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Dear Catherine,

The American Society for Cell Biology (ASCB) is pleased to have this opportunity to respond to the request for information on approaches for supporting team science in the biomedical research community. The ASCB is a nonprofit scientific society of over 9,000 members at leading research institutions, state colleges, undergraduate teaching institutions, and biotechnology companies. Our comments reflect the input from our society's leadership.

Interest in team science: Twenty-first century biological research will rely on more than just classically trained cell biologists to answer the most interesting biological questions. The complexity and scale of scientific research has expanded tremendously in the past 15 years, and thus requires cross-disciplinary approaches that engaged team members with expertise in different fields to work together.

Team science in cell biology has historically involved groups of laboratories with complementary expertise working together on a particular biological system or organism funded by a program project grant. More recently, teams with broader expertise, including physical scientists, have been working together to develop scientific instruments or new technologies, such as the development of super-resolution microscopy, sequencing and analysis of genomes, and mathematical models of complex cellular processes.

Today, addressing complex challenges in cell biology encourages and often requires quantitative approaches to deal with mechanisms at the systems level. This imperative naturally brings together with cell biologists even broader assemblages of scientific expertise, including individuals trained in engineering, mathematics, statistics, computer science, chemistry, physics, and clinical sciences. Key discoveries often require crossing these traditional boundaries. Indeed, new areas in cell biology, such as synthetic cell biology, emerged at the intersection of engineering and cell biology.

Team composition: Cell biology teams of the 21st century need mathematicians, computer scientists, chemists, physicists, engineers, social and behavioral researchers, and bench cell biologists. The composition of the team will depend on the biological process being explored. A premium should be placed on supporting teams composed in ways that will be much more than the sum of the parts, those with synergisms that truly can break new ground rather than simply being a collection of excellent investigator-initiated research projects like traditional program project grants.

Review of team science grant applications: Reviewing applications for truly creative, multidisciplinary projects will likely be challenging. For example, the traditional way of reviewing each part of a program project grant like a separate R01 application and then adding up the scores may fail to identify the best team science. In fact truly synergistic, novel, integrated programs from creative investigators may not score well according to traditional R01 criteria, so NIH should carefully develop new review criteria and processes for new types of team science. Clearly the review groups must be populated with individuals with the expertise to review multidisciplinary applications. This will require study sections populated with investigators with a broad purview of cell biology, including interdisciplinary and quantitative approaches.

Management and advisory structures in team science: The inherent goal is to maximize creativity without becoming bureaucratic or stifling innovation, yet there must be some organizing principle to bring investigators together with effective leadership.

The ASCB recommends team science projects include leadership that brings investigators together and keeps the project moving forward and meeting goals. This oversight structure must be built into the grant and its evaluation will likely require a different style of oversight from the traditional monitoring of R01 and Program Project Grants. Team science approaches may well benefit from more iterative interactions between program officers and the team than is required for the management of the traditional R01 grant. DARPA projects, for instance, have monthly teleconferences to discuss research goals and progress toward those goals with the program manager, and some similar interactions could benefit team-based approaches funded by NIGMS.

Most team science programs will benefit from an outside advisory group to oversee the program and to answer and review critical areas of the program. For instance, is the team science program meeting the overall goals? Are the teams more than the sum of their parts (and if so, what metrics are being used to evaluate this)? Are there ways to address problems in the administration of team science programs? Are there ways to coordinate and harmonize team science programs taking place at other Institutes?

Resources and infrastructure needed to encourage and support team science: We believe that excellent team science can be encouraged and supported via a two-tiered funding mechanism. We propose that teams could apply for initial shorter-term seed funding to support early phase proof-of-concept work that is deemed high impact. Larger scale, more mature team science projects would be

funded by a longer term funding mechanism. NIH/NIGMS could also promote team science by supporting scientific conferences that include significant team efforts.

Training to prepare team scientists: The most essential resource necessary for team science to be successful is the people on the team. To ensure that we meet the needs of 21st century biology, the ASCB recommends programs that train the next generation of scientists to think across the spectrum of science. Why is this so critical? Many of the most pressing problems facing humanity are biological at their core: health, food, energy, the environment. We need a generation of biologists, trained broadly, with interdisciplinary talents.

Other issues (comparative advantages and disadvantages of supporting team science): One ongoing and complex problem facing the development of team science is the challenge of defining cross-disciplinary teams. As NIGMS looks for avenues to take advantage of multi-discipline collaborations to solve complicated biological questions, the ASCB recommends that NIGMS clearly defines what constitutes a team science project. Too often, the Institute has constituted teams that look like four or more R01 grants tied together. In our opinion, this is not a successful method of composing teams. NIGMS needs to address the question of how the formation of a team benefits science and how the collective and individual roles of the investigators come together to produce an outcome that is not individually possible.

Thank you for this opportunity to respond. Please let me know if you would like further details on any of these ideas.

Sincerely,

Erika Shugart, PhD
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Connie Lee, PhD
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