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Perspective

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BECOMING A PHYSICIAN

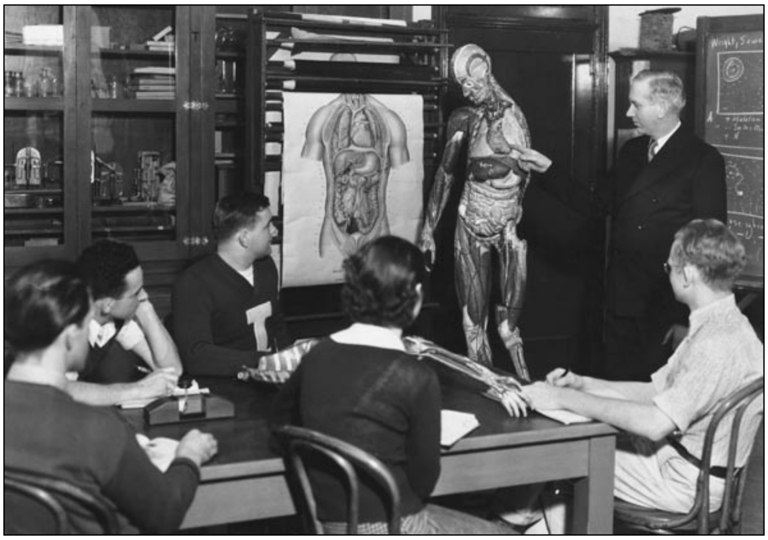
Relevance and Rigor in Premedical Education

Jules L. Dienstag, M.D.

In recent decades, scientific knowledge has changed dramatically, once-settled scientific principles have been replaced by more sophisticated concepts and entirely new disciplines, and parallel changes have occurred in medical practice and health care delivery. In the face of these new realities, medical school curricula have had to adapt. Yet despite these sweeping changes, including the permeation of most areas of medicine by molecular and cellular biology and genetics, requirements for admission to medical school have remained virtually unchanged for many decades.

Ironically, though many of today's high-school students are learning advanced science and mathematics that my generation studied in college or medical school, U.S. medical schools continue to devote precious time in the preclinical years to elementary-level biochemistry, cell biology, and genetics. With so much new scientific material to cover, medical school faculties must struggle to fit it all in while addressing the needs of students with widely varied levels of science preparation. Pressure on faculty members teaching preclinical courses is intensified by the truncation of the preclinical program at many medical schools to allow for earlier entry into the clinical curriculum. At the same time, many medical schools, recognizing the value of student scholarship, are adding a requirement for an in-depth scholarly project that must also fit into a 4-year curriculum.

Some view the current premedical science requirements — 1 year of biology, 2 years of chemistry (especially organic chemistry), 1 year of physics, and, in some schools, 1 year of mathematics — as a necessary gauntlet that thins out the applicant pool. Unfortunately, current college courses that fulfill admissions requirements are not adequately focused on human biology; the topics covered in many courses in chemistry, physics, mathematics, and even biology are so removed from human biologic principles that they offer little value to the premedical — or advanced human biology — student and steal time and attention from more relevant science preparation. Does a student, for example, really need a full year of organic chemistry to prepare for the study of biochemistry? Moreover, premedical science courses often fail to achieve sufficient rigor to prepare stu-



Premedical Students Receiving an Anatomy Lesson.

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dents for tackling the sciences fundamental to medicine at the advanced molecular level now required. We should expect a higher standard from students who wish to pursue medicine in an era in which genomics and informatics will revolutionize biomedical science and health care.

No one is arguing for more time in college devoted to premedical science courses; rather, I support greater efficiency and a tighter focus on science that "matters" to medicine. In addition, because of the growing commonality of language among scientific disciplines, and because human beings are complex organisms whose discrete systems are linked intricately and elaborately within the body and modified profoundly by external influences, we need to teach in ways that reflect this complexity and that stimulate students to synthesize information across disciplines. Unfortunately, asking faculty members to undertake such synthesis defies the long-sacred compartmentalization of disciplines into departmental silos. Such isolation among disciplines has already begun to change, and many medical schools have added new departments of systems biology, which focus on this complexity and the interdependence and interaction among different body systems. A sick patient does not represent a biochemistry problem, an anatomy problem, a genetics problem, or an immunology problem; rather, each person is the product of myriad molecular, cellular, genetic, environmental, and social influences that interact in complex ways to determine health and disease. Our teaching, in both college and medical school, ought to echo this conceptual framework and cut across disciplines.

In 2006, we at Harvard Medical School launched a new, more cross-disciplinary, integrated curriculum, one of whose goals was to amplify reinforcement of basic and population sciences during the clinical years. In preparation for curriculum reform, a working group reassessed medical school admission requirements to determine whether premedical education prepared students adequately for our new curriculum (see the Supplementary Appendix, available with the full text of this article at www.nejm.org). This group advocated for increased rigor of undergraduate science preparation and a refocusing on more biologically relevant and interdisciplinary science courses that demonstrate and build on complementary concepts in biology, chemistry, physics, and mathematics. To fulfill expectations for more advanced premedical science preparation, college science courses ought to foster scholastic rigor, analytic thinking, quantitative assessment, and analysis of complex systems in human biology; their goal should be to help students acquire a different, larger, more molecularly oriented and scientifically sophisticated knowledge base than that mastered by previous generations of premedical students.

Many colleges have successfully incorporated cellular and molecular biology and genetics into introductory biology courses. They have been less successful, however, at increasing the relevance and rigor of premedical chemistry and math requirements. Instead of the current chemistry sequence, colleges could expose premedical students to general chemistry, organic chemistry, and biochemistry in a 2-year sequence that provides the foundation for the study of biologically relevant chemistry. Ideally, instead of devoting time to a second semester of organic synthesis, college students could take a seamless sequence of preparatory organic chemistry and basic principles of biochemistry (especially protein structure and function), completing the study of introductory biochemistry before medical school and building a foundation for medical school courses that begin from and reach higher plateaus.

To provide premedical students with the computational skills required for the advanced study of biology, college math courses should focus on biologically relevant algebraic and trigonometric quantitative skills; require familiarity with calculus and the mathematical description and uncertainties of dynamic biologic systems but not divert attention to the derivation of theorems that have little relevance to biology; and provide adequate grounding in probability and statistics, which are required for an understanding of the scientific and medical literature.

The college years should not be designed primarily to prepare students for professional schools. College should be a time to explore and stretch academically and intellectually; to engage creatively in an expansive liberal arts education encompassing literature, languages, the arts, humanities, and social sciences; and to prepare for citizenship in society. Included in this foundation should be analytic, writing, and communications skills; fluency and a nuanced facility in English; mastery of a foreign language; the basis for understanding human behavior, appreciating societal structure and function, achieving cultural awareness, and facilitating a habit of lifelong self-education; and in-depth, sustained, independent study, which fosters deep reflection, an active role in acquiring knowledge, and scholarly ownership in an area of inquiry. How do we accomplish all this and encourage attention to other scholarly avenues without rendering the time commitment for science courses too burdensome? A reasonable prescription for efficiency and economy would involve refocusing, increasing relevance, setting a higher standard, and encouraging the design of more interdisciplinary premedical science courses.

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Responding to the same concerns about premedical science education, the Association of American Medical Colleges and the Howard Hughes Medical Institute have undertaken a joint, comprehensive assessment of the continuum of premedical and medical science education. Themes likely to be included in their recommendations are the importance of introducing synergy and efficiency through cross-disciplinary and biologically relevant teaching; of educating "inquisitive" physicians, who understand not only medical knowledge but also how it is acquired; and of establishing a habit of scientific thought on which to build the practice of medicine. The recommendations are likely to favor scientific competencies over specific discrete courses, implying that premedical requirements for rigid, 1-to-2-year, discipline-specific science courses should give way to more creative and innovative courses that span and unite disciplines, offering a glimpse of the way biologists and physicians actually navigate real-life problems.

Creating such new, cross-disciplinary science courses may well be difficult for colleges, which vary in the availability of resources, depth of faculty, and political will of traditional departments to address these curricular demands. Medical school admissions committees, for their part, will face difficulties in assessing who has met admissions requirements focused more on competencies than on courses. If both colleges and medical schools succeed, however, students will begin medical school with more advanced and relevant preparation in science, ready to tackle higher-level medical science courses. While admissions requirements are evolving, premedical students will face increased uncertainty, but as the standards and rigor increase, their courses will become more relevant and compelling. The competencies evaluated by the Medical College Admissions Test, in turn, will have to be revised. I believe that for students and teachers alike, the positive effects of these changes far outweigh the negatives. Those who teach undergraduates should not shy away from the challenge. Medical schools should stimulate colleges to innovate, and premedical students should demand science courses that prepare them directly and efficiently for the advanced study of biology. Premedical science should never have become a "trial by fire."

In recent years, calls have come from various quarters for medical schools to require and for colleges to teach ethics, altruism, compassion, listening skills, and skills relevant to health policy and economics — at the expense of science requirements. In my view, these aspects of medicine are best reserved for medical schools, where they can be taught in the meaningful context of interactions with patients. Medical educators take seriously their responsibility to equip students for the practice of scientifically anchored medicine. If medical schools are to have the freedom to fulfill that responsibility, students should arrive with a higher level of scientific competence, and colleges can contribute by preparing students more efficiently for the study of contemporary, sophisticated, biologically relevant science.

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Dr. Dienstag is the dean for medical education at Harvard Medical School, Boston.

BECOMING A PHYSICIAN

From All Walks of Life — Nontraditional Medical Students and the Future of Medicine

Sandeep Jauhar, M.D., Ph.D.

When I was growing up, my parents wanted me to become a doctor, but I had other ideas. I wanted to be a television journalist, or perhaps a trial lawyer or private investigator — something with panache. In college, intoxicated by the mysteries of the universe, I ended up studying condensed-matter physics, in which I eventually earned a Ph.D. But after a close friend contracted an incurable illness, I began to have doubts about my career path. Seeking a profession of tangible purpose — like many older students — I was drawn to medicine.

When I entered medical school at 26, I was considered to be a nontraditional student — but I was hardly alone. A middle-aged woman in my class had an advanced degree in cell biology. One classmate in his early 30s had been a physician assistant for 10 years; there were also a lawyer and an AmeriCorps organizer among us. We were the new face of medicine, or so we were told, and there was considerable interest in us from professors and administrators, if not from our classmates.

The mean age of first-year medical students today is about 24, though 10% are 27 or older. Medical schools now routinely admit students in their 30s or 40s who already have families or are well into another career before turning toward medicine. In general, these students have been welcomed into the profession. They bring maturity, diversity, broader perspectives, "life experience." But what do these physicists, musicians, actors, lawyers, writers, stockbrokers, and dancers add to the profession? Since primary care physicians are in short supply, doesn't medicine just need more conventional, nose-to-the-grindstone clinicians?

Of course, nowadays, when many medical school applicants boast myriad resumé-building experiences, it isn't always clear what "nontraditional" means. Quirky undergraduate concentrations such as music or film are popular among applicants, and so are dual degrees. Female sex ceased to be a distinguishing characteristic years ago. "'Nontraditional' these days is quite a bit different from what it was back when I was in medical school," notes Scott Barnett, associate dean for admissions and graduate medical education at New York's Mount Sinai School of Medicine. "At our school, 50% of medical students are non-science majors. Out of 140 students, a quarter are from our [undergraduate] Humanities in

Supplementary Appendix

This appendix has been provided by the author to give readers additional information about his work.

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Report of the Working Group on Admission Requirements

Harvard Medical School

August 9, 2004

Executive Summary

The HMS Working Group on Admission Requirements identified the following **guiding principles** for premedical science education:

1. Develop a seamless continuum from the premedical to the medical curriculum.
2. Acknowledge the permeation of biochemistry, cell biology, genetics in most areas of medicine.
3. Integrate human biology into undergraduate science education – make premedical sciences more relevant.
4. Foster scholastic rigor, analytical thinking, quantitative assessment, and analysis of complex systems in human biology.
5. Require a different, larger, more molecularly oriented and scientifically sophisticated knowledgebase.

General Recommendations:

1. Encourage interdisciplinary courses that break down barriers (and traditional educational “silos”) among, and demonstrate complementary concepts in, biology, chemistry, physics, and mathematics.
2. Emphasize the basis of ideas, not rote recitation of principles.
3. Emphasize hypothesis-driven problem derivation in course content, small-section exercises, and laboratory components of courses.
4. Refocus the scientific rigor or undergraduate education.

Discipline-Specific Recommendations:

Biology:
1. The required1-year biology course should be devoted to genetics and cell biology.
2. Emphasize human biology (signal transduction, basic pharmacologic principles, homeostasis and feedback, hormone receptors, neuronal signaling, immunology).
3. Emphasize computational skills that tie previously disparate disciplines together.

Chemistry:
1. Expose students to general chemistry, organic chemistry, and biochemistry in a 2-year sequence that provides the foundation for the study of *biologically relevant* chemistry.
2. Organic chemistry preparation should be woven seamlessly with basic principles of biochemistry (especially protein structure and function).

Laboratory components of science courses:
1. Cut down lab hours (long, time-consuming, not well/efficiently spent)
2. Focus on hypothesis-driven exercises, problem-solving, hands-on demonstrations of important principles.

Computational skills:
1. Focus on biologically relevant algebraic and trigonometric quantitative skills.
2. Require familiarity with calculus, but not a focus on derivation of biologically low-relevance theorems.
3. Provide adequate grounding in statistics.

Physics:
1. Prepare students in biologically relevant areas (mechanics, kinetics, thermodynamics, properties of matter (quantum theory), wave theory, electricity and magnetism, and optics).

Analytical and writing skills:
1. Require a full year of critical writing/thinking (expository writing)

Effective communications skills:
1. Require fluency, with a nuanced facility, in English.
2. Mastery of a foreign language reinforces preparation for patient care in a multicultural society.

Other courses:
1. Encourage courses/activities that prepare students to understand human behavior, appreciate societal structure and function, achieve cultural awareness, and facilitate a habit of lifelong self-education.
    a. Literature, languages, the arts, humanities, social sciences (psychology, sociology, anthropology, ethics, etc.)
    b. Familiarity with computers
    c. Honors courses and independent study/research

The Working Group also recommended that a joint HMS-FAS committee be formed to specify topics and details of courses. In specifying the focus on science preparation for postgraduate biology or medical studies, the Working Group recommended that curriculum planners avoid rendering the science-course time commitment too burdensome to allow attention to other academically challenging scholarly avenues, relying instead on refocusing and increasing the relevance and interdisciplinary content of science courses. To amplify the impact of these recommendations beyond our borders the Working Group urged HMS and FAS to open a dialogue among medical schools and undergraduate colleges on premedical requirements

Introduction

The Committee interpreted the main goal of its charge as a request to develop a continuum in the education process from the premedical curriculum leading to the medical curriculum. While acknowledging the desirability of heterogeneity in undergraduate majors/concentrations and choosing not to recommend homogeneity in undergraduate preparation, the Committee emphasized the importance of providing the tools necessary to navigate a seamless continuum in scholastic and scientific rigor between the premedical curriculum and the 21st century curriculum at Harvard Medical School. Based upon a consensus that we are entering a sea change in the biological, social, economic, and ethical underpinnings of premedical and medical education, the Committee concentrated on a continuum in the preparation of students entering medical school, beginning in the undergraduate years. One primary goal should be an understanding of, and consensus about, what college science education ought to be and how it continues into the medical school years. A crucial link the Committee focused on was that between the undergraduate curriculum and the first two years of the medical school curriculum in which the seamlessness of science is most essential.

The requirements for medical school have remained basically unchanged for many decades, despite the obvious change in medical knowledge (e.g., about disease mechanisms and our understanding of drug actions), the pace of new discovery, and the permeation of biochemistry, cell biology, and genetics in most areas of medicine. Therefore, adequacy of preparation in the preclinical sciences requires acquisition of more information than in the past. Unlike in the past, currently, pathophysiology and pharmacology require detailed knowledge of molecular targets and biochemical mechanisms, and modern cell biology has become the language of medical disciplines such as pathology, oncology, cardiology, and neurology. A fundamental theme in the deliberations of the Committee was the desire to integrate human biology into undergraduate science education, taking into account the influences of systems biology.

General Recommendations

The premedical curriculum should foster scholastic rigor, analytical thinking, quantitative assessment, and analyses of complex systems in human biology. In fact, an inculcation of scientific method and scientific rigor are deemed more important than the specific content of premedical science courses per se. We do recognize the reality that the college years are not, and should not be, designed primarily to prepare students for professional schools. Instead, the college years should be devoted to a creative engagement in the elements of a broad, intellectually expansive liberal arts education. Therefore, we support the basic elements of curricular review at Harvard College, including a reduction in the minimum number of required courses for a concentration and later declaration of concentration selection, which should foster freedom to experiment with new disciplines during the first two years. On the other hand, the current science courses offered in college that fulfill the admissions requirements of medical schools are not adequately focused on human biology to prepare a candidate for medical school. To prepare for a medical career in the 21st Century will require a different, larger, more molecularly oriented and scientifically sophisticated knowledge-base than that required for the curriculum when the New Pathway was introduced 20 years ago.

Given how constrained the time can be for science preparation in an undergraduate curriculum, students who are interested in the biological sciences and medicine would benefit more from chemistry, physics, and even biology courses that emphasize preparation for the contemporary biomedical scientific enterprise. Current introductory undergraduate courses in these sciences are designed for a wide range of students, many of whom will take no additional science courses and some of whom are preparing for careers in disciplines far removed from human biology and medicine. Students preparing for medical school are often required to spend considerable time on areas of physics, chemistry, mathematics, and biology that are so removed from human biological principles that they offer little value to the premedical student and actually occupy valuable time that could be spent on more relevant science preparation. Therefore, instead of relinquishing to undergraduate departments decisions over what constitutes a course in *general* chemistry or organic chemistry, medical schools ought, instead, to define exactly what areas of preparation in these sciences are necessary for the preparation of a future physician or biomedical scientist. Potentially, without adding extra semesters or years spent in premedical science courses, colleges could provide more focused, relevant courses that would include, for example, more biochemistry, molecular biology, and cellular biology.

Moreover, achieving economies in time spent on science courses would be facilitated by breaking down barriers among departments and fostering interdisciplinary approaches to science education. Indeed, the need for increased scientific rigor is most likely to be met by more interdisciplinary courses. For students preparing to become physicians or to pursue biomedical careers, medical school requirements often drive undergraduate science curriculums. Thus, a partnership to make biology, chemistry, physics, and mathematics come together is absolutely essential to a well-grounded preparation for medical school and for a seamless transition into the new medical school curriculum. Again, we applaud the Harvard College Curricular Review proposal to introduce interdisciplinary courses in the life sciences and physical sciences. Moreover, critical reading and thinking are an essential component of the undergraduate and continuing education of the premedical and medical student. Critical and analytical approaches to learning among both premedical and medical students should be especially emphasized at a time when the barriers between the scientific disciplines are becoming less distinct.. Thus, English and mathematics, which involve critical and quantitative thinking, respectively, should be emphasized in curriculum reform and admission requirements, not de-emphasized.

From the perspective of the basic science faculty at Harvard Medical School, currently, the preparation and knowledge base of entering Harvard medical students are too diverse; in each class, a wide range exists in the scholastic rigor, content, and quantitative skills necessary for mastery of such courses as biochemistry and cell biology. On the extremes of this wide spectrum are, on the one hand, students with limited preparation in biochemistry, who struggle academically during the first year at HMS. On the other hand, students better prepared in the quantitative areas of biochemistry, physics, and mathematics, including some with advanced degrees in these disciplines, find HMS first-year course work dull, slow, and intellectually unchallenging. The Committee concluded that a uniform level of preparation in biochemistry should be required and/or that stratified tiers of first-year HMS courses like biochemistry be offered to accommodate those with different backgrounds.

Specific Recommendations

To foster the type of preparation necessary for the new HMS curriculum, the Committee proposed the following:

1. Skill sets should be taught to undergraduates in an integrative way, with the goal of developing a shared vocabulary of modern biology. Interdisciplinary courses that break down the barriers among, demonstrate complementary concepts of, and highlight collective wisdom in, biology, chemistry, physics, and mathematics should be encouraged. In short, a focus on integration of principles over several courses should be emphasized. Realistically, this will require champions at the college level for breaking down traditional educational "silos," and this approach increases the workload of teaching and demands on students. The HMS faculty are prepared to work with the Faculty of Arts and Sciences to foster such interdisciplinary approaches to undergraduate science education.

2. The experimental basis of ideas, not rote recitation of principles, should be emphasized in the undergraduate science curriculum.

3. Course content, small-section exercises, and, especially, laboratory components of courses should emphasize hypothesis-driven problem derivation.

4. HMS faculty should work with Harvard undergraduate science departments to refocus the scientific rigor of undergraduate education. This process will be vitalized by the current curricular review at Harvard College in which core courses are to be eliminated and distribution requirements redefined.

5. The one-year required biology course should be devoted to genetics (including nucleic acid structure and function, genetic recombination, and mechanisms of gene expression in eukaryotic and prokaryotic cells, i.e., molecular biology/genetics) and cell biology (including subcellular organization, differentiation, cellular metabolic function, energy transfer, structure-function relationships, reproduction, and membrane properties). Preparation in biology should place more of an emphasis on human biology and on principles of systems biology. Thus, specific concepts to be covered should include signal transduction, basic pharmacologic principles, principles of homeostasis and feedback, an introduction to hormone receptors, neuronal signaling, and immunology. Because biology is the most elegant expression of

chemistry, physics, and mathematics, computational skills that tie these previously separate disciplines together should be emphasized.

6. Without an increase in the two-year requirement in chemistry, the premedical chemistry curriculum should focus on more biologically relevant areas of general and organic chemistry. General chemistry preparation should include foundational topics in physical and inorganic chemistry such as bonding, molecular structure, chemical reactivity, equilibrium, energetics, and thermodynamics. Organic chemistry preparation should be woven seamlessly with basic principles of biochemistry (especially protein structure and function). The goal should be to expose students to general chemistry, organic chemistry, and biochemistry in a, two-year sequence that provides the foundation for the study of biologically relevant chemistry. There are many possible course sequences that can be used to satisfy this requirement, from the traditional sequence of one year of general chemistry followed by one year of organic chemistry to a sequence of interdisciplinary or more advanced courses that treat necessary core material.

7. Laboratory components of the science requirement courses should be re-evaluated. Consider cutting down on laboratory hours, which are long and time-consuming but not necessarily all well and efficiently spent. Proper focus on hypothesis-driven exercises, problem solving, and hands-on demonstrations of important principles should take precedence over lengthy laboratory time commitments that steal time away from other, more productive educational opportunities.

8. Computational skills are required for contemporary scientific literacy. Although the calculus of derivatives and integration represents important concepts for the precise, quantifiable understanding of dynamic physiological processes and systems, a full year of calculus focusing on the derivation of biologically low-relevance theorems is less important than a focus on more relevant algebraic and trigonometric quantitative skills. Still, for a medical student body adequately prepared for the quantitative reasoning demands of the new medical curriculum and certain medical specialties, to provide analytic perspective and to appreciate the uncertainties in evaluation of biological systems, students should be required to have familiarity with calculus. A broader and more flexible range of requirements should be encouraged, however, and, given the importance of statistics for understanding the literature of science and medicine, adequate grounding in statistics is recommended. Rather than increasing the one year devoted to mathematics preparation, the one-year effort should be more relevant to biology and medicine than the formerly required, traditional, one-year calculus course.

9. In the area of physics, students should be well prepared in biologically relevant areas of mechanics, kinetics, thermodynamics, the properties of matter (quantum theory)

and wave theory, electricity and magnetism, and optics.

10. Creative, complex, and compelling discoveries in medicine, as in other fields, involve grappling with good questions borne from close reading analyses and careful observations. Therefore, effective courses in science and non-science disciplines should focus on analytical and writing skills. In addition, at a minimum, HMS matriculants should have one year of critical writing/thinking preparation, preferably in a course devoted specifically to the development of expository writing skills. Specific skills students may be expected to master and apply to the fields of medicine and scientific inquiry include the following abilities:
    a. Write logically and with clarity and style about important questions across disciplines.
    b. Articulate persuasively, both on paper and in oral presentations, focused, sophisticated, and credible thesis arguments.
    c. Appreciate the methodologies that particular disciplines apply for understanding and communicating results effectively.
    d. Approach evidence with probity and intellectual independence.
    e. Use source material appropriately with scrupulous and rigorous attribution.

11. Because effective communication among the medical care team and between physicians and patients is so crucial to the delivery of care, all matriculants should be fluent and have a nuanced facility in English. Mastery of a foreign language is a valuable skill that reinforces preparation for patient care in a multicultural society.

12. Courses and extracurricular experiences and activities that prepare candidates to understand human behavior, to appreciate societal structure and function, and to achieve cultural awareness provide valuable preparation for the study and practice medicine. Courses in literature, languages, the arts, humanities, and the social sciences (e.g., psychology, sociology, anthropology, and ethics) are encouraged. At least 16 hours should be completed in these areas. In addition, familiarity with computers is necessary. Honors courses and independent study or research are encouraged, because they permit the student to explore an area of knowledge in depth and provide a scholarly experience that will facilitate a lifelong habit of self-education.

13. For each course requirement, Harvard Medical School should include specificity about topics that fall under general coursework in the list of requirements. Identifying the specific material to be covered is beyond the scope of this committee's mandate, but we recommend that a joint HMS and FAS committee be convened, as a logical extension of curricular reform at both the College and the Medical School, to specify these areas of preparation in the premedical sciences.

14. Currently, the time required for premedical undergraduate science preparation is substantial. In increasing the expectations for scientific rigor at the undergraduate level, the Committee was careful to avoid rendering the time commitment to science courses so burdensome that medical school candidacy would be limited to science

majors/concentrators and that little time would be available in college to pursue other academically challenging scholarly avenues, the foundation for intellectual growth. Therefore, the ideal solution is one in which the current time commitment to premedical science courses is refocused on more relevant content, interdisciplinary when practical, that can be covered within the same time frame or a time frame only modestly expanded.

15. On the one hand, the Committee acknowledges that issuing these recommendations may have a limited impact, at least initially, on premedical curricula at our own college and at other colleges. If the requirements for admission to Harvard Medical School differ too substantially from those at other medical schools, undergraduates preparing for medicine will encounter an impractical array of conflicting curricular demands. In addition, many undergraduate colleges base their premedical course offerings on the material required for the Medical College Application Test (MCAT). On the other hand, our goal is to challenge those who teach undergraduates and to lead by example, to open a dialogue among medical schools and undergraduate colleges and their faculties that will rationalize undergraduate preparation for the study of medicine. Our expectation is that such dialogue and the curricular experimentation engendered will reform the undergraduate education of future physicians and, in turn, lead to revisions in the competencies evaluated by the MCAT.

Membership

Dennis Ausiello, MD, *chair*
Jackson Professor of Clinical Medicine
Harvard Medical School
Chief, Department of Medicine
Massachusetts General Hospital

Jules Dienstag, MD, *co-chair*
Professor of Medicine
Associate Dean for Academic and Clinical Programs
Harvard Medical School
Massachusetts General Hospital

Anne Berg
Director of Admissions and Student Affairs
Harvard School of Dental Medicine

Mohan Boodram, *Senior Staff*
Director of Admissions and Financial Aid
Harvard Medical School

Kenneth Bridges, MD
Associate Professor of Medicine
Brigham and Women's Hospital

Michael Gimbrone, MD
Elsie T. Friedman Professor of Pathology
Head, Department of Pathology
Brigham and Women's Hospital

Alfred Goldberg, PhD
Professor of Cell Biology
Harvard Medical School

Allan Goroll, MD
Associate Professor of Medicine
Massachusetts General Hospital

Judith Murciano-Goroff
Assistant Senior Tutor
Expository Writing Program
Harvard College
Faculty of Arts and Sciences

David Haig, Ph.D.
Professor, Department of Organismic and Evolutionary Biology
Head Biology Tutor, Harvard College
Faculty of Arts and Sciences

Stuart Mushlin, MD
Assistant Professor of Medicine
Brigham and Women's Hospital

Shari Nethersole, MD
Assistant Professor of Pediatrics
Children's Hospital Boston

Theresa Orr
Associate Dean for Admissions and Student Services
Harvard Medical School

Thomas Ptak, MD
Assistant Professor of Radiology
Massachusetts General Hospital

Christopher John Russell
Student
Harvard Medical School

Daniel Shannon, MD
Professor of Pediatrics and Health Sciences and Technology
Massachusetts General Hospital

Helen Shields, MD
Associate Professor of Medicine
Beth Israel Deaconess Medical Center

Darrell Smith, MD
Assistant Professor of Radiology
Brigham and Women's Hospital

Bruce Spiegelman, PhD
Professor of Cell Biology
Dana Farber Cancer Institute

Gregg Tucci, Ph.D.
Assistant Director of Undergraduate Studies
Department of Chemistry
Faculty of Arts and Sciences

Gordon Strewler, MD
Professor of Medicine
Beth Israel Deaconess Medical Center

Invited Guests and Witnesses

John Dowling, Ph.D.
Professor of Biology
Faculty of Arts and Sciences

Benedict (Dick) Gross, Ph.D.
Dean, Harvard College
George Vasmer Leverett Professor of Mathematics
Faculty of Arts and Sciences

Dudley Herschbach, Ph.D.
Frank B. Baird, Jr. Professor of Science
Faculty of Arts and Sciences

Jeffrey Wolcowitz
Associate Dean for Curriculum
Harvard College