

Intermeshing Passive and Active Learning Strategies in Teaching Biochemistry

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Case studies and student presentations to the class were intermeshed with lectures and demonstrations into a three-semester hour, required biochemistry course in the first professional year of the entry level PharmD curriculum. The resulting course structure, made possible in part through the use of computer-assisted lecture presentations and lecture handouts, combined the high efficiency of information transfer of the lecture format with the high effectiveness of more active learning formats. This approach increased the motivation of the students to learn the material by helping them to see the relevance of biochemistry to the practice of pharmacy. Simultaneously, it made assimilation of the mass of information embodied in the course more manageable.

INTRODUCTION

The problems of how to make biochemistry more interesting, more palatable, more relevant, more easily understood, and, in general, a more satisfying and enjoyable learning experience for pharmacy students have been of utmost concern to the author throughout his teaching career. Biochemical principles underlie most aspects of pharmaceutical care. Consequently, this course material is generally encountered in the early phases of pharmacy professional curricula. As is probably true in all pharmacy schools, the pharmacy curriculum at the University of Mississippi is very full. There is room for only a single, three-semester hour course in biochemistry. For many pharmacy students this may be the only biochemistry course they will ever take. Many of the author's former students have informed him that the biochemistry course ranked among the most difficult courses for them in the pharmacy curriculum. Perhaps due to the early exposure to this material, students have frequently complained that they could not see any relevance of biochemistry to the practice of pharmacy.

While the lecture format suffers from the fact that it is not a highly efficacious learning format it is probably the most efficient means of information transfer^(1,2). Learning strategies in which the students are more actively involved have the advantage of being highly effective, but they suffer from being not as efficient at information transfer⁽²⁻⁴⁾. With the sheer mass of knowledge that students must assimilate, a learning approach that does not incorporate the lecture will probably be inadequate. The author's experience has shown that the lecture format has been inadequate. Combining and intermeshing multiple learning strategies, made possible, in part, through the use of multimedia technologies, has proven to be far more successful than was ever imagined possible.

DESCRIPTION OF TEACHING METHODS

The use of a computer-assisted lecture format with handouts has provided a means for successfully intermeshing multiple learning strategies into this very important, content intensive course in the pharmacy curriculum. Beginning in 1995 approximately one-third of the scheduled class time was devoted to exercises in which the class examined the roles that biochemical principles play in wellness and disease. Each student in the class was assigned to a group (3-6

students per group). Each group was assigned a medical condition for which they were required to give a 20-minute presentation to the class and distribute to the class a one-page handout outlining their presentation. The presentations had to include information on how current lecture material was related to the assigned medical condition. Each group was responsible for only one presentation worth 10 percent of their course grade. Two presentations were given during one of the three class sessions nearly every week. The students have used a wide range of information technologies, including their textbooks, medical and scientific literature, and the Internet, to research their presentation topics. The groups have used skits, videos, multimedia presentations, demonstrations, panel, lecture, and game-show formats for their presentations.

One problem that was identified after the first year of using this learning format was that in order to make time for the student presentations it was necessary to hurry through the lecture material, and the students had great difficulty keeping up. A second problem, which was also brought to light in written comments from several students in the Survey of Student Perception of Course/Instructor and in voluntary personal communications with some of the students, was that the students who were not presenting tended not to pay serious attention to the presentations. One such comment from the 1995 evaluation instrument reads: "The material is gone over so fast on Monday and Wednesday that we do not have time to understand it. The presentations on Friday are useless. No one pays any attention to them."

One commonly stated reason for the lack of attention was that they were not being tested over the material covered in the presentations. To solve the second problem, in the second year of using this learning format, short quizzes, covering information from the presentation, were given at the end of each presentation period. These quizzes represented part of the grade for the course as described below.

The solution to the problem of making time for the student presentation format was provided through developing computer-assisted lecture materials and providing these lecture materials in handouts. This, in turn, was facilitated by the installation of a multimedia package in the lecture room during the summer of 1996. In 1996, using Persuasion® software (Aldus Corp., South Seattle, WA), computer-assisted lecture materials were developed for the entire

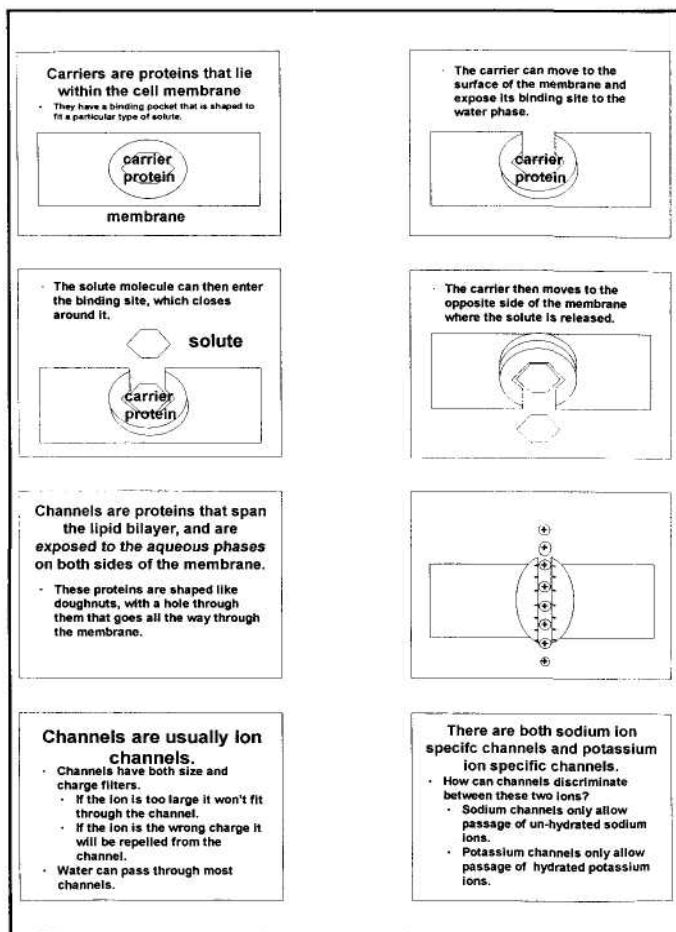


Fig. 1. A page from a typical lecture handout. The order of the frames is left to right and top to bottom. Frames two, three, four and six are static representations of membrane transport processes that are animated in the computer-assisted presentation.

course. Preparation of these materials required approximately three hours for each 50-minute lecture. The computer presentations had illustrations and animations interspersed with text. The text portions served as a detailed outline of the lecture material.

The ability to animate is the single most important advantage that computer-assisted presentations brought to the lecture format. By illustrating many of the more difficult concepts of biochemistry with animation it was possible to make these concepts more easy for the students to grasp and retain. One advantage of computer animation is that the instructor can develop course specific animations for the many concepts for which no commercial products are available, and for which there is little expectation that anything will become available in the foreseeable future. Certainly, no other medium allows generation of lecture-related animations in a typically equipped faculty office. Another advantage of computer-assisted presentation of information is layering. Layering is the process by which multiple points (or bulleted items) in a slide can be added to the display one at a time. Layering gives the ability to present complex information in small packets that are easier to grasp, while simultaneously building larger concepts. Although layering can be done with other technologies the computer makes layering easier.

Persuasion® software is a presentation package that permits the user to develop and display text slides and

graphics. Other presentation software packages, e.g., Powerpoint® (Microsoft Corp., Redmond, WA), have similar capabilities. Several slide backgrounds are provided, and the user can develop customized backgrounds. A 256-color drawing pallet is incorporated, and photographs, graphics, short video clips, music, or narratives, in addition to text can be added to the presentation. The author has found that the rather limited animation capabilities of Persuasion® software can be greatly extended by creative use of the layering feature. This software also allows the user to jump to other applications, and later return to the presentation.

Everything that the students viewed on the screen from the computer was printed out eight frames per page using the handout feature of Persuasion®. These were copied double sided and provided to the students. Sixteen frames represented approximately one, 50-minute presentation. In this format the information was still easy to read, and there was a small amount of space available on the sheet for notes. An example of a lecture handout page including an animation sequence, is shown in Figure 1. The handouts freed the students from the need to try to write down every word that was uttered in the lecture. This allowed them to devote their energies to absorbing the impact of the lecture material. They still took notes but much of these were written on the handout sheets, thereby rounding out the information that had already been provided for them. Utilization of the computer-assisted lecture format with handouts allowed coverage of the essential lecture/demonstration material in two thirds of the allotted classroom time without overwhelming the students.

Demonstrations were frequently incorporated into classroom presentations. The demonstrations assisted with the illustration of difficult concepts, and they provided for a change of pace in the presentation format. Changing the pace periodically during lecture-type presentations has been reported to enhance student's recall of lecture material(5). The following is a list of a few examples of demonstrations used:

- to assist with the concepts of protein secondary and tertiary structure a length of heavy rope was used to illustrate folding and coiling;
- to illustrate the unique properties of water a flask of water with ice floating in it and a flask of partially frozen glacial acetic acid with the solid phase lying at the bottom were displayed;
- to illustrate how easy it is to make membranes small pieces of dry ice were dropped into an Erlenmeyer flask that contained a small amount of water and soap. This generated a "membrane volcano;"
- to illustrate enzymatic coupling of energy producing reactions, with energy requiring reactions a device consisting of two sets of weights connected by cords and two wheels fixed to an axle is demonstrated. One set of weights, looped over one wheel, pulled the second set of weights, looped over the other wheel, in the direction opposite to that of gravity.

For many years unannounced extra credit quizzes covering current and recent lecture materials have been given at the end of the lecture period. In total these extra credit quizzes can add up to approximately five percent to the students grade in the course. These quizzes accomplish two very important goals. They provide positive incentives for the students to attend lectures, and to review lecture materials more frequently than they might otherwise do.

Table I. Student perception of course^a/instructor^b Fall 1995 (N=98)

Questions	Percent responding (N=98)				
	A	B	C	D	E
1. Is this a required course or an elective? (A) Required (B) Elective	100				
2. Were the class lectures and in-class activities relevant to the course objectives? (A) Almost always (B) Usually (C) Sometimes (D) Rarely	31	47	18	2	
3. Did the examinations reflect the course objectives and the material emphasized in class? (A) Almost always (B) Usually (C) Sometimes (D) Rarely	13	40	27	17	
4. Was the instructor well organized and prepared for class sessions? (A) Almost always (B) Usually (C) Sometimes (D) Rarely	26	44	22	6	
5. To what extent did the instructor exhibit command of the course material? (A) Very poor (B) Inadequate (C) Marginal (D) Adequate (E) Excellent	2	3	19	50	25
6. What percentage of the course material have you learned? (A) 90%-100% (B) 80%-89% (C) 70%-79% (D) 60%-69% (E) less than 60%	7	29	35	18	8
7. To what degree did the instructor's teaching methods help you understand the course material? (A) Very low (B) Low (C) Average (D) High (E) Very	25	33	33	7	
8. How does your amount of effort in this course compare to your amount of effort in other courses? (A) Very low (B) Low (C) Average (D) High (E) Very		3	20	40	35
9. How beneficial were the instructors responses to student questions? (A) Excellent (B) Good (C) Marginal (D) Poor (E) Very poor	4	36	39	14	5
10. Did the instructor demonstrate enthusiasm for the subject matter? (A) Strongly disagree (B) Disagree (C) No opinion (D) Agree (E) Strongly agree	3	8	16	45	26
11. If you needed assistance from the instructor outside of class, to what extent was the instructor available to you? (A) Almost always (B) Usually (C) Sometimes (D) Rarely (E) Not applicable	22	38	22	2	14
12. Did the instructor return assignments and examinations in a reasonable period of time? (A) Yes (B) No (C) Not applicable	71	26	2		
13. How beneficial was the textbook in this course? (A) Excellent (B) Good (C) Marginal (D) Poor (E) Not applicable	3	15	41	38	1
14. How would you rate the difficulty level of this course? ⁰ (A) Very difficult (B) Difficult (C) Average (D) Easy (E) Very easy	57	32	9		
15. How would you rate the instructor's overall performance in this course? (A) Excellent (B) Good (C) Marginal (D) Poor (E) Very poor	3	35	40	13	7

^aBiochemical Foundations of Therapeutics, PHCL 343.^cOne respondent said "not applicable."^bJohn C. Matthews.

A case-based learning paradigm was added to the course in 1996. On the first meeting of the class a three page clinical description of a person with non-insulin dependent diabetes mellitus and hypertension was distributed to the students. Each week for approximately the first half of the course the students received a question about this medical case. The question each week had some relationship with the lecture material that was to be covered during the upcoming week. Each student was required to research the question to develop answers. The written, essay-style answers to the questions about the cases were due the following week. About midway through the course the students received a second case study for a patient with cardiovascular disease. Subsequent case questions were in relation to this second clinical case. These cases with some of the weekly questions

are provided in the Appendix. Short video tapes of patients with medical conditions related to the case studies were shown during a few of the lecture periods as supplementary information on the case studies. Some of the video clips used were from the C. Everett Koop Series (Time Life Medical, New York, NY). The presentations and case studies served to get the students actively involved in applying biochemical principles to the analysis and interpretation of medical conditions. This helped to provide the relevance factor that was deficient in the lecture/demonstration format.

EVALUATIVE DATA

Grades

The course grading structure for 1996 was 80 percent from two major exams and a final exam, 10 percent from the

Table II. Student perception of course^a/instructor^b, Fall 1996 (N-63)

Questions	Number and percent responding					
	A	B	C	D	E	
1. Is this a required course or an elective? (A) Required (B) Elective	# 63 % 100					
2. Were the class lectures and in-class activities relevant to the course objectives? (A) Almost always (B) Usually (C) Sometimes (D) Rarely	# 46 % 73	15 23	2 3			
3. Did the examinations reflect the course objectives and the material emphasized in class? (A) Almost always (B) Usually (C) Sometimes (D) Rarely	# 21 % 33	23 36	15 23	4 6		
4. Was the instructor well organized and prepared for class sessions? (A) Almost always (B) Usually (C) Sometimes (D) Rarely	# 55 % 87	8 12				
5. To what extent did the instructor exhibit command of the course material? (A) Very poor (B) inadequate (C) Marginal (D) Adequate (E) Excellent	# %		4 6	20 31	39 61	
6. What percentage of the course material have you learned? (A) 90%-100% (B) 80%-89% (C) 70%-79% (D) 60%-69% (E) less than 60%	# 13 % 20	28 44	19 30	2 3	1 1	
7. To what degree did the instructor's teaching methods help you understand the course materials? ⁰ (A) Very low (B) Low (C) Average (D) High (E) Very high	# 2 % 3	7 11	27 42	24 38	2 3	
8. How does your amount of effort in this course compare to your amount of effort in other courses? (A) Very low (B) Low (C) Average (D) High (E) Very high	# %		1 1	7 11	27 42	28 44
9. How beneficial were the instructors responses to student questions? (A) Excellent (B) Good (C) Marginal (D) Poor (E) Very poor	# 10 % 15	43 68	8 12	2 3		
10. Did the instructor demonstrate enthusiasm for the subject matter? (A) Strongly disagree (B) Disagree (C) No opinion (D) Agree (E) Strongly agree	# %		2 3	1 1	29 46	31 49
11. If you needed assistance from the instructor outside of class, to what extent was the instructor available to you? (A) Almost always (B) Usually (C) Sometimes (D) Rarely (E) not applicable	# 42 % 66	14 22	2 3		5 7	
12. Did the instructor return assignments and examinations in a reasonable period of time? (A) Yes (B) No (C) Not applicable	# 63 % 100					
13. How beneficial was the textbook in this course? (A) Excellent (B) Good (C) Marginal (D) Poor (E) Not applicable	# 1 % 1	5 7	27 42	27 42	3 4	
14. How would you rate the difficulty level of this course? (A) Very difficult (B) Difficult (C) Average (D) Easy (E) Very easy	# 42 % 66	20 31	1 1			
15. How would you rate the instructor's overall performance in this course? (A) Excellent (B) Good (C) Marginal (D) Poor (E) Very poor	# 22 % 34	35 55	4 6	2 3		

^aBiochemical Foundations of Therapeutics, PHCL 343.

^bJohn C. Matthews.

^cOne respondent said "not applicable."

presentation, and 10 percent from a combination of the weekly case questions and the required quiz questions drawn from the student presentations. The difference in grading structure from 1995 to 1996 was the latter 10 percent. In 1995 there were no case questions and no quizzes covering the student presentations, and the three major exams counted 90 percent of the final grade. The difficulty level and the material covered by the exams in 1996 was equivalent to the previous year. The class average for 1996 was 1.4 percentage points higher than for 1995. This difference was not statistically significant as determined by Student's *t*-test, *t* (178) = 1.07, *P* = 0.287. Grades tend to be an unreliable index of student satis-

faction with the learning experience(6). It is intuitively obvious that time and effort management are critical skills for students to be successful in pharmacy school. Students will expend as much time and effort as necessary to achieve the grade they feel they want or need in any particular course. Thus, students who are maintaining the grade level they desire in a course will devote more of their time and effort to other courses.

Annual Course Evaluations

Annual course evaluations, completed by the students, represent a much more informative measure of student satisfaction with the learning experience. The cumulative

results from the University of Mississippi Survey of Student Perception of Course/Instructor evaluation instrument, for the 1995 and 1996 biochemistry classes, are presented as Tables I and II. The evaluation instrument was intentionally designed such that the response pattern is variable from question to question. This allows a quick, first approximation assessment of whether the students have provided a good-faith evaluation of the course. Previous evaluation instruments used by the University of Mississippi suffered from the problem that a portion of the students gave the same response for every question, often the most unfavorable one.

As can be seen from comparing the 1995 and 1996 evaluations the level of student satisfaction with the course/instructor showed a consistent and substantial shift in the positive direction in nearly every category from 1995 to 1996. This result was further reinforced by the overwhelmingly positive responses in the narrative section of the evaluation instrument. Students in both years ranked the course as very difficult (>55 percent) or difficult (>30 percent) (# 14), and they ranked their level of effort in the course as high (40 percent) or very high (35 percent) (# 8). An important change from 1995 to 1996 was that the students perception of the amount of the course material they learned increased by about one ranking level (10 percent) (# 6). The largest changes in ranking from 1995 to 1996 were in items 2 and 7. These questions relate to relevance of in-class activities and effectiveness of teaching methods. The specific features of the course that the students listed as positive in the narrative section of the evaluation instrument for fall 1996 were the handouts (18 of 30 responses), the computer-assisted lecture format (five of 30 responses), student presentations (four of 30 responses), and case studies (four of 30 responses). An example student comment from the 1996 evaluation instrument reads:

"The class is interesting. Dr. Matthews' notes are excellent. The case studies were very beneficial. I am glad he introduced us to the method of researching case studies." In personal communications several students have volunteered the information that they liked the computer-assisted lecture format, and that the handouts really helped them to assimilate the lecture material. They have also stated that the student presentations and the questions about the medical cases really helped them to see the relevance of the lecture material.

One area from the survey that remains a concern is the textbook (#13). The textbook, *Principles of Biochemistry*, 2nd edition, by A. L. Lehninger, D. L. Nelson and M.M. Cox, Worth Publishers, New York, NY (1993), was used primarily as supplemental reference material for the course. A small portion of the assigned readings from the text were designated as material that was not covered in lecture. Most of the assigned readings from the text paralleled the lecture material. The students were responsible for assigned reading material on tests. In addition, some case-related and student presentation-related materials were available in the text. The most probable reason for student dissatisfaction with the text is the way that it is used in the course.

Other areas of concern about the course that the students commented on in the narrative section of the survey were that the exams were too hard/the questions did not relate to the lecture material (10 of 18 responses), too much work was needed for the case studies (two of 18 responses), too much material (one of 18 responses) and not enough

tests (one of 18 responses). These same concerns have been expressed in personal communications with the students.

CONCLUSIONS

Intermeshing student presentations and case studies with lectures and demonstrations in a basic science course in the first professional year of the pharmacy curriculum has achieved a course structure that retains the best features of each of the learning paradigms. The student presentations and case studies served to get the students actively involved with the learning process, and they helped to provide the relevance factor that has been extremely difficult to achieve with the lecture/demonstration format. The lecture/demonstration format retains the advantage of allowing the efficiency of information transfer that is necessary for the students to be able to assimilate the sheer mass of essential background knowledge. The development of computer-assisted lecture material and the provision of lecture handouts were critically important components for the success of this approach.

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APPENDIX. PATIENT CASES

PHCL 343 Biochemical Foundations of Therapeutics Fall 1996

History of Present Illness:

Patient G.O., a 52 y/o white male in for routine yearly physical exam and evaluation of hypertension, diabetes mellitus, chronic back pain, lipid disorder and peripheral neuropathy. He has generally felt fine except for recurrent episodes of malaise and fatigue over the past three or four months. He stresses strict compliance with all medicines and has a good history of compliance. He says his finger stick Tracer glucometer has been showing his fasting blood glucose levels running 135-150 two weeks ago. He checks his sugars usually once or twice weekly. He also says his home blood pressures have shown 135/80 to 140/90 on a regular weekly basis.

Past Medical History

- Childhood Illnesses: Usual childhood illnesses.
- Adult Illnesses: Hypertension 25 years; non-insulin dependent diabetes mellitus 22 years (controlled by diet for the first ten years); chronic back pain that waxes and wanes from muscle spasms arising from a motor vehicle accident at age 18

Was hospitalized 11 months ago due to a severe case of influenza resulting in noncompliance with medications that led to dangerously elevated blood pressure, heart rate, and blood sugar. Past history of ingrown toenails.

- Trauma: Motor vehicle accident at age 18 w/ resulting back pain.
- Surgeries: Patient had 2 smallest toes on left foot amputated 3 years ago to control gangrene. Patient had laser surgery on both eyes 7 years ago to correct retinopathies.
- Habits: (-) EtOH, (-) smoking, light sleeper, drinks 3 cups of coffee per day and occasional diet cola.
- Immunizations: Gets flu shots annually. Can't remember date of last tetanus booster.

Family History: Father died from a blood clot to the brain from a "failed pacemaker" at age 55. Unknown if he had a history of hypertension or lipid disorder. Mother 78 y/o and in good health except for hip fracture five years ago and osteoporosis with a Dowager's hump. No family history of diabetes. No sibs.

Social History: Married 28 years w/ two college age children. Lives at home w/ wife. High school graduate + 2 years college. Owns a successful business and only eats once or twice daily due to his busy work schedule. He has not followed his proper diabetic diet in over six months. No financial or personal complaints. Aetna health insurance through his group policy at work.

Review of Systems

- General Appearance: No complaints of fever or chills. Reports feeling run down for several months.
- Head: No headaches or dizziness.
- Eyes: Denies diplopia, blurring, pain or discharge.
- Ears: Denies past infections, tinnitus, pain or discharge. Reports normal hearing.
- Nose: Chronic congestion and sinusitis during allergy season.
- Mouth and throat: Complains of dry mouth. No history of thyroid disease. No recent sore throats.
- Chest: No cough, no pain, shortness of breath, wheezing, hemoptysis, or sputum production. Last chest x-ray at previous annual physical examination (normal). Last skin test for tuberculosis at previous annual physical examination (nonreactive).
- Cardiovascular: Denies chest pain, dyspnea on exertion. No history of palpitations or heart murmur. No history of rheumatic fever as a child, claudication or Raynaud's phenomenon. Complains of lightheadedness. Reports history of hypertension.
- Gastrointestinal: Good appetite, but eating is irregular. Poorly compliant to diabetic diet. Complains of occasional constipation. No complaints of heartburn, nausea, vomiting. Doesn't generally take antacids or laxatives.
- Genitourinary: No history of sexually transmitted diseases, urinary tract infections, or urethritis, denies polyuria.
- Neuromuscular: Reports mild tingling sensation and numbness in feet. Denies tingling in hands. Has chronic low back pain. No history of psychiatric illness.
- Skin: No photosensitivity or rashes.

Physical Examination

- General appearance: Well developed, well nourished white male, no apparent diseases; appears stated age of 52 y/o.
- Vital Signs: 140/92 sitting, 120/80 standing, pulse 97, respiration 20, temperature 98.4, 198 lbs, 72".
- Skin, hair and nails: No abnormal pigmentation, scars, bruises, or skin turgor. Minor ulceration and cracking on feet.
- Nodes: None palpated.
- Head: Normal cephalic, atraumatic.
- Eyes: Pupils equal, round, reactive to light and accommodating. Funduscopic reveals some arterial/venous nicking w/ preproliferative retinopathy changes. No exudates,

papilledema or hemorrhages.

- Ears: Normal.
- Nose: Normal.
- Mouth and throat: Normal dentition with old dental repairs noted. No lesions.
- Neck: Supple. No thyroid enlargement appreciated. No jugular venous distension.
- Chest and lungs: Normal.
- Heart: Regular rate and rhythm w/ borderline elevated rate. No murmurs, rubs or gallops.
- Abdomen: Normal.
- Rectum: Unremarkable.
- Extremities: Pulses symmetric bilaterally. Joints with good mobility; no deformity. Normal muscle mass.
- Back: Normal contour of spine. Slight tenderness in lower back. No sacral edema.
- Neurologic:
 - Mental Status: Alert; normal memory, judgement, mood.
 - Cranial Nerves: Intact.
 - Cerebellum: Normal gait, finger-nose, heel-shin, no tremor.
 - Motor: Normal grip strength, Deep tendon reflexes (+).
 - Sensory: Reduced sensitivity to touch, pain, vibration, heat, cold, in feet and hands.

Medication Use History

- Rx: Glynase 6 mg BID.
Cardizem CD 240 mg QD.
Tenex 2 mg QD.
Elavil 50 mg qHS for sleep and back pain.
Zocor 20 mg qAM.
Dyazide 1 cap q week.
OTC: Ibuprofen 200 mg 1-2 tabs prn pain.
Icy Hot to shoulder hHS.
Vit E 400 IU QD.
Allergies: No known drug allergies.

Representative weekly questions:

List 3 medical conditions that G.O. has now that have something to do with defects/deficits in facilitated membrane transport processes. Give a one sentence description/explanation for each outlining how facilitated membrane transport is involved.

Give 3 different nutrient storage defects/deficits caused by non-insulin dependent diabetes mellitus and briefly explain how each of these contributes to medical conditions exhibited by G.O.

PATIENT CASE II PHCL 343 Biochemical Foundations of Therapeutics Fall 1996

History of Present Illness:

Patient N.R., a 47 y/o black male was referred to a cardiologist because of severe, intermittent chest pains. He had had these pains for the past 1 yr and they were gradually becoming worse. They typically occurred after exertion such as brisk walking, carrying a bag of groceries up a flight of stairs, or mowing the lawn. He smokes about 1 pack of cigarettes per day, and consumes about 18 cans of beer each week. He has an office job in which he sits at his desk for several hours each day. He leads a moderately active lifestyle bowling 2 nights per week and playing 18 holes of golf on most Sunday afternoons. Prior to this complaint he has not seen a physician since his discharge from the army at age 24.

Physical Examination Results:

Vital signs: bp 150/95, pulse 81, respiration 13, 98.4°, 190 lbs, 68", waist/hip ratio 0.98.

A coronary artery angiogram revealed coronary artery atherosclerosis. His serum cholesterol was found to be 318 mg/dl (LDL 215 mg/dl, HDL 35 mg/dl, triglycerides 340 mg/dl). A dietary evaluation revealed that his typical dietary intake was 140g of protein, 190g of fat and 350g of carbohydrate. His typical daily sodium intake was 3500 mg.

Treatment:

The patient was placed on a 2500 Calorie per day diet, low in sodium, cholesterol and saturated fat and ordered to quit smoking and to reduce his beer consumption by at least 2/3. Patient was advised to maintain his normal level of physical activity but to add 15 minutes of walking at a normal pace during his lunchtime each day.

Rx:

Cardizem CD 240 mg QD
Fluvastatin 20 mg QD

Representative weekly questions:

Explain the biochemical/physiological bases of the dietary/exercise/smoking changes ordered for N.R.s therapy.

Explain the reasons for decreasing, but not eliminating N.R.s beer intake.