BUDGET - PART D

APPLICATIONS OF CARBON(13) NUCLEAR MAGNETIC RESONANCE SPECTROMETRY TO ASSIST IN CHEMICAL STRUCTURE DETERMINATION
### Detailed Budget for First 12-Month Period

**Period Covered:**
- **From:** 5/1/74
- **Through:** 4/30/75

#### 1. Personnel

<table>
<thead>
<tr>
<th>Name</th>
<th>Title of Position</th>
<th>%/Hrs.</th>
<th>Amount Requested</th>
</tr>
</thead>
<tbody>
<tr>
<td>Djerassi, Carl</td>
<td>Principal Investigator or Program Director</td>
<td>3</td>
<td></td>
</tr>
<tr>
<td>Carhart, Ray</td>
<td>Post Doctoral Fellow</td>
<td>100</td>
<td></td>
</tr>
<tr>
<td>Unnamed</td>
<td>Post Doc. Res. Assoc.</td>
<td>100</td>
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</tr>
<tr>
<td>Van Antwerp, Craig</td>
<td>Research Assistant</td>
<td>50</td>
<td></td>
</tr>
</tbody>
</table>

(1) See budget notes
(2) Covers 9/1/74-4/30/75 in year 1

**Total:** $33,592

#### 2. Consultant Costs

- Include Fees and Travel

**Total:** $-

#### 3. Equipment

- Itemize

**Total:** $-

#### 4. Supplies

- Chemical supplies

**Total:** $900

#### 5. Staff Travel

- Domestic
  - East coast trip
    - Amount: $500

- Foreign
  - Amount: $-

**Total:** $500

#### 6. Patient Costs

- Separate Inpatient and Outpatient

**Total:** $-

#### 7. Alterations and Renovations

**Total:** $-

#### 8. Other Expenses

- Itemize per instructions
  - Publication costs and reproduction services: $100
  - NMR instrument usage (25 hrs/month @ $25/hour): 7,500
  - Computer usage: 10,800

**Total:** $18,400

#### 9. Subtotal - Items 1 thru 8

**Total:** $53,392

#### 10. Trainee Expenses

- See Instructions

<table>
<thead>
<tr>
<th>Type of Expense</th>
<th>No. Proposed</th>
<th>Amount</th>
</tr>
</thead>
<tbody>
<tr>
<td>Predoctoral Stipends</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Postdoctoral Stipends</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Other (Specify)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Dependency Allowance</td>
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<td></td>
</tr>
</tbody>
</table>

**Total Stipend Expenses:** $-

#### 11. Subtotal - Trainee Expenses

**Total:** $53,392

#### 12. Total Direct Cost

(Add Subtotals, Items 9 and 11, and enter on Page I)

**Total:** $53,392
## Budget Estimates for All Years of Support Requested from Public Health Service

**Direct Costs Only (Omit Cents)**

<table>
<thead>
<tr>
<th>Description</th>
<th>1st Period (Same as Detailed Budget)</th>
<th>Additional Years Support Requested (This application only)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>1st Year</td>
<td>2nd Year</td>
</tr>
<tr>
<td>Personnel Costs</td>
<td>33,592</td>
<td>53,178</td>
</tr>
<tr>
<td>Consultant Costs</td>
<td>-</td>
<td>-</td>
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<tr>
<td>(Include fees, travel, etc.)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Equipment</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>Supplies</td>
<td>900</td>
<td>1,000</td>
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<tr>
<td>Travel</td>
<td>500</td>
<td>500</td>
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<tr>
<td>Domestic</td>
<td></td>
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</tr>
<tr>
<td>Foreign</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Patient Costs</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>Alterations and Renovations</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>Other Expenses</td>
<td>18,400</td>
<td>20,000</td>
</tr>
<tr>
<td>Total Direct Costs</td>
<td>53,392</td>
<td>74,678</td>
</tr>
</tbody>
</table>

**Total for Entire Proposed Project Period (Enter on Page 1, Item 4)**: $208,046

**Remarks**: Justify all costs for the first year for which the need may not be obvious. For future years, justify equipment costs, as well as any significant increases in any other category. If a recurring annual increase in personnel costs is requested, give percentage. (Use continuation page if needed.)

See attached budget justification notes.
COMPOSITE BUDGET –

PARTS A + B + C + D
# Detailed Budget for First 12-Month Period

**Period Covered:** FROM 5/1/74 THROUGH 4/30/75

## 1. Personnel

<table>
<thead>
<tr>
<th>Name</th>
<th>Title of Position</th>
<th>Time or Effort</th>
<th>Amount Requested</th>
</tr>
</thead>
<tbody>
<tr>
<td>Lederberg, Joshua</td>
<td>Principal Investigator or Program Director</td>
<td>10</td>
<td></td>
</tr>
<tr>
<td>Feigenbaum, Edward</td>
<td>Co-Principal Investigator</td>
<td>20</td>
<td></td>
</tr>
<tr>
<td>Djerassi, Carl</td>
<td>Co-Principal Investigator</td>
<td>3</td>
<td></td>
</tr>
<tr>
<td>Buchanan, Bruce</td>
<td>Associate Investigator</td>
<td>100</td>
<td></td>
</tr>
<tr>
<td>Duffield, Alan</td>
<td>Associate Investigator</td>
<td>50</td>
<td></td>
</tr>
<tr>
<td>Smith, Dennis</td>
<td>Research Associate</td>
<td>100</td>
<td></td>
</tr>
<tr>
<td>Sridharan Natesa</td>
<td>Research Associate</td>
<td>100</td>
<td></td>
</tr>
<tr>
<td>Hammerum, Steen</td>
<td>Research Associate</td>
<td>100</td>
<td></td>
</tr>
<tr>
<td>Pereira, Wilfred</td>
<td>Research Associate</td>
<td>50</td>
<td></td>
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<tr>
<td>Mindfleisch, Thomas</td>
<td>Research Associate</td>
<td>100</td>
<td></td>
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<tr>
<td>Carhart, Ray</td>
<td>Post Doctoral Fellow</td>
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<tr>
<td>Summons, Roger</td>
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<tr>
<td>Unnamed</td>
<td>Post Doc.Res.Assoc.</td>
<td>100</td>
<td></td>
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</tbody>
</table>

See attached sheet

**COMPOSITE BUDGET**

TOTAL $302,567

## 2. Consultant Costs

- INCLUDE FEES and TRAVEL
- TOTAL $1,100

## 3. Equipment

- COMPUTER TERMINAL
- TOTAL $3,000

## 4. Supplies

See attached sheet

- TOTAL $22,000

## 5. Staff Travel

- DOMESTIC
- TOTAL $4,300

- FOREIGN
- TOTAL 

## 6. Patient Costs

- SEPARATE INPATIENT and OUTPATIENT
- TOTAL 

## 7. Alterations and Renovations

- MASS SPECTROMETER LABORATORY AIR CONDITIONING and POWER MODIFICATIONS
- TOTAL $2,500

## 8. Other Expenses

- TELEPHONE, DATA COMMUNICATIONS, POSTAGE, etc.
- TOTAL $1,600

- PUBLICATION COSTS
- TOTAL $2,500

- MINI-COMPUTER MAINTENANCE CONTRACT
- TOTAL $4,600

- NMR INSTRUMENT USAGE
- TOTAL $7,500

- COMPUTER TERMINAL RENTAL
- TOTAL $4,800

- COMPUTER USAGE (ACME FOLLOWS-ON, CAMPUS 360/67, AND ARPA.NET)
- TOTAL $131,800

**TOTAL - ITEMS 1 thru 8**

$488,267

## 9. Trainee Expenses

**FOR TRAINING**

<table>
<thead>
<tr>
<th>Type</th>
<th>No. Proposed</th>
<th>Amount Requested</th>
</tr>
</thead>
<tbody>
<tr>
<td>A. STIPENDS</td>
<td></td>
<td></td>
</tr>
<tr>
<td>POSTDOCTORAL</td>
<td></td>
<td></td>
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<tr>
<td>OTHER (SPECIFY)</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

**DEPENendency ALLOWANCE**

TOTAL STIPEND EXPENSES $488,267

## 10. Tuition and Fees

**TOTAL**

$488,267

## 11. Trainee Travel

**TOTAL**

$488,267

## 12. Total Direct Cost

(Ass Substitute, Items 9 and 11, and enter on Page 1)

$488,267
### PERSONNEL (Continued)

<table>
<thead>
<tr>
<th>Name</th>
<th>Title of Position</th>
<th>Time or Effort</th>
</tr>
</thead>
<tbody>
<tr>
<td>Veizades, Nicholas</td>
<td>Research Engineer</td>
<td>100</td>
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<tr>
<td>Reynolds, Walter</td>
<td>Research Engineer</td>
<td>20</td>
</tr>
<tr>
<td>Steed, Ernest</td>
<td>Research Engineer</td>
<td>10</td>
</tr>
<tr>
<td>White, William</td>
<td>Computer Programmer</td>
<td>50</td>
</tr>
<tr>
<td>Tucker, Robert</td>
<td>Computer Programmer</td>
<td>75</td>
</tr>
<tr>
<td>Reiss, Steve</td>
<td>Computer Programmer</td>
<td>50</td>
</tr>
<tr>
<td>Wegmann, Annemarie</td>
<td>Senior Research Assistant</td>
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</tr>
<tr>
<td>Pearson, Dale</td>
<td>Electronics Technician</td>
<td>60</td>
</tr>
<tr>
<td>Hjelmeland, Larry</td>
<td>Research Assistant</td>
<td>100</td>
</tr>
<tr>
<td>Masinter, Larry</td>
<td>Research Assistant</td>
<td>50</td>
</tr>
<tr>
<td>Stefik, Mark</td>
<td>Research Assistant</td>
<td>50</td>
</tr>
<tr>
<td>Farrell, Carl</td>
<td>Research Assistant</td>
<td>100</td>
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<tr>
<td>Van Antwerp, Craig</td>
<td>Research Assistant</td>
<td>50</td>
</tr>
<tr>
<td>Wyche, Margaret</td>
<td>Laboratory Technician</td>
<td>50</td>
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<tr>
<td>DeFrancisci, Richard</td>
<td>Machinist</td>
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</tr>
<tr>
<td>Wharton, Kathy</td>
<td>Administrative Assistant</td>
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</tr>
<tr>
<td>Larson, Dee</td>
<td>Secretary</td>
<td>50</td>
</tr>
<tr>
<td>Allan, Muriel</td>
<td>Secretary</td>
<td>25</td>
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### SUPPLIES

<table>
<thead>
<tr>
<th>Description</th>
<th>Cost</th>
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</thead>
<tbody>
<tr>
<td>Office supplies</td>
<td>$1,450</td>
</tr>
<tr>
<td>Chemicals, glassware, and laboratory apparatus</td>
<td>3,400</td>
</tr>
<tr>
<td>GC supplies (gases, phases, columns, etc.)</td>
<td>950</td>
</tr>
<tr>
<td>Dry ice and liquid nitrogen</td>
<td>1,500</td>
</tr>
<tr>
<td>Electronic supplies and parts</td>
<td>3,500</td>
</tr>
<tr>
<td>GC/MS data recording media (chart paper, Calcomp, etc.)</td>
<td>2,100</td>
</tr>
<tr>
<td>Mini-computer supplies (paper, ribbons, tapes, disks, etc.)</td>
<td>1,500</td>
</tr>
<tr>
<td>Mass spectrometer repairs and replacement parts</td>
<td>7,600</td>
</tr>
<tr>
<td></td>
<td><strong>$22,000</strong></td>
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</table>
### BUDGET ESTIMATES FOR ALL YEARS OF SUPPORT REQUESTED FROM PUBLIC HEALTH SERVICE

**DIRECT COSTS ONLY (Omit Cents)**

<table>
<thead>
<tr>
<th>DESCRIPTION</th>
<th>1ST PERIOD (SAME AS DETAILED BUDGET)</th>
<th>ADDITIONAL YEARS SUPPORT REQUESTED (This application only)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>1ST PERIOD</td>
<td>2ND YEAR</td>
</tr>
<tr>
<td>PERSONNEL COSTS</td>
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<td>357,613</td>
</tr>
<tr>
<td>CONSULTANT COSTS</td>
<td>1,100</td>
<td>1,200</td>
</tr>
<tr>
<td>(Include fees, travel, etc.)</td>
<td>1,100</td>
<td>1,200</td>
</tr>
<tr>
<td>EQUIPMENT</td>
<td>3,000</td>
<td>3,000</td>
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<tr>
<td>SUPPLIES</td>
<td>22,000</td>
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<tr>
<td>TRAVEL</td>
<td>4,300</td>
<td>4,700</td>
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<tr>
<td>DOMESTIC</td>
<td>4,300</td>
<td>4,700</td>
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<tr>
<td>FOREIGN</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>PATIENT COSTS</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>ALTERATIONS AND RENOVATIONS</td>
<td>2,500</td>
<td>-</td>
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<tr>
<td>OTHER EXPENSES</td>
<td>152,800</td>
<td>168,100</td>
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<tr>
<td>TOTAL DIRECT COSTS</td>
<td>488,267</td>
<td>557,463</td>
</tr>
</tbody>
</table>

**TOTAL FOR ENTIRE PROPOSED PROJECT PERIOD (Enter on Page 1, Item 4)**: $1,639,456

**REMARKS**: Justify all costs for the first year for which the need may not be obvious. For future years, justify equipment costs, as well as any significant increases in any other category. If a recurring annual increase in personnel costs is requested, give percentage. (Use continuation page if needed.)
The budgets for the DENDRAL project are presented in four parts, corresponding to the four proposal sections: A, B(i) and (ii), C, and D. Parts A and C represent the portions concerned with Heuristic and Meta-DENDRAL; Part B deals with the data system automation and instrument maintenance functions as well as the development aspects of GC/MS analysis of body fluids; and Part D is an extension of DENDRAL methodology to Carbon(13) nuclear magnetic resonance spectrometry.

As a general note, Professor Lederberg will devote a total of 10% of his time to this research as the Principal Investigator. His time is budgeted as follows: 4% on Part A, 3% on Part B, and 3% on Part C.

The narrative comments on Parts A and C have been combined below because the personnel and computer resources overlap to a large extent.

BUDGET EXPLANATION - PARTS A & C

PERSONNEL:

a) The personnel on the DENDRAL staff constitute its most valuable resource. All of the people listed in the proposal are now working on the DENDRAL Project. All are necessary to support the high level of scientific activity in Chemistry (A. Duffield, D. Smith, S. Hammarum, and L. Hjelmeland) and Computer Science (R. Feigenbaum, B. Buchanan, N. Sridharan, W. White, S. Weiss, M. Stefik, L. Masinter, and C. Farrell).

Mr. Mark Stefik's status will have changed to Research Assistant for Part A from his current status as Computer Programmer on Part B.

Mr. Steve deiss' salary has been increased in order to properly compensate him for the duties he performs. Recent changes in draft board policies allow Conscientious Objectors to receive higher compensation to reflect actual job duties. Specific University approval has been requested for this increase but has not yet been received.

Mr. Larry Masinter has previously been paid from other funds, but is essential to the NIH-related work.
b) Salary figures are increased annually by 5% for merit increases and promotions. Fringe benefits are budgeted at the standard University rates of 17% through 8/74 and are increased annually per University projections to 18.3% in 9/74, 19.3% in 9/75, and 20.4% in 9/76.

No new personnel are added in Year 2. However, the salary budget increases by more than the rates noted above because all of Dr. Buchanan's salary is covered (see c) below) and Professor Feigenbaum returns from his leave of absence (see d) below).

c) Bruce Buchanan currently has an NIH Career Development Award through 8/31/76. However, because of recent NIH budget cutbacks, there is a strong probability that this award will be cancelled before that date. Dr. Ferguson of NIH stated on 2/8/74 that the award could only be guaranteed through 8/74.

d) As noted in the Introduction to this proposal, Dr. Feigenbaum will be on leave of absence with AAAA for a period of two years. This overlaps the term of this grant application such that no salary is budgeted for Dr. Feigenbaum during the first grant year. His salary is budgeted starting in the second grant year when he will formally return to his position in this research project.

EQUIPMENT:

No equipment purchases are required for Parts A and C.

SUPPLIES AND TRAVEL:

Office supplies are budgeted based on our experience over the past year. The travel budget covers expected costs for attending professional meetings and maintaining contact with related work at other locations. Because Artificial Intelligence is a rapidly expanding field, it is essential to maintain a high degree of personal interaction in order to assimilate new developments. These budget items are increased and rounded at 10% per year.
OTHER EXPENSES:

Telephone costs include connections and usage for computer terminals. Publication costs are budgeted at a nominal rate based on past experience and are increased by 10% per year. In the category of Computer Terminal Rent, the budget for Part A includes the lease cost of 2 portable Texas Instruments terminals. An additional terminal is added in 5/75 to accommodate increased use of the programs by personnel and a larger community of Stanford users. The Part C budget covers the continued lease of one T.I. terminal and an additional terminal starting in 5/75.

Computer time is budgeted according to current rate structures based on our on-going experience in utilizing the Stanford (SCC) 360/70 and machines available via the ARPA NET. We will not make use of the ACME follow-on machine (370/158) for Parts A and C because of the availability of superior LISP facilities on these other machines. Instrument data will be communicated from the 370/158 (see Part B) to the LISP programs for analysis.
BUDGET EXPLANATION - PARTS B(i) AND B(ii)

This budget covers instrumentation maintenance, data system development, and research into applications of GC/MS analysis of body fluids, as described in Parts B(i) and B(ii) of this proposal. This budget represents a significant increase over that submitted for Part B of the DENDRAL grant currently in-progress (current budget $80,000 per year). The major reasons for this increase are twofold: a) Increases in required personnel support because of corresponding decreases in support from other sources and b) The need to implement our computing support from a source other than the ACME 360/50 for which NIH funding is terminating. We have rigorously attempted to keep these increases to an absolute minimum consistent with maintaining the viability of our unaugmented research program.

We have previously received substantial support for our GC/MS research from NASA. Because of shifting federal priorities, however, NASA support has declined substantially and we project will terminate in the first year of this renewal. At the same time, our research has been moving to emphasize more and more heavily GC/MS applications in clinically related aspects or metabolic indicators of disease. Thus it is reasonable, as well as necessary, that support for this continued research shift to NIH.

As mentioned in the Introduction to this proposal, we have an application pending with NIH-GHS for support in applying these techniques to aspects of genetic disease. These proposals are complementary in goals and it is assumed in this budget that the Genetics Center proposal will provide support for a major fraction (approximately 50%) of the low resolution GC/MS laboratory (Finnigan 1015 instrument) including personnel, supplies, etc. There is, however, a small amount of operational manpower overlap between the two proposed efforts. If both proposals are funded, a savings will result through common operational support which will be negotiated with NIH at the appropriate time.

As discussed under future plans for Part B(i) of this proposal, we have had to plan an alternative source of computing to support this research because NIH subsidy of the ACME facility terminates in July 1973. We have chosen to use the Stanford-sponsored follow-on to ACME, mounted on an Ibm 370/150, since our computer programs will operate with a minimum of modification. This facility will operate on a fee-for-service basis. Whereas its rate structure is still evolving, we have estimated, on the basis of available information, the cost of transferring our computing to that facility as reflected in our budget ($64,000 per year). It should be noted that this rate structure does not include indirect charges at this time. As the rate structure becomes better defined, the indirect cost may be
included in the usage rates. This would necessitate a slight modification of the budget as will be negotiated with NIH as appropriate.

The following gives a detailed description of the various components of the Part I budget:

PERSONNEL:

The personnel budgeted for GC/MS applications, laboratory operations, and data system development are necessary to achieve our research goals and are currently active in the GC/MS programs. Chemistry support for the interpretation of body fluid analyses in cooperation with our clinical collaborators include Mrs. A. Bufffield (25%), M. Perlera (30%), and R. Summons (100%). M. Wyche provides laboratory and instrument operation support for the low resolution GC/MS laboratory. Messrs. Kandlileisch, Veizades, Reynolds, and Tucker are essential to the data system development effort and provide hardware and software maintenance support as well. Messrs. Kandlileisch (100%) and Tucker (75%) are primarily responsible for the software system design, implementation, and maintenance. Mr. Veizades (100%) is primarily concerned with the hardware maintenance and development aspects of the high resolution MAT-711 instrument and Mr. Reynolds (20%) with the Finnigan 1V15 low resolution instrument. Ms. A. Wegmann (100%) is responsible for the operation of the high resolution GC/MS instrument (MAT-711). Mr. Steed (10%) provides necessary glasswork development and maintenance, Mr. Pearson (60%) supports the fabrication and repair of electronic hardware for both instruments, and Mr. DeFrancisci (20%) provides necessary machinist support for mechanical repairs and fixtures. Ms. Allan (25%) provides required secretarial support for the above Instrumentation Research Laboratory personnel.

This manpower complement is carried into the future years as shown. Salaries are increased by 5% per year and staff benefits are applied at standard University rates. These start at 17% in fiscal year 1974 (9/73 - 8/74) and increase to 18.3% in 9/74, 19.3% in 9/75, and 20.4% in 9/76 based on University projections.

EQUIPMENT:

Our request for additional equipment is minimal. We budget for the purchase of a computer terminal in the first year for $3,000. This replaces a currently rented terminal integral to the GC/MS data system and saves $5,260 over the three year
grant period by purchasing instead of continued rental.

In the second year we budget for an event counter necessary for proper equipment maintenance for which we are assuming responsibility. We already maintain the Finnigan 1015 instrument and will take over the MAT-711 because of progressively poorer performance by VARIAN Associates in maintaining that instrument over the past year. This equipment is also needed to implement experimental control functions on the mass spectrometer.

In the third year, replacement of outdated test equipment will be required. $3,000 are budgeted for this purpose.

SUPPLIES:

Supplies are budgeted based on our actual operating experience and are minimized consistent with a viable research effort. Office supplies include stationery supplies, postage, reproduction services, etc. and are budgeted at $60 per month. The budget for chemicals, glassware, and laboratory apparatus ($2,500) provides the necessary materials for derivatizing and analyzing body fluid samples. GC supplies ($950) and dry ice and liquid nitrogen ($1,500) are necessary for instrument operation and are based on past experience. The largest part of the liquid nitrogen budget is used for the high resolution instrument. Electronics supplies and parts ($3,500) include circuit boards, semi-conductors, etc. needed for mass spectrometer control electronics such as for the metastable acquisition system as well as for maintaining our existing test equipment (oscilloscopes, voltmeters, power supplies, etc.). GC/MS data recording media ($2,100) include chart and Calcomp plotter papers of various types (including UV-sensitive paper for the MAT-711) for the purpose of recording mass spectrometer and gas chromatograph effluent data. The budgeted amount reflects our usage over the past year. Similarly, mini-computer supplies ($1,500) include Teletype and line printer paper and ribbons, magnetic tapes (DEC tape and IBM compatible tape), and disk cartridges based on previous usage history. The budget for mass spectrometer repairs and replacement parts ($7,600) covers our maintenance of these instruments based in part on predictable replacements (filaments, multipliers, etc.) and in part on an estimate from previous experience of unscheduled problems (power supplies, valves, pumps, etc.).

The supplies budget for future years covers these same items with 6% added for increased usage and inflation.
TRAVEL:

We have budgeted for travel to attend professional meetings and to visit other GC/MS laboratories on the basis of 1 east coast trip ($500), 1 mid-west trip ($350), and 1 west coast trip ($150).

ALTERATIONS AND RENOVATIONS:

We have had problems with thermal overloads on the high resolution mass spectrometer instrument and associated electronics during the summer months. In addition, because of the modified computing configuration required by the ACME transition, we will locate a disk and printer equipment in the same laboratory to support the mini-computer interfacing the MAT-711. These conditions require an augmentation to existing air-conditioning and power facilities in the laboratory estimated at $2,500.

OTHER EXPENSES:

We budget for telephone and data communications service based on our current experience ($100 per month). In addition, $1,010 is budgeted for publication costs and $4,600 for mini-computer maintenance. This maintenance is an extension of our current contract with Digital Equipment Corporation and includes the prevailing 10% discount in the Stanford/DEC contract.

We budget for data reduction and storage computing costs on the ACME follow-on machine (370/156) as follows, based on our ACME experience and current information on the follow-on system rate structure. We consume approximately 300,000 page-minutes of computing per month on ACME for development and production computing. At a rate of $.02 per page-minute, this comes to $6,000 per month. In addition, we use approximately $2,000 per month for data storage (20,000 blocks at $.10 per block per month). This gives a total of $86,000 per year and applying a projected 10% discount rate for high volume usage, leaves an estimated net cost of $64,000 per year.

These estimates are increased by 6% in succeeding years for increased usage and inflation.
BUDGET EXPLANATION - PART D

This budget covers the portion of the research program which extends the DENDRAL methodology to Carbon(13) Nuclear Magnetic Resonance Spectrometry.

PERSONNEL:

The personnel budget includes a salary for Dr. R. Garhart after the expiration of his NIH fellowship in 6/74, one Post Doctoral Research Associate (to be added to the staff), and one half-time Research Assistant (Mr. Van Antwerp). No funding is requested for Dr. Carl Djerassi's time (3%). A Computer Programmer (to be added to the staff) is budgeted in 1975 to assume the additional anticipated programming duties.

Salaries are increased by 5% per year and staff benefits are applied at standard University rates. These start at 17% in fiscal year 1974 (9/73 - 8/74) and increase per University projections to 15.3% in 9/74, 19.3% in 9/75, and 20.4% in 9/76.

SUPPLIES:

We budget $900 for chemical supplies for the preparation of test samples.

TRAVEL:

We budget $500 to cover one east coast trip.

OTHER EXPENSES:

Other expenses include $100 for publication and reproduction costs and $7,500 for usage of the existing NMR instrument in the Department of Chemistry. This NMR usage is budgeted at standard rates covering 25 hours of usage per month at $25 per hour. In addition, we budget for use of the Stanford (SCC) 360/67 computer where NMR analysis programs, at the current level of development, are run. These costs are computed on the
basis of 1.5 hours of usage per month at approximately $600 per hour.
<table>
<thead>
<tr>
<th>NAME</th>
<th>LEDERBERG, JOSHUA</th>
</tr>
</thead>
<tbody>
<tr>
<td>TITLE</td>
<td>Professor and Executive Head, Department of Genetics</td>
</tr>
<tr>
<td>BIRTHDATE</td>
<td>5-23-25</td>
</tr>
<tr>
<td>PLACE OF BIRTH</td>
<td>Montclair, New Jersey, USA</td>
</tr>
</tbody>
</table>

**EDUCATION:**

<table>
<thead>
<tr>
<th>INSTITUTION AND LOCATION</th>
<th>DEGREE</th>
<th>YEAR CONFERRED</th>
<th>SCIENTIFIC FIELD</th>
</tr>
</thead>
<tbody>
<tr>
<td>Columbia College, New York</td>
<td>B.A.</td>
<td>1944</td>
<td></td>
</tr>
</tbody>
</table>

**HONORS:**

- 1957 - National Academy of Sciences
- 1958 - Nobel Prize in Medicine

**MAJOR RESEARCH INTEREST:**

Molecular Genetics; Artificial Intelligence

**ROLE IN PROPOSED PROJECT:**

PRINCIPAL INVESTIGATOR

**RESEARCH SUPPORT**

SEE ATTACHMENTS:

**RESEARCH AND/OR PROFESSIONAL EXPERIENCE:**

- **1961-** Stanford University
  - Director, Kennedy Laboratories for Molecular Medicine

- **1959-**
  - Professor, Genetics and Biology, and Executive Head, Department of Genetics, Stanford University

- **1957-1959** University of Wisconsin
  - Chairman, Department of Medical Genetics

- **1957** Melbourne University, Australia
  - Fulbright Visiting Professor of Bacteriology

- **1950** University of California, Berkeley
  - Visiting Professor of Bacteriology

- **1947-1959** University of Wisconsin
  - Professor of Genetics

- **1946-1947** Yale University
  - Research Fellow of the Jane Coffin Childs Fund for Medical Research

- **1945-1946** Columbia University
  - Research Assistant in Zoology

**Professional Activities:**

- **1967-** NIMH: National Mental Health Advisory Council
- **1961-1962** President (Kennedy)'s Panel on Mental Retardation
- **1960-** NASA Committee: Lunar and Planetary Missions Board
- **1958-** National Academy of Sciences: Committees on Space Biology
- **1950-** President's Science Advisory Committee panels: National Institutes of Health, National Science Foundation study sections (genetics)
<table>
<thead>
<tr>
<th>Grant Number</th>
<th>Grant Title</th>
<th>Current Year</th>
<th>Total Award</th>
<th>Grant Term</th>
<th>Budgeted % Time</th>
</tr>
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<tbody>
<tr>
<td>1) NASA:NGR-05-020</td>
<td>Cytochemical Studies of Planetary Micro-organisms</td>
<td>$ 180,000</td>
<td>$3,800,000</td>
<td>9/60-8/73</td>
<td>4%</td>
</tr>
<tr>
<td>2) NIH:AI-05160</td>
<td>Genetics of Bacteria</td>
<td>60,000</td>
<td>280,000</td>
<td>9/60-8/73</td>
<td>15%</td>
</tr>
<tr>
<td>3) NIH:RR-00311</td>
<td>Advanced Computer for Medical Research (ACME) Stanford Medical School Facility</td>
<td>362,632</td>
<td>2,612,632</td>
<td>1966-7/73</td>
<td>25%</td>
</tr>
<tr>
<td>4) NIH:GM-</td>
<td>Genetics Research Center (J. Lederberg, Principal Investigator)</td>
<td>547,035</td>
<td>2,609,383</td>
<td>9/73-8/78</td>
<td>10%</td>
</tr>
<tr>
<td>5) NIH:RR-00785</td>
<td>Stanford University Medical Experimental Computer Facility (SUMEX) Successor to #3</td>
<td>884,660</td>
<td>5,960,417</td>
<td>9/73-8/78</td>
<td>20%</td>
</tr>
<tr>
<td>6) NIH: Computer Laboratory Health Care Resource Program</td>
<td>Large Scale Screening of Body Fluids for Metabolic Signs of Disease with Computer-managed Gas Chromatography and Mass Spectrometry</td>
<td>159,881</td>
<td>900,238</td>
<td>9/73-8/78</td>
<td>10%</td>
</tr>
<tr>
<td>7) NIH:GM00295</td>
<td>Training Grant in Genetics</td>
<td>143,964</td>
<td>756,650</td>
<td>7/60-6/73</td>
<td>15%</td>
</tr>
</tbody>
</table>
SELECTED LIST OF PUBLICATIONS

Lederberg, J., 1959
A View of Genetics


Feigenbaum, E. A., B. G. Buchanan, J. Lederberg, 1971

A Computer Operated Mass Spectrometer System.

Lederberg, J.
### BIOGRAPHICAL SKETCH

(Give the following information for all professional personnel listed on page 3, beginning with the Principal Investigator. Use continuation pages and follow the same general format for each person.)

<table>
<thead>
<tr>
<th>NAME</th>
<th>TITLE</th>
<th>BIRTHDATE (Mo. Day, Yr.)</th>
<th>SEX</th>
</tr>
</thead>
<tbody>
<tr>
<td>Carl DJERASSI</td>
<td>Professor of Chemistry</td>
<td>October 29, 1923</td>
<td>Male</td>
</tr>
</tbody>
</table>

**PLACE OF BIRTH (City, State, Country)**

Vienna, Austria

**PRESENT NATIONALITY (If non-U.S. citizen, indicate kind of visa and expiration date)**

U.S.A.

**EDUCATION** (Begin with baccalaureate training and include postdoctoral)

<table>
<thead>
<tr>
<th>INSTITUTION AND LOCATION</th>
<th>DEGREE</th>
<th>YEAR CONFERRED</th>
<th>SCIENTIFIC FIELD</th>
</tr>
</thead>
<tbody>
<tr>
<td>Kenyon College</td>
<td>A.B. (summa cum laude)</td>
<td>1942</td>
<td>Chemistry, Biology</td>
</tr>
<tr>
<td>University of Wisconsin</td>
<td>Ph.D.</td>
<td>1945</td>
<td>Organic chemistry, Biochemistry (minor)</td>
</tr>
</tbody>
</table>

**HONORS**


**MAJOR RESEARCH INTEREST**

Nat., prod. chemistry (steroids, alkaloids, terpenoids, antibiotics), and chem. applications of physical methods (mass spec., optical rotary dispersion, circular dichroism).

**ROLE IN PROPOSED PROJECT**

Principal Investigator

**Grant Support (See instructions)**

<table>
<thead>
<tr>
<th>Grant</th>
<th>Title</th>
<th>Period</th>
<th>Current Year</th>
<th>Total Budgeted</th>
<th>% Time Effort</th>
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</thead>
<tbody>
<tr>
<td>NIH AM 04257</td>
<td>Mass Spectrometry in Organic and Biochemistry</td>
<td>10/1/70 to 9/30/75</td>
<td>$56,833</td>
<td>$316,016</td>
<td>10%</td>
</tr>
<tr>
<td>NIH GM AM 06840-15</td>
<td>Marine Chemistry with special emphasis on steroids</td>
<td>1/1/73 to 12/31/77</td>
<td>112,550</td>
<td>578,180</td>
<td>18%</td>
</tr>
</tbody>
</table>

This is a pending application which, if approved, will represent a renewal of my current NIH Grants No. GM 06840 and No. AMCA-12785, both of which expire in 1973.

**RESEARCH AND/OR PROFESSIONAL EXPERIENCE**

Academic Experience:

Professor of Chemistry, Stanford University, 1959–present.

Associate Professor (1952–1954) and Professor (1954–1959), Wayne State University.

Industrial Research Experience:


Editorial Boards:


(continued on next page)
RESEARCH AND/OR PROFESSIONAL EXPERIENCE (cont.)

Miscellaneous:
Chairman of the AAAS Gordon Research Conferences on Steroids and Natural Products (1952-1954);
Member of American Pugwash Committee (1968 to present); Chairman of Latin America Science Board
of National Academy of Sciences (1966-1968); Chairman of National Academy's Board on Science
and Technology for International Development.

PUBLICATIONS

Author or co-author of 750 publications and six books. Approximately 150 papers and one book
deal with various applications of chiroptical methods in organic and biochemistry.
### BIOGRAPHICAL SKETCH

**NAME**

Feigenbaum, Edward A.

**TITLE**

Principal Investigator, DENDRAL Project

**PLACE OF BIRTH**

Weehawken, New Jersey

**BIRTHDATE**

1-20-36

**EDUCATION**

<table>
<thead>
<tr>
<th>INSTITUTION AND LOCATION</th>
<th>DEGREE</th>
<th>YEAR CONFERRED</th>
<th>SCIENTIFIC FIELD</th>
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<tbody>
<tr>
<td>Carnegie Institute of Technology, Pittsburgh, Pennsylvania</td>
<td>B.S.</td>
<td>1956</td>
<td>Electrical Engineering</td>
</tr>
<tr>
<td>Carnegie Institute of Technology, Pittsburgh, Pennsylvania</td>
<td>Ph.D.</td>
<td>1959</td>
<td>Behavioral Sciences</td>
</tr>
</tbody>
</table>

**HONORS and memberships:**

- American Psychological Association
- Association for Computing Machinery (Member of the National Council 1966-68)
- American Association for the Advancement of Science

**MAJOR RESEARCH INTEREST**

Artificial Intelligence

**ROLE IN PROPOSED PROJECT**

Principal Investigator

**RESEARCH SUPPORT**

Selected Publications:


Publications of Edward Feigenbaum


"Applications of Artificial Intelligence for Chemical Inference X. Datsum. A Data Interpretation Program as Applied to the Collected Mass Spectra of Estrogenic Steroids", to be submitted. (Co-Author).
SECTION II – PRIVILEGED COMMUNICATION

BIOGRAPHICAL SKETCH

(Give the following information for all professional personnel listed on page 3, beginning with the Principal Investigator.
Use continuation pages and follow the same general format for each person.)

<table>
<thead>
<tr>
<th>NAME</th>
<th>TITLE</th>
<th>BIRTHDATE (Mo., Day, Yr.)</th>
<th>PLACE OF BIRTH (City, State, Country)</th>
<th>PRESENT NATIONALITY (If non-U.S. citizen, indicate kind of visa and expiration date)</th>
<th>SEX</th>
</tr>
</thead>
<tbody>
<tr>
<td>Buchanan, Bruce G.</td>
<td>Research Computer Scientist</td>
<td>7-7-40</td>
<td>St. Louis, Missouri</td>
<td>U.S. Citizen</td>
<td>Male</td>
</tr>
</tbody>
</table>

EDUCATION (Begin with baccalaureate training and include postdoctoral)

<table>
<thead>
<tr>
<th>INSTITUTION AND LOCATION</th>
<th>DEGREE</th>
<th>YEAR CONFERRED</th>
<th>SCIENTIFIC FIELD</th>
</tr>
</thead>
<tbody>
<tr>
<td>Ohio Wesleyan University</td>
<td>B.A.</td>
<td>1961</td>
<td>Mathematics</td>
</tr>
<tr>
<td>Michigan State University</td>
<td>M.A., Ph.D.</td>
<td>1966</td>
<td>Philosophy</td>
</tr>
</tbody>
</table>

HONORS

Invited Speaker at 1972 National Institutes of Health Symposium on Numerical Methods in Chemistry (Washington)

MAJOR RESEARCH INTEREST

Associate Investigator

RESEARCH SUPPORT (See instructions)

RESEARCH AND/OR PROFESSIONAL EXPERIENCE (Starting with present position, list training and experience relevant to area of project. List all or most representative publications. Do not exceed 3 pages for each individual.)

1972-present Research Computer Scientist, Stanford University
1966-1971 Research Associate, Stanford Artificial Intelligence Project

Publications:


Publications of Bruce Buchanan:


"Applications of Artificial Intelligence for Chemical Inference IX. Analysis of Mixtures Without Prior Separation as Illustrated for Estrogens". Submitted to the Journal of the American Chemical Society. (Co-Author).

"Applications of Artificial Intelligence for Chemical Inference X. Datsum. A Data Interpretation Program as Applied to the Collected Mass Spectra of Estrogenic Steroids". To be submitted. (Co-Author).

Memberships

Association for Computing Machinery (ACM)
Philosophy of Science Association
American Association for Advancement of Science (AAAS)
<table>
<thead>
<tr>
<th>NAME</th>
<th>Alan M. DUFFIELD</th>
<th>TITLE</th>
<th>Research Associate</th>
<th>BIRTH GATE (Month, Year)</th>
<th>December 16, 1936</th>
</tr>
</thead>
<tbody>
<tr>
<td>PLACE OF BIRTH (City, State, Country)</td>
<td>Perth, Western Australia</td>
<td>PRESENT NATIONALITY (If non-U.S. citizen, indicate kind of visa and expiration date)</td>
<td>Australian, Permanent resident</td>
<td>SEX</td>
<td>Male</td>
</tr>
<tr>
<td>INSTITUTION AND LOCATION</td>
<td>University of Western Australia</td>
<td>DEGREE</td>
<td>B. Sc (1st Class Honors)</td>
<td>YEAR CONFERRED</td>
<td>1958</td>
</tr>
<tr>
<td>INSTITUTION AND LOCATION</td>
<td>University of Western Australia</td>
<td>DEGREE</td>
<td>Ph.D.</td>
<td>YEAR CONFERRED</td>
<td>1962</td>
</tr>
<tr>
<td>RESEARCH SUPPORT (See instructions)</td>
<td>N/A</td>
<td>SCIENTIFIC FIELD</td>
<td>Organic Chemistry</td>
<td>Organic Chemistry</td>
<td></td>
</tr>
<tr>
<td>MAJOR RESEARCH INTEREST</td>
<td>Applications of mass spectrometry to Biology and Biomedical Problems</td>
<td>ROLE IN PROPOSED PROJECT</td>
<td>Organic Chemist/mass spectrometrist</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

1970 - Research Associate, Department of Genetics, Stanford University School of Medicine
1969 - Head of the Mass Spectrometry Laboratory, Chemistry Department Stanford University
1965 - 69 Research Associate, Department of Chemistry, Stanford University
1963 - 65 Postdoctoral Fellow, Department of Chemistry, Stanford University
1962 - 63 Postdoctoral Fellow, Department of Biochemistry, Stanford University School of Medicine.

PUBLICATIONS SINCE 1971
By B. G. Buchanan, A. M. Duffield and A. V. Robertson
   By R. A. Corral, O. O. Orato, A. M. Duffield and C. Djerassi

3. Electron Impact Induced Hydrogen Scrambling in Cyclohexanol and Isomeric Methylcyclohexanols.
   By R. H. Shapiro, S. P. Levine and A. M. Duffield

4. Derivatives of 2-Biphenylcarboxylic Acid.
   By A. T. Balaban and A. M. Duffield

5. Alkaloids aus Evonymus europaeus L.
   By A. Klášek, T. Reichstein, A. M. Duffield and F. Santavy

   Tetrahedron, 28, 303 (1972)

   Org. Mass Spectr., 5, 199 (1972)
   By B. A. Brady, W. T. O'Sullivan and A. M. Duffield

8. The Determination of Cyclohexylamine in Aqueous Solutions of Sodium Cyclamate by Electron Capture Gas Chromatography.
   Anal. Letters, 4, 301 (1971)
   By M. D. Solomon, W. E. Pereira and A. M. Duffield

   By A. M. Duffield, W. E. Reynolds, D. A. Anderson, R. A. Stillman, Jr. and C. E. Carroll

10. Spectrometrie de Masse. VI. Fragmentation de Dimethyl-2,2-dioxolanes-1,3-Insatures.
    By J. Kossanyi, J. Chuche and A. M. Duffield

11. Chlorpromazine Metabolism in Sheep. II. In vitro Metabolism and Preparation of 3H-7-Hydroxychlorpromazine.
    Journees D'Agressologie, 12, 333 (1971)
    By L. G. Brooks, M. A. Holmes, I. S. Forrest, V. A. Bacon, A. M. Duffield and M. D. Solomon

    Canadian J. Chem., 50, 2776 (1972)
    By Y. M. Sheikh, R. J. Liedtke, A. M. Duffield and C. Djerassi
Wilfred E. PEREIRA

Research Associate

June 23, 1936

PLACE OF BIRTH (City, State, Country)

Madras, S. India

PRESENT NATIONALITY (If non-U.S. citizen, indicate kind of visa and expiration date)

Indian, Permanent Resident

ImmiGrant Visa

SEX

Male

EDUCATION (Begin with baccalaureate training and include postdoctoral)

INSTITUTION AND LOCATION

DEGREE

YEAR CONFERRED

SCIENTIFIC FIELD

Madras Medical College, Madras, India

B. Pharm

1960

Pharmaceutical Chemistry

Saugar Univ, Madhya Pradesh, India

M. Pharm

1962

Pharm. Chem & Chem of Nature

U.C. Med. Center, San Francisco, Calif

Ph.D.

1968

Pharm. Chem & Pharmacology

HONORS

1960 Doctoral Fellow, Dept. of Genetics Stanford University Med. School

1970 - present Research Associate, same institution

During these four years I have been involved with peptide synthesis, amino acid analysis and synthetic organic chemistry. I helped develop methods for the separation of diasterioisomers by gas chromatography and have been involved with the routine use of gas chromatography/mass spectrometry for the identification of urinary metabolites in normal and pathological urine and serum samples. My applications of mass spectrometry have included the development of mass fragmentography for the determination of the amino acid contents of soil and serum. My present project involves the screening of urine from leukemic patients for abnormal metabolites and to investigate the metabolic fate of anti-leukemic chemotherapeutic agents in the body.

PUBLICATIONS

1. Transesterification with an Anion-exchange Resin;
   W. Pereira, V. Close, W. Patton and B. Halpern,

2. Alcoholysis of the Merrifield-type Peptide-polymer Bond with an Anion Exchange Resin;
   W. Pereira, V. A. Close, E. Jellum, W. Patton and B. Halpern,
Publications

   By A. M. Duffield and O. Buchardt

   By D. H. Smith, B. G. Buchanan, R. S. Englemore, A. M. Duffield, A. Yeo, E. A. Feigenbaum, J. Lederberg and C. Djerassi

   By R. J. Liedtke, Y. H. Sheikh, A. M. Duffield and C. Djerassi

   Clinical Biochem., 5, 166 (1972).
   By E. Steed, W. Pereira, B. Halpern, M. D. Solomon and A. M. Duffield

17. Pyrrolizidine Alkaloids. XIX. Structure of the Alkaloid Erucifoline.
   By P. Sedmera, A. Klasek, A. M. Duffield and F. Santavy

   By D. H. Smith, A. M. Duffield and C. Djerassi

   By W. Patton, V. Bacon, A. M. Duffield, B. Halpern, Y. Hoyano, W. Pereira and J. Lederberg

   By M. D. Solomon, R. Summons, W. Pereira and A. M. Duffield

21. Spectrometric de Masse. VIII. Elimination d’eau Induite par Impact Electronique dans le Tetrahydro-1,2,3,4-naphtaledien-1,2.
   By P. Perros, J. P. Morizui, J. Kossanyi and A. M. Duffield

22. The Determination of Phenylalanine in Serum by Mass Fragmentography
   By W. E. Pereira, V. A. Bacon, Y. Hoyano, R. Summons and A. M. Duffield


Publications continued—


BIographiesKETCH
(Give the following information for all professional personnel listed on page 2, beginning with the Principal Investigator. Use continuation pages and follow the same general format for each person.)

NAME
Thomas C. Rindfleisch

TITLE
Research Associate

BIRTHDATE (MM, DD, YYYY)
12-10-41

PLACE OF BIRTH (City, State, Country)
Oshkosh, Wisconsin, USA

PRESENT NATIONALITY (If non-U.S. citizen, indicate kind of visa and expiration date)
USA

SEX

Male

EDUCATION (Begin with baccalaureate training and include postdoctoral)

INSTITUTION AND LOCATION
Purdue University, Lafayette, Ind.
California Institute of Technology, Pasadena, CA

DEGREE
B.S
M.S
Ph.D

YEAR
1962
1965

SCIENTIFIC FIELD
Physics
Physics

Thesis to be completed. All course work and examinations completed.

INSTITUTION AND LOCATION
Purdue University, Graduated with Highest Honors, Sigma Xi.

HONORS

MAJOR RESEARCH INTEREST
Space science, computer science and image processing

ROLE IN PROPOSED PROJECT
Technical Support

RESEARCH SUPPORT (See instructions)

RESEARCH AND/OR PROFESSIONAL EXPERIENCE (Starting with present position, list training and experience relevant to area of project. List all of most representative publications. Do not exceed 3 pages for each individual.)

1971-Present
Stanford University Medical School, Department of Genetics, Stanford, CA.
Research Associate - Mass Spectrometry, Instrumentation research.

1962-1971
Jet Propulsion Laboratory, California Institute of Technology, Pasadena, CA.
Relevant Experience:
1962-1968: Engineer - design and implement image processing computer software.


<table>
<thead>
<tr>
<th>NAME</th>
<th>TITLE</th>
<th>BIRTHDATE (Mo., Day, Yr.)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Dennis H. Smith</td>
<td>Research Associate</td>
<td>11/12/42</td>
</tr>
</tbody>
</table>

**PLACE OF BIRTH (City, State, Country)**
- New York, USA

**PRESENT NATIONALITY (If non-U.S. citizen, indicate kind of visa and expiration date)**
- USA

**SEX**
- Male

**EDUCATION (Begin with baccalaureate training and include postdoctoral)**

<table>
<thead>
<tr>
<th>INSTITUTION AND LOCATION</th>
<th>DEGREE</th>
<th>YEAR CONFERRED</th>
<th>SCIENTIFIC FIELD</th>
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<tbody>
<tr>
<td>Massachusetts Inst. of Technology</td>
<td>S.B.</td>
<td>1964</td>
<td>Chemistry</td>
</tr>
<tr>
<td>Cambridge, Mass.</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>University of California, Berkeley</td>
<td>Ph.D.</td>
<td>1967</td>
<td>Chemistry</td>
</tr>
<tr>
<td>Berkeley, California</td>
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**HONORS**
- Alfred P. Sloan Foundation Scholarship
- NASA Predoctoral Traineeship
- Phi Lambda Upsilon, Sigma Xi

**MAJOR RESEARCH INTEREST**
- Mass Spectrometry and A.I. in Chemistry

**ROLE IN PROPOSED PROJECT**
- Research Associate

**RESEARCH SUPPORT (See instructions)**
- N/A

**RESEARCH AND/OR PROFESSIONAL EXPERIENCE (Starting with present position, list training and experience relevant to area of project. List all or most representative publications. Do not exceed 3 pages for each individual.)**

- 1971-Present: Research Associate, Stanford University, Stanford, Ca.
- 1970-1971: Visiting Scientist, University of Bristol, Bristol, England

**Publications:** See attached list.
Publications:


## BIOGRAPHICAL SKETCH

(Give the following information for all professional personnel listed on page 3, beginning with the Principal Investigator. Use continuation pages and follow the same general format for each person.)

<table>
<thead>
<tr>
<th>NAME</th>
<th>TITLE</th>
<th>BIRTHDATE (Mo., Day, Yr.)</th>
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</thead>
<tbody>
<tr>
<td>Sridharan, Natesa S.</td>
<td>Research Associate</td>
<td>10-2-46</td>
</tr>
</tbody>
</table>

### PLACE OF BIRTH (City, State, Country)

Madras, India

### PRESENT NATIONALITY

India; pending permanent residence

### SEX

♂ Male  □ Female

### EDUCATION (Begin with baccalaureate training and include postdoctoral)

<table>
<thead>
<tr>
<th>INSTITUTION AND LOCATION</th>
<th>DEGREE</th>
<th>YEAR CONFERRED</th>
<th>SCIENTIFIC FIELD</th>
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<tbody>
<tr>
<td>Indian Institute of Technology, Madras, India</td>
<td>Bachelor of Technology</td>
<td>1967</td>
<td>Electrical Engineering</td>
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<tr>
<td>State University of New York, Stony Brook</td>
<td>M.S.</td>
<td>1969</td>
<td>Computer Science</td>
</tr>
<tr>
<td></td>
<td>Ph.D.</td>
<td>1971</td>
<td>Computer Science</td>
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### HONORS

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<th>HONORS</th>
<th>YEAR</th>
<th>INSTITUTION/LOCATION</th>
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</thead>
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<tr>
<td>University Fellow</td>
<td>1968-1971</td>
<td>SUNY Stony Brook</td>
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<tr>
<td>Graduate Assistant</td>
<td>1967-1968</td>
<td>SUNY Stony Brook</td>
</tr>
<tr>
<td>Siemens' Award (awarded for top rank in Electrical Engineering 1967)</td>
<td>1963-1967</td>
<td>ITT Madras</td>
</tr>
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### MAJOR RESEARCH INTEREST

- Computer Applications in Chemistry
- and Medicine

### ROLE IN PROPOSED PROJECT

Research Associate

### RESEARCH SUPPORT (See instructions)

### RESEARCH AND/OR PROFESSIONAL EXPERIENCE (Starting with present position, list training and experience relevant to area of project. List all or most representative publications. Do not exceed 3 pages for each individual.)

1971-present  Research Associate, Heuristic Programming Project, Stanford University


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