UNIVERSITY HONORS PROGRAM

SENIOR PROJECT - APPROVAL

Name: John A. Flatt

College: A+S Department: College Scholars

Faculty Mentor: Glenn Gruber

PROJECT TITLE: Medicinal and Clinical Studies:
A Balanced Approach to Premedical Education

I have reviewed this completed senior honors thesis with this student and certify that it is a project commensurate with honors level undergraduate research in this field.

Signed: _____, Faculty Mentor

Date: 5/11/99

Comments (Optional):

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SENIOR PROJECT - APPROVAL

Name: Benson Scott

College: Arts Sciences Department: College Scholars

Faculty Mentor: Glenn Graber

PROJECT TITLE: Medicinal and Clinical Medicine

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Medicinal and Clinical Studies

A Balanced Approach To Premedical Education

Benson A. Scott
John A. Flatt

Introduction

The medical profession is gaining more and more technology and special skills everyday, yet there is one component that many doctors still have trouble performing to the best of their abilities, working with the patients and all aspects of the condition they bring to the table. Furthermore, doctors are being increasingly challenged to balance working with the patient and working with the financial position both the patient and the physician's own practice. Through this dynamic interaction of patient-physician, it becomes apparent that there exist situations in which some doctors lack the background skills to handle certain concerns effectively. These areas include dealing with ethical issues, utilizing communicative processes, and understanding the gender and cultural differences in racial, ethnic, or religious backgrounds. However, these issues may be confronted and dealt with through education in the areas that need improvement.

Ethical concerns at first sight seem to be a decision of making one choice or another; therefore, we could simply rely on emotion and arbitrary whim (Edwards & Graber, 1988). However, it is not a decision that a physician could make without having some rational defense for the decision prepared and by being able to communicate the decision to others effectively. To ultimately achieve this solid standard of which to progress in the decision making process, a physician would need to be armed with the ability to make careful and systematic reflection on his own values and moral principles as well as the values and moral principles of all others involved (Edwards & Graber, 1988). Although many individuals feel they have the ability to make ethical decisions, some structured and guided experience through looking at ethical issues as they relate to medicine would improve a physician's understanding of the issues at hand. Furthermore,

working with more cases will only improve one's ability to exercise clear and systematic reflection on what issues may arise. By enrolling in some class in an undergraduate education, physicians would gain insightful experience in working on handling ethical issues even before matriculation into medical school.

Communication concerns are often reported initially by the patients of physicians even though the physicians may feel as though they are communicating effectively. According to Kreps and Thornton, human communication in the health care system is often taken for granted, yet it is the most important tool health professionals have to provide health care to their patients (1992). Communication is very important in many aspects of medicine, such as working in health care teams, the health care interview, developing health communication campaigns, and relaying ethical decisions better. Also, good communication skills will help physicians avoid malpractice lawsuits by gaining complete information on a patient's condition and thus allow the physician to direct the appropriate treatment (Kreps & Thornton, 1992). Health care communication also improves the ability of physicians to analyze both the verbal and, equally as important, the nonverbal messages being sent by their patients. It is further shown that without good communication on the physicians part patients may demonstrate low levels of compliance and cooperation, miscommunication and misinformation occurs, unrealistic and unfulfilled expectations linked to cultural stereotypes may develop, general insensitivity may result, and an overall dissatisfaction with health care by both providers and consumers may develop (Kreps & Thornton, 1992). To accomplish a good ability to communicate to patients, nurses, and other physicians, a doctor must learn the skills and

competencies that have to be examined and practiced in order to master communication in the health care setting.

Communication concerns stretch beyond just simple problems in communication using the same language, they are also more relevant in dealing with someone of a different culture. Health care personnel must possess an adequate understanding of both their own culture as well as the culture of their patients. The cultural variances can originate in language, friendship, communication practices, the meaning of nonverbal signals, religious differences, or even economic emphasis (Kreps &Thornton, 1992). In many instances, there is not a clear-cut cultural difference, but there does lie a different conditioning for reactions to certain stimuli, sometimes more difficult to deal with than complete cultural variance. To battle any problems that may arise due to cultural variances, a physician must strive to reduce any cultural bias he or she may have and strive to work with each patient as an individual not assuming that a certain culture determines every aspect of their life. Also, differences in gender can create problems because men and women tend to view issues and ideas in different manners (Kreps &Thornton, 1992). All-in-all, a simple understanding of one's own beliefs and how they may differ from others provides a good context on which to combat any problems that may develop because of a difference in gender or culture.

By looking these three main areas in which problems may develop, a simple few courses in areas such as medical ethics, nonverbal or interpersonal communication, religious studies, or foreign studies could greatly empower a physician to better improve his or her interaction with patients. Given that the graduate level medical education focuses mainly on scientific understanding and then places one immediately into a

clinical setting in a sink-or-swim method, it might be best advised that these selected classes be attained in the premedical undergraduate education.

Statement of Purpose

In order to combat issues that arise during clinical interaction with patients, it is proposed that a medical education at the undergraduate level, the more flexible level in relation to graduate medical education, be aimed to prepared students for both the scientific and clinical aspects of medical practice. This academic program would vary from the current model at the University of Tennessee, Knoxville because it would not solely focus on preparation for scientific study, but would also maintain a strong component of communication, social issue, and business coursework. Moreover, this program would distribute the education of a premedical student in all of these areas giving them the classic liberal arts education within the confines of a premedical program. Therefore, a premedical program should be designed to not only to aid in entrance and performance in medical school, but more importantly provide the needed skills and understanding to help in the clinical practice of medicine. By following this medical practice preparation approach to the undergraduate education of premedical students, the program will benefit the students in three distinct areas: provides a balanced approach to medical education which is attractive to most medical schools, provides them with the skills necessary to deal with issues beyond physiological and pathological concerns, and develops marketable skills for the workforce for those students who ultimately do not matriculate to medical school.

The idea of a balanced approach to premedical study is one that is relatively new to the academic world. In the past, premedical study was focused almost solely on scientific study and left the social sciences and humanities aside. Then, a little over a decade ago, the medical field started highly desiring those who had not majored in a

natural science and had majored in a social science or humanities based curriculum. However, currently the trend is to take those students who have not only taken the required natural science courses along with some upper division natural science courses, but who have also enrolled in a few courses outside of the natural sciences. Looking for this balanced medical school candidate is becoming more of the routine of medical schools who emphasize clinical practice according to Nelson Strother Dean of Admissions at the University of Tennessee, Memphis. By performing well in a balanced curricular setting, one is able to show the ability not only to learn the science, but also to interact and understand people and issues. Understanding both aspects of medicine, the science and the social, will allow a future physician to be best prepared for clinical performance in his or her career.

When working with patients doctors will often have to treat more than just the physiological or pathological conditions of their patients, they will also have to deal with socioeconomic issues, ethical issues, family issues, and time issues. Learning how to work with these challenging issues cannot be achieved within a lab setting, but must be understood through study of how the issues arise within various groups of people. Some individuals may need to have an issue that lies outside of their own body handled more than a physiological concern that may be affecting them, and in some cases it might be the exterior problem that is manifesting itself as a physiological abnormality. By gaining knowledge in these areas, a physician may be able to not only help the patient from a medical standpoint, but also from a socially focused stand effecting the patient and all those who interact with him or her.

We must also understand that all premedical students do not matriculate to medical school. For one reason or another, whether simply they were not accepted or that they chose a different career path to follow, students do not always making it to the goal initially set for them. This can become a significant concern if the individual desires to enter medical school but is rejected and then only has a biology degree to utilize in the job market. Unless one wishes to be a biologist or work with animals in some manner, getting other jobs with the minimal experience outside of biology in its curriculum is tough, a situation in which many premedical students find themselves if their interest lies in service to humans, not animals. By enrolling in a program that includes communications, social issues, and business, a non-matriculating graduate will have specific skills to market in addition to the scientific requirements of the biology curriculum. Given that the University of Tennessee, Knoxville has a matriculate rate of approximately forty-five percent annually (AAMC, 1997), this type of preparation could effect up to half of the premedical population each year. Therefore, it is well justified for not only the students who will eventually attend medical school and become physicians, but also for those who desire a medical career and are not accepted, to have a premedical program that offers classes marketable to both medical schools and to private industry.

The development of a significant premedical program that would include natural sciences, social sciences, communications, and business, all in relative amounts as they would be useful in medicine, would be an enormous benefit to the premedical students at the University of Tennessee, Knoxville and any other college seeking to develop well-balanced and well-prepared applicants. It has been shown that it will not only make them

more attractive to medical schools, but more importantly it will make them better people and thus better physicians or any other professional position they may choose.

Research Methodology

In seeking to explore the answers to what would be the best set of classes that would balance a premedical student for performance not only in medical school but also further into practice, a three-pronged approach was taken. Initially, a literature review of programs from other undergraduate institutions will be performed to see if any programs took this balanced and wholistic approach to premedical studies. This portion of the research will provide information about what higher education instructors and administrators feel would prepare a premedical student for future performance. Secondly, a questionnaire will be designed and sent to medical residents in the effort to understand in retrospect what undergraduate courses they felt were useful or would have been useful to them in both medical school and now into their practice (Appendix A). This reference frame resource will provide the most useful and knowledgeable information in determining the coursework that will be the most beneficial to an undergraduate student seeking a career in medicine. The third source of information will be referencing personal experiences from an undergraduate perspective. This point of view will provide the most current information about undergraduate coursework pertinent to gaining acceptance into medical school, including fulfilling medical school requirements as well as improving performance on the Medical College Admissions Test. Combining these three distinct perspectives on premedical education, a broad base of information will be gathered providing ample resources for developing a well designed premedical undergraduate curriculum.

In an effort to explore what premedical programs are offered at other colleges and universities, a web-based literature review was implemented. Logistically, a web-based

search allowed for a greater number of undergraduate institutions to be examined in a more timely manner (Appendix B). Also, by having a greater number of institutions, a more diversified philosophy of undergraduate premedical education would be attained. This search will involve not only peer institutions of The University of Tennessee, Knoxville, but also schools that function on a smaller and more focused educational emphasis. Through exploration of these other college and university websites, it will be possible to determine whether or not any other institutions take the proposed balanced and global approach to premedical education.

In the second area of our research, a survey was developed for distribution to medical residents. Medical residents were viewed as a more useful population than medical students or those who had been in practice for more than five years because they have a very recent view of what comprises medical school and what aspects of clinical practice are not covered in the medical school experience. Furthermore, medical residents provide a very diverse reference group even though they are all located in one area of the country at the present time because of their varied background institutions both in undergraduate and in medical school. Also, by gaining support of the study from the physicians and deans who guide the residents through the programs they are following, more credibility will be attained for the survey and because of this support elicit a better response.

The survey will be distributed to residents in both Memphis and Knoxville who are concentrating in areas associated with primary care or general practice. The programs in these cities were chosen because contacts had been established with either a physician

or a dean associated with a residency program that could ease the process of distribution of the surveys and also provide the support previously mentioned.

The structure of the survey will contain two distinct sections in an effort to attain both a qualitative and a quantitative evaluation of the coursework the residents deemed beneficial for medical school and/or medical practice (Appendix A). Initially, the resident will provide some demographical information including field of study, years in that field, undergraduate major and size of undergraduate institution. The first section contains open-ended questions aimed at determining what classes taken by the residents in undergraduate programs were beneficial in medical school and/or medical practice. Also, the residents will be able to comment on classes not taken in undergraduate study that would have been significantly beneficial to their performance in either medial school or medical practice. The ensuing section aims to develop a more quantitative study or coursework and its relative importance to medical school and medical practice separately. Coursework was divided into areas such as Biology based, Chemistry based, Speech/Oral Communications, and Business and then ranked on a numeric scale. These rankings will then be averaged to determine order of importance of certain areas of study according to the residents. Additionally, a comment section is provided to allow the residents the opportunity to express any concerns or interests they feel applicable.

The distributed survey will consist of a cover letter explaining the intents for the study, the survey itself and a self addressed and stamped envelope. Distribution will be planned to total eighty surveys with a minimal return of at least twenty surveys to qualify as the significant research component.

The final component of the research project will take the form of self-evaluation of the undergraduate education undertaken by the two proprietors of this research. Discussion will be emphasized in what classes have shown beneficial to performance on the Medical College Admission Test and are available at the University of Tennessee, Knoxville. Also, suggestion as when to enroll in certain classes will be included.

Either of the first two methods in itself could justify moving towards implementation of such a program, however, the survey will be the strongest aspect and therefore will be used as the main source of guidance when designing the decided curriculum.

Research Results

Section I: Literature Review

By reviewing an excess of twenty undergraduate colleges and universities in an evaluation of the programs offered to students desiring to follow a premedical undergraduate curriculum, it was discovered that most programs merely focused on the scientific emphasis of the premedical program and only a few programs featured courses relevant to medicine that dealt with areas outside of the natural sciences (Appendix B). The University of Florida, University of Georgia, and the University of South Carolina, all peer institutions of the University of Tennessee, offer premedical curricula similar to that offered by UTK. The programs of other institutions varied from no medical specialization to a Biology major with a medical emphasis consisting of only a few specialized biology courses. No evidence was found to support a more balanced approached.

Section II: Resident Surveys

From the number of surveys distributed, 23 were returned and of those two could not be used for quantitative analysis due to improper completion. Most of the surveys were completed by those in family medicine, internal medicine, and pediatrics with years in the field ranging from one to four. The majors were mainly biology and chemistry oriented (only four of the twenty-three returned were not a biology or chemistry emphasis), thus giving a clear trend of specialized classes that were seen as beneficial in medical school. The sizes of their undergraduate institutions varied greatly and did not show a clear correlation to answers provided in any of the sections.

Qualitative:

Each survey was carefully read over and the free responses to the open ended questions were evaluated according to each question. Notes were taken on what courses seemed to be recurrent in each section. Common undergraduate courses taken that were beneficial in the first two years of medical school were biology and chemistry based, such as cell biology, physiology, and biochemistry. Other more specialized classes were also listed; however, many of those were very specific to that individual. For classes not taken in undergraduate that would have been helpful, mainly very specialized classes were again listed and varied greatly from individual to individual. Classes such as anatomy, histology, immunology, and pharmacology were some that were repeated on a few surveys. On classes that were beneficial for the last two years of medical school, or the clinical portion, biology based classes were once again prevalent along with a host of social science and communications based courses. Some of those listed included medical ethics, speech, psychology (various forms), and physiology. Two main areas were the main focus for classes not taken that would have been helpful, foreign language (especially Spanish) and business courses. The business courses listed included accounting, finance, statistics, and economics and were limited quite frequently to just these selections. The comments section was also considered in this section of the research. One interesting statement from a physiology major who is currently a second year resident in family medicine stated that "what you learn in college only preps you for medical school – there things get repeated and multiplied." It was interesting to see that this same individual listed that he had taken all of the classes he felt needed in preparation for the first two years of study in medical school, but he created a long list of courses he needed for the clinical portion of medical school that his undergraduate curriculum omitted (these included English, history, political science, psychology, and economics).

Quantitative:

The rankings were tabulated by averaging the rankings given to each component both for medical school and medical practice. Then the average rankings from those two sections were then averaged to give an overall ranking of the course as another indicator of overall importance.

Courses		Medical School	Medical Practice	Overall
Biology based		1.14	2.38	1.76
Chemistry based		2.38	6.14	4.26
Physics		5.52	8.62	7.07
Math based		6.52	9.14	7.83
Speech/Oral Communications		5.62	3.57	4.60
Business (general)		9.29	3.48	6.38
Social Science (psych., soc.)		5.33	4.38	4.86
Philosophical (philos., rel. std.)		8.67	8.00	8.34
Foreign Lang./ Cultural Studies		8.95	7.43	8.19
English/ Lit./ Writing based		7.14	7.66	7.40
Health/ Social Work based		6.43	5.81	6.12
Fine Arts (music/ theater/ art)		11.19	10.90	11.05

Section III: Self-Evaluation

This section involved reflecting back on our own premedical education as to what classes have helped prepare us for the process of being accepted into medical school, mainly in

improving performance on the Medical College Admissions Test. Working outside the confines of those basic classes need for entrance into medical school as well as minimum performance on the MCAT (Biology, Chemistry, Physics, and Organic Chemistry), we felt like physiology and biochemistry were two courses that prepared us better than other courses we had taken. Most of the information presented in those two courses demonstrated a high recurrence on the Biological Sciences portion of the MCAT, along with general biology and organic chemistry. Preparation was deemed sufficient for the Physical Sciences section through only physics and general chemistry, giving no need for higher level physics or inorganic chemistry. We also believe that any courses that will challenge one to read faster and comprehend just as well will help improve MCAT scores, not only on the Verbal Section, but in the sciences as well. Classes beyond these will not compromise one's performance and may even enhance it; however, the time spent in a semester long class might not be worth the one or two questions it would be helpful in answering on the MCAT. Additionally, with the design of the questions present on the MCAT being aimed at preparation with only the four required courses, a class such as immunology might be superfluous in that any question it would help you answer could also be answered with knowledge gained from general biology. However, this reason is not enough to define not ever taking courses such as immunology that might have much worth in medical school.

Analysis of Results

In looking at all three components of the research in summation, it becomes clear that there is a large need for more emphasis on social sciences, humanities, communications, and business while retaining a strong concentration in the biological and chemical sciences. Although the literature review provided little information about classes that might provide a good base in preparation for medical practice, the resident surveys functioned exactly if not better than expected in establishing courses that would be beneficial both in medical school and medical practice.

Seeing that a solid base of biological and chemical sciences is truly most beneficial during the first two years and maintains most of its worth on into clinical practice, it warrants the most emphasis in a premedical education. This emphasis is further supported by the strong correlation between what classes the self-evaluation recommended for positive performance on the MCAT and the classes deemed most beneficial during medical school by the residents. However, social sciences, speech/oral communications, and business all ranked relatively high in the overall category, even though some had very low rankings in the medical school category.

The social sciences will enable the physician to be better prepared for and more properly handle the vast array of situations that they will undoubtedly encounter in the practice of medicine. Speech/ Oral Communications, extremely underrated in medical preparation today, will provide a background in the science of communicating with patients and understanding both the verbal and nonverbal needs and signs they may portray. The majority of the residents felt extremely unprepared for the business side of the medical field and even expressed the idea that this aspect was unexpected as well.

It follows that, in designing a balanced premedical program, one must include a healthy dose of natural sciences, significant amounts of social sciences and communications, and a good base of business courses. Also, given the original hypothesis of preparing for medical practice over only preparing for medical school, the overall rankings must be taken into account only after considering the rankings for worth in medical practice. Following this perspective, even more credibility is attained for the emphasis in the four areas previously listed because their rankings rise high above the other courses listed. Furthermore, it should also be considered that a component of a foreign language and cultural studies be added to the curriculum. Even though its rankings are not as high as some other courses, it was frequently mentioned within the free response portion of the survey and therefore should be strongly considered a part of the premedical curriculum.

Overall, the balanced approach was supported understanding the balance needs to be between the natural sciences and the grouping of the social sciences, communications, and business courses. Additionally, this program must be placed within the setting of a College of Arts and Sciences Interdisciplinary Major which has to fulfill all college requirements. Surprisingly this placement can be done while still maintaining a fair number of general elective-like hours.

Implementation and Justification

Medicinal and Clinical Studies

Preview

The Medicinal and Clinical Studies program strives to encompass all of the classes needed to perform well in both medical school and further into medical practice. The program utilizes well-planned prerequisite coursework and a four module major consisting of a Biological and Chemical module, a Communications module, a Social Issues module, and a Business Foundations module.

Initially, the prerequisite courses and the major will be presented. Following that section will be the plan of how it can be encompassed into a College of Arts and Sciences curriculum and then a concluding section will justify why each class was chosen in each area, including what courses would be suggested for the structured choice hours.

Section I

Prerequisites

Courses	Hours Credit
Biology 130-140	4,4
Chemistry 120-130	4,4
Physics 221-222	4,4
Math 141-142 or 151-152	4,4 or 3,3
Economics 201	4
Total Prerequisites Hours	**34-36**

Major Courses

Module One: Biological and Chemical Sciences	Hours Credit
Chemistry 350/360/369	3,3,2
BCMB 410	4
BCMB 440	4
Structured Electives	6
Total Hours Module One	**24**

Module Two: Communications	Hours Credit
Speech Communications 300	3
Structured Electives	6
Total Hours Module Two	**9**

Module Three: Social Issues	Hours Credit
Philosophy 345	3
Structured Electives	6
Total Hours Module Three	**9**

Module Four: Business Foundations	Hours Credit
Accounting 201-202	3,3
Statistics 201	3
Finance 301	3
Total Hours Module Four	**12**

Total Hours in Prerequisites	**34-36**
Total Hours in Major	**52**
Total Hours Combined	**86-88**

Section II

Seeing that the major coursework and prerequisites total 89 total hours, it is a interesting project to fill all of the Arts and Sciences College requirements; however, it can be accomplished in a clear and simple format.

Arts and Sciences Requirements

Basic Skills	Courses	Hours
English Composition	English 101-102	3,3
Foreign Language	Intermediate Competence*	3,3
Mathematics or Formal Reasoning	Waived by Natural Science Part II package	---

* *A suggestion of Spanish would be made here.*

Divisional Distribution	Courses	Hours
Non-US History	Non-US History Approved Courses or Foreign Language 300+ courses*	3,3
Natural Science Part I	Biology 130-140	4,4
Natural Science Part II	Math 141-142 or 151-152	4,4 or 3,3
Social Science	Speech Communications 300**, Economics 201,Approved Social Science Courses	3,4, 6 (3,2+)
Humanities Part I	Philosophy 240-345**	3,3
Humanities Part II	Approved Humanities Part II course	3

** Foreign language would be requested as a suitable exception for those students who wish to improve fluency in their selected foreign language and to use the cultural component of the class to fulfill the philosophy behind the Non-US History requirement.*

*** Important: Six hours from college requirements should be crossed into the major requirements to allow for maximum benefits. These courses are Speech Communications 300 and Philosophy 345.*

Upper-Level Distribution	Courses	Hours
U.S. Studies, Foreign Studies, Capstone Experience	Approved Courses and Distribution for Upper-Level Distribution	6,3

Total Hours from Prerequisites and Major	86-88
Total Hours from College Requirements (not previously filled above)	39
Total Hours Required for Graduation in the Medicinal and Clinical Studies Program	**125-127***

** May vary upon math taken and the extra hour of Social Sciences that will be obtained.*

Section III

Prerequisites

Biology 130: Unifying concepts and principles of biology, illustrated with diversity of lig, intended for science majors. Properties of life, molecular basis, origin of life, cells, genetics, introduction to kingdoms, origins or multicellularity, multicellular plants and animals, ideas about evolution, man's place in nature, Emphasis on common themes in living systems (e.g., metabolism, protein and nucleotide sequence similarities, morphology), phylogeny construction, fossils, and the major plant and animal groups. Writing and analysis of lab activities required. 3 hours lecture, 1 hour lab each week.

Biology 140: Topics include: basic organic chemistry and biomolecules, cell structure—membranes, cell walls, and internal organelles: energetics—respiration and photosynthesis: cell division- mitosis: and molecular biology. Labs will stress basic laboratory skills and procedures such as measuring pipetting and mixing solutions, as well as introduce modern methods for analysis of cell components such as electrophoresis and centrifugation.

General Chemistry 120-130: A general course in theoretical and descriptive chemistry. 120 – Modern atomic theory, chemical bonding, stoichiometry, quantitative treatment of gas laws, quantitative aspects of solution chemistry,, kinetics. 130 – Chemical equilibria, thermochemistry, descriptive chemistry of nonmetallic and metallic elements, electrochemistry, introduction to organic and biochemistry.

Physics 221-222: Basic physical principles and applications required in premedical, predental, pre-pharmacy and pre-veterinary programs. 221 – Mechanics, heat wave motion and optics. 222 – Electricity and magnetism, modern physics. 3 hours lecture, 3 hours lab.

Math 141-142: Standard first-year course in single variable calculus, especially for students of science, engineering, mathematics, and computer science. Differential and integral calculus with applications.
or
Math 151-152: For students majoring in the Life Sciences. Does not serve as a prerequisite for 231 or 241. Topics include: descriptive statistics, linear regression, discrete probability, matrix algebra, difference equations, calculus, and differential equations. Emphasis on applications in the life sciences. Includes computer projects.

Economics 201: Theory of consumer behavior, theory of firms, supply and demand, costs of production, market models, national income and employment theory, money and backing, monetary and fiscal policy, debt, and international economics.

All these prerequisites, except Economics, are required are required for entrance into most medical schools and therefore justified their inclusion as prerequisites in the Medicinal and

Clinical Studies Program. Economics 201 is included as a prerequisite for two reasons: it serves to fulfill a Social Science requirement and is part of the recommended business courses.

Medicinal and Clinical Studies

Module One – Biological and Chemical Sciences

Chemistry 350-360: Organic Chemistry: Compounds of carbon and their reactions. Reaction mechanisms, synthesis, spectroscopic and other physical properties. Must be taken in sequence.

Chemistry 369: Organic Chemistry Lab: Experiments on topics discussed in 350-360.

Biochemistry and Cellular and Molecular Biology 410: Cellular and Comparative Biochemistry: Electrolyte behavior, chemistry and structure of proteins; enzyme behavior and biological function; catabolism and energy capture; synthetic metabolism; nucleic acid function, protein synthesis, and biomechanical genetics; regulation of biological processes.

Biochemistry and Cellular and Molecular Biology 440: General Physiology: Principles of cellular and organ-system animal physiology.

Elective courses may be chosen from the following:

- Any 200 level or higher course under the biological sciences (omitting BCMB 240) approved by the advisor
- Anthropology 480: Human Osteology
- Any Chemistry at the 230 level or higher approved by the advisor
- Exercise Science 332: Applied Anatomy
- Exercise Science 350: Disease and Injury: Epidemiologic and Demographic Perspectives

The courses listed as required courses for the major have been selected based on recommendation from both the resident surveys and the self-evaluation as well as organic chemistry being a requirement for most all medical schools. The electives have been left open to encourage individual exploration in whatever area of medicine the individual wishes to pursue. For example, if someone wanted to concentrate several hours doing research they could easily fit this into the program as elective hours within the Biological and Chemical Science module. However, if someone else did not find research intriguing, they might concentrate more on the anatomy and injury aspects within the BCS module. Therefore, by working with an advisor who could help someone plan how to best work toward the type of medicine in which they are

interested. All of the courses listed have some direct application to performance in the medical field, whether the application is in scientific study or in clinical practice.

Module Two -- Communications

Speech Communications 300: Nonverbal Communications: Exploration of nonverbal communication from human communication perspective; origins and research, usage and coding of nonverbal behavior, research strategies and theoretical approaches.

Elective Courses may be chosen from the following:

- Speech Communication 220: Interpersonal Communication
- Speech Communication 230: Listening
- Speech Communication 330: Group Communication
- Speech Communication 425: Interpersonal Health Communication
- English 295: Business and Technical Writing **or** English 360: Technical and Professional Writing **or** English 462: Writing for Publication (only one of these may be taken for credit in the major).

By requiring only one course in the Communications module, we are able to direct all students into the most helpful communications course, Nonverbal Communication, because it covers the less obvious phases of communication. Nonverbal will allow one to have a better knowledge of how touch, dress, colors, and voice characteristics may effect the communication pathway. The courses that will go to fill the elective portion of the Communication module all directly relate to some form of interaction in which a physician would undergo on nearly an everyday basis. The reason only one English course may be taken results from the comments from some of the free response answers as well as the higher ranking for speech/oral communications over English in the quantitative portion of the survey. The speech communications courses presented help improve the communication process by working on either sharpening message sending or receiving skills or by improving understanding on where the communication process may breakdown.

Module Three – Social Issues

Philosophy 345: Medical Ethics: Ethical issues in medicine such as abortion, euthanasia, human experimentation, fairness in healthcare delivery and the doctor-patient relationship. Writing emphasis course. (Same as Religious Studies 345).

Elective Courses may be chosen from the following:

- Psychology 300: Child Psychology **or** Psychology 330: Abnormal Psychology **or** Psychology 430: Health Psychology
- Psychology 434: Psychology of Gender **or** Sociology 375: Gender in Society (Same as Women's Studies 375)
- Sociology 319: Sociology of Religion (Same as Religious Studies 319) **or** Religious Studies 355: Religion and Culture in the United States
- Sociology 343: Race and Ethnicity (Same as African-American Studies 343 and American Studies 343)
- Sociology 414: Sociology of Health Care
- Sociology 415: Sociology of Aging **or** University Studies 321: Aging and Society
- University Studies 311: AIDS and Society **or** Health 406: Death, Dying, and Bereavement **or** Health 430: Suicide and Crisis Intervention

As one of the most frequently mentioned undergraduate courses that was or would have been beneficial in the clinical portion of medical school, and thus into medical practice, Medical Ethics is the only required Course in the Social Issues module. Medical ethics is most likely the best class for preparing premedical students to deal with issues that may arise in medical practice such as confidentiality, socioeconomic issues, or dealing with death and dying issues. The SI module also possesses the largest variance of elective courses aimed several different social issue areas. These areas include psychology specialization, religion, and gender and race concerns. Also, one can study the plight of certain groups through classes focusing on specific aspects of the individual's predicament. The great variance here will again allow an individual to tailor his or her program to the interests he or she possesses in medicine.

Module Four – Business Foundations

Accounting 201: Principles of Financial Accounting: Introduction to the financial accounting theory and practice with emphasis on the role of financial information in business decisions.

Accounting 202: Principles of Managerial Accounting: Introduction to managerial and cost accounting concepts with emphasis on uses of accounting data by managers in planning operations, controlling activities, and decision making.

Statistics 201: Introduction to Statistics: Data collection; descriptive statistics. Concepts of probability and probability distributions. Binomial and normal distributions. Estimations of means; confidence intervals; hypothesis tests for single mean and proportion. Simple regression and correlation. Contingency tables. Process improvement and statistical process control. Use of statistical computing software. Applied course appropriate for a general audience.

Finance 301: Financial Management: Principles of financial management. Investment, financing and asset management functions of the firm.

No elective courses are available within this module.

All of the classes in the Business Foundations module were listed by the residents in the free response section of the surveys. The classes appeared to be quite fitting and appropriate for a premedical education in terms of providing a basic foundation of understanding of business practices and policies that might be faced within medical practice.

All-in-all, this program gives a balanced premedical program that will allow a student to not only fulfill all college requirements, but also reach a minimum of forty-three hours of 300-level plus credit hours on the way to only 125 to 127 total hours.

Conclusion

It has been shown that our initial hypothesis was indeed correct because of the results of the literature review and more importantly the surveys completed by the medical residents. Given the ability to develop a well designed balanced and globally oriented curriculum that fits well within the already established requirements of the Bachelor of Arts Degree in the College of Arts and Sciences, an attempt at implementation is the next logical step. This program could be an extremely beneficial tool to incoming students interested in pursuing a career in clinical medicine and could serve as a strong recruiting tool for the University.

Appendix A

Copy of the Cover Letter and the Survey

SENIOR RESEARCH QUESTIONNAIRE

TO: MEDICAL REISDENTS AND PHYSICIANS

FROM: JOHN A. FLATT AND BENSON A. SCOTT

SUBJECT: PROJECT INFORMATION AND QUESTIONNAIRE

DATE: 03/11/99

CC: GLENN GRABER, FACULTY MENTOR

UNDERGRADUATE EDUCATION ASSESSMENT

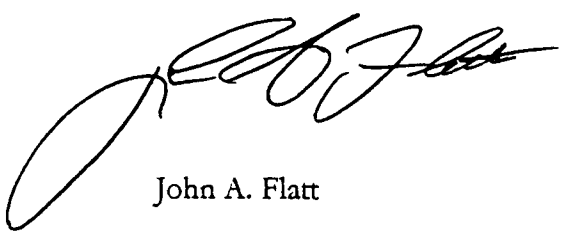
The following questionnaire is one part, however a major part, of a senior research project aimed to develop and to implement a new interdisciplinary program at the University of Tennessee, Knoxville. This program would serve students who wish to gain a more global education than what he or she could attain through a strict science curriculum. In order to accomplish the development of a program generated for success in medical school and into medical practice, we have decided to ask those who would know what classes could provide the most benefit, you. As residents and practicing physicians, you have a unique viewpoint on the education needed for a medical career. Your view is different from those in higher education who have never truly experienced a medical career but who are constantly responsible for trying to develop better students for the medical field.

The questionnaire seeks to find out what classes you have found personally beneficial in your progress through the medical field in both the scientific and clinical phases of medical school and in clinical practice. It also seeks to find out how you would rank classes in order of importance relative to medical school and to medical practice. The questionnaire is simple and open responses are encouraged since they will undergo a qualitative study.

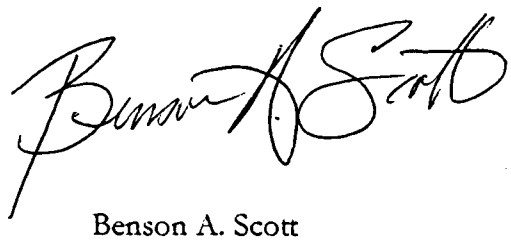
If you have any questions or concerns, please feel free to e-mail John Flatt at jaflatt@aol.com and a response will follow quickly. Please return the completed questionnaire in the envelope provided for you.

Thank you for all of your time and help in this important endeavor. You are not only aiding us, but you are also helping future medical students.

Sincerely,



John A. Flatt



Benson A. Scott

Undergraduate Education Assessment

Field of Practice: _____ Years in Field: _____

Undergraduate Major: _____ Size of Undergraduate Institution: _____

The following questions are based on a medical school education in which the first two years consist mainly of scientific courses and the following two years are comprised of clinical experience. Your responses to these questions will be used to determine the best possible course selection for premedical undergraduate students to promote success in both the scientific and clinical phases of medical school, but also further into their medical practice. All responses to this questionnaire will remain confidential.

What undergraduate courses, taken by you, were most beneficial in the scientific classes in medical school? (eg. Genetics, Biochemistry, Calculus, etc.)

_____

_____

_____

_____

_____

_____

What undergraduate courses **not** taken **would have been** beneficial in the scientific classes in medical school?

_____

_____

_____

_____

_____

_____

What undergraduate courses, taken by you, were most beneficial in the clinical aspect of medical school and into practice? (eg. Calculus, Speech, Health, Psychology, etc.)

_____

_____

_____

_____

_____

_____

What undergraduate courses **not** taken **would have been/would be** most beneficial in the clinical aspect of medical school and practice?

_____

_____

_____

_____

_____

_____

Please rank the following courses in the order of importance for success in medical school and in medical practice (1-12):

	Medical School	Medical Practice
Biology based	_____	_____
Chemistry based	_____	_____
Physics	_____	_____
Math based	_____	_____
Speech / Oral Communication	_____	_____
Business (general)	_____	_____
Social Science (Psychology/Sociology/etc.)	_____	_____
Philosophical (Philosophy/Religious Studies/etc.)	_____	_____
Foreign Language/Cultural Studies	_____	_____
English / Literature / Writing based	_____	_____
Health / Social Work based	_____	_____
Fine Arts (Music/Theater/Art/etc.)	_____	_____

Comments:

_____

_____

_____

_____

_____

Thank you for your time in completing this questionnaire.

Appendix B

University of Florida	www.ufl.edu
University of Georgia	www.uga.edu
University of South Carolina	www.usc.edu
Duke University	www.aas.duke.edu
Stanford University	www.stanford.edu
University of New Hampshire	www.unh.edu
Franklin College	www.franklincoll.edu
Southern Illinois University	www.science.siu.edu
Hope College	www.hope.edu
University of Miami	fig.cox.miami.edu
Cedarville College of Science and Math	www.cedarville.edu
Baylor University	www.baylor.edu
Old Dominion University	www.odu.edu
Washington College	www.washcoll.edu
North Carolina Weslyan College	www.ncwc.edu
Oakwood College	www.oakwood.edu
Louisiana State University	www.lsu.edu
University of Hartford	uhavax.hartford.edu
University of Virginia	www.virginia.edu
Skidmore College	www.skidmore.edu
University of California, Davis	www.ucdavis.edu
University of Arkansas	www.uark.edu
East Tennessee State University	www.etsu.edu
University of Colorado	www.colorado.edu
Rhodes College	www.rhodes.edu
Rice University	www.rice.edu

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