Budget Justification

The table on the preceding page presents estimated costs for the current fiscal year (both as awarded and an updated estimate). It also presents the original estimate for FY1971, and a current estimate for the coming year which starts August 1, 1970.

In summary, ACME expects to spend $700,000 in direct costs in the current year and to receive user fees or income of about $170,000. For next year, costs are estimated at $750,000 for the base program plus an additional $90,000 for desirable budget restorations and contingency items. The budget justification material presented below contains three parts: (1) changes between amounts awarded and amounts to be expended in current year by budget elements; (2) review of base program requested for next fiscal year; and (3) explanation of proposed additions to base budget for next year and contingency items.

The major variation in expenditures for the current year is found in the part of the award allocated for services by IBM personnel as a result of IBM's unbundling. The Stanford Computation Center has adopted a position which does not permit acceptance of the IBM service engineering service agreement under its current restraints and conditions. Further, the IBM Service Engineer who has been servicing ACME's support needs, was transferred to the marketing group. ACME did receive some assistance from the former IBM Service Engineer, but was forced to use some of its own staff time to maintain the system software. S. E. Service on IBM's Operating System continues to be given without charge. The IBM S. E. service, programs, products, and staff training were budgeted to cost $16,380, but will result in less than $1,000 in actual cost. A second major change area involves engineering and technician services. In the past, ACME employed its own engineer and technicians. During the past year, ACME elected to use the services

of the Engineering Services Group attached organizationally to the Stanford Computation Center. These services are no longer budgeted under "salaries"; a new budget category of "Engineering Services" has been added. Finally, the funds originally budgeted for a second interactive graphics unit have been applied to the purchase of three add-on graphics units plus an input/output device control system. This equipment acquisition is the subject of separate correspondence in which N. I. H. approval is being sought at present.

Revenue from service charges in FY1970 will exceed the estimates prepared one year ago by approximately $70,000. Last July, user charges were estimated at $100,000 for the-04 year. This estimate was made on a highly conservative basis since this was to be the first full year of user charges and the impact of such charges was not known. During the past fiscal year, most of our users have become eligible to pay on the anniversary date of their grants. In the first half of the year, it became apparent that the original estimate was too low. A major rate decrease was made effective mid-February 1970, this gave some relief to the researchers whose grant funds had been reduced from earlier expectations. During May, 1970, ACME received income of approximately $14,000. Therefore, much of the effect of the rate reduction has been offset by increased utilization by paying users as well as an increase in the number of paying users.

The ACME renewal proposal included a budget for the second year of the three-year renewal amounting to $812,000. The Site Review Committee and N. I. H. Research Council have recommended that ACME be supported at a level of only $750,000 in Year 5. Therefore, a base budget of $750,000 has been prepared; however, it must be emphasized that some incremental funding over the $750,000 level is deemed essential in order for ACME to achieve a reasonable number of the goals established in the renewal proposal and to fulfill the requirements set down by the ACME users.

The base budget of $750,000 fails to provide adequate funding from ACME's viewpoint. If no more than this cost level were made available, the core research activities would suffer. ACME's top priority must now be placed on serving a community of users; and the development of new facilities and structures will have to be assigned a relatively lower priority. Also, the base budget permits no expansion of hardware facilities to accomodate growing user demands. (One minor exception to this statement is the purchase of additional core for the 1800 system which has been retained in the base budget because of the extreme need for added 1800 core for real time users.)

A desirable budget for ACME for the next fiscal year (FY1971) would be $840,000. This level of authorized cost ceiling would provide $42,900 for personnel, services, and supplies for development activities and expanded operating hours, and $47,000 for so-called "contingency" items. The items associated with each of these figures are presented below. In order to reduce the "desired" budget level to the base budget level, the following personnel costs were withdrawn:

System Programmer	$15,400
User Consultant (1/3)	4,262
Research Assistance	3,564
Secretarial Assistance	1,000
Computer Operators (for two added shifts per weeek)	2,915
subtotal, salaries	27,141
Staff Benefits on Above	3,736
Total, personnel	$30,877

The system programmer position identified above would constitute a reduction from present staff, or a redirection of charges to a user group. It is questionable whether alternate funding could be found in the current tight money situation. One-third of an exisiting full-time user consultant has been withdrawn from the base program budget with the assumption that his time will be charged to users' projects. The research assistance item would cover the hiring of graduate student assistants to help with various development tasks at ACME. Historically, such

student help has been found to be highly productive and creative. The secretarial assistance item reflects a part-time position created during the last year to reduce the amount of clerical work for the professional staff. The tight budget situation will cause elimination of this part-time position with the consequent transfer of clerical functions back to other staff. Finally, the additional shifts of operator coverage have been withdrawn. It was intended that the graveyard shifts on Sunday and Monday mornings would be covered during the coming year. As evening and nighttime use by users increase, it will become increasingly necessary for system functions to be performed on weekends and for the users' data on ACME to be available around the clock.

Other budget cuts from a "desired" budget level, exclusive of contingency items, were:

Outside Consulting	$ 500
Travel	1,000
Publications	1,000
Engineering Services	5,000
IBM Products and Services	1,500
Supplies	3,023
	$12,023

These were arbitrary cuts made in order to get the budget level down to $750,000. The most significant two items involve engineering services and IBM products and services. The engineering services budget has been cut from $20,000 to $15,000. It is likely that this leaves adequate funds for maintenance functions but nearly zero funding for development tasks. The IBM product and service budget items covers customer engineering service, system engineering service, and IBM educational courses. One system programmer course which we would like to make available for a staff person costs $2,500. This one course is highly recommended but has not been budgeted specifically. The education courses generally cost $80 to $150 for three to five day courses. The major six week course costing $2,500 will be incorporated in the contingency budget.

Contingency items which ACME feels should be included in the FY1971 (RR 311-05) budget include the following:

Added on-line storage (such as data cell and control unit, rented for six months)	$18,800
Second 2701 to accomodate added real time users or special devices (6 months rent)	5,800
Three additional "add-on" graphics units and interface hardware	15,000
Portable typewriter terminal and modems	5,000
Sub Total Equipment	44,600
System Programmer six week course	2,500
Total	$47,100

The added on-line storage device would supplement the two existing 2314 disk drives. It is assumed that normal system growth will result in need for some additional storage capacity within one year. The exact timing of this need is difficult to predict. The second 2701 device is likely to be needed within six months. The present 2701 device has four ports of which three are now used regularly. Support for new devices such as strip printers, mark sense readers, etc. would require additional port capacity from 2701's. In addition, satellite computer systems would likely be connected to the system via a 2701 port. Three "add-on" graphics would simply expand the number of public graphics terminals available to the users. The portable terminal and modems would prove useful for both staff and users of ACME. The portable terminal would facilitate work at home on evenings and weekends as well as presentations to prospective users of the system in their laboratories.

ACME proposes to use FY1970 income in excess of the $100,000 estimate to fund the non-contingency additions to the base budget level as well as the contingency items identified above.

Income for FY1971 (RR 311-05) would amount to $180,000 if the average monthly user fees were equal to May, 1970 fees. Some increase in paid usage appears

reasonable based upon overall utilization history. Therefore, ACME projects user fees for page minutes and disk storage at $220,000 for FY1971. Some attempt has been made to allow for rates, the tight money situation, user eligibility to accept charges in FY1970, normal usage growth, and resource capacity in making this estimate.

Category 1

Name: Anderson, D. Project: JOAN

Department: Genetics

Project Description: The project involves instrumentation and control of a mass spectrometer using a time-shared computer system interfaced with smaller data gathering devices.

Name: Bacon, V. Project: GAME

Department: Genetics

Project Description: Data collection, storage, analysis from Finnigan 1015 mass spectrometer. In this on-line project, the decision making capabilities of the computer are coupled with those of an operator to direct the operation of a Finnigan 1015 quadrupole mass spectrometer.

The computer is used to actively direct the operation of the mass spectrometer by controlling the mass filtering system of the instrument. It is used to recognize and control the voltage changes which define mass peaks and enable the rapid collection and presentation of data.

The computer traces out peak shapes of the known masses in a reference gas allowing the operator to determine correct mass positions, and to enter any shifts in calibration into the computer register for compensation automatically.

While taking data, the information may be displayed on an oscilloscope or recorded on magnetic tape. Once data is acquired, the structural identification of organic compounds is made from orthogonal coordinate or spiral base plots of mass spectra made by computer direction of a calcomp plotter. The system is also used to analyze gas liquid chromatograph effluent permitting the structural identification of mixtures of organic compounds.

Stored data offer the future possibility of spectra matching of unknown compounds.

Name: Bridges, J. Project: JOY

Department: Genetics

Project Description: Write programs to control a quadrapole mass spectrometer; collect, manipulate, and plot data from same.

Name: DeGrazia, J. Project: CLINIGAS

Department: Nuclear Medicine

Project Description: This project supplements a second project, RADIOGAS, whose purpose is the development of a project co-ordinating the use of a computer with an instrument called a metabolic gas analyzer. In contrast to RADIOGAS which will be used primarily for program development, this project will provide for the routine handling of patient data from studies where program development has been basically completed. This will allow us to account for our patient computer time independently of RADIOGAS.

Name: Hanawalt, P. Project: TRI_CARB

Department: Biological Sciences

Project Description: The project involves the use of radioisotope tracers in studies of the molecular biology of cell growth and repair of damage to genetic material. Materials studied include normal and malignant human cells in culture as well as polio and adeno-viruses and various other virus and bacteriophage systems important to medical research.

Name: Harrison, D. Project: CATH_LAB

Department: Cardiology

Project Description: An extensive cardiac catheterization data analysis program has been developed. Statistical analysis of the results obtained by the computer justify routinely using such a program on a day-by-day basis for calculation of the results of cardiac catheterization. This would greatly decrease the amount of time a physician need spend after the catheterization in analysis of the data. Because of the time required to complete a catheterization, the large size of the program and the fact that it is resident in core while data is being collected, serious consideration is now being given to the use of digitally coded magnetic tapes which may be played back after the completion of the catheterization. This would result in decreased computational cost. In addition, other catheterization laboratories in the area may then be in a position to utilize such a program.

Given the necessary computer reliability to routinely analyze catheterization data, a program is available to automatically transfer the results of computation to a patient record in a data file. Forms are available which will be used to obtain clinical, X-ray, EKG, and surgical followup data permitting statistical correlations on a large group of patients.

ACME is also being used to develop a program for recognition of abnormal EKG complexes. In the near future, we hope to be able to use such a program in a computer devoted to monitoring of Coronary Care Unit patients.

In view of the cost of the analysis of a complete cardiac catheterization, new programs are being developed for a small computer system to carry on the same type of analysis of the catheterization data as was originally programmed in the ACME system. These new systems will be compared for accuracy and reproducibility with the old system presently being utilized under the ACME Facility.

Name: Jones, R. Project: FLU

Department: Biochemistry

Project Description: Work with ACME centers around a nanosecond fluormeter designed by Stryer, et. al. which measures kinetics of fluorescence as a function of time directly. Data acquisition is accomplished through the 1800, and subsequent data reduction is carried out in the 360/50 proper. The instrument as a whole has been used to determine 1) excited state lifetimes of various organic fluorescent componds; 2) rotational relaxation times of various proteins, using fluorescent labels to determine rotational behavior of the protein in both natural and denatural states; and 3) excited state proton-transfer reactions.

Name: Kennedy, D. Project: NERVOUS

Department: Biological Sciences

Project Description: Perform several basic methods of analysis of neurophysiological data: 1) preliminary conversion of analog to digital form of neuronal data, 2) reduction of these data with tabulation and graphical display, and 3) statistical treatment of the data, including visual display of the results. Further simulation and modelling of neuronal systems are also planned on ACME, including Monte Carlo and deterministic models.

Proposed research involving ACME is directly related to an understanding of the nervous system. All results support and supplement most medical/clinical aspects of neurophysiology.

Name: Lederberg, J. Project: NOHANDS

Department: Genetics

Project Description: Research and development in methods of automating the operation and service on the Finnigan 1015 mass spectrometer in the IRL exobiology labs.

Name: Lederberg, J. Project: LEARN

Department: Genetics

Project Description: Program instruction; work area for programming and instrumentation use practice.

Name: Liebes, S. Project: MS

Department: Genetics

Project Description: This project is directed toward the development and application of techniques of high-spatial-resolution mass spectroscopy to organic materials of biological interest. The current investigation involves the use of focused radiation from a pulsed ruby laser to vaporize portions of solid samples in the ionization chamber of a Bendix Time-of-lFlight mass spectrometer. The plume of vaporized material is ionized by electron bombardment, and the time evaluation of the mass spectra of these ions is monitored at a 10-kc/sec repetition rate.

The materials so far studied include amino acids, the nitrogenous base constituents of DNA, samples of DNA, nucleohistone, lymphocytes, fibroblasts, and red blood cells. We are moving now to the comparison of normal versus abnormal blood and tissue samples.

The ACME Computer Facility serves the following important supportive functions:

1. Automation of data acquisition.

2. Storage of all derived mass spectral data.

3. Manipulation and comparison of data--certain aspects of these operations involve extensive use of the interactive television graphic display.

4. Performance of analytical studies related to the interpretation of data, the refinement of existing instrumentation, and the development of new apparatus.

Name: Reynolds, W. Project: S007

Department: Genetics

Project Description: This project supports the basic development of automated mass spectrometer and other instrumentation systems.

The mass spectrometer has become of interest in the biochemistry field. In the case of DNA and related structures, the basic principles involved are common to at least the Genetics Department and to the Organic Chemistry Department. Hence the efforts of this project span over five mass spectrometers in three diverse locations on the Stanford campus. The technical development consists in the origination of instrumentation concepts and the realization, in both hardware and software, of complete operating systems.

These systems are intended to automate the mass spectrometers (low resolution Bendix t-o-f, Finnigan quadrupoles, Atlas CH-4, and a high resolution AEI MS-9) and to provide the following benefits to the biological user-researcher: Saving of the researcher's time in instrument operation and data reduction, and improving the quality of the data, improving the presentation of the data, and fostering computer files of pertinent data.

This is being accomplished by basic research and development in the application of computers, both dedicated and time-shared in the field of computer-instrument integration.

The ACME system is being used as the final computer in the automated system and as an engineering design aid to achieve the final systems. Some phases of this development are in current use. In these cases the usage is supported by other projects, i.e., VABACON.GAME.

Name: Stryer, L. Project: NANOS

Department: Biochemistry

Project Description: The principal aims of the research are: (1) to acquire an understanding of mechanisms of electronic excitation energy transfer, (2) to develop novel fluorescence and phosphorescence methods which can provide detailed information concerning the structure and dynamics of biological macromolecules, and (3) to apply these optical techniques to obtain insight into aspects of the structure and function of selected proteins.

The experimental approach which is used in these studies involves: (1) the synthesis of model compounds which serve to define relationships between observable emission parameters and structure, (2) the synthesis of fluorescent and phosphorescent labeling reagents which have appropriate spectral properties and can be specifically attached to defined sites on proteins, and (3) the development of optical instrumentation of kinetic measurements in the nanosecond time range and for the detection of fluorescence and phosphorescence emission from membranes and cells.

Name: Tucker, R. Project: MS

Department: Genetics

Project Description: The project consists primarily of developing a computer system for the control of a quadrupole mass spectrometer-GLC apparatus and the collection, analysis, and presentation of the resulting data. This system utilizes the 1800 computer to transfer control data from the 360/50 to the mass spectrometer and to digitize the output of the mass spectrometer for storage in the ACME file system. This bidirectional data flow results in the mass spectrometer being "set" to successive predetermined position rather than scanned in the conventional manner. The data is presented to the user in the form of tabular listings and bargraph plots produced by a digital plotter located in the laboratory and driven by the 1800.

Name: Wilson, D. Project: NERVOUS

Department: Biological Sciences

Project Description: Use ACME in order to perform several basic methods of analysis of neurophysiological data: 1) preliminary conversion of analog to digital form of neuronal data, 2) reduction of these data with tabulation and graphical display, and 3) statistical treatment of the data, including visual display of the results. Further simulation and modelling of neuronal systems are also planned on ACME, including Monte Carlo and deterministic models.

Proposed research involving ACME is directly related to an understanding of the nervous system. All results support and supplement most medical/clinical aspects of neurophysiology.

Name: Yguerabide, J. Project: LUM

Department: Biochemistry

Project Description: Same project description as for L. Stryer, Biochemistry Department, project NANOS.

Name: Zwick, M. Project: CRYSTAL

Department: Biochemistry

Project Description: This project concerns the development of new theoretical techniques for the solution of protein crystal structures. The method currently used, "isomorphous replacement," generally requires a team of scientists working for a number of years with no guarantee of success. This method has the surprising feature that it makes virtually no use of a great deal of a priori stereochemical information about proteins: e.g., the bond distances and angles of the repeating pephile unit in the protein backbone or on the amino acid side-chains. Hence it is very plausible that new improved methods might be developed which utilize such information and which can solve protein structures much more rapidly and easily. In this project, attempts are being made to define a new set of variables which can specify the protein structure, which is much smaller and hence more easily determinable than the set of atomic coordinates. This new set of variables might conceivably be determinable simply from the X-ray intensities of the native crystal, i.e., isomorphous derivative may not be required. The new set of structure variables are designed to implicitly include the fact that a protein is a linear polymer folded up in some manner in three dimensions, and that this polymer has a set of well known bond distances and angles in its repeating unit and in its branching side chains.

Category 2

Name: Atkinson, M. Project: FLYHIGH

Department: Stanford Medical School - Admissions Committee

Project Description: This project is a series of programs to assist the Admissions Committee in selecting new Medical School classes. The programs all work off of one large file which contains information on the applicants. Included in the programs are file creation and update, listing, and sorting programs. The sorted listings are then used by the Committee to aide in decision making.

Name: Bagshaw, M. Project: PLAN

Department: Radiology

Project Description: Research is under way, and we hope to be able to use ACME to provide the radiation therapists with: 1) external beam treatment planning, 2) interstitial and intracavitary dose calculation, and 3) data accession and retrieval.

Name: Bergstresser, P. Project: FLOW

Department: Dermatology

Project Description: Compute blood flow in fingers and toes. The values are derived from experimental data and converted to flow, expressed in cc/min/100cc digit.

Name: Brown, B. W. Project: CONSULT

Department: Community & Preventive Medicine

Project Description: Computations done in support of a multitude of public health research projects.

Name: Brown, B. W. Project: RESEARCH

Department: Community & Preventive Medicine

Project Description: Development of new biostatistical techniques.

Name: Brown, B. W. Project: BIOSTAT

Department: Community & Preventive Medicine

Project Description: Conduct various statistical computations in support of research carried out by members of the Department of Anesthesia under their Program Projects Grant from NIH.

Name: Crowley, L. Project: WNDSTUDY

Department: Surgery

Project Description: Study of results of antibiotic agents instilled into wound at time of surgery to reduce infection rate of general surgery patients.

Name: Durbridge, T. Project: ROOT

Department: Pathology

Project Description: 1) Statistics: using ACME subroutines, programs, and minimal own coding to compute statistics for S.V.H. research projects. 2) Pathologese S.N.O.P. translation: working with Derek Enlander on same.

Name: Enlander, D. Project: cl050937

Department: Clinical Lab

Project Description: Back-up routines for the clinical lab computerization main project. These routines will consist of statistical analysis of the data generated in the clinical lab.

Name: Fletcher, G. Project: DIALYSIS

Department: Anesthesia

Project Description: Statistical analysis of laboratory results from in-vivo and in-vitro studies of uptake, metabolism, and elimination of sedative drugs.

Name: Forrest, W. Project: ANALGESI

Department: Anesthesia

Project Description: Same project description as for project DATA.

Name: Forrest, W. Project: DATA

Department: Anesthesia

Project Description: We use the 360/50 time sharing real-time system to research the management and statistical application of methods to the Cooperative Study. Problems of pilot studies, data validity, quality, cost of clinical trials and useful reduction of data for active sane management are constantly evaluated and updated. The plan is to develop an inexpensive system of quality and quantity control of large masses of clinical data from several sources so that data diarrhea and "gigo" are diagnosed properly and treated prophylactically rather than symtomatically.

Name: Grindle, J. Project: ROSAN

Department: Community & Preventive Medicine

Project Description: The purpose of this project is to correlate the laboratory and clinical findings in newborn infants with respiratory distress syndrome who have been treated with oxygen and mechanical ventilation. This is a new and unusual group of infants whose natural histories have been significantly modified by treatment, and who have a disease due in part to oxygen toxicity. The disease was first discovered at Stanford by Dr. William Northway (Radiology) and Dr. R. Rosan (Pathology).

In this analysis, we seek to correlate the oxygen doses, clinical histories, and biochemical analyses of the endobronchial secretions. The latter analyses, result of a technic also invented at Stanford by our group, include DNA/protein ratios, distribution of DNA and protein in soluble and insoluble fractions of secretions, and gel acrylamide discontinuous electrophoreses of the fractions. The aim of the computer-assisted study is to set up a matrix covering the principle parameters and variables in order to permit extraction of the most significant correlations.

The number of elements and categories in the matrix is too large to permit of conventional treatment. This is particularly true for the electrophoreses, there being some 163 possible band positions in the system studied with the resolution used. Therefore, use of the computer is essential in extracting the most significant and useful information from this study of human patients.

Name: Hilf, F. Project: BLACKBOX

Department: Psychiatry

Project Description: We are conducting a study in which paranoid and non-paranoid psychiatric patients are tested on-line with the ACME computer. The patients are presented with stimuli in the form of character strings and are prompted for responses. Reinforcement is non-contingent at several different probability levels. An analysis of responses will be conducted to see if this method is useful in differentiating paranoid from non-paranoid patients.

Name: Hogness, D. Project: OREGON-R

Department: Biochemistry

Project Description: Analyze experimental data. Use ACME in recognizing chromosome fragments in Drosophila. That is, being able to recognize a linear band--interband pattern and compare it to known patterns to determine the fragment's location, i.e., the chromosome from which it came.

Name: Huberman, J. Project: TEMPLATE

Department: Biochemistry

Project Description: Using ACME to perform the lengthy and tedious calculations required to reduce the raw data obtained in equilibrium dialysis experiments to a meaningful form. I am performing equilibrium dialysis experiments with the enzyme, DNA polymerase, and various nucleotide substrates, in order to get a better understanding of the active site of the enzyme. Using equilibrium dialysis, it is possible to answer such questions as--What kinds of molecules bind to DNA polymerase? How strongly do they bind? How many binding sites does each enzyme molecule have? The answers to these questions help in understanding the structure of the active site of DNA polymerase and its mechanism of action.

Name: Kohen-Raz, R. Project: ATAXIAM

Department: Pediatrics

Project Description: Diagnosis and treatment of statis balance impairment in educationally handicapped school children. Data processing will include analysis of electronic ataxia metric data, as well as analysis of simultaneous recordings of ataxia-grams, EMG and EEG.

Name: Koran, L. Project: SEX

Department: Psychiatry

Project Description: We plan to use ACME to complete one, two, and three-way analyses of variance on test scores made by one thousand students. We wish to explore the relation of these scores to a number of variables including sex, class of college, size of home, major field, religion, and other demographic information. After completing the analysis of the data, we plan to write two articles on the relation of the students identifying characteristics to their knowledge as measured by the exam.

Name: Kountz, S. Project: KIDNEY

Department: Surgery - University of California

Project Description: The ACME computer is used by the Transplant Service at the University of California in two areas. The first area is the selection of recipients for renal homotransplantation, and the storage and analysis of data from the follow-up on the degree of renal function in an effort to predict the onset of rejection crisis. The computer has been programmed to include sixty or more patients in the Bay Area who are on cronic hemodialysis awaiting a cadaver transplant. Their ABO blood groups and their HL-A antigens are stored in the computer. When a cadaver kidney becomes available, similar tests are performed on the donor; the kidneys are preserved and the information on the donor is fed into the computer and the matched recipients are then selected and brought into the Hospital for transplantation. The second area is to measure and calculate hemodynamic changes in transplant patients as a means to detect early incipient rejection. Renal function is measured by the single injection of radioisotopes and the disappearance curves are analyzed by the computer and compared with previous determinations. This has provided a very accurate method of following patients and detecting early incipient rejection. In the future we hope to feed all this information into the computer and analyze it in terms of survival in an effort to pick out which HL-A antigens or other factors might be playing a significant role in rejection as well as survival.

Name: Kraemer, H. Project: PSYSTAT

Department: Psychiatry

Project Description: The work done in PSYSTAT is that of developing statistical programs and evaluating sets of data coming from research where output is not extensive enough to justify opening a separate file.

Name: Lederberg, J. Project: DENDRAL

Department: Genetics

Project Description: This project is used to do limited generating chemical structures and display on Sanders 720 by interfacing.

Name: Levinthal, E. Project: MM71

Department: Genetics

Project Description: We are just initiating efforts to use ACME for photo-interpretation. The direct application is for the 1971 Mars Mariner Orbiter Mission. The photointerpretation techniques will be applicable to medical research problems as they have already been at the Jet Propulsion Laboratory.

Name: Lieberman, M. Project: RACE_GEP

Department: Psychiatry

Project Description: Project involves the measurement of the efficacy of "small groups" in education. Relevancy of statistical test will yield hypothesis testing of various such efficacies.

Name: Liebes, S. Project: MV73

Department: Genetics

Project Description: In support of a proposed involvement, on the part of members of the Department of Genetics, with the imagery system to be landed on the surface of the planet Mars in the course of the Viking 1973 Lander Mission.

The camera system will be utilized for scientific exploration of the Martian surface and atmosphere. Investigations will particularly be directed toward the elucidation of the petrographic character of the Martian surface and extant or extinct biota.

Initial effort will be devoted to design aspects of the camera system and an augmented microscopic capability.

Name: Liebes, S. Project: MM71

Department: Genetics

Project Description: Investigating means of data processing for interpretation of photographic data from the Mariner Mars 1971 Orbiter program. Principle focus at the present is on analogue optical data processing by use of coherent light techniques.

Name: Lorenson, M. Project: PFK_1

Department: Pharmacology

Project Description: A portion of the research work carried out in this laboratory is on the sheep heart enzyme, phosophofructokinase. Investigations are being made on the binding of carbon-14 labelled ligands to the enzyme. It is hoped that from these data, information will be gained on the molecular mechanisms by which this enzyme and possibly carbohydrate metabolism are controlled and regulated in vivo. The method being used involved chromatography on G-25 Sephadex columns which have been equilibrated with the radioactive ligand. In order for a thorough study, large numbers of columns must be run. Statistical analyses must be made on a large number of fractions including (1) calculation of radioactivity present; (2) specific activity of ligands; (3) determinations of units of enzyme activity; (4) determinations of protein concentrations and specific activities; (5) and binding and the standard deviations involved. In addition, the data are summarized and related to the concentrations of unbound ligands. If the computer were not used for these calculations, the information to be gained would be difficult to compile and the research work would be slowed considerably.

Name: Luzzatti, L. Project: GRAGSON

Department: Pediatrics

Project Description: Programs previously utilized for statistical analysis of chromosome measurements in a family with chromosomal abnormalities are now being used for an ongoing study of the morphology of the late replicating X chromosome. Programs are also used for another ongoing study of synchronization of human lymphocytes in culture.

The use of the ACME computer for the study of children with birth defects continues. In addition, a program is now available for the storage of anthropometric data on all patients with congenital defects. A study of anthropometric measurements and dermatoglyphic patterns of sixty children with cleft lip and/or palate, utilizing the data stored in the computer and computer-assisted statistical analysis, has been recently completed. By using computer information, we have been able to define certain characteristics of body configuration in children with clefts. Further similar studies in other syndromes are now in progress.

Name: Maffly, R. Project: CO2

Department: Medicine - Lipid Research

Project Description: Under study is active sodium transport by the toad bladder. We correlate three variables: short circuit current, CO_2 production, and $C^{14}O_2$ production. The computer is used to calculate the variables and to interrelate them, and to perform statistical analyses.

I plan to collect data on patients with elevation of blood urea nitrogen and with decreased serum sodium concentration and to use the computer to find out the predictive value of a variety of tests and procedures and laboratory data.

Name: Maffly, R. Project: TEACH

Department: Medicine - Lipid Research

Project Description: Develop programs which can be used to educate medical students, house officers, and fellows in the principles and practical aspects of water and electrolyte problems which occur in patients. Develop programs dealing with disorders of serum sodium concentration and serum urea nitrogen concentration. We have begun with a program obtained from Dr. William Schwartz of Tufts University Medical School dealing with the evaluation of acid-base disorders: data on individual patients are presented to the computer by the student and the computer responds with physiologic interpretation, therapy, logic, and references.