Interdisciplinary Research

Council of Councils
March 31st 2008

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* Previous Principal Leads:
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  Betsy Wilder

* Project Team Leaders
Points to Cover

Context and Background
  Team Science; Multi- and Interdisciplinary Research (IR)
  IR in the Context of Roadmap
  Assumptions and goals of the IR Implementation Group (IG)
Challenges to IR and the IRIG Response
  Research Consortia
  Integration of Behavioral and Social Science Research
Incentives for collaboration among disciplines
Training
Evaluation of IRIG Activities
Interdisciplinary Research in \textit{cis} and \textit{trans}
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Interdisciplinary Research in cis and trans
Multi- and interdisciplinary research teams, will be required to solve the “puzzle” of complex diseases and conditions.

Genes
Behavior
Diet/Nutrition
Infectious agents
Environment
Society
???
Evolution of the Scientific Enterprise*

*Barabási, Science 308:639, 2005
Evolution of Team Size: Science is still Searching for the Optimal Size

Guimerà et al., Science 308:639, 2005
Relationship between team assembly mechanisms, network structure and performance

$p$, the probability of selecting incumbents, was positively correlated with impact factor.

- Successful teams have a higher fraction of incumbents who contribute expertise and know-how to the team.

$q$, the propensity of incumbents to select past collaborators, was negatively correlated with impact factor.

- Teams that are less diverse typically have lower levels of performance.

Guimerà et al., Science 308:639, 2005
The Relative Impact of Teams

Mean team size comparing all papers and patents with those that received more citations than average in the subfield.

Relative Team Impact (RTI) – mean number of citations received by team authored work divided by the mean number of citations received by solo-authored work. An RTI = 1 means there is no difference.

Wuchty et al., Science 316:1036, 2007
Team Science is not necessarily Multi- or Interdisciplinary Science

Multidisciplinary

Interdisciplinary

A

Work on

common problem

A

B

Multidisciplinary

A

Interaction

C

B

forges new discipline
Interdisciplinary Research Implementation Group

A trans-NIH group to focus on developing initiatives that would *incubate* IR.

✓ **Goal:** to support significant advances in public health by stimulating research that crosses boundaries defined by scientific disciplines (i.e., IR)

✓ **Approach:** identify the barriers to IR and propose/support initiatives that remove these barriers
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Interdisciplinary Research in cis and trans
Challenges to Team and IR

The current system of academic advancement favors the independent investigator.
Challenges to Team and IR

The current system of academic advancement favors the independent investigator.

Most institutions house scientists in discrete departments.

“I see by the current issue of ‘Lab News,’ Ridgeway, that you’ve been working for the last twenty years on the same problem I’ve been working on for the last twenty years.”
Challenges to Team and IR

The current system of academic advancement favors the independent investigator. Most institutions house scientists in discrete departments. Interdisciplinary science requires interdisciplinary peer review.

RESUME AND SUMMARY OF DISCUSSION: The proposed interdisciplinary study will investigate………………………………………………………......
…………………………………………………………
…………………………………………………………

While the reviewers agree that the principal investigator and her team is outstanding, this remains an overly ambitious, unfocused application.
Challenges to Team and IR

The current system of academic advancement favors the independent investigator.

Most institutions house scientists in discrete departments.

Interdisciplinary science requires interdisciplinary peer review.

Project management and oversight is currently performed by discrete NIH Institutes.
Challenges to Team and IR

The current system of academic advancement favors the independent investigator.
Most institutions house scientists in discrete departments.
Interdisciplinary science requires interdisciplinary peer review.
Project management and oversight is currently performed by discrete NIH Institutes.
Interdisciplinary research teams take time to assemble and require unique resources.
Barriers to IR

Infrastructure to support IR

Bridging basic biological sciences and behavioral and social sciences

Incentives for collaborations among disciplines

IR training of new and established investigators disciplinary Research
Barriers to IR

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IRIG Initiative

IR Consortia

- 21 P20 Exploratory Centers
- X02 (Pre-application) for IR Consortium → 17 groups
- 9 U54 IR Consortium
- 84 individual awards to 32 institutions
- ~$42.5M in total costs per year
- 16 ICs are participating in the management of awards
## IR Consortia

<table>
<thead>
<tr>
<th>Focus Area</th>
<th># of Awards</th>
<th>ICs</th>
<th>Institutions</th>
</tr>
</thead>
<tbody>
<tr>
<td>Genome Engineering</td>
<td>11</td>
<td>NCI, NHLBI, NIGMS, NCRR/NIDCR</td>
<td>Children’s Hospital Seattle, University of Washington, Fred Hutchinson</td>
</tr>
<tr>
<td>Drug Discovery</td>
<td>4</td>
<td>NCI, NHGRI, NIGMS, NCRR/NIDCR</td>
<td>Broad Institute</td>
</tr>
<tr>
<td>Stress &amp; Addiction</td>
<td>14</td>
<td>NIAAA, NIDA, NCRR/NIDCR</td>
<td>Yale, UC Irvine, Florida State</td>
</tr>
<tr>
<td>Oncofertility</td>
<td>10</td>
<td>NCI, NIBIB, NICHD, NCRR/NIDCR</td>
<td>Northwestern, University of Missouri, Oregon Health Sciences U, UC San Diego, Evanston Northwestern Healthcare Research Institute</td>
</tr>
</tbody>
</table>
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<th># of Awards</th>
<th>ICs</th>
<th>Institutions</th>
</tr>
</thead>
<tbody>
<tr>
<td>Neuropsychiatric Phenomics</td>
<td>8</td>
<td>NIDA, NIMH, NINDS, NLM, NCRR/NIDCR</td>
<td>UCLA, University of Helsinki, University of Oulu, UC Santa Barbara, MUSC</td>
</tr>
<tr>
<td>Geroscience</td>
<td>10</td>
<td>NIA, NIEHS, NIGMS, NINDS, NCRR/NIDCR</td>
<td>Buck Institute</td>
</tr>
<tr>
<td>Neurotherapeutics</td>
<td>6</td>
<td>NIA, NIDA, NINDS, NCRR/NIDCR</td>
<td>UC Davis, Scripps Florida, University of Washington, Erasmus Medical College, University of Colorado Health Sciences Center</td>
</tr>
<tr>
<td>Obesity</td>
<td>10</td>
<td>NHLBI, NIDDK, NIGMS, NCRR/NIDCR</td>
<td>UT Southwestern, Integrative Bioinformatics, Inc.</td>
</tr>
<tr>
<td>Organ Design</td>
<td>11</td>
<td>NHLBI, NIBIB, NIDDK, NCRR/NIDCR</td>
<td>Brigham and Women’s, Harvard, Vanderbilt, Children’s Hospital Boston, Harvard Med, Boston U, MIT, Mass General</td>
</tr>
</tbody>
</table>
Barriers to IR

Infrastructure to support IR

Bridging basic biological sciences and behavioral and social sciences

Incentives for collaborations among disciplines

IR training of new and established investigators

IRIG Initiative

Research collaborations between behavioral/social sciences and biomedical sciences:

- Facilitating IR via Methodological and Technological Innovation in Behavioral and Social Sciences (R21) – RM-07-004
- Administrative Supplements to Support IR in the Behavioral and Social Sciences (R01-R37) – RM-05-007
- Supplements for Methodological Innovations in the Behavioral and Social Sciences (Type 3 R01/P01) – RM-04-013
- Meetings and Networks for Methodological Development in IR (R13/R21)–RM-04014
Barriers to IR

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IRIG Initiative

Multiple PI policy change at NIH*
Sharing of credit for funding across ICs

*A joint initiative among several trans-NIH groups and Offices
Multiple Principal Investigators

All Federal research agencies are currently preparing for the implementation of policies and procedures to formally allow more than one Principal Investigator (PI) on individual research awards. This presents a new and important opportunity for investigators seeking support for projects or activities that clearly require a “team science” approach. The multiple-PI option is targeted specifically to those projects that do not fit the single-PI model, and therefore is intended to supplement, and not to replace, the traditional single PI model. The overarching goal is to maximize the potential of team science efforts, responsive to the challenges and opportunities of the 21st century.

The "General Information" section of this site presents the essential background and features of the multiple-PI policy, frequently asked questions as well as the major issues to be considered during implementation. The remaining sections on this page focus on implementation strategies beginning in February 2007, the results from the Requests for Information through which the National Institutes of Health (NIH) and the Office of Science and Technology Policy (OSTP) solicited advice and comments from the scientific Community, and information uncovered during the Pilot Phase of the Initiative between May and December 2006.
Barriers to IR

Infrastructure to support IR
Bridging basic biological sciences and behavioral and social sciences
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IRIG Initiative

RFAs to establish training programs:

- Curriculum Development Award in IR (K07) – RM-04-007
- Short Programs for IR Training (R13) – RM-04-008
- Interdisciplinary Health Research Training: Behavior, Environment and Biology (T32) - RM-04-010 & RM-05-010
- Training for a New IR Workforce (T90/R90) –RM-04-015 & RM-06-006
# Training a New Workforce (T'90)

<table>
<thead>
<tr>
<th>Feature</th>
<th>T32 (NRSA)</th>
<th>T90 (NIH Roadmap)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Trainee</td>
<td>NRSA requirements</td>
<td>Foreign nationals, Any stage of career</td>
</tr>
<tr>
<td>Salary</td>
<td>None for PI</td>
<td>Up to 10% allowed</td>
</tr>
<tr>
<td>Approach</td>
<td>Multidisciplinary</td>
<td>Interdisciplinary</td>
</tr>
<tr>
<td>Evaluation</td>
<td>Peer review and progress reports</td>
<td>Self-evaluation and annual meeting</td>
</tr>
<tr>
<td>Payback requirements</td>
<td>All trainees</td>
<td>No payback for trainees on R90</td>
</tr>
<tr>
<td>Unfilled trainee slots</td>
<td>Pre/Post flexible</td>
<td>Fixed # slots</td>
</tr>
</tbody>
</table>
Points to Cover

Context and Background
- The Place of IR in the Context of Roadmap
- Assumptions and goals of the IRWG

Barriers to IR and the IRWG Response
- Research Consortia
- Integration of Behavioral and Social Science Research
- Incentives for collaboration among disciplines
- Training

Evaluation of IRIG Activities
- Interdisciplinary Research in *cis* and *trans*
Assessing the overall contribution of the team

- Ascertain contributions to the creation of a new field - the degree to which the work relates to antecedent disciplinary knowledge
- Ascertain degree to which the work contributes to a network of knowledge
- Social network analysis to assess relationships among investigators in the team and to identify “hot spots” of interdisciplinary research
- Ascertain degree to which the work leads to practical answers to societal questions

Assessing the contribution of the individual team member

- Does the team member publish work independently (e.g. methods develop) that enables the team effort?
- Does the team member participate in reviews of interdisciplinary science?
- Has the team member been asked to speak at national/international meetings in areas outside of their own traditional discipline?
- Analyze the informal network to ascertain the degree to which the individual contributes to a network of knowledge
Evaluation Plan is Focused on Process and Short-term Outcomes

- **Process**
  - Initiative-Planning & Grants Announcements
  - Scientific Review
  - Portfolio Selection
  - Program Management & Grants Oversight

- **Short-term outcomes**
  - **IR Consortia:**
    - Do investigators see added value to IR collaborations? Do NIH staff view activities of consortium researchers as unique?
  - **Bridging Biomedical and Behavioral Sciences:**
    - Have new methodologies/technologies been developed to facilitate bridging fields? Have new or stronger collaborations been established? Do investigators plan to continue these collaborations?
Evaluation Plan is Focused on Process and Short-Term Outcomes (cont.)

- Process
  - Initiative-Planning & Grants Announcements
  - Scientific Review
  - Portfolio Selection
  - Program Management & Grants Oversight

- Multiple PI Policy Change:
  - Have there been any changes in institutional policies related to credit sharing resulting from MPI? Have there been any other benefits to grantees resulting from MPI?

- IR Training:
  - Does IR training have an impact on student attitudes towards IR? Do faculty-mentors engage in more collaborative research?
Short-Term* Assessment of IR Training Initiatives

- Census
- Meeting of T90/R90 Training Directors – May, 2007
- Independent assessment by training directors NOT supported by IR training grants – October 29, 2007
- Evaluation of Training program content for similarity or uniqueness relative to other NIH training programs - ongoing

* Referred to within RM as the “Mid-Course”
Census of T90/R90 and T32 (Interdisciplinary Health Research Training: Behavior, Environment and Biology) Programs

Number of trainees supported in 2006:

<table>
<thead>
<tr>
<th></th>
<th>Undergraduates</th>
<th>Pre-doctoral</th>
<th>Post-doctoral</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td>NRSA</td>
<td>non-NRSA</td>
</tr>
<tr>
<td>T32</td>
<td>NA</td>
<td>NA</td>
<td>NA</td>
</tr>
<tr>
<td>T90/R90 Phase 1</td>
<td>38</td>
<td>88</td>
<td>31</td>
</tr>
<tr>
<td>T90/R90 Phase 2</td>
<td>9</td>
<td>23</td>
<td>2</td>
</tr>
<tr>
<td>TOTAL (268)</td>
<td>47</td>
<td>111</td>
<td>33</td>
</tr>
</tbody>
</table>

*FTTP provided by grantee institution*
Summary of Short-Term Assessment

Institutional Issues:

- Insuring quality of training by building measures of scientific rigor into programs
- Identifying whether or not there is a core skill set that all IR trainees should have following training.
- Need to facilitate a stronger connection between the various components that make up IR (e.g., between biological and quantitative areas or between basic and clinical approaches)
- IR training activities should not be an add-on to ongoing departmental requirements for faculty.
- Developing methods for attracting, identifying and selecting the very best students available including those from underrepresented groups and foreign students.
Summary of Short-Term Assessment

Program-specific issues include:

- Development of degree-granting programs
- Use of mentoring committees/teams vs. co-mentors
- Core competency courses vs. a ‘menu’ of courses individually tailored for students
- Front-loading courses before students engage in research
- Involvement of basic research students in clinical work
Summary of Short-Term Assessment

- Both IR and independent training directors indicated that IR focused training programs are needed –
  - Led to creation of new programs at most institutions
  - Increases institutional recognition for/acceptance of IR training
  - Provides a vehicle for more broadly-based IR training than available through individual IC-supported programs
- Even at institutions where IR training was ongoing, the RM program allowed funding from a single source centralizing administration and consolidating training efforts; in some cases increased the breadth of the scope of training
- T90/R90 inclusion of undergrads and international students enhances diversity of trainee cohorts
- Disease-specific peer review/funding make support of IR training difficult to obtain
- Single-IC designations, even for administrative purposes, can have profound, negative effects on attracting broadest applicant base
Questions Arising from Short-Term Assessment of IR Training Programs

- Should NIH support IR training outside of traditional IC training programs?
  - Where does the money come from?
  - Who does the primary and secondary review?
  - Need IR expertise to give fair peer review; should IR applications compete with traditional IC training programs?
- How are grants designated to reflect trans-NIH support?
  - Needs a designation to reflect the fact that this is trans-NIH and not tied to a specific IC
  - Use of IC designation can reduce response to program
- Who makes funding decisions? Who has programmatic responsibilities for grants?
Life After Roadmap: Current Transition Plan

- IRIG members are working with TAC and PIs of IR training programs to match currently funded IR training programs with relevant/interested ICs
- Will ICs support full IR programs as currently constituted – or will they be morphed into greater alignment with IC mission relevance?
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Interdisciplinary Research in *cis* and *trans*

- There is a fundamental tension between IR that lies within the interface of traditional IC boundaries and the alignment of support for IC mission.
- We find that the more IR a training program is, the less likely it is will be “adopted” up by an IC.
Interdisciplinary Research in *cis* and *trans*

But, “without tension, there can be no music”

Mary Beckerle