# Strategies for Developing Large-Scale, Collaborative Grants

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# Learning Objectives

- Define interdisciplinary research, team science and collaboration
- Understand the increased emphasis on team science and collaboration in grant programs
- List strategies that will enhance the development of complex, large-scale, multi-disciplinary grant proposals
- Describe challenges in preparing large-scale collaborative grant applications.

# Inter-multi-cross disciplinary Research (IR), also becoming known as Team Science (TS)

- A mode of research by teams or individuals that integrates data, information, tools, techniques, perspectives, concepts, and/or theories
- from two or more disciplines or bodies of specialized knowledge
- to advance fundamental understanding or to solve problems
- whose solutions are beyond the scope of a single discipline or area of research practice.

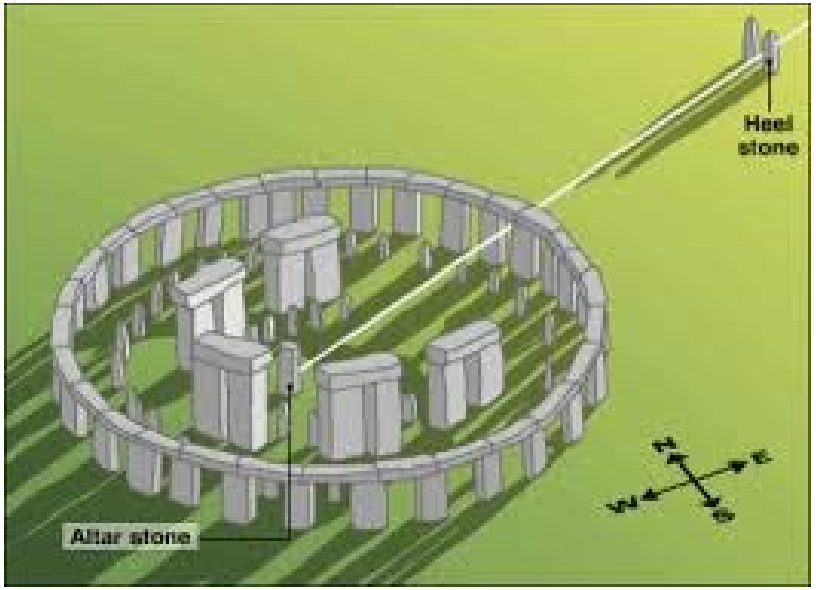
Definition from *Facilitating Interdisciplinary Research*: National Academies, 2004

# Why is team science the new normal?

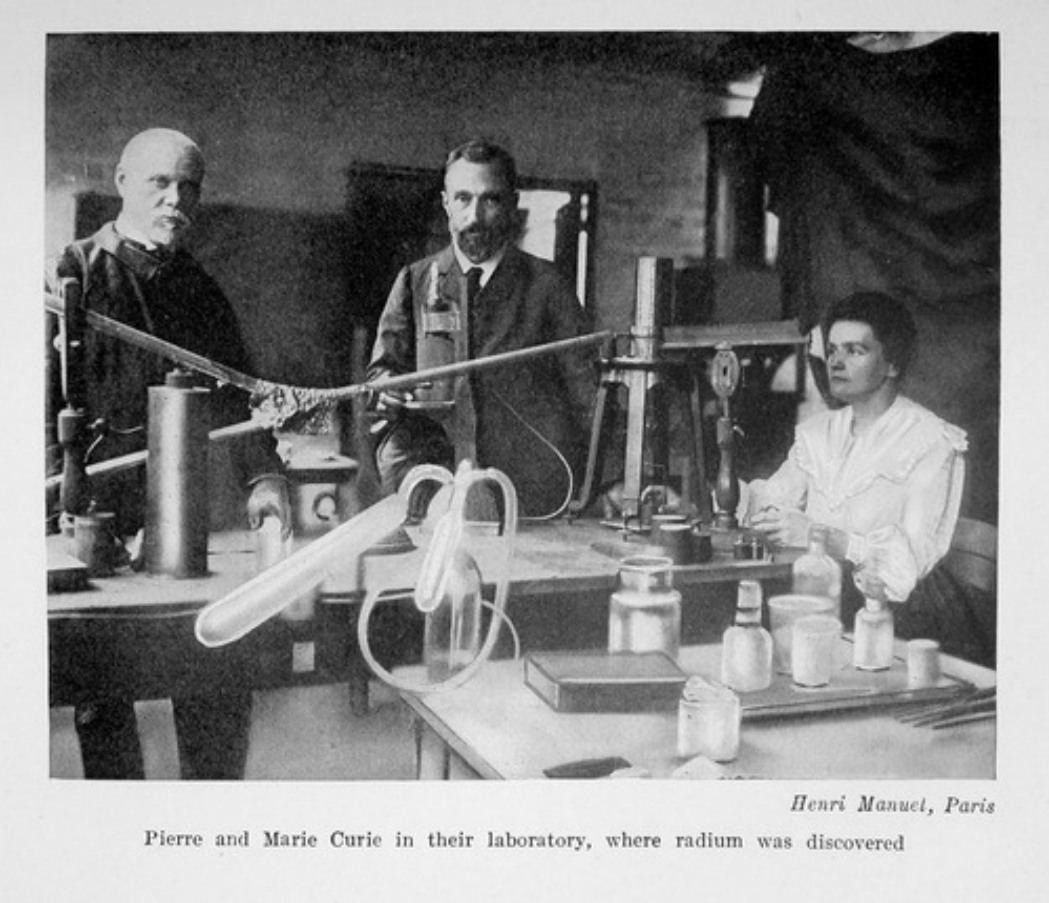
- Continued advances in the technologies available to researchers (imaging, three-d printing, nanoscience)
- Generation of vast data sets (human genome, Hubble)
- Complex and global problems requiring multiple disciplinary approaches:
  - Emerging diseases and other world health issues:
    - Aging populations worldwide
    - Infant and child mortality
    - War-related injuries
    - Health disparities
  - Natural and human-created disasters (droughts, famines, floods, earthquakes, climate change)

# Without team science and collaboration

# Ancient Team Science: Building Stonehenge



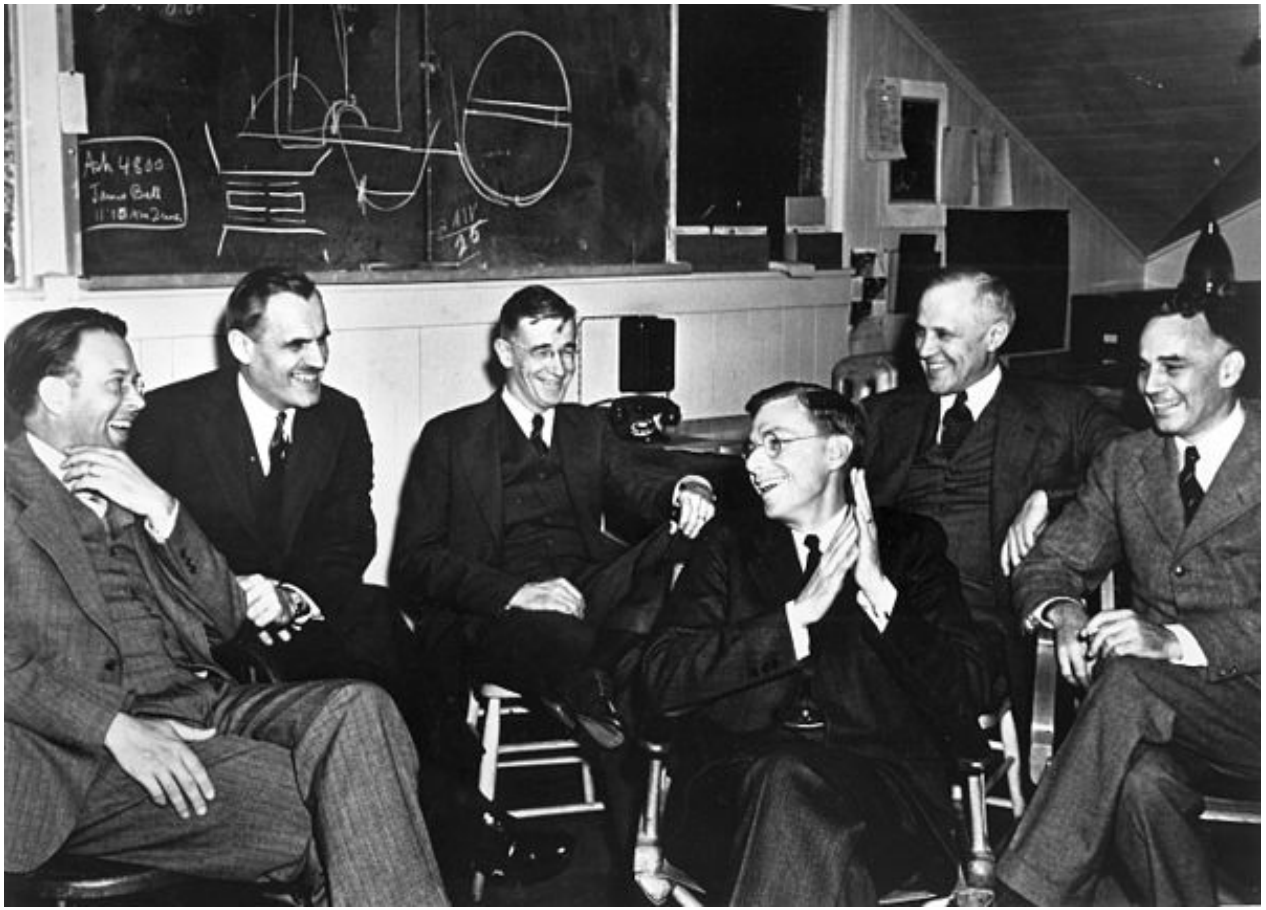
# Early Team Science in the late 1800's: Marie and Pierre Curie



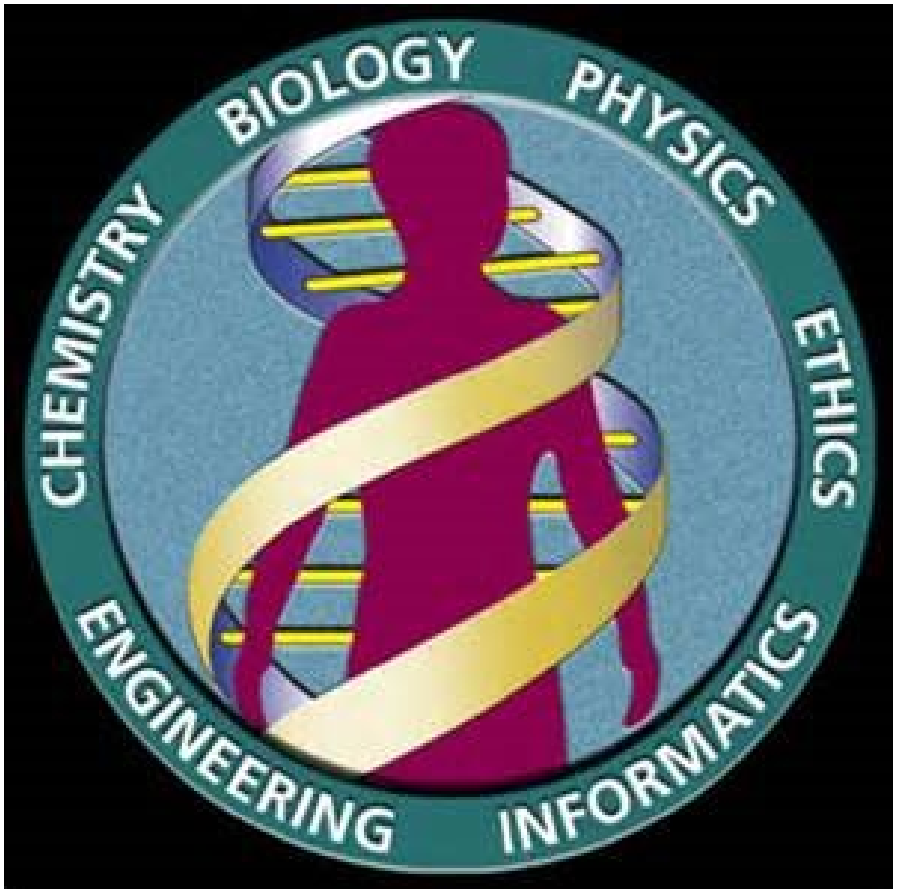
*Henri Manuel, Paris*

Pierre and Marie Curie in their laboratory, where radium was discovered

# Early Team Science in the 1940's: The U.S. Manhattan Project

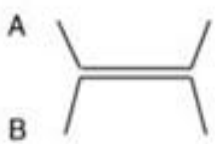


# Modern Team Science and Collaboration: Mapping the Human Genome



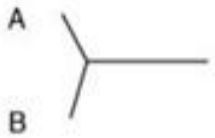
# The wrong reason for collaboration

# Modes of Team Science




A
B

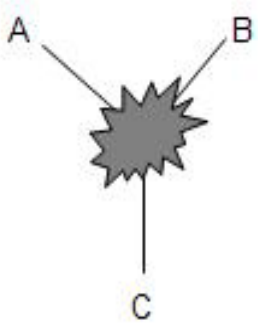
*Multidisciplinary:*
Join together to work on common problem, split apart unchanged when work is done.




C

*Interdisciplinary:*
Join together to work on common question or problem. Interaction may forge a new research field or discipline.

**Source:** *Facilitating Interdisciplinary Research*, 2005, 27.




*Transdisciplinary:*
Join together to define the problem in the context of application
Dynamic, flexible, transient, generative
Reflexive & social

**Source:** Moore, G.2007, after Gibbons et al, 1994.

# Research Collaboration/Team Science

- Combine or integrate from more than one field
  - Concepts
  - Methods
  - Theories
- Three cross-disciplinary orientations
  - Multidisciplinary:
    fruit basket
    - Independent, sequential
  - Interdisciplinary:
    fruit salad
    - Joint, interactive
  - Transdisciplinary: fruit smoothie
    - Blended, no independent identity

Thanks to Leigh Botner, University of Delaware, for this slide

# What kinds of institutional support are needed to facilitate this type of research?

- Foster a collaborative environment
- Provide seed or start-up funding
- Strategic plans that promote IR/TS
- Provide faculty incentives for IR/TS that reflect and reward involvement in IR/TS
  - Hiring and tenure policies
  - Time and institutional support to prepare proposals
- Cross-department budgeting mechanisms
- Lab/meeting space co-location
- Cross-department/team teaching mechanisms

Source: Klein, J.T. and Porter, A.L., “Preconditions for Interdisciplinary Research.”

# Characteristics of Team Science Grants

- NIH Road Map, NSF Strategic Plan
  - May be determined politically, financially, strategically
- Response to national/global needs (long-term)
- Response to emerging problems (short-term)
- One-time/limited opportunity
- Restricted applications
- Large budgets ($5 million or more)
- Complex, long proposals
- Large teams, with sub-groups, partners
- Multiple stages of application
  - Letter of intent, pre-proposal, proposal, site visit, etc.

# How Research Development Plays a Critical Role in These Grants

- Establishing focus and scope
- Advising on time/budget allocations
- Arbitrating competing interests
- Identifying key players
- Organizing/managing team meetings
- Keeping team informed/staying on schedule
- Being central point for proposal components
- Editing/drafting/refining
- Coordinating internal and red team reviews

# Collaboration in Science and Beyond

- Many international grant agencies support collaboration
  - UK Engineering and Physical Sciences Research Council
  - Human Frontier Science Program (Australia, Canada, France, Germany, India, Italy, Japan, Republic of Korea, Norway, New Zealand, Singapore, Switzerland, UK, USA, EU)
  - DAAD (German  Academic Exchange Program)
  - Yamagiwa-Yoshida Memorial International Study Grants
  - Trust Africa (higher education development for 7 regions)
  - DFG (Deutsche Forschungsgemeinschaft) International Collaboration
  - Kuwaiti Foundation for the Advancement of Sciences (KFAS)
  - Wenner-Gren International Collaborative Research Grants
  - Malaysia International Collaboration Fund
  - International Foundation for Science (Sweden)

# NIH Support of Team Science

- 2003: NIH Roadmap includes “Research Teams of the Future” as a focus area:
  - “stimulate new ways of combining skills and disciplines in the physical, biological, and social sciences to realize the great promise of 21st century medical research”
- 2006: Clinical and Translational Science Awards (CTSA) established to support and promote interdisciplinary teams
- 2007: NIH institutes Multiple-PI grant mechanism
- 2016 and on: Single-investigator R01 grant awards continue to decrease in numbers and dollars
- Teamwork is the new normal for biomedical research

# NIH Mechanism to Support Team Science

- Research Program Project Grant
  - Support for integrated, multi-project research projects involving a number of independent investigators who share knowledge and common resources
  - Each project contributes or is directly related to the common theme of the total research effort, thus forming a system of research activities and projects directed toward a well-defined research program goal
  - Specific dollar limit unless specified in Funding Opportunity Announcement (FOA)

# NIH Specialized Centers

- To support any part of the full range of research and development: very basic science to clinical applications.
- May involve ancillary supportive activities such as protracted patient care necessary to the primary research effort.
- The spectrum of activities comprises a multidisciplinary attack on a specific disease entity or biomedical problem area.
- Receive continuous attention from funding IC.
- Centers may serve as regional or national resources for special research purpose.

# Examples of Multi-Interdisciplinary, Collaborative Proposals and Projects

- Opportunities at many other U.S. federal agencies
  - National Science Foundation
  - Department of Energy
  - Department of Education
  - Department of Transportation
  - National Endowment for the Humanities

# NSF Opportunities + Commitment

- Solicited Interdisciplinary Programs
  - Cyber-enabled Discovery and Innovation
  - Water Sustainability and Climate
  - Collaboration in Mathematical Geosciences
- Areas of National Importance
  - The National Nanotechnology Initiative
- Center Competitions (next slide)
- Unsolicited Interdisciplinary Proposals
- Education and Training
- Workshops, Conferences and Symposia

# More NSF Examples

- Materials Engineering Research Centers
- Center for Research at the Interface of the Mathematical and Biological Sciences
- Engineering Research Centers
- Centers for Chemical Innovation
- Science and Technology Centers: Integrative Partnerships
- Science of Learning Centers
- Industry-University Cooperative Research Centers
- Cyber-Physical Systems

# US ED Collaborative Examples

- GEAR-UP
- First in the World
- American Overseas Research Centers
- Education Research and Development Centers
- Language Resource Centers

# Other Agency Examples

- Department of Homeland Security
  - Transportation Security Innovative Concepts
- Department of Energy
  - Biomass Research and Development Initiative
- Department of Defense + branches
- National Endowment for the Humanities-NEH
  - Collaborative Research Grants: two or more scholars, for full-time or part-time activities for periods of a minimum of one year up to a maximum of three years.
- Health and Human Services
  - Centers of Excellence Program

# Why do PIs collaborate? Advantages

- Creative synergy of multiple brains
- Learn new skills, approaches, thinking
- More efficient use of resources
- Large problems need more expertise
- Project not dependent on one person
- Team members can leave/join
- Better use of students, post-docs
- More institutional visibility, impact
- Broader publication opportunities

# Disadvantages: Individuals

- Difficulty for young faculty at tenure:
  - Department may not value collaboration
  - Publications may not be in standard journals of the field
  - Credit on publications may differ in disciplines
    - Single vs. multiple authors
  - May take time away from primary research and teaching area

# More disadvantages: Department

- Distribution of indirect costs
- Allocation of other grant resources:
  - Equipment
  - Space
  - Research assistants
  - Travel money
- Teaching assignments
- Tenure review:  finding external reviewers in another discipline

# Making the decision: Top Down

- Central administration
  - New top leadership, especially research
  - New institutional focus:
    - New strategic plan
    - New mission statement
  - External factors:
    - Local industry/community needs
      - Local schools, unemployment, economic development
    - Major contributor(s)
    - One-time event (bridge collapse, hurricane, disease)

# Making the decision: Bottom Up

- Senior faculty
- Existing team/lab
- New grant opportunity
- New department/college leadership
- New space/resources
- Significant event:
  - Climate change/global warming
  - Energy crisis
  - Graduation/retention rates

# Building the team: Internal

- Existing research groups
- Individuals already acquainted:
  - Interest/discussion/seminar groups
  - Internal committee colleagues
- Co-publishers, co-presenters in same or other departments/colleges
- Resources: persons, offices, groups
  - Grants office
  - Internal publications
  - Institutional web pages

# Building the team: External:

- Former students and post-docs
- Colleagues at a former university/institution
- Co-panelists at conferences
- Co-authors
- Publications, conference panelists
- Databases:
  - Community of Science
  - SPIN, other experts directories

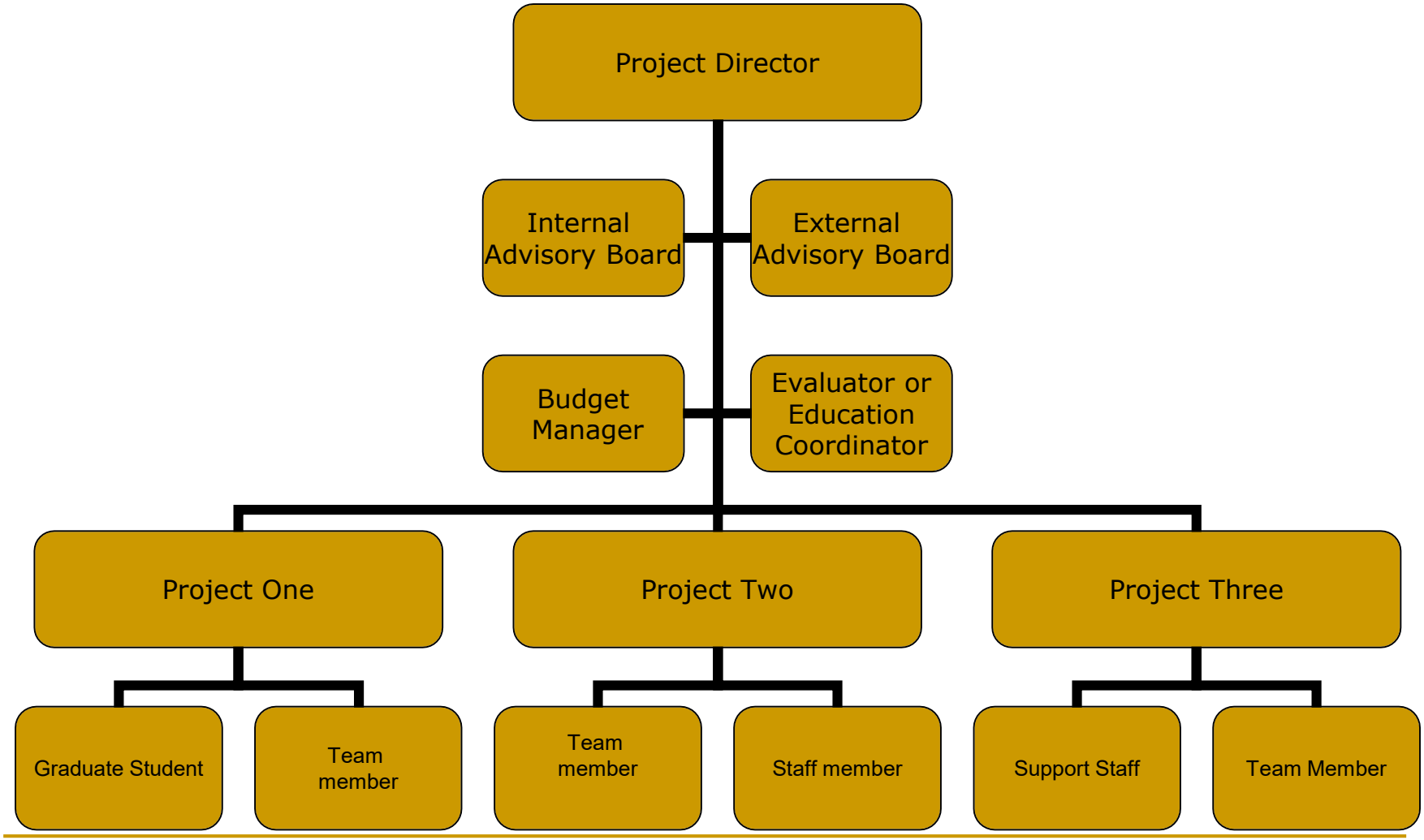
# Project Leadership: Research

- Senior researcher, known in field
- Owner of original idea
- Person with administrative experience
- Person with grant management and budget experience
- Well-respected internally and externally
- Person with good people skills
- Person who has ability to follow schedules
- Person who can say no
- Person with interest in the project

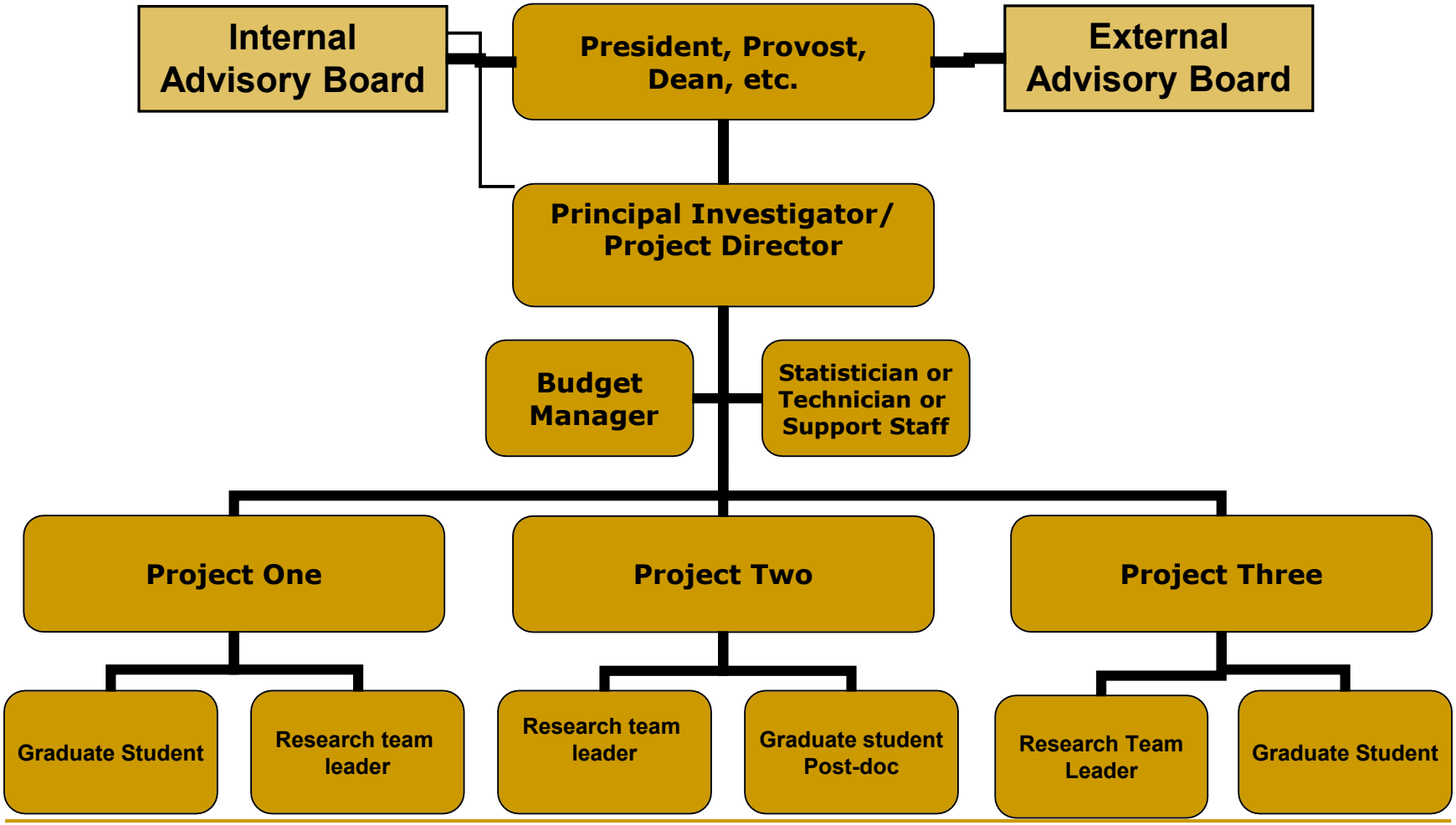
# Typical Proposal Components

- Administrative Core/Operations
- Multiple projects/multiple PIs
- Project management plans
- Organizational charts (next slides)
- Elaborate time and task charts
- External collaborators and/or Advisory boards
- Complex evaluation plans/treatment plans
- Data management plans
- Human/animal subjects and other compliances

# Example of Organization Chart: Service, Outreach, Community-Based Project



# Typical Organization Chart: Research



# Proposal Components, continued

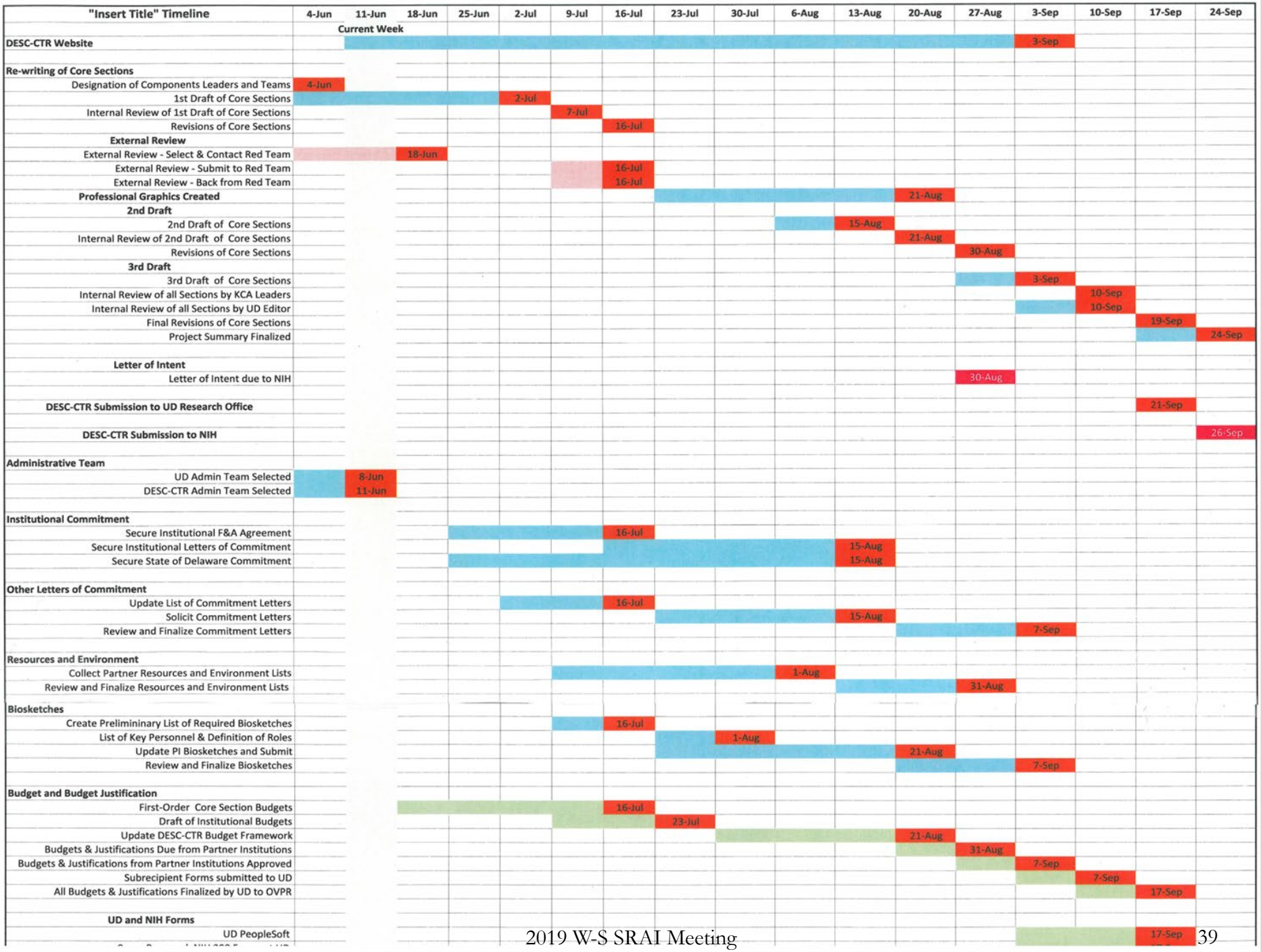
- Multi-year detailed budgets
  - By project, person, month, benchmarks
- Detailed lists of labs, facilities and equipment
- Diversity/community outreach plan
- Education plan/postdoc mentoring plan
- Letters of support/commitment
- Institutional cost-sharing
- Letter of intent/pre-screening

# Administrative Challenges: RD and PI

- Identifying participants
- Gathering information
- Coordinating meetings
- Managing the writing
- Assessing/sorting/merging input
- Staying on track
- Developing budget
- Handling external connections

# RD Planning Processes

- The next slides show examples of research development planning and management processes for large-scale, collaborative proposals.
- The first two slides are from the University of Delaware
- The third slide is from Arizona State University


"Insert Title" Timeline
4-Jun
11-Jun
18-Jun
25-Jun
2-Jul
9-Jul
16-Jul
23-Jul
30-Jul
6-Aug
13-Aug
20-Aug
27-Aug
3-Sep
10-Sep
17-Sep
24-Sep
Current Week
DESC-CTR Website
3-Sep
Re-writing of Core Sections
Designation of Components Leaders and Teams
4-Jun
1st Draft of Core Sections
2-Jul
Internal Review of 1st Draft of Core Sections
7-Jul
Revisions of Core Sections
16-Jul
External Review
External Review - Select & Contact Red Team
18-Jun
External Review - Submit to Red Team
16-Jul
External Review - Back from Red Team
16-Jul
Professional Graphics Created
21-Aug
2nd Draft
2nd Draft of Core Sections
15-Aug
Internal Review of 2nd Draft of Core Sections
21-Aug
Revisions of Core Sections
30-Aug
3rd Draft
3rd Draft of Core Sections
3-Sep
Internal Review of all Sections by KCA Leaders
10-Sep
Internal Review of all Sections by UD Editor
10-Sep
Final Revisions of Core Sections
19-Sep
Project Summary Finalized
24-Sep
Letter of Intent
Letter of Intent due to NIH
30-Aug
DESC-CTR Submission to UD Research Office
21-Sep
DESC-CTR Submission to NIH
26-Sep
Administrative Team
UD Admin Team Selected
8-Jun
DESC-CTR Admin Team Selected
11-Jun
Institutional Commitment
Secure Institutional F&A Agreement
16-Jul
Secure Institutional Letters of Commitment
15-Aug
Secure State of Delaware Commitment
15-Aug
Other Letters of Commitment
Update List of Commitment Letters
16-Jul
Solicit Commitment Letters
15-Aug
Review and Finalize Commitment Letters
7-Sep
Resources and Environment
Collect Partner Resources and Environment Lists
1-Aug
Review and Finalize Resources and Environment Lists
31-Aug
Biosketches
Create Preliminary List of Required Biosketches
16-Jul
List of Key Personnel & Definition of Roles
1-Aug
Update PI Biosketches and Submit
21-Aug
Review and Finalize Biosketches
7-Sep
Budget and Budget Justification
First-Order Core Section Budgets
16-Jul
Draft of Institutional Budgets
23-Jul
Update DESC-CTR Budget Framework
21-Aug
Budgets & Justifications Due from Partner Institutions
31-Aug
Budgets & Justifications from Partner Institutions Approved
7-Sep
Subrecipient Forms submitted to UD
7-Sep
All Budgets & Justifications Finalized by UD to OVPR
17-Sep
UD and NIH Forms
UD PeopleSoft
17-Sep

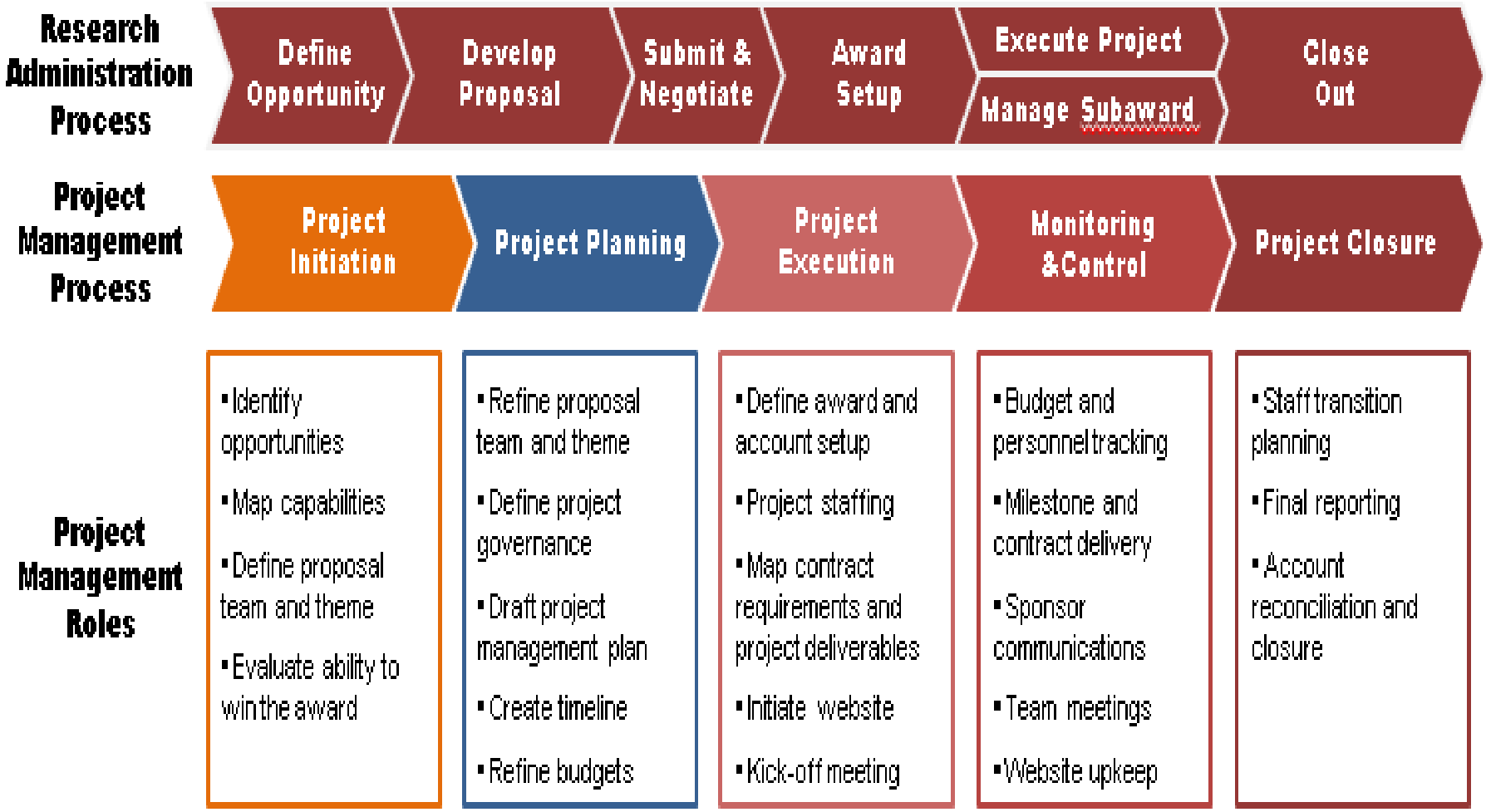
# UD Research Administration Roles and Responsibilities

## "Insert Title"

**All large scale interdisciplinary and/or multi-institutional proposals are different. This model should be modified/adapted for each specific funding opportunity. The key is to define the roles early and communicate them to the entire team!**

| | Lead PI | Research Dean for the PI | Research Development Office & Research Development Network | Co-Director of Program | Proposal Manager | Dept. Admin -for Lead PI | OSP C&G | Thrust/Subproject Leaders | Other Key Personnel | Subcontract Site Leaders | Department Administrator for Thrust/Subproject Leaders | Dept. Admin for Key Personnel | Administrative Support Team | Subcontract Administrative Liaisons | Grant Editor/Skilled Writer | Graphic Artist | External Reviewers | IT Professionals |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| ***Help - How to filter*** | | | | | | | | | | | | | | | | | | |
| Legend: L = Leads; B= Backup; P= Prepares; C= Collects; A= Ensures Formatting on Admin Pieces; S= Schedules; M= Takes Minutes | | | | | | | | | | | | | | | | | | |
| ***Proposal Preparation - Sponsor*** | | | | | | | | | | | | | | | | | | |
| Identifies sponsor solicitation and disseminates | • | | | | | • | | | | | | | | | | | | |
| Reviews sponsor solicitation | • | • | • | • | • | • | • | • | • | • | • | • | • | • | | | | |
| Provides guidance and interpretation of federal regulations, agency specific requirements and UD policies & procedures | | | | | | | • | | | | | | | | | | | |
| Meets to discuss needed proposal preparation resources | • | • | | • | • | • | • | | | | | | | | | | | |
| Assists PI w/building the internal/external teams | • | L | • | • | L | • | | | | • | | | | | | | | |

# ASU Project Management Office




http://researchadmin.asu.edu/pmo

# Challenges for the Investigators

- Generating truly collaborative ideas
- Academic egos
- Thinking as managers, not as researchers
- Seeing the big picture (research project and proposal development)
- Following timelines/meeting deadlines
- Articulating a common vision
- Identifying collaborators and keeping them in the loop

# Differences to Reconcile

- Style of investigators (leadership, time management, collaboration
- Style of doing research
- Style of writing and publication across and within disciplines
  - Authorship and credit
- Technical jargon:
  - within subspecialties
  - within a discipline
  - across disciplines.

# More differences

- Academic and industrial cultures:
  - Sharing of data/publication/intellectual property
  - Use of resources
- Institutional styles and cultures: public and private universities:
  - Salary levels
  - Resources (labs, libraries, support staff)
  - Unionized faculty and staff

# More differences

- Styles and cultures: community-based organizations, schools, government labs, local government agencies
- Work habits and timetables in different academic disciplines
  - Length and frequency of publication
  - Academic year, summer, weekends, breaks
  - Solo researcher vs. team member

# Strategies: First Steps

- Identify an intellectual leader early
- Develop a firm time and task chart
- Identify potential team members and leaders
- Get written department, college, institutional buy-in and commitment
- Identify primary writer/editor early
- Study and learn the RFP
- Consider project management software

# Project Management Steps for Large Proposals

| | |
|---|---|
| Initiation | • Assign a project manager<br>• Identify stakeholders<br>• Establish objectives |
| Planning | • Develop a timeline and list of activities<br>• Establish roles and responsibilities<br>• Evaluate available collaboration tools |
| Execution | • Finalize proposal team<br>• Establish regular meeting schedule<br>• Establish and maintain a document repository |
| Monitoring and control | • Monitor timeline and activities<br>• Provide corrective measures as needed |
| Closure | • Conduct compliance review<br>• Submit proposal<br>• Conduct formal lessons learned meeting/survey |

# Writing the Large-Scale Proposal

- Three possibilities:
  - Professional grant writer
    - Internal or external
  - One primary team writer, with multiple input from rest of team
  - Several team writers, one for each section
    - Separate editor
      - Reconcile styles, language, tone
      - Produce coherent document
      - Write transitions, introductions, conclusions
      - Fill omissions, eliminate redundancies

# Advantages and disadvantages: Professional Grant Writer

- Pros
  - Proven track record
  - Can write quickly and expertly
  - Used to deadlines
  - May find the gaps
  - Not involved with egos or personal history
  - Can commit the time
- Cons
  - Expensive
  - Difficult to find
  - May not understand the science/project
  - May not know the institution
  - May not share the passion
  - May not know the grant program

# Advantages and disadvantages: Individual Writer

- Pros
  - Consistent voice and point of view
  - Knows the science or field
  - Less chance for gaps or redundancy
  - Ability to choose relevant content
  - Has passion and commitment
  - Knows the institution
- Cons
  - Scientific expert may not be skilled writer
  - Time crunch
  - May not have editing skills
  - Will not know all areas of the topic
  - May not understand broad project goals
  - May not have large budget skills

# Advantages and disadvantages: Writing Teams

- Pros
  - Guaranteed technical knowledge
  - Less burdensome on individual time
  - Each section will be strong
  - Simultaneous writing, faster completion
- Cons
  - Disjointed style
  - Gaps/redundancies
  - Different levels of detail
  - Inconsistent goals or approaches
  - Failure to provide big picture
  - Need for editing to achieve consistency

# Strategies: Second Steps

- Prepare proposal outline using RFP
- Prepare templates for each section
- Hold first meeting, using outline as agenda
- Get written commitments of team
- Identify team leaders, if possible
- Assign writing and research tasks
- Set regular meeting dates and deadlines
- Assign person to collect/prepare required proposal components (bios, facilities, etc.)

# Strategies: Third Steps

- Develop working draft budget
- Develop draft organization chart
- Compile first rough draft
- Circulate for review
- Identify gaps and weaknesses
- Add more team members, if needed
- Ask for missing information
- Collate reviews and write next draft
- Establish deadline for final draft

# Strategies: Fourth Steps

- Circulate second draft with deadline for comments
- Collate comments; identify holes in format, content
- Prepare near-final draft proposal
- Conduct red/green/pink team review
- Prepare final proposal narrative
- Prepare final budget and justification
- Complete format, graphics, final editing

# Last Steps

- Complete institutional approvals
- Submit to agency
- Circulate copies of submitted proposal:
  - Full copies to
    - Team leaders
    - Team members
    - Editor/writer
  - Edited version to
    - External partners
    - Administration

# Last steps, after submission…

- Provide additional material, if requested by funding agency
- Prepare for site visit, if selected
- Wait for decision
- Revise budget and tasks, if requested
- If not funded, request reviews
- Revise and resubmit, if feasible
- If funded, begin the project

# References and Acknowledgements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- Leigh Botner, Director of Research Development, University of Delaware
- Andrea Buford, Ph.D., Northern Illinois University
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# Thanks

For Questions and Follow-up

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