

*Massachusetts Institute of Technology*  
**TASK FORCE ON THE UNDERGRADUATE EDUCATIONAL COMMONS**  
**Optimizing the Science & Engineering Components of the GIRs**  
*Introduction to the Subcommittee v.2*

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## **I. Membership**

Kip Hodges, Chair  
Steve Eppinger  
Liz Greenwood, '05  
Thomas Greytak  
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## **II. Background**

There is little debate among MIT alumni that the Science Core component of the General Institute Requirements is a valuable part of the MIT experience. It prepares our students well for their future careers and gives them a broad perspective on the fundamental sciences. Nevertheless, it is important to review the content and structure of the Science Core periodically to ensure that it adequately meets the evolving educational needs of our undergraduates. Moreover, it is reasonable to ask whether or not the Science Core should be expanded to include engineering science and practice in light of the large number of MIT undergraduates who major in engineering. And, since the Science Core currently defines much of the freshman year, it is important to reflect on how changes in the Core would impact the freshman experience as a whole.

In the early stages of its deliberations, the Task Force has identified a series of specific questions or concerns regarding the Science Core, possible expansions of it to include engineering, and the nature of the freshman year:

- *The rationale for the Core is no longer commonly understood or appreciated by the MIT community.* Many believe that the MIT faculty should adopt an agreed-upon goal for the Core and redesign Core subjects as necessary to achieve that goal. For example, should the goal be a broad exposure to different scientific disciplines, a specific body of material tailored to prepare students for their majors, or an optimized mix of the two? Regardless, the goal of the Core must be communicated effectively to the freshmen when they arrive on campus.

- *Is the current design of the freshman year optimal?* Is the heavy focus on science in the freshman year appropriate? Should there be a greater focus on multiple modes of learning that promotes a better sense of the breadth of the MIT intellectual landscape? Should freshman-year subjects be more coordinated?
- *Is the Science Core an adequate and effective preparation for education in engineering and science?* Some have suggested that there should be new requirements in computation or statistics. Moreover, some faculty – particularly in the School of Engineering – are concerned that the foundational material taught in the Science Core is not being retained effectively by students despite the best efforts of instructors.
- *Should engineering be part of a redesigned "Science and Engineering Core"?* Many engineering faculty have suggested that an introductory engineering subject is important to ensure technological literacy among our students.
- *The freshman year – and the Science Core in particular – does not instill our students with a passion for learning.* Many members of the MIT community are concerned that we do not do enough to expose our newest students to the creativity and intellectual excitement that define the MIT experience. Despite successful innovations like the studio subjects offered by the Physics Department, the lecture-problem set-quiz structure of much of the Science Core encourages a passive role on the part of students. Many faculty feel that self-motivated, design activities might encourage a more active role, may help students integrate across narrow disciplinary requirements to discover important overarching themes, and may prepare students for a more informed choice of major.
- *We must continue to address variations in the backgrounds and learning styles of our students.* Some recent initiatives in the Science Core represent a shift away from multiple modes of teaching and variations in the depth of enquiry to a "one size fits all" design. Is this in the best interest of our students?

### III. Charge

The subcommittee is charged with continuing the work begun by the Scientific and Technical Knowledge Working Group and answering some of the questions posed by that effort. Among the questions to be answered by the subcommittee are the following:

- 1) What are the goals of the current Science Requirement, and how well are these goals being met? Is the current set of science requirement subjects the right mix? Why? If not, what should be added or taken away? Where should students receive exposure to important engineering and technical

- ideas? Should computation or statistics be added to the core requirements of all MIT undergraduates?
- 2) Is there a way to develop a menu-based, multi-tiered Core that would serve the students well *and* provide greater choice?
  - 3) Who should be involved in Core instruction? Should there be increased engineering presence in the teaching of fundamental science material? For example, 3.091 and 5.111 provide healthy competition; should other core subjects provide something similar? Is there interest in more discipline-related section teaching?
  - 4) Is the current culture of weekly problem sets and frequent testing providing the best learning environment for our students? Or would less drilling leave more time for learning? The subcommittee is encouraged to acquaint itself with recent initiatives that might inform recommendations in this area.
  - 5) Should departments continue to assume that all students have the same general preparation? Or, should departments be able to prescribe optional parts of a broader-based set of Core subjects? Should there be different requirements depending on one's major or school? Should students be advised and encouraged to be more flexible in choosing when to satisfy Core subjects during their undergraduate years?
  - 6) Should the REST and LAB requirements be modified? At present, these requirements have been "privatized" by many departments as part of their major programs. Should the content of subjects satisfying REST and LAB be closer to the original spirit of these requirements?
  - 7) Should there be more avenues through the first year such as the current special freshman programs? Should departments be encouraged to develop such programs that provide an exposure on their discipline and approach to problems?
  - 8) What classroom and laboratory facilities are needed for optimal Core education?
  - 9) What are some of the general operational issues – including schedule and academic calendar limitations -- that should be resolved before some of the more interesting pedagogical initiatives can be implemented? This subcommittee is encouraged to consider innovative calendar options, including the use of IAP and half-term subjects.
  - 10) Is exposure to material taken elsewhere equivalent and thus worthy of MIT credit? Should MIT continue to accept AP scores for science and math and thus, for example, allow students to avoid taking MIT biology?

- 11) Finally, should there be an institutional strategy for the freshman year based on the well-defined set of goals for the freshman experience drawn up in 1999 by the CUP? For example, should the freshman year have an explicit, carefully designed and centrally managed range of curricular offerings that are considered preparatory for the following three-years of undergraduate education? How should individual academic departments and those in charge of the general education program communicate regarding outcomes and expectations?

30 November 2004