training program
C [] Improving present training program
D [] Continuing grant-supported training program

Table with 2 columns: NAME AND TITLE OF TRAINING PROGRAM DIRECTOR, NAME OF INSTITUTION, NAME OF DEPARTMENT, NAME AND TITLE OF DEPARTMENT HEAD, NAME AND TITLE OF FINANCIAL OFFICER, NAME AND TITLE OF OFFICIAL AUTHORIZED TO SIGN FOR INSTITUTION. Corresponding mailing addresses for each role.

AGREEMENT

It is understood and agreed by the applicant: (1) that funds granted as a result of this request are to be expended for the purposes set forth herein; (2) that the grant may be revoked in whole or in part at any time by the Surgeon General of the Public Health Service in the event that the funds are not utilized in accordance with the purposes set forth in this application; (3) that the training center will comply with the current requirements established by the Surgeon General to qualify for training grants; and (4) that, if any invention arises or is developed in the course of the work aided by any grant received as a result of this application, the applicant institution will either (a) refer to the Surgeon General for determination, or (b) determine in accordance with its own policies, as formally stipulated in a separate supplementary agreement entered into between the Surgeon General and the grantee institution, whether patent protection on such invention shall be sought and how the rights in the invention, including rights under any patent issued thereon, shall be disposed of and administered, in order to protect the public interest.

PERSONAL SIGNATURE

(Sign original only if ink)

Frederic O. Glover, Assistant to the Preside

These dates to be the same as period on page 1.

1A. Budget Proposed for the Year April 1, 1959, 19 through March 31, 1960, 19

CATEGORY AND ITEM (Use additional blank sheets, if needed)	% time on grad. trng. proj. & related resch	BUDGET	
		REQUESTED FROM P.M.S.	OTHER SOURCES
PERSONNEL (Itemize) figures yearly basis; see*			
J. Lederberg, Professor; Proj. Director	80	--000--	University salary
(a) Professor of Genetics	85	--000--	--
(b) Assistant Professor of Genetics	90	10,000	--
(c) Instructor in Genetics	90	4,000	4,000
G. Nossal Research Associate	100	----	7 500
Esther M. Lederberg Research Associate	100	----	6 500
Diener; secretary; dishwashers	90	6,000	6 000
Technical assistants (research programs)	100	----	20 000
TRAINING STIPENDS (first year scope)			
4 + ? Postdoctoral trainees at 5,000 avg	100	20 000	variable and unpredictable;
6 + ? Predoctoral 2,200	100	13 200	personal fellow
*Adjustment personnel & stipends a/c initial delay less		-12 000	ship awards from
4, Medical student: part time res. fellows at 1000	30	4 000	Univ., NSF, NIH
O.A.S.I.		370	etc.
CATEGORY TOTAL		45,570 xxxxx	75 - 90,000xxx
PERMANENT EQUIPMENT (Itemize) LABORATORY APPARATUS;			
Autoclave 2500; refrigerators 1500; refr. centrifuge 2000; dishwasher 1500; Microscopes 6000; stereo-			also capital
microscopes 1800; Micromanipulators 2000; Animal cages and animal room eq. 1500; Other items: 20,000 (these are mainly utility items less than 500 per unit, not special apparatus)			construction
CATEGORY TOTAL		18 400 xxxxxxxx	University: \$ 70,000
CONSUMABLE SUPPLIES (Itemize) Connected research --			
Chemicals, glassware, animals, office supplies avg. 600 per trainee; 200 per fellow, per annum (pipettes, plates etc) initial stocking		6 800	5 000
General deptl. operation		5 000	3 000
CATEGORY TOTAL		11,800xxxx	8 000 xxxxx
TRAVEL Staff, related to program administration av 250			
		1 000	
Trainees, avg. 300 postdoct; 200 predoct; mtgs & labs.		2 400	
Visiting seminar speakers 4 at 250		1 000	
CATEGORY TOTAL		4,400 xxxxx	2 500 xxxxx
OTHER EXPENSE (Itemize) Tuition 6 x 1005			
Remodelling and furnishing research trng facilities		6,030	
Genetics library, 3000 initial + 3000 per annum		15 000	25 000
CATEGORY TOTAL		4 000	2 000
CATEGORY TOTAL		25,030 xxxxx	27 500 xxxxx
SUBTOTAL		105,200	
INDIRECT COSTS (Not to exceed 8% of subtotal)			
		8,416	
1B. TOTAL FOR THE YEAR		113,616	

1C. ESTIMATE OF FUTURE REQUIREMENTS

FIRST ADDITIONAL YEAR \$ 111,153 THIRD ADDITIONAL YEAR \$ 141,264 \$ 111,000

SECOND ADDITIONAL YEAR \$ 139,320 \$ 110,000 FOURTH ADDITIONAL YEAR \$ 157,874 \$ 111,000

2. List support for this training program from all sources, including the Public Health Service. Specify the source in each case.

SOURCE	AMOUNT	PERIOD OF SUPPORT
PREVIOUS (within last five years)	NONE: NEW PROGRAM	*** --
RESEARCH Grants pending, related to graduate training program: Further applications will doubtless be filed by other staff after they are appointed.	Lederberg - Genetics of Bacteria - NSF (renew) \$ 20,900 NIH (transfer of C-2157 from Univ. of Wisconsin) \$ 13,000 Lederberg & Nossal - Cell. genotypes in antibody form \$ 21,000	avg. per yr 5 yrs. 1959 - 1963 4 1/2 yrs 1959 - 1963 5 yrs 1959 - 1963
CURRENT Ly Committed Stanford University: Staff salaries and other expenses Department of Genetics Construction and equipment	40, 000 80, 000	1959
PENDING applications. None specifically for training program of the department. See listing above for program-related research projects An unpredictable number of personal fellowship awards may support individual candidates.		

TRAINING PLAN AND SUPPORTING DATA

On the continuation pages provided, give details of the proposed training plan and other necessary data in accordance with the outline below. Number each page consecutively. Additional continuation pages, if needed, may be requested from the appropriate Institute.

Before preparing this portion of the application, see the instruction sheet from the specific Institute to which you are applying.

I. PROPOSED PROGRAM

- A. Purpose: provide a complete but concise statement of the training needs that the proposed training program will fulfill.
- B. Training Plan:
 1. Describe the current training program (if any) at your institution in this area of training.
 2. Describe the proposed training program for which support is requested.
 3. Provide a list of the categories of professional personnel and the estimated number of persons within each category for whom training will be provided annually.

II. STAFF AND FACILITIES

- A. Staff: Provide brief biographical sketches of all professional staff having major responsibilities in this training program.
- B. Facilities: Describe the training facilities at your disposal.

Genetics Program at Stanford University

The opportunity to establish a program of genetics oriented to medicine has accompanied the move of the medical school from Stanford Hospital, San Francisco to the university campus. The new academic setting of the school symbolizes its orientation for the scientific foundations of medicine with strong emphasis on preparing students for academic, research and specialty. ^{careers} The educational program should encourage and accommodate the academic and research interests of the undergraduate medical students, as well as research by and advanced training for Ph.D. candidates and postdoctoral fellows. The recent appointment of Arthur Kornberg and of his accompanying staff in Biochemistry furnishes unique support for work in the biochemical and physiological aspects of genetics. The Genetics Department will have a definite role in the program of medical-undergraduate education, but this will be a relatively minor charge (20 to 30 lecture hours per year) on the time of its staff, and its principal role will be graduate training and research in cooperation with other departments. Primary responsibility for the undergraduate teaching of genetics and related remains with the Department of Biological Sciences in the School of Humanities and Sciences where Drs. Yanofsky and Perkins also pursue an active graduate program.

Plans for genetics did not materialize until after contracts had been let for present construction of the new medical center. However, the Departments of Pharmacology and Biochemistry relinquished 1800 sq. ft. of laboratory and office space to house the unit in microbial genetics. Equally important, we will share in their general facilities and services needed for the work (e.g. cold rooms, sterilizers, some special apparatus). Professors Kornberg (Biochemistry), Kaplan (Radiology), Goldstein (Pharmacology) and Alway (then Pediatrics, now Dean) personally played especially active roles in laying the groundwork for the foundation of the Genetics Department, a measure of their concern for establishing a secure place for genetics in the medical research and training program.

For the other units in genetics, 5000 sq. ft. has been set aside in a separate building about 600 feet away, this area, now utilized by Pharmacology, is especially adaptable for animal experimentation. The medical school is making provision for remodelling and refurnishing this area which, together with the funds requested in this application, should make this a not very fancy but a utilitarian facility. There is an admitted disadvantage even in this limited separation and the medical school is planning a substantial addition during the next few years to allow for a final consolidation of the genetics laboratories.

Genetics has had a long tradition at Stanford, in the medical school (e.g. Danforth in Anatomy), and elsewhere (e.g. the now classic studies of Beadle and Tatum in Biology), and there will continue to be considerable activity in several departments. The attached list names some of the colleagues with whom we would have the closest working relationships. This chart shows only an administrative skeleton but it may help to show the breadth of talent available to a trainee or research fellow. Professors Kaiser, Gross, Cohn, Yanofsky and Perkins are expecting to play a specially active role in joint sponsorship of the training of students and fellows with overlapping interests, and brief sketches for them are also appended.

We are not trying to "cover" every possible facet of genetics, for example we have no direct representation of work in *Drosophila*. On the other hand this

-2-

faculty represents a concentration of interests and skills on the problems of cellular determination and the participation of nucleic information in this and in the fundamental process of genetic replication. Fortunately we also have many congenial colleagues at the University of California who reinforce and complement our interests. The universities have recently made new agreements to help graduate students take better advantage of the academic pool. Finally, Professor van Niel's summer course in microbiology is a unique training opportunity (which was exploited as far as possible by the best graduate students in microbial genetics at Wisconsin).

The chart will give some idea of the breadth of genetical work on the campus as a whole. The final complexion of the Genetics Department itself will of course depend on the choice of its staff: 2 professors and a junior instructorship. These colleagues would be responsible for independent research programs, but we are looking for a balanced group to generate the utmost in mutual provocation, assistance and criticism, as among ourselves and in the training of students and fellows.

Professor Lederberg will be immediately responsible for the work in bacterial genetics, which will be a direct continuation of his research at the University of Wisconsin, 1947-1958 (see appendix.). The immediate program will stress: (1) the characterization of the sexual determinant 'F' in *E. coli* in its alternative nuclear and extranuclear phases; (2) the mating reaction by biochemical and cytogenetic analysis; (3) intergeneric hybridization, *Escherichia* X *Salmonella* and (?) *Escherichia* X *Pseudomonas*; (4) biochemical genetics (fine structure analysis) of mutations affecting enzymes for fermentation of various sugars; and (5) search for additional mechanisms of recombination, especially DNA-mediated transduction. Item (5) is urgently needed for a direct attack on the role of extranucleic information in cellular heredity, now a leading question in the controversies of geneticists and embryologists. This item also relates closely to Professor Kornberg's studies of biosynthesis of DNA which may soon call for a genetics of in vitro replication. His associate Dr. A. D. Kaiser has already made an exciting discovery of the transduction of Gal markers by DNA extracted from lambda phage and we are most eager to tie this in with our own longstanding devotion to the lambda transductional system.

Two remaining faculty appointments are planned: one full professor (from university funds) and one assistant professor (a non-tenure appointment, initial support for which is being requested in this application). These are being actively discussed with a limited group of qualified candidates.

In addition, we are requesting partial support for an instructor to initiate a project in tissue culture genetics. He may be expected to give practical training to the rest of us in this technique and, in due course, to expand his own research and graduate training activity.

Our expectation for the first of these appointments is to bridge the gap between these experimental studies on microbes and laboratory animals, on one side, and clinical studies on man, on the other. Sound work in human genetics today is impossible without a sound grasp of advanced biometrical methods to retrospectively exploit the large scale genetic 'experiments' of the human population. Ideally, we should recruit a candidate who was, at the same time, a sound biometrician and an experimentalist dealing with human material along lines material to the other

programs. The study of human blood factors perhaps will furnish the most apt area for such a program; one can point to contemporary studies of chemical polymorphism in human hemoglobins, chimerism in dizygotic twins, and mutation of serotype in the developing erythron as illustrations of quasi-experimental approaches to human genetics. We have the ultimate prospect of analysis of human genotypes through somatic cells in culture, though it is difficult to justify bypassing experimentally more suitable material such as in coisogenic lines of mice for the foundational work.

Our expectation for the other might be called "histogenetics": the genetics of tissue cells. The methodology of microbial genetics has already impressed a number of workers (e.g. George Klein, N. A. Mitchison) with the possibility of systematic genetic study of clones of mammalian tissue cells in transplant. The aim of such an approach is not to furnish another 'microorganism' (which may be rather more difficult to handle than *E. coli*) but to apply factorial analysis to hitherto elusive problems of the genetic basis of differentiation— in normal development, in the immune response and acquired tolerance, and in the initiation of cancer. The advantages of affiliating such a program with microbial genetics are obvious. In many respects, the immune response may be the most amenable aspect of differentiation owing to the extreme specificity of the induced cell type. Its genetic analysis might be expected to proceed by two main steps: (1) its basis in cellular heredity through vegetative reproduction, encompassing issues similar to that of induction versus selection in bacterial drug resistance, and (2) more hopefully, the establishment of procedures for recombination viz. parasexuality, transduction of micrurgical transplantation, which can lead to more precise localization of genetic functions in intracellular organelles. While this is getting under way, a study on the clonal basis of antibody formation is planned to be renewed immediately with the help of Dr. G. Nossal, who will be a visiting research associate for two years, 1959-1961 (cf. Nossal and Lederberg (1958)).

Although several prospects are being actively considered, the acute shortage of workers trained in mammalian genetics which motivates the NIH training grant program is bound to be reflected in difficulties in securing topflight people for the department. In this search, personnel rather than funds may prove to be the limiting factor. This applies especially to the full professorship. We plan not to hasten to fill these positions until they can be taken by candidates whose qualifications match the responsibilities and opportunities. However, they may still be filled at very short notice, and the availability of the funds here requested will make the negotiations so much more straightforward, that on both counts an optimistic view on the staff question is important to get the training program well under way.

The Genetics Department is construed as a basic science department; its members will hope to advise, but not undertake primary responsibility for, clinical functions such as counselling or diagnosis and treatment of genetic diseases. We have a tacit understanding that an active clinical genetics program will be undertaken in one of the clinical departments, perhaps Pediatrics or Medicine. Dr. Ruth T. Gross, Associate Professor and Acting Head of Pediatrics has voiced her own special interest in such collaboration. She is involved now in her own research with genetic factors in hemolytic anemia of the newborn, and is planning to spend 1959-60 on a post doctoral fellowship in genetics with Cavalli. Further proposals involving additional

staff in clinical genetics will be formulated in consultation with the new heads of the appropriate departments.

This discussion does not do justice to the values expected from other departments in the medical school. For example, Professor Henry Kaplan of the Department of Radiology leads an energetic study program of the cellular origins of tumor clones in inbred mice and on the immunological interactions of graft and host — the ready presence of his colonies of mice and their tumors will be of great advantage to the orderly development of our work in histogenetics. Professor Goldstein in Pharmacology is actively working on the genetic mechanism of drug-resistance in tissue culture. Although retired, Professor Danforth is continuing his studies on genetics of congenital malformation in mice (with Dr. Center) and has established a strong tradition of genetic research in the Anatomy Department, which department is interested in recruiting a younger staff member to succeed in this tradition of morphogenetic research. The Biophysical Laboratory is building a facility and organization to include studies (i.a.) on effects of radiant energy on microorganisms and tissue cells and technically exciting advances in non-optical microscopy (cf. Pattee, 1958). Outside the medical school, in the Biology Department, Yanofsky and Perkins are studying the enzymology of tryptophane mutants of *E. coli* and the formal genetics of *Neurospora* — projects very relevant and usefully complementary to our own. We are studying the most suitable administrative arrangements to effect the mutual exploitation of our resources; for the time being, although there are a number of geneticists in departments other than Genetics, our personal relationships and cohesion of interests are such as to assure the maximum benefits as among ourselves and our students.

Department of Genetics
Stanford University

Training Program: Budget Analysis

Year->	April- 1959			July 1- 1960			1961			1962			1963		
	a	b	c	a	b	c	a	b	c	a	b	c	a	b	c
Trainee Census															
categories*	4	6	4	6	8	4	9	10	6	9	10	6	10	12	6
total	14			18			25			25			28		

Staff Census: 2 Professors; 1 Assistant Professor; 1 instructor; 2-4 research assc

BUDGET:

						yr. total	%.	
personnel	\$ 16 000	✓	20 000	21 000	22 000	23 000	102 000	16.6
trainee stipends	29 200	✓	53 600	73 200	73 200	82 400	311 600	50.6
Equipment	18 400		3 000	2 000	2 500	2 500	28 400	4.6
Supplies	11 800		8 200	10 700	11 000	12 800	54 500	8.8
Travel -trainee	2 400		3 400	4 700	4 700	5 400	20 600	3.3
-staff	2 000		2 000	2 000	2 000	2 000	10 000	1.6
Tuition (b only)	8 040		10 720	13 400	13 400	16 080	61 640	10.0
Remodelling	15 000		--	--	--	--	15 000	2.4
Library	4 000		3 000	2 000	2 000	2 000	12 000	1.9
Annual Total Net:	106 840		102 920	129 000	130 800	146 180	615 740	
8 % Indirect cost:	8 547		8 233	10 320	10 464	11 694	49 259	
* Gross TOTALS	115 387		111 153	139 320	141 264	157 874	664 999	

* a: postdoctoral b: predoctoral c: medical student, part-time fellows

** calculated at \$= 1340 per annum (full time registration)

✓ prorated at about 3/4 for the initial year.

Summary of expenditures by class: (from training grant)

Trainees (Stipends; supplies, travel, tuition)	73 %.
Staff (salaries; travel)	18 %.
Facilities (remodelling, equipment, library)	9 %.

TRAINING PLAN

This plan summarized on the Budget Analysis sheet supposes that each staff member might accommodate up to 3 post doctoral (a) and 3 pre Ph.D. trainees (b), plus 2 medical student fellows (c). The instructor, as he matures would also share these responsibilities. A few additional trainees may be added to this population by virtue of private support from other sources. At present we contemplate that the major source of trainee stipends would come from the grant. The research functions of the department will be helped by but not dependent on this grant; however, for full scale training functions the program director does not visualize any alternative, regular source of support for the stipends that can be exploited without an intolerable diversion of his time from laboratory research.

We would expect the trainee census for the whole department to reach a steady state at 25-30 by 1961. The budget for 1959 shows an allowance for capital costs which is offset by a reduction in salaries and stipends to take account of expected delays in getting the program in gear. Subsequent increases are mainly for stipends, which will be awarded at the levels announced for PHS research fellowships in various categories. It should be stressed that expenditures directly to the account of the trainees will make up almost three fourths of the net total for the 5 year period. The remaining one fourth is a fixed cost which would not vary greatly with adjustments in the census. The starting date, April 1, 1959, coincides with the start of spring quarter; three graduate students are already committed to be on hand by then. Full scale operation, comprising several postdoctoral fellows is expected by July or August 1959.

The post doctoral fellows will probably be M.D.'s or Ph.D.'s in about equal proportions. Both from past experience and present intention most of these fellows will come with substantial accomplishment in biochemistry, microbiology, medicine or other fields besides genetics, having discovered only more recently the pivotal role that genetics may play in the development of their research interests. No rigid program is set for them and their training will consist of the conduct of research in association with one or more members of the staff (which may include other departments mentioned). They will be eligible to attend regular courses of instruction in any areas where they find themselves deficient. The relatively small size of the Genetics staff should manage frequent informal interchanges at seminars, etc., many of which will be held in common with Biochemistry.

Predocutorial trainees will be candidates for a Ph.D. in Genetics, or conceivably in a related department by arrangement. We are endeavoring to avoid too rigid a pattern in order to meet the diverse needs of trainees with different backgrounds and interests. Candidates with undergraduate credentials in Biology or Biochemistry will be expected to meet the standards of qualifying examinations in these departments. Special curricula will be set for students with an undergraduate major in Chemistry, Physics or Bacteriology who approach genetics from these quarters. With some supplementary work in microbiology, biometry and chemistry, the basic medical sciences curriculum of the combined M.D. course may qualify also. In addition to these diverse "background programs" every student majoring in Genetics will be expected to complete about 20 units (quarters x lecture hours) of specialized courses in genetics to be offered in the Biology and Genetics Departments in the specialties of the various professors. However, the main emphasis will be on the actual conduct of research and self-education in the library (see below) rather than didactic

didactic teaching. The course is expected to take four years after the bachelor's degree for most students. Exceptional students will be encouraged to diversify their research experience rather than accelerate their course. Our aim in selection and training will be to train graduates capable of functioning as research workers in genetics without further postdoctoral training, as far as possible. This extended course of training, which might frequently extend four years, may require occasional concessions of stipends for the final year over established scales.

The new, combined university-medical curriculum has as one object the encouragement of medical students in part time participation in research. In some cases, this might involve stretching out the M. D. course to allow for concurrent candidacy for another degree, M.S. in Medical Sciences, or a Ph. D. Selected students will be offered stipends in proportion to time actually spent as research assistants. Other academic programs to help bridge the gap between traditional clinical and scientific training, and research, will be under study.

The library plays a more important role in the training plan than indicated by its budget allotment (less than 2%), since the capacity for self-education is the most productive of skills. Fortunately, the Lane Medical library, a central repository for the western U.S. is being moved to a convenient location in the medical center, and should be eminently suitable for archival literature. The departmental library should supplement this by being a convenient center for recent periodicals and books, some of these in replicate in connection with advanced teaching and intensive laboratory reference use. Whenever possible, microfilm and microcard methods will be used, partly to conserve space, partly to familiarize trainees with the effective use of these devices and to focus attention on the growingly vexatious problems of communication and data retrieval. We would regard the library as one of the most important tools of research and training, though one whose mechanization has perhaps not kept pace with technological possibilities.

GENETICS AT STANFORD UNIVERSITY

(LEAVE BLANK)

2G-295

All schools will be centralized at the Palo Alto campus July 1959.

GRADUATE SCHOOL: A coordinating body for the administration of graduate work in the various operating schools of the University.

SCHOOL OF HUMANITIES AND SCIENCES

Department of Biological Sciences (Victor C. Twitty, Exec.)

David D. Perkins Formal Genetics of Neurospora
 Charles Yanofsky Genetic control of tryptophane synthetase
 Clifford Grobstein Experimental embryology of the mouse

SCHOOL OF MEDICINE

Department of Genetics (J. Lederberg, Exec.)

Joshua Lederberg; E. M. Lederberg; Peter Sneath Genetics of Bacteria
 --Professor-- } (Human Genetics
 - Asst. Professor- } (Histogenetics; transplantation
 --Instructor-- } Tissue cell clones in vitro
 G. Nossal (Vistg. Res. Assoc.) Cellular basis of antibody formation

Department of Biochemistry (Arthur Kornberg, Exec.)

A. Kornberg, P. Berg, D. Hogness Biosynthesis of proteins and amino ac. nucleic acids
 M. Cohn Biosynthesis of enzymes and antibodies
 A. D. Kaiser Physiological genetics of phage; transduction of Gal genes by phage DNA

Department of Pharmacology (A. Goldstein, Exec.)

A. Goldstein Development of drug resistance in tissue culture; and assoc. genetic control of bacterial cholinesterase; nucleotide intermediates in protein synthesis

Department of Anatomy

(W. W. Greulich, Exec.)

W. Greulich Racial factors in human growth patterns
 G. E. Danforth (Prof. emer.) Genetics of congenital malformation in the mouse

Department of Radiology

(H. S. Kaplan, Exec.)

H. S. Kaplan & assoc. Cellular origin of X-ray induced tumors; histocompatibility reactions of grafts and hosts

Department of Pediatrics

(Exec.)

R. T. Gross Biochemical genetics of hemolytic drug-sensitivity in the newborn

Department of

Clinical genetics

Past training record (Professor J. Lederberg, University of Wisconsin)
The following graduate students and postdoctoral fellows* have been significantly influenced in their academic careers by their association with the laboratory program at Wisconsin, (and, needless to say, vice versa.) The date refers to the Ph.D. degree or the termination of postdoctoral training and is followed by their current affiliation.

Graduate Students:	Ph.D.	
Lederberg, Esther M.	1950	Research Associate, U. of Wisconsin (-> Stanford)
Zinder, Norton D.	1952	Associate Member, Rockefeller Institute for Medical Research, New York
Morse, M.L.	1955	Associate Professor, Department of Biophysics, University of Colorado Medical School, Denver
*Howe, H.B. Jr.	1955	Assistant Professor of Biology, University of Virginia
Wright, Robert E.	1957	Lecturer, Department of Bacteriology, Melbourne University, Australia
Iino, T.	1958	Assistant, National Institute of Genetics, Misima, Japan
Richter, Alan A.	Jan. '59	(pending)

Postdoctoral Fellows:

Bradley, S.G.	Assistant Professor of Bacteriology, University of Minnesota Medical School, Minneapolis
Skaar, P.D.	Assistant Professor of Zoology, University of Montana, Bozeman, Montana
Stocker, B.A.D.	Member, Lister Institute for Preventive Medicine, London, England
Bernstein, Aleck	Research Microbiologist, Central Public Health Laboratory, London, England
Cavalli-Sforza, L.L.	Professor, Institute of Genetics, University of Pavia, Italy
Rubbo, S.D.	Professor of Bacteriology, Melbourne University

Orskov, Frits	Serologist, State Serum Institute, Copenhagen, Denmark
Orskov, Ida	Serologist, State Serum Institute, Copenhagen, Denmark
Heumann, W.	Docent, Botanical Institute, Technische Hochschule, Braunschweig, Germany
*Morton, N.E.	Assistant Professor of Medical Genetics, University of Wisconsin
Rotman, B.	Assistant Professor of Physiological Chemistry, University of Santiago, Chile

* (Jointly sponsored by Prof. J.F. Crow)

STAFF BIOGRAPHIES:

Program Director

Joshua Lederberg. b. Montclair, N.J., May 23, 1925. B.A. Columbia College 1944.
Columbia Univ. Medical School 1944-1946. Ph.D. (Microbiology) Yale Univ. 1947

University of Wisconsin, Department of Genetics: Assistant Professor 1947;
Associate Professor 1950; Professor 1954-1958. Department of Medical Genetics:
Professor and Chairman 1957-1958,

Stanford University: Department of Genetics, School of Medicine: Professor and
Executive Head 1959-----.

Visiting Professor of Bacteriology: Berkeley, 1950; Melbourne, 1957.

Department of Genetics

Professor --- to be appointed (Stanford University funds)

Assistant Professor --- to be appointed (funds from this grant)

Instructor ---- (one half, funds from this grant)

Gustav J. V. Nossal (as Research Associate in Genetics)

b. Bad Ischl, Austria, June 4, 1931. Emigrated to Australia 1939 and now
Australian citizen. B.S. (First class honors) Sydney University, 1952.

B. Med. and B. Chir. (First Class honors) Sydney University 1954. Ph.D.
(Experimental Medicine) Melbourne University 1959 (pending).

Resident, Senior Resident Medical Officer, Royal Prince Alfred Hospital 1955-1956

Research Fellow, Natl. Health and Med. Res. Council Austral., at Hall Institute
with F.M. Burnet 1957-1959. Dr. Nossal plans to accept a two year ap-

pointment at Stanford, 1959-61.

Esther M. Lederberg (as Research Associate in Genetics)

b. New York, N.Y. (née Zimmer). B.A. Hunter College 1942/. M.A. (Biology)

* Jointly sponsored by Prof. J.F. Crow

Stanford 1946. Ph. D. (Wisconsin)
Stanford 1946. Ph.D. (Genetics) Wisconsin 1950.

Scholar (mycology) N.Y. Bot. Garden 1941-1942 (with B.O. Dodge). Res. Asst. (Carnegie Institution of Washington, stationed at NIH, Bethesda) 1942-1943. Junior Biologist, PHS, NIH 1943-1944. USPHS Predoctoral Research Fellow 1948-1949. University of Wisconsin, Project Associate in Genetics, 1950-1958. Stanford University, Research Associate in Genetics, 1959-----.

Staff Members of other Departments, most closely affiliated with Genetics training program.

A. D. Kaiser. b. Piqua, Ohio, Nov. 10, 1927. B.S. Purdue, 1950. Ph.D. Calif. Inst. Techn. 1954. American Cancer Society Fellow at Institut Pasteur Paris, 1954-1956. Instructor, 1956-1958; Assistant Professor of Microbiology, 1958. Washington University School of Medicine. Stanford University, Asst. Professor of Biochemistry 1959-----.

Melvin Cohn. b. March 28, 1922, New York, N.Y. B.S., City College, N.Y., 1941; M.A. Columbia 1942; Ph.D. N.Y. Univ. 1949. NRC, Merck and other fellowships at Institut Pasteur Paris 1949-1954. Department of Microbiology, Washington University School of Medicine: ~~Instructor 1954~~, Asst. Professor 1954-1955; Associate Professor 1955-1957; Professor 1957-1959. Stanford University, Professor of Biochemistry 1959-----.

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Ruth T. Gross, b. June 24, 1920, Bryan, Texas (née Taubenhaus). B.A. Barnard College, 1941; M.D. Columbia University, 1945. Diplomate: American Board of Pediatrics 1952. Radcliffe Infirmary, Oxford, Eng., Instructor 1949-1950. Stanford University Medical School, Department of Pediatrics; Instructor 1950-1953; Asst. Professor 1953-1956; Associate Professor 1956-----. Acting Executive, 1957-----.

Avram Goldstein. b. July 3, 1919, New York, N.Y. B.A. Harvard 1940; M.D. Harvard 1943; Instructor, Associate in Pharmacology, Harvard, 1947-1951. Assistant, Pharmacological Institute, Berne, Switzerland, 1951-1952. Assistant Professor, Dept. Pharmacology, Harvard 1952-1955. Stanford University, Dept. Pharmacology, Professor and Executive 1955-----.

Henry S. Kaplan, b. April 24, 1918, Chicago, Ill. B. S., University of Chicago 1938; M.D. Rush 1940. Instructor, Asst. Professor of Radiology, Yale Univ. 1944-1947. Radiologist, NCI, PHS, 1947-1948. Stanford University, Department of Radiology, Professor and Executive 1948-----.

PUBLICATIONS

Some key publications from Professor Lederberg and his associates at the University of Wisconsin are cited in the attached summary (marked Q36). The following citations are selected to define the major research interests of connected staff:

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