

**Program Announcement
To DOE National Laboratories
LAB 07-16**

***Ethical, Legal, and Societal Implications (ELSI) of Research
on Alternative Bioenergy Technologies, Synthetic Genomics,
or Nanotechnologies***

SUMMARY: The Office of Biological and Environmental Research (OBER) of the Office of Science (SC), U.S. Department of Energy (DOE), hereby announces its interest in receiving applications for research in the area of **Ethical, Legal, and Societal Implications (ELSI)** of research on alternative bioenergy technologies, synthetic genomics, or nanotechnologies. The aims of this Notice are to support explorations of the potential societal implications arising from scientific research in areas of systems microbiology pertaining to the DOE mission of bioenergy, and, in addition, issues arising from synthetic genomics applied to bioenergy, and research on nanomaterials and nanotechnologies relevant to bioenergy.

Dates: Potential researchers are **required** to submit a brief preproposal, referencing **LAB 07-16 for receipt by DOE by 4:30 p.m., Eastern Time, February 8, 2007**. Preproposals will be reviewed for conformance with the guidelines presented in this Solicitation and suitability in the technical areas specified in this Solicitation. A response to the preproposals encouraging or discouraging formal proposals will be communicated to researchers by **February 22, 2007**. Researchers who have not received a response regarding the status of their preproposal by this date are responsible for contacting the program to confirm this status.

Only those preproposals that receive notification from DOE encouraging a formal proposal may submit full proposals. **No other formal proposals will be considered.**

Potential researchers **must** submit a brief preproposal that consists of no more than three pages of narrative stating the research objectives, describing the technical approach(s), and identifying the proposed team members and their expertise. The intent in requesting a preproposal is to save the time and effort of researchers in preparing and submitting a formal project proposal that may be inappropriate for the program. Preproposals will be reviewed relative to the scope and research needs as outlined in the summary paragraph and in the SUPPLEMENTARY INFORMATION. The preproposal should identify, on the cover sheet, the title of the project, the institution or organization, principal investigator name, telephone number, fax number, and e-mail address. No budget information or biographical data need be included, nor is an institutional endorsement necessary.

Preproposals referencing the first aim in LAB 07-16 should be sent as a text file without attachments or a single PDF file attachment via e-mail to: **genomicsGTL@science.doe.gov** with "**Preproposal LAB 07-16 ELSI Lastname Institution**" as the subject. **No FAX or mail submission of preproposals will be accepted.**

Eligibility: Researchers from FFRDCs (Federally Funded Research and Development Centers) or DOE National Laboratories. BER reserves the right to encourage, in whole or in part, any, all, or none of the preproposals submitted, and may issue further guidance on the scope of the full proposal submissions of those encouraged.

Formal proposals in response to this Solicitation should be submitted via ePMA and must be received by 8:00 pm Eastern Time, **April 19, 2007**.

This section pertains only to those proposers that have been encouraged to submit a full proposal. A complete formal FWP in a single Portable Document Format (PDF) file must be submitted through the DOE ePMA system (<https://epma.doe.gov>) as an attachment. To identify that the FWP is responding to this program announcement, please fill in the following fields in the "ePMA Create Proposal Admin Information" screen as shown:

Proposal Short Name:

Fiscal Year:

Proposal Reason:

Program Announcement Number: LAB 07-16 *

Program announcement Title: Ethical, Legal, and Societal Implications (ELSI) of Research on Alternative Bioenergy Technologies, Synthetic Genomics, or Nanotechnologies *

Proposal Purpose:

Estimated Proposal Begin Date:

HQ Program Manager Organization:

* Please use the wording shown when filling in these fields to identify that the FWP is responding to this Program Announcement.

In order to expedite the review process, please submit a CD and three copies of the proposal using the following, by U.S. Postal Service Express Mail, any commercial mail delivery service, or when hand-carried to:

Ms. Joanne Corcoran

U.S. Department of Energy

Office of Biological and Environmental Research, SC-23.2

19901 Germantown Road

Germantown, MD 20874-1290

ATTN: Program Announcement LAB 07-16

FOR FURTHER INFORMATION CONTACT:

Contact Dr. Daniel Drell, telephone: (301) 903-4742, E-mail: Daniel.drell@science.doe.gov

SUPPLEMENTARY INFORMATION: Biology has entered the era of systems biology in which we strive to understand entire living organisms and their interactions with the environment. Although scientists have long tried to understand the workings of individual genes or small groups of genes, this new era in biology will focus research on entire networks of genes

and even entire biological systems - small, single celled organisms at first, then more complex microbial communities and plant microbe interactions, ultimately ecosystems.

The Department of Energy's Genomics:GTL program is a systems biology research program that is exploring biotechnology solutions that can give us abundant sources of clean energy yet control greenhouse gases such as carbon dioxide (a key factor in global climate change), better understand the cycling of carbon and emissions of CO₂ in the environment, and support more effective efforts to clean up past contamination of the environment. The Genomics:GTL Program supports a combination of large, well integrated, multidisciplinary research teams as well as a portfolio of smaller, focused research projects. The overall aim of the Genomics:GTL program is to encourage the development of new energy sources and supplies, foster more effective technologies and approaches to mitigating greenhouse gas impacts on global climate processes, and to support the development of more effective biological approaches to the cleanup of legacy wastes at DOE sites associated with a 62 year history of nuclear weapons and nuclear materials development. This solicitation will support focused research projects to explore societal implications arising from or consequent to research on alternative bioenergy technologies under the aegis of the Genomics:GTL program. Information on the research projects currently funded by the Genomics:GTL Program and a description of project goals and overall program organization can be found at: <http://genomicsgtl.energy.gov>. The topic areas of particular interest to this Notice include but may not be limited to: societal implications of alternate bioenergy technologies, considerations impacting the use of "dual-use" crops (food vs. energy), and possible international implications. Additionally, a large biomass to biofuels contribution to the energy supply sector will require the exploration, and the exploitation, of microbes and microbial capabilities, which may raise issues of the use of altered microbes. The development of sustainable biofuels may involve a large shift in crop growth patterns in the US, involving growing biofuel feedstocks on acres that are currently fallow, used for pasture and grazing, managed for timber crops, or crops grown for food. Research is requested to help understand the societal issues and concerns associated with changes from any of the previous land use patterns to likely biomass crops.

Synthetic genomics and nanotechnology are two recent areas of technology development that the DOE (among other agencies) supports. While these programs promise great benefits, they also raise possible issues of misuse or unanticipated consequences. Synthetic genomics is the rapidly advancing area of gene, viral, and genome synthesis from single base pairs and short oligonucleotide fragments to introduce properties into living organisms that hitherto lacked them (e.g. a bioenergy synthesis pathway into a previously nonsynthetic microbe, or genetic control regions that could enhance an existing process (for example, cellulose degradation) in a fungus). At its most ambitious, synthetic genomics could lead to the reconstruction, de novo, of an entire microbial genome either in native form, or engineered to have useful properties. Assuming success at these efforts, what societal implications could be expected and what challenges will they present to us? (Note: biodefense implications will not be supported under this notice, since those are the subject of discussions by the National Science Advisory Board on Biosecurity, <http://www.biosecurityboard.gov/>).

Nanotechnology is a very broad area of activity focused on the science and properties of substances from 1 to 100 nanometers in size. As such, nanotechnology includes most scientific

disciplines from chemistry and physics to materials sciences, biology, engineering and computational science. Activities are already being funded to explore environmental, safety and health questions (e.g. toxicities of certain nanomaterials) arising from nanotechnologies and work is needed to look at longer range at potential societal implications if nanotechnologies (including nanoparticles and nanomaterials) are successfully developed. Assuming success at these efforts, what societal implications could be expected and what challenges will they present to us?

Research Focus: *Ethical, Legal, and Societal Implications of Research on Alternative Bioenergy Technologies, Synthetic Genomics, and Nanotechnologies.*

In this Notice, research is solicited into the potential societal implications arising from research being conducted under the auspices of the Genomics:GTL program on bioenergy technologies and synthetic genomics, as well as nanotechnologies relevant to the development of alternative bioenergy approaches. Responsive applications could propose studies of various energy scenarios to which GTL science might contribute; exploring international implications and sensitivities, opportunities and barriers, to the use of bioenergy advances, synthetic genomics technologies, and nanotechnologies. This could include studies, conferences and workshops, research efforts aimed either at more precisely defining the agenda of issues that may arise and/or analyzing potential options for dealing with identified issues arising from GTL Bioenergy research, synthetic genomics, or nanoscience research. While the national interest is in developing biofuels as an alternative to imported oil and ensuring sustainability of the biofuels production pipeline while balancing competing interests for land use, the purpose of this notice is to objectively analyze the implications of biofuels, not to advocate for their adoption. The results of this research should provide a better understanding of the potential environmental and societal impacts of biofuels throughout the entire supply chain, and contribute to the development of informed policies on bioenergy crops and their consequences. Similarly, it is the aim of this notice to encourage analyses of societal implications of synthetic genomics and nanotechnologies without passing judgment on their respective merits for any particular application. **Two considerations are paramount: 1) activities for which support is sought under this Notice must be strongly scientifically and technically grounded and 2) activities for which support is sought under this Notice must recognize that it is not the role or place of this program to advocate or defend particular policy options.**

Investigations are encouraged that focus on:

- Defining the range, nature, scope, and potential societal, legal, or economic impacts that may arise from research on alternative bioenergy technologies, synthetic genomics, or nanotechnologies, and the applications of that research. A principal need is to explore how to balance conflicting values and imperatives between environmental, economic, and societal implications of biologically-based energy technologies. Literature reviews, focus groups, and other approaches that do not involve opinion-surveys will be considered.
- Expanding the cultivation of biofuel crops has the potential to change a range of societal characteristics, patterns, and practices, among them land use practices (e.g. soil depletion and erosion, habitat availability, biodiversity, topography, landscapes, competing demands for resources such as acreage and water), employment, property values, and

economic realities (which may raise issues of social justice). Questions of interest to this program may include: What impacts would the construction and ownership pattern of biorefineries have on societal preferences and practices and how might these vary by stakeholder, e.g. local farmer, local non-farming resident, stockholder in a major industrial entity that owns the facility, biofuels consumer, etc.? What impacts might changes in the availability or use patterns of bioenergy crops have on other markets and societal preferences and practices? In what ways might altering the types of microbes or other aspects of pathways inside the biorefinery affect the utility of bioproducts for animal feed and other uses? For instance, if a biorefinery has a permit to use one organism for fermentation, what flexibility is there for introducing alternative organisms or alternative techniques for degradation and conversion? What issues may arise in siting of biofuels production facilities?

- Conversion of large tracts of agricultural (or previously marginal) lands to cultivation of biofuel crops will result in a host of changes that will disproportionately affect adjacent communities. Potential impacts could include shifting employment opportunities, changes in local/regional economics, and alterations to the landscape. What are the most probable short and long term societal impacts of these types of changes? What would be the broader public perception of such changes? How could potential negative impacts best be minimized?
- Exploring legal issues such as intellectual property protection and commercialization practices that may be relevant to advances from research on alternative bioenergy technologies, synthetic genomics, and nanomaterials and nanotechnologies. This could include analytic studies on the range of outcomes that could follow from different commercialization options, the impact(s) of the fractionation of patents in any of these areas into small pieces requiring patent pools, cross licensing or other strategies for achieving translation from research scale discoveries to useful and commercially viable inventions, to how potentially commercially viable inventions might impact different economic sectors.

In all cases, proposed research in societal implications of research activities, whether Genomics:GTL or synthetic genomics, should address issues arising in the context of BER missions of bioenergy development. For nanotechnology research, the focus should be on mid-term implications, grounded in the presumption that environment, safety and health issues are already under sufficient study, and presuming "success" in the development of nanotechnologies and nanomaterials with topicality for bioenergy. It is acknowledged that the scope of research in the ELSI Program is evolving as opportunities are identified to explore the consequences of Genomics:GTL science, synthetic genomics research, and nanoscience research activities for society.

References:

Genomics:GTL Program: <http://genomicsgtl.energy.gov>

Genomics:GTL Roadmap: <http://genomicsgtl.energy.gov/roadmap/index.shtml>

Genomics:GTL Bioenergy Mission Appendix to Roadmap:
http://genomicsgtl.energy.gov/roadmap/pdf/GTL05_05Energy.pdf

Genomics:GTL Biomass to Biofuels Report:
<http://genomicsgtl.energy.gov/biofuels/b2bworkshop.shtml>

History of DOE ELSI Research:
http://www.ornl.gov/sci/techresources/Human_Genome/elsi/elsi.shtml

BERAC report on Synthetic Genomics: <http://www.science.doe.gov/ober/berac/SynBio.pdf>

National Nanotechnology Initiative: <http://www.nano.gov/>

Office of Basic Energy Sciences Nanotechnology Home Page:
http://www.science.doe.gov/News_Information/News_Room/2006/nano/index.htm

Program Funding: Up to \$500,000 is available in Fiscal Year 2007, contingent upon availability of appropriated funds. It is anticipated that from 5 to 9 individual awards will be funded at a level of not more than \$300,000 per year (total costs). Annual budgets are expected to range from \$50,000 to \$300,000, total costs. Terms of requested award should not exceed 3 years, subject to continued programmatic need, satisfactory progress and the availability of funds. DOE is under no obligation to pay for any costs associated with preparation or submission of applications. DOE reserves the right to fund, in whole or in part, any, all, or none of the applications submitted in response to this Notice.

Submission Information

Full Proposal

The Department of Energy will accept Full Proposals by invitation only, based upon the evaluation of the preproposals. After receiving notification from DOE concerning successful preproposals, researchers may prepare formal proposals. The Project Description must not exceed 20 pages, including tables and figures, but exclusive of attachments. The proposal must contain an abstract or project summary, short vitae, and letters of intent from collaborators if appropriate.

Full proposals adhering to DOE Field Work Proposal format (Reference DOE Order 412.1) are to be prepared and submitted consistent with policies of the investigator's laboratory and the local DOE Operations Office. Laboratories may submit proposals directly to the SC Program Office listed above. A copy should also be provided to the appropriate DOE Operations Office.

The instructions and format described below should be followed. You must reference Program Announcement LAB 07-16 on all submissions and inquiries about this program.

OFFICE OF SCIENCE GUIDE FOR PREPARATION OF SCIENTIFIC/TECHNICAL PROPOSALS TO BE SUBMITTED BY NATIONAL LABORATORIES

Proposals from National Laboratories submitted to the Office of Science (SC) as a result of this program announcement will follow the Department of Energy Field Work Proposal process with additional information requested to allow for scientific/technical merit review. The following guidelines for content and format are intended to facilitate an understanding of the requirements necessary for SC to conduct a merit review of a proposal. Please follow the guidelines carefully, as deviations could be cause for declination of a proposal without merit review.

1. Evaluation Criteria

Proposals will be subjected to formal merit review (peer review) and will be evaluated against the following criteria which are listed in descending order of importance:

Scientific and/or Technical Merit of the Project
Appropriateness of the Proposed Method or Approach
Competency of the Personnel and Adequacy of the Proposed Resources
Reasonableness and Appropriateness of the Proposed Budget

The evaluation will include program policy factors such as the relevance of the proposed research to the terms of the announcement and the Department's programmatic needs. External peer reviewers are selected with regard to both their scientific expertise and the absence of conflict-of-interest issues. Non-federal reviewers may be used, and submission of a proposal constitutes agreement that this is acceptable to the investigator(s) and the submitting institution.

2. Summary of Proposal Contents

- Field Work Proposal (FWP) Format (Reference DOE O 412.1A) (DOE ONLY)
- Proposal Cover Page
- Table of Contents
- Budget (DOE Form 4620.1) and Budget Explanation
- Abstract (one page)
- Narrative (main technical portion of the proposal, including background/introduction, proposed research and methods, timetable of activities, and responsibilities of key project personnel)
- Literature Cited
- Biographical Sketch(es)
- Description of Facilities and Resources
- Other Support of Investigator(s)
- Appendix (optional)

2.1 Number of Copies to Submit

This section pertains only to those proposers that have been encouraged to submit a full proposal. A complete formal FWP in a single Portable Document Format (PDF) file must be submitted through the DOE ePMA system (<https://epma.doe.gov>) as an attachment. To identify that the FWP is responding to this program announcement, please fill in the following fields in the "ePMA Create Proposal Admin Information" screen as shown:

Proposal Short Name:

Fiscal Year:

Proposal Reason:

Program Announcement Number: LAB 07-16 *

Program announcement Title: Ethical, Legal, and Societal Implications (ELSI) of Research on Alternative Bioenergy Technologies, Synthetic Genomics, or Nanotechnologies *

Proposal Purpose:

Estimated Proposal Begin Date:

HQ Program Manager Organization:

* Please use the wording shown when filling in these fields to identify that the FWP is responding to this Program Announcement.

In order to expedite the review process, please submit a CD and three copies of the proposal using the following, by U.S. Postal Service Express Mail, any commercial mail delivery service, or when hand-carried to:

Ms. Joanne Corcoran
U.S. Department of Energy
Office of Biological and Environmental Research, SC-23.2
19901 Germantown Road
Germantown, MD 20874-1290
ATTN: Program Announcement LAB 07-16

3. Detailed Contents of the Proposal

Adherence to type size and line spacing requirements is necessary for several reasons. No researcher should have the advantage, or by using small type, of providing more text in their proposals. Small type may also make it difficult for reviewers to read the proposal. Proposals must have 1-inch margins at the top, bottom, and on each side. Type sizes must be 10 point or larger. Line spacing is at the discretion of the researcher but there must be no more than 6 lines per vertical inch of text. Pages should be standard 8 1/2" x 11" (or metric A4, i.e., 210 mm x 297 mm).

3.1 Field Work Proposal Format (Reference DOE O 412.1A) (DOE ONLY)

The Field Work Proposal (FWP) is to be prepared and submitted consistent with policies of the investigator's laboratory and the local DOE Operations Office. Additional information is also requested to allow for scientific/technical merit review. Laboratories may submit proposals directly to ePMA.

3.2 Proposal Cover Page

The following proposal cover page information may be placed on plain paper. No form is required.

Title of proposed project
SC Program announcement title
Name of laboratory
Name of principal investigator (PI)
Position title of PI
Mailing address of PI
Telephone of PI
Fax number of PI
Electronic mail address of PI
Name of official signing for laboratory*
Title of official
Fax number of official
Telephone of official
Electronic mail address of official
Requested funding for each year; total request
Use of human subjects in proposed project:
 If activities involving human subjects are not planned at any time during the proposed project period, state "No"; otherwise state "Yes", provide the IRB Approval date and Assurance of Compliance Number and include all necessary information with the proposal should human subjects be involved.
Use of vertebrate animals in proposed project:
 If activities involving vertebrate animals are not planned at any time during this project, state "No"; otherwise state "Yes" and provide the IACUC Approval date and Animal Welfare Assurance number from NIH and include all necessary information with the proposal.
Signature of PI, date of signature
Signature of official, date of signature*

*The signature certifies that personnel and facilities are available as stated in the proposal, if the project is funded.

3.3 Table of Contents

Provide the initial page number for each of the sections of the proposal. Number pages consecutively at the bottom of each page throughout the proposal. Start each major section at the top of a new page. Do not use unnumbered pages and do not use suffices, such as 5a, 5b.

3.4 Budget and Budget Explanation

A detailed budget is required for the entire project period and for each fiscal year. It is preferred that DOE's budget page, Form 4620.1 be used for providing budget information*. Modifications of categories are permissible to comply with institutional practices, for example with regard to overhead costs.

A written justification of each budget item is to follow the budget pages. For personnel this should take the form of a one-sentence statement of the role of the person in the project. Provide

a detailed justification of the need for each item of permanent equipment. Explain each of the other direct costs in sufficient detail for reviewers to be able to judge the appropriateness of the amount requested.

Further instructions regarding the budget are given in section 4 of this guide. * Form 4620.1 is available at web site: <http://www.science.doe.gov/grants/budgetform.pdf>

3.5 Abstract

Provide an abstract of less than 400 words. Give the project objectives (in broad scientific terms), the approach to be used, and what the research is intended to accomplish. State the hypotheses to be tested (if any). At the top of the abstract give the project title, names of all the investigators and their institutions, and contact information for the principal investigator, including e-mail address.

3.6 Narrative (main technical portion of the proposal, including background/introduction, proposed research and methods, timetable of activities, and responsibilities of key project personnel)

The narrative comprises the research plan for the project and is limited to 20 pages (maximum). It should contain enough background material in the Introduction, including review of the relevant literature, to demonstrate sufficient knowledge of the state of the science. The major part of the narrative should be devoted to a description and justification of the proposed project, including details of the methods to be used. It should also include a timeline for the major activities of the proposed project, and should indicate which project personnel will be responsible for which activities.

If any portion of the project is to be done in collaboration with another institution (or institutions), provide information on the institution(s) and what part of the project it will carry out. Further information on any such arrangements is to be given in the sections "Budget and Budget Explanation", "Biographical Sketches", and "Description of Facilities and Resources".

3.7 Literature Cited

Give full bibliographic entries for each publication cited in the narrative.

3.8 Biographical Sketches

This information is required for senior personnel at the institution submitting the proposal and at all subcontracting institutions (if any). The biographical sketch is limited to a maximum of **two pages** for each investigator.

To assist in the identification of potential conflicts of interest or bias in the selection of reviewers, the following information **must be provided in each biographical sketch**.

Collaborators and Co-editors: A list of all persons in alphabetical order (including their current organizational affiliations) who are currently, or who have been, collaborators or co- authors with the investigator on a research project, book or book article, report, abstract, or paper during the 48 months preceding the submission of the proposal. Also include those individuals who are currently or have been co-editors of a special issue of a journal, compendium, or conference proceedings during the 24 months preceding the submission of the proposal. If there are no collaborators or co-editors to report, this should be so indicated.

Graduate and Postdoctoral Advisors and Advisees: A list of the names of the individual's own graduate advisor(s) and principal postdoctoral sponsor(s), and their current organizational affiliations. A list of the names of the individual's graduate students and postdoctoral associates during the past 5 years, and their current organizational affiliations.

3.9 Description of Facilities and Resources

Facilities to be used for the conduct of the proposed research should be briefly described. Indicate the pertinent capabilities of the institution, including support facilities (such as machine shops), that will be used during the project. List the most important equipment items already available for the project and their pertinent capabilities. Include this information for each subcontracting institution (if any).

3.10 Other Support of Investigators

Other support is defined as all financial resources, whether Federal, non-Federal, commercial, or institutional, available in direct support of an individual's research endeavors. Information on active and pending other support is required for all senior personnel, including investigators at collaborating institutions to be funded by a subcontract. For each item of other support, give the organization or agency, inclusive dates of the project or proposed project, annual funding, and level of effort (months per year or percentage of the year) devoted to the project.

3.11 Appendix

Information not easily accessible to a reviewer may be included in an appendix, but **do not use the appendix to circumvent the page limitations of the proposal**. Reviewers are not required to consider information in an appendix, and reviewers may not have time to read extensive appendix materials with the same care they would use with the proposal proper.

The appendix may contain the following items: up to five publications, manuscripts accepted for publication, abstracts, patents, or other printed materials directly relevant to this project, but not generally available to the scientific community; and letters from investigators at other institutions stating their agreement to participate in the project (do not include letters of endorsement of the project).

4. Detailed Instructions for the Budget

(DOE Form 4620.1 "Budget Page" may be used)

4.1 Salaries and Wages

List the names of the principal investigator and other key personnel and the estimated number of person-months for which DOE funding is requested. Proposers should list the number of postdoctoral associates and other professional positions included in the proposal and indicate the number of full-time-equivalent (FTE) person-months and rate of pay (hourly, monthly or annually). For graduate and undergraduate students and all other personnel categories such as secretarial, clerical, technical, etc., show the total number of people needed in each job title and total salaries needed. Salaries requested must be consistent with the institution's regular practices. The budget explanation should define concisely the role of each position in the overall project.

4.2 Equipment

DOE defines equipment as "an item of tangible personal property that has a useful life of more than two years and an acquisition cost of \$25,000 or more." Special purpose equipment means equipment which is used only for research, scientific or other technical activities. Items of needed equipment should be individually listed by description and estimated cost, including tax, and adequately justified. Allowable items ordinarily will be limited to scientific equipment that is not already available for the conduct of the work. General purpose office equipment normally will not be considered eligible for support.

4.3 Domestic Travel

The type and extent of travel and its relation to the research should be specified. Funds may be requested for attendance at meetings and conferences, other travel associated with the work and subsistence. In order to qualify for support, attendance at meetings or conferences must enhance the investigator's capability to perform the research, plan extensions of it, or disseminate its results. Consultant's travel costs also may be requested.

4.4 Foreign Travel

Foreign travel is any travel outside Canada and the United States and its territories and possessions. Foreign travel may be approved only if it is directly related to project objectives.

4.5 Other Direct Costs

The budget should itemize other anticipated direct costs not included under the headings above, including materials and supplies, publication costs, computer services, and consultant services (which are discussed below). Other examples are: aircraft rental, space rental at research establishments away from the institution, minor building alterations, service charges, and fabrication of equipment or systems not available off-the-shelf. Reference books and periodicals may be charged to the project only if they are specifically related to the research.

a. Materials and Supplies

The budget should indicate in general terms the type of required expendable materials and supplies with their estimated costs. The breakdown should be more detailed when the cost is substantial.

b. Publication Costs/Page Charges

The budget may request funds for the costs of preparing and publishing the results of research, including costs of reports, reprints page charges, or other journal costs (except costs for prior or early publication), and necessary illustrations.

c. Consultant Services

Anticipated consultant services should be justified and information furnished on each individual's expertise, primary organizational affiliation, daily compensation rate and number of days expected service. Consultant's travel costs should be listed separately under travel in the budget.

d. Computer Services

The cost of computer services, including computer-based retrieval of scientific and technical information, may be requested. A justification based on the established computer service rates should be included.

e. Subcontracts

Subcontracts should be listed so that they can be properly evaluated. There should be an anticipated cost and an explanation of that cost for each subcontract. The total amount of each subcontract should also appear as a budget item.

4.6 Indirect Costs

Explain the basis for each overhead and indirect cost. Include the current rates.