The following report outlines proposed changes to Caltech’s core curriculum. This report is a preliminary version intended to promote vigorous campus-wide discussion. Depending on the outcome of these discussions, significant modification may occur. At the end of this report, we highlight particular areas where we specifically solicit input.

Purpose of committee

The Report by the 2007 Committee on the Caltech Student Experience and Student Affairs made an explicit recommendation that a review of the Caltech core was in order. The Report stated:

The Core Curriculum should be reviewed for content and breadth. In reviewing the Core, the Committee recommends that the undergraduate program have sufficient flexibility to allow students to participate in academic-year research and to provide opportunities for freshman to interact directly with faculty. The review should also consider the range of backgrounds of incoming students, the scheduling of the Core courses, and the use of grades in the third term of the freshman year.

The Core Committee Task Force was formed in response to that recommendation. The charge to the Task Force from the Faculty Board was as follows:

The Core Curriculum comprises the Institute requirements for undergraduates for all options and is a defining feature of the Caltech undergraduate experience. A recent study of the Student Experience at Caltech made a convincing argument that a rethinking of the current Core is in order. The Ad Hoc Core Curriculum Task Force will define the purpose and goals of the Core, the desired learning outcomes (what students learn from the Core), and a process by which the success of the Core Curriculum can be assessed. The committee will report their conclusions to the Faculty Board along with recommendations for energizing the curriculum through new content and/or approaches. It is expected that to achieve these goals extensive internal and external consultation will be required.

The scope of the committee's deliberations should include, but need not be limited to:

1. Formulating the learning outcomes associated with the core curriculum and specifically investigating the possibility that there be a more flexible core that does not require that every student have the same knowledge but that they prepare for each field in similar fashion;
2. Recommending curricula (and how to deliver them) that will support the learning outcomes, with specific attention to how we may capitalize, in a way we have never done before in the Core, on the research orientation of the faculty;
3. Defining mechanisms to assess the level of student achievement (breadth and depth) and the quality of the student experience;
4. Recommending ways of improving professorial teaching in the Core;
5. Recommending ways that research and/or independent activities can be brought into the curriculum at the earliest stages of the Core Curriculum;
6. Recommending ways of optimizing student/faculty interactions (class attendance and mentoring/advising)
7. Considering a restructuring of the academic calendar to improve how the students go about their education and to enhance the student experience;
8. Recommending other changes or innovations to strengthen the Core Curriculum experience, such as trial courses, technology in the classroom, or variations in the pass-fail grading system.

The committee has interpreted these charges as asking:

1. What should a student learn in the core?
2. What classes should be taught?
3. How do we know it is working?
4. How can we make sure it is taught well?
5. Can research be brought into the core?
6. Can we increase student-faculty interaction?
7. Should we switch to semesters?
8. Is there anything else we should be doing?

The following report is our response to these questions.

**The purpose of a core**

The first question that should be considered before considering changes to the core is: should there even be a core? Few other educational institutions attempt a scientific core. Most rely instead on distribution and option requirements to determine student course selection. Yet, in surveys of faculty, students, and alumni, the answer to the question of whether or not Caltech should have a core is an overwhelming “yes.” Not everyone necessarily agrees on what the core should be or even why it should be, but there is extremely strong support throughout the community for maintaining a core. The sentiment is often expressed that “Core is what makes Caltech special;” however, there is no general agreement on what it is about the core that makes Caltech special. Nonetheless, the Task Force took this strong support to start with the boundary
condition that Caltech should have a core, and as a mandate to make certain that the core is indeed something that does make Caltech special.

Given a core, the next important question (the answer to which should then drive every other decision to be made) is simple: what is the educational point of the Caltech core?

In discussing this question among the committee and with students, faculty, and alumni, we heard five main philosophies that motivate a core:

**Depth:** The core should teach much of the important knowledge in most scientific disciplines. Students should emerge with a substantial working knowledge of the basics of all of the important areas of science.

**Breadth:** The core should give students knowledge of a breadth of scientific disciplines. Students should emerge with sufficient background to understand or teach themselves about most scientific issues.

**Exposure:** The core should give students enough insight into each field that they can make informed decisions about their major at the end of the core and still complete their degree in four years of study.

**Bonding:** The Core should give all students the same experience, as that permits them to build bridges that will serve them for their studies at Caltech.

**Utility:** The core should include only classes that are needed as common prerequisites for all majors. Students should learn anything that might help them in their discipline.

Caltech now implements an inconsistent mixture of four of these five goals. The current core tries to teach much of the important knowledge in some fields, while giving only a preview of other fields, while maintaining some aspects of bonding, while making sure that decisions on majors can be made as late as possible. The only aspect not explicitly attempted in the current core is simple utility, but a truly utilitarian core would be no core at all but rather individual prerequisites and requirements.

We find significant educational flaws in most of these philosophies. True depth across all important areas of science is simply not achievable in a 4 year education, whether it is a worthwhile educational goal or not. Bonding, while an important goal to be considered for a class, should not be a prime driver of curricular choices. Truly inclusive exposure packs so much material into the first few quarters that the effect can be intellectual saturation, rather than intellectual enlightenment.

We believe that it is significantly more important to train students in a broad range of important basics that allow them to teach themselves new things when needed than it is to teach them everything. We thus feel that the design of the core should follow most closely the philosophy of breadth. The Caltech core, then, becomes a “liberal science” program, the scientific counterpart
of a traditional liberal arts education. The purpose of a liberal arts education is not to teach the student a defined set of specific topics but rather to teach the student how to think about, learn about, and understand all aspects of society. This goal is met by exposing a student to a wide range of classes in a variety of disciplines.

Most undergraduate scientific educations focus narrowly on their field of expertise (while usually having distribution requirements outside of their chosen field and the sciences). A student receiving such an education is not learning how different scientists across different disciplines think, but rather being trained to be a specialist in a specific discipline. In contrast, a “liberal science” education would teach a student how to think about, learn about, and understand all aspects of science. In a world in which science is increasingly interdisciplinary and in which science of all sorts is increasingly intertwined with society, such an education would be increasingly valuable. Such a broad scientific education would also be unique among universities, and it could truly be part of what makes a Caltech undergraduate education special.

This philosophy for the core is not significantly different from that stated in the current Caltech catalog:

A Caltech education requires not just the depth of an option but also considerable breadth in basic science, humanities, and social science. Caltech's core curriculum prepares students for the interdisciplinary nature of contemporary research in science and technology. This encourages a culture of problem solving, collaboration, and communication while providing valuable experience in all fields of science. Significant study in the humanities and social sciences is an important component of Caltech's core curriculum, giving alumni the ability to navigate the societal, political, and economic factors, that influence, and are influenced by, their work.

Indeed, a similar philosophy was endorsed by Noyes, Millikan, and Hale, who suggested that a Caltech education should

... include an unusually thorough training in the basic sciences of physics, chemistry, and mathematics, and a large proportion of cultural studies... It is hoped in this way to make the undergraduate courses of the Institute a combination of the fundamental scientific training with a broad cultural outlook.

Proposed philosophical changes to Caltech core
Based on the above considerations, we propose six major philosophical changes to how we approach the core. Combined with a faculty commitment to quality undergraduate education at Caltech, we believe these changes could significantly reenergize education at Caltech.

(1) **Multiple paths through the core**

The goal of the core is for every student to acquire and be able to build upon a foundation in key areas while also being exposed to breadth across disciplines in science, engineering, and humanities. Currently, Caltech attempts to implement these foundational aspects of the core by requiring a certain set of classes which the majority of students take. This implementation poses some serious difficulties. Even at a place like Caltech, students arrive with a wide variety of pre-college experiences and abilities. Attempting to place these students into a small number of classes leads, inevitably, to some students having classes over their heads and some students coasting through classes which are below their level of preparation.

The current solution to students being put in classes over their heads is to make the first two terms pass-fail, allowing students time to catch up. While some students may do poorly in core classes the first two terms, their GPAs are not penalized by this initial floundering. But while their GPAs are not penalized, their education is. No educator would suggest that struggling in a class that is more advanced than one’s level of preparation is an appropriate way to learn. It is clear that, instead, the wide variety of abilities amongst incoming students demands a wide number of potential paths for satisfying the core requirements. While every student should acquire a deep foundation in key areas and a breadth across disciplines, the manner in which these are acquired should be considerably more flexible and tuned for the range of abilities of the Caltech undergraduates. We believe that one of the most important philosophical changes to the current core is thus multiple paths through mandatory core requirements.

Indeed, we believe that flexibility and choice at as many junctures as possible – instead of prescribed classes and few options – is an excellent way in which to improve the student experience. If multiple paths through the core exist, a student need not feel oppressed by any particular required aspect of the program.

(2) **Early exposure to faculty in non-lecture settings.**

Adding more flexibility also allows us the opportunity to exploit one of Caltech’s unique aspects. Few institutions have lower student-faculty ratios, yet incoming students have almost no opportunity to take advantage of this aspect of Caltech. Students arrive at Caltech excited by the possibilities of participating in science and engineering. Such excitement is best built upon not by classroom requirements but by exposure to and interaction with faculty. We thus recommend exposure to faculty in non-lecture settings as part of core requirements (in our section on implementation below we recommend a particularly appealing method of achieving this goal).

(3) **Renormalization of requirements across the key sciences**
Math, physics, and chemistry have always been the important foundational aspects of the core. More recently biology was added. In reexamining these key foundations in light of our overall core philosophy, we believe that while math, physics, chemistry, and biology remain critical, several modifications are in order. As part of the goal of breadth, we deem the current core, which creates, for example, physicists who know a little bit about biology and biologists who know much more about physics, to be less ideal than a core which creates physicists who know a breadth of biology in addition to biologists who know a breadth of physics. We thus recommend a renormalization of the requirements across the key sciences.

(4) An intensive emphasis on critical writing skills

Two key areas are missing from the foundational part of our core. The first of these is writing. While we traditionally think of science and math as being the only foundational parts of the core, few would argue that critical writing is not equally important. Indeed, the current core explicitly requires writing intensive classes, but we believe this aspect of the core is sufficiently important that it should be philosophically elevated to the same level as the foundational sciences. We thus recommend an intensive emphasis on critical writing skills.

(5) Exposure to the fundamental ideas and applications of algorithms

The second foundational area that is missing from the Caltech core is algorithms. Over the last six decades, algorithms have transformed science and engineering, yet the current Caltech core gives no hint of this transformation. Every Caltech undergraduate should be introduced to the analysis, implementation and application of algorithms in the information and/or physical sciences (depending on the path selected by the student). We thus recommend exposure to the fundamental ideas and application of algorithms

(6) A commitment to labs involving data collection & analysis and design & build

Finally, what students learn at Caltech ultimately involves describing, measuring, and/or manipulating things in the real world. As part of the core experience it is thus critical for students to learn how to deal with the real world. Lab classes provide this exposure to reality. Labs require dealing with real world issues such as tips, techniques, malfunctions, errors, time management, sharing, and discussion of how to interpret data and decide to what extent it is credible. Furthermore, labs provide the important role of teaching doubt. We propose that the Institute commit to undergraduate labs. Such a commitment could require, among other things, investing significant new resources in lab classes to bring Caltech labs up to standards of other institutions. An important part of this core lab experience should be for a student to design something, build it, and make it work. This provides exposure to a different and equally critical aspect of the real world, namely the tradeoffs that have to be made between what is desired, the time/money/hardware/skills available, and the underlying scientific feasibility.
With these philosophical underpinnings in place, we attempt below to formulate a specific implementation of a new core.

**Results of Faculty Poll**

Core reform is not simply a slight shuffling of requirements; achieving the philosophical goals of the core requires significantly more changes. However, specific course requirements are still the bedrock on which the core rests. Thus we sought to understand the range of faculty opinions on which topics should be taught in the core. In our survey we asked detailed questions about topics, but also the simple question of how many classes should be required in each subject. We found the results enlightening. The following table shows the *maximum* number of units of each subject recommended by the majority of the faculty.

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<tr>
<th></th>
<th>Physics</th>
<th>Chemistry</th>
<th>Math</th>
<th>Biology</th>
<th>Engineering</th>
<th>Interdisciplinary</th>
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</thead>
<tbody>
<tr>
<td>All faculty</td>
<td>4</td>
<td>3</td>
<td>5</td>
<td>2</td>
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The difference between this majority opinion and the current core is a simple reduction of one term of physics and addition of one term of biology and engineering.

Breaking down the responses into different faculty options shows interesting patterns. In the following table we highlight the major differences between “all faculty” and faculty in a few broadly defined areas. In particular we find that the majority of chemists recommend less math and less physics, while the majority of biologists recommend less chemistry. No strong consensus emerges on “engineering” and “inter-disciplinary.” The HSS faculty have a more egalitarian view of the recommended distribution across disciplines.

<table>
<thead>
<tr>
<th></th>
<th>Physics</th>
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<th>Math</th>
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Finally, we view the result not by only including specific faculty, but instead of excluding specific faculty. In particular, we are interested, for example, in how much biology everyone except the biologists recommends. The results here are also instructive.

<table>
<thead>
<tr>
<th></th>
<th>Physics</th>
<th>Chemistry</th>
<th>Math</th>
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<td>All faculty</td>
<td>4</td>
<td>3</td>
<td>5</td>
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<td>1</td>
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<tr>
<td>no Phys</td>
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<td>3</td>
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<td>no Chem</td>
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</tbody>
</table>
The majority of faculty in areas in which physics would not be a requirement recommends 4 or fewer terms of physics. Faculty in areas in which chemistry would not be a requirement recommend 3 terms of chemistry. Faculty in areas in which biology would not be a requirement recommend 2 terms of biology. Faculty in areas in which additional math would not be a requirement recommend 4 terms of math. The only difference between the results from all faculty and from these subsets is in the math requirements, where faculty in areas without richer math requirements believe one term less math is appropriate.

The committee did not consider this survey a vote to be blindly followed, but it still views these results as a valuable statement of the general attitudes of the faculty.

**Strawman core implementation**

Starting from the stated core philosophy, and using faculty and student opinions about specific topics that should be included in the core, we propose the following for strawman core academic requirements at Caltech.

<table>
<thead>
<tr>
<th>Frosh Fall</th>
<th>Frosh Winter</th>
<th>Frosh Spring</th>
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</thead>
<tbody>
<tr>
<td>Freshmen Seminar</td>
<td>Frosh hum</td>
<td>Frosh hum</td>
</tr>
<tr>
<td>Mechanics, paths</td>
<td>E&amp;M 1, paths</td>
<td>E&amp;M &amp; Modern Phys., paths</td>
</tr>
<tr>
<td>Intro Chem, paths</td>
<td>Chem menu</td>
<td></td>
</tr>
<tr>
<td>Multi-var calculus, paths</td>
<td>Linear algebra, paths</td>
<td>Diff eqn., paths</td>
</tr>
</tbody>
</table>
Our strawman proposal includes all core classes P/F the first term and then all core classes on grades. Also included are a total of 4 terms of humanities – of which two must be writing intensive frosh hums and two must be writing intensive advances humanities classes – 4 terms of social science, and 2 terms of 2 HSS electives, which, uniquely out of core classes, can be taken P/F.

Details and explanations for this proposal are below.

*Frosh Seminar*

The Frosh Seminar is our recommended way to help achieve two of our most important goals, the ability to take multiple paths through the core, and the exposure of incoming students to faculty in non-lecture settings. We envision Frosh Seminar as a required first term class with 10-15 freshmen and a single faculty member exploring in depth an exciting topic in the lab, around a table, in the field, or anywhere else appropriate. Examples that have been mentioned by a variety of faculty members include an exploration of signatures of the ice age glaciations in Southern California, an exploration of the physics of music, the reproduction of important classical experiments in different fields, and more. We believe that the Caltech faculty members are sufficiently interesting and creative that everyone could imagine one or two such seminars that they might enjoy teaching. The seminars are not intended to be a requirement for SURF-type individual research, though, done well, such research could work well as such a Frosh Seminar.

We believe that such seminars would not only advance our core philosophical goals, but would also be an important part of dramatically change the incoming student experience. Rather than being excited about science but not having the opportunity to do much more than sit in classrooms, the Frosh Seminar would provide a means of immediately channeling the students’
excitement and curiosity while also building a relationship with a faculty member and acquiring an experience that could be unique to Caltech.

Physics paths

Rather than a monolithic or nearly monolithic introductory physics class designed to serve all students, we envision multiple paths through the core physics requirements. Each of the paths would cover the same basic material, but in different – possibly extremely different – ways and at different levels. Many of those paths could resemble the current tracks of Phys 1ab, for example, but we would also recommend paths at a level more appropriate for students with less physics or math background and stronger outside interests. Such paths, while providing the flexibility demanded by our core philosophy also provide an excellent framework for students and faculty interested in experimental and innovative courses and instructional techniques. As with many classes we are considering in the core, we do not believe that staffing of these courses should be the sole responsibility of the Division in which the class Such classes could be (and, we believe, should be) taught by a wider variety of faculty at the Institute.

The current core physics strawman requirements consist of one term of classical mechanics, one and one half terms of electricity and magnetism, and a one half term survey of modern physics (i.e., twentieth century physics). Classical mechanics and electricity and magnetism are relevant to essentially all aspects of engineering and science, either intrinsically or via instrumentation use to measure phenomena. Furthermore, the concepts in these subjects often provide metaphors for behavior in other areas, so knowledge in these areas very often provides a means for deciphering problems in very different areas. The survey of modern physics will include brief introductions to quantum mechanics, special relativity, nuclear physics, and selected other aspects of twentieth century physics. This survey will serve in a two-fold way. First, for students planning to major in physics, it will provide an overview of what they will study later and so will help with choice of courses and with seeing how one course relates to another. Second, for students not planning to major in physics, this survey which will be their last exposure to physics, will provide exposure to the "mind-bending" concepts developed in twentieth century physics.

Chemistry paths

Like physics, and for the same reasons, we propose multiple pathways through the chemistry first term requirement. The chemistry core courses should provide students with the foundations for understanding the properties and behavior of matter. The first term should cover bonding and valency through an understanding of the quantum mechanical nature of the electron, similar to the current Chem 1a, but with the possibility of multiple paths for students of different ability, training, and interest. For the second term, however, we propose an expansion to a menu of potential chemistry classes. The purpose of this chemistry menu is to deepen understanding of the fundamentals of chemistry while also providing the first opportunity to allow students to
make choices about the different aspects of breadth that they would like to explore. Our proposed chemistry menu classes would all cover most of the same topics, such as molecular structure, spectroscopy, chemical and statistical thermodynamics, and kinetics, organic chemistry, and the chemistry of life, but would emphasize different areas, e.g. materials, biochemistry. There would likely be a class recommended or even required for future chemistry majors.

_Labs_

As an important component of breadth, our proposed includes 3 required labs. Two of those labs emphasize data collection and analysis, in a manner similar to the current Chem 3x, while the other is a required design and build lab. Multiple choices should be offered in each of the categories. While it is possible that these requirements would mainly be fulfilled through the large lab course that already exist in the current menu, but propose that other labs be encouraged and developed in all disciplines. While we propose flexible choice in cores, it is likely that certain options would require particular labs to fulfill these requirements.

The “design and build lab” menu will provide students the challenge of designing and constructing a functional device or system in one of a variety of research areas (e.g., biological, chemical, mechanical, structural, electrical, etc…). This is an empowering and transformative experience, forcing students to move beyond problem set and textbook comprehension and put principles and concepts into practice in a forward engineering process. In many cases, design and build classes will give student teams the opportunity to directly address societal needs.

_Biology_

We propose that biology, as one of the foundations of the core, receive more emphasis than in the current core. At present, Bi1 attempts to serve as an introductory course and an interdisciplinary menu course, which makes it challenging to teach. We propose that the core present a one term true introductory biology course, focusing on topics of cell and molecular biology, and mentioning key principles such as evolution. In order to build on this increased depth, we propose the expansion of the core requirement by the addition of a one term biology menu class. In this menu offering we envision classes ranging from more advanced offerings in cell and molecular biology, or biochemistry, to more interdisciplinary offerings such as geobiology. As with chemistry and labs, there may be a subset of the menu classes required for students in certain options.

_Math_

The proposed math requirements include multiple paths through the topics of multi-variable calculus, linear algebra, differential equations, and probability and statistics. These requirements resemble the current core but with the deletion of the current version of Math 1a, which is a proof-based single-variable calculus class. We anticipate that some of the paths through these topics would include more proof-based methods and concepts while others would
be more practical or applied. Like in the other disciplines, such paths reflecting the differences in initial preparation and inclination of students are essential.

**Breadth menu**

The breadth menu in our proposed core resembles the current Menu requirement. We believe that the philosophical reasons for the current Menu are consistent with the core philosophy proposed here.

**Basic Programming**

Every Caltech student should have basic programming skills. We propose that students should take (or pass out of) a basic programming course during the very first term at Caltech. The goal here is not to require students to learn advanced programming concepts, but rather to bring every student up to a basic level of competence that can be further developed by exercises in the other core courses. We recommend that instructors include computational problems in many of the core or all of the core classes. With a minimal level of competency now able to be assumed, such problems could be assigned without the usual worries of teaching the remedial programming aspects. Continual exposure to such problems would give students critical practice and allow them to become comfortable applying these tools in all aspects of their education and research.

**Algorithms**

Modern science and engineering rely on three pillars: theory, experiment and computation. The proposed algorithms requirement will introduce Caltech undergraduates to the analysis, implementation and application of algorithms. The requirement could be satisfied by one of a menu of courses that would introduce fundamental concepts and inspiring applications of algorithms in the information sciences, physical sciences, or both.

**Humanities and Social Science**

Humanities and social sciences are an important component of the breadth of a liberal science education. Caltech should maintain its strong commitment to the humanities and social sciences. It is essential that students moving out into world of science and technology understand the human societies in which they will be working and which their work will impact. It is equally important that they be able to communicate to others what their work is about and why it is important, whether it be to committees in charge of grants, legislators controlling government research appropriations, or members of the general public who want to understand science and its conclusions. Caltech students therefore need to take as many courses as is reasonably possible in history, literature, philosophy, and ethics, as well as in economics, political science, law, anthropology etc.
Humanities classes are particularly important for implementing the emphasis on critical writing skills. Our proposal specifically calls for two Frosh Hum and two advanced Hum classes, each of which is writing intensive. This course requirement appears only marginally different from current course requirement, but one major difference appears. All of these classes are to be on grades. In the current core, the freshman hums are most often taken in the first two terms, when they are required to be P/F. Upper classmen frequently use their optional P/F rights on their advanced hum courses. As a consequence, the humanities faculty has little leverage with students to get them to work on their writing. As part of emphasizing critical writing skills, then, we deem it essential that all writing classes be taken for grades.

We realize, however, that this step will only add to the sense of pressure and overwork on students. Given that one motivation for reforming the Core in general is to lessen the pressure on students (and that lack of time is one reason students do not devote more effort to their writing), an argument can be made that if we do away with P/F in hum courses, we should also lighten the institute HSS requirements.

We therefore suggest the following: require 10 HSS courses rather than the current 12. These 10 courses should be broken down in the following fashion: 4 required hums (2 frosh + 2 advanced), 4 required SS (2 intro, 2 advanced), and 2 elective HSS. The 4 required hums and the 4 required SS courses should be taken GRADES ONLY. The two elective HSS course could be P/F at the students’ and the instructors’ option; we still want to encourage students who have already satisfied their advanced HSS requirements to explore interesting subjects without the feeling that they might endanger their GPAs.

This set of requirements, while making life easier for the students who already recognize how important their hum courses are, will give the humanities instructors the leverage they need to get the others to work on improving their writing.

We note that the total terms of HSS were a compromise for those wanting no cuts and those wanting substantial cuts.

P/F

In addition to the specific course requirements discussed above, we have considered the effects of the first two terms of P/F for incoming freshmen and recommend removing P/F for the second term. Many reasons are given for P/F in the first two terms, but most of these reasons are better dealt with in alternative ways. The academic difficulties of incoming students are better solved through appropriate classes, the desire to teach collaboration can be instilled through classes not graded on curves, the initial pressures of classes should be relieved through limiting early term class hours and providing more enjoyable experiences like Frosh Seminar. P/F obscures these problems in educationally inappropriate ways.
These arguments could be used to support the idea of abolishing P/F in the first term also, but most on the committee feel strongly that the main important reason for P/F is to ease the transition to Caltech for incoming students and that this is still needed in the first term, at the minimum. Like for the HSS requirements above, the range of opinions on the committee were wide, from those wanting zero to those wanting three P/F terms for the first year. Opinions were difficult to change. We anticipate vigorous faculty discussion of this recommendation.

Timing of the core

The educational philosophy of our proposed core does not lead to a requirement on the timing of most of the classes. While it is true that connections to different sciences will be easier to see if the foundational classes are all taken early, it may also be true that relaxing the pressure to put most of the classes in the first year has more benefits. The main exceptions to this relaxation that we would propose would be for the Frosh Seminar and the programming class, which we believe are important in the first term, and the Frosh Hums which are likewise important in the first year. Additional arguments for pushing certain classes earlier may arise, but care should be taken to ensure that the arguments are consistent with the overall educational goals of the core and not simply a desire to have students learn everything all at once.

Conclusions

This preliminary report details changes to the Caltech core proposed by the Core Curriculum Task Force. While it is tempting to look only at the implementation aspects of the proposal, we believe it is significantly more important to closely consider the philosophical underpinnings instead. We believe that after an appropriate discussion period and subsequent revision, a faculty vote should be taken as to whether or not to endorse the proposed philosophical changes. Specific implementation strategies will then need to be developed with the collaboration of the entire faculty. While the committee has presented a strawman implementation here with features that we think are desirable, implementation is sufficiently complex and intertwined that we believe a substantial and careful effort will be required to achieve the final core. Our recommendation is that, therefore, a vote on the (possibly revised, after discussion) philosophical aspects of the core be taken in the winter of 2010 and that, if the proposed changes are accepted, the committee begin work in close collaboration with the academic options to come up with a specific and detailed implementation proposals. The new core, if there is to be one, should be implemented in the fall of 2011, which will give sufficient time to all options to examine changes, rethink course offerings, and prepare for revisions. Our final hope is that from 2011 on, Caltech will increasingly be known for an institute that is outstanding for both its research and for its quality and commitment to education.
Appendix: Areas for particular discussion

The report reflects the overall majority view of the committee, but there are areas in which no consensus emerged and strong alternative opinions are held by some on the committee. Areas also exist in which the committee is not polarized but nonetheless feels broader faculty discussion would be particularly beneficial. We highlight a few.

Pass/Fail

Some on the committee feel strongly that P/F is critical to the well being of the incoming students and that any change should be towards expanding rather than contracting these requirements. Other members of the committee feel that P/F undermines both learning and teaching in the core courses. A majority of committee members support the use of P/F for core courses only during the first term, but a strong minority strongly disagrees. We anticipate vigorous faculty discussion.

HSS

Some of the committee feel strongly that HSS is a sufficiently important component of the Caltech education that dropping any requirements is a mistake. According to data from the recent alumni survey, many Caltech graduates feel that they were very weakly prepared to understand or cope with the social, political, and economic problems important to our society, or to understand and connect with the larger world of people who are not Caltech graduates. Some reported that they found their humanities courses unexpectedly valuable, especially when their career paths took them into non-academic settings. For example, one graduate from the period 1999-2003 noted, “Ironically, many of my electives (economics, law, history, literature, business, Japanese, electrical engineering, and computer science) turned out to have a far more lasting impact on my life than any of my core classes.”

Finally, in the opinion of some members of the committee, and in the opinion of most of the HSS faculty, the stress imposed on the students by the current number of HSS requirements is overstated. HSS classes are perceived as adding to student stress levels because students are trying to cope with science classes that, particularly in the first two years, are much too difficult and often poorly taught (hence the need for a general core revision). Given the reasons why most of them came to Caltech, it is little wonder that they prioritize trying to stay afloat in their science classes, and seek to blame their HSS classes for their situation.
*Chem 3a vs. general lab*

While the committee is united in the recommendation for 2 data collection + analysis labs and one design-and-build lab, there is disagreement on whether or not one of the labs should specifically be a chemistry lab (Chem 3a or 3x, in the current core). Chemistry is an experimental science that includes both the synthesis of new molecules and the measurement of molecular properties. Some argue that laboratory experience is central to a complete a basic education in chemistry. In this view, we should offer a menu of six-unit laboratory courses to provide students with exposure to modern experimental methods in chemical science applied to a broad, interdisciplinary range of topics of contemporary interest.

*Semesters*

One of the charges to the Task Force was to consider a switch to semesters. Most on the Task Force believe that if Caltech were starting from scratch, semesters would be the logical choice. We are also aware, however, the implementing a switch from quarters to semesters would be incredibly disruptive to the entire community. While such a disruption might be warranted for the long term benefits that would accrue, we believe that it is best to separate that discussion from the discussion of the philosophy of the core. We recommend that a separate committee specifically address this issue; we are willing to formulate an implementation plan for a new core for either semesters or quarters.

*Teaching load*

The committee is aware that any proposal that leads to an increase in teaching load for faculty is likely to doom any core revision. Yet the desire for smaller classes and increased faculty interactions for incoming students will certainly lead to a need for larger number of instructors in the core than current exist. Creative solutions to this obvious problem need to be found. We trust that a faculty committed to undergraduate education will have excellent suggestions and work with the committee to explore them.