

UNIVERSITY SENATE ROUTING LOG

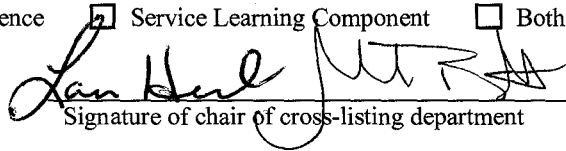
Proposal Title: Biosynthesis of Natural Products

Name/email/phone for proposal contact: Jurgen Rohr, jrohr2@email.uky.edu; 3.5031

Instruction: To facilitate the processing of this proposal please identify the groups or individuals reviewing the proposal, identify a contact person for each entry, provide the consequences of the review (specifically, approval, rejection, no decision and vote outcome, if any) and please attach a copy of any report or memorandum developed with comments on this proposal.

Reviewed by: (Chairs, Directors, Faculty Groups, Faculty Councils, Committees, etc)	Contact person Name (phone/email)	Consequences of Review:	Date of Proposal Review	Review Summary Attached? (yes or no)
College of Pharmacy Graduate Faculty	Dr J Buss 3.0094 jbuss2@email.uky.edu	unanimous approval	5/8/07 - 5/15/07	yes
College of Pharmacy Graduate Program Comm	Dr J Buss 3.0094 jbuss2@email.uky.e +	unanimous approval	5/8/07-5/15/07	yes
Dept of Pharmaceutical Sciences Executive Comm	Dr P McNamara 7.8656 pmcnamar +	unanimous approval	5/24/07	yes
Collg of Pharmacy- Assoc.Dean-Rsrch &Grad Ed	Dr R Yokel 7.4855 ryokel@email.uky +	approval	5/9/07	yes
Health Care Colleges Council	Heidi Anderson	Approved	7/15/08	-

APPLICATION FOR NEW COURSE

1. Submitted by the College of Pharmacy Date: 5/8/2008
Department/Division proposing course: Department of Pharmaceutical Sciences
2. Proposed designation and Bulletin description of this course:
- a. Prefix and Number PHR 620
- b. Title* Biosynthesis of Natural Products
*If title is longer than 24 characters, write a sensible title (24 characters or less) for use on transcripts:
Biosyn of Natural Prod
- c. Courses must be described by at least one of the categories below. Include the number of actual contact hours per week for each category, as applicable.
- () CLINICAL () COLLOQUIUM () DISCUSSION () LABORATORY () LECTURE
() INDEPEND. STUDY () PRACTICUM () RECITATION () RESEARCH () RESIDENCY
() SEMINAR () STUDIO () OTHER – Please explain: _____
- d. Please choose a grading system: Letter (A, B, C, etc.) Pass/Fail
- e. Number of credit hours: 3
- f. Is this course repeatable? YES NO If YES, maximum number of credit hours: _____
- g. Course description:
An overview of the biochemical pathways leading to compounds called natural products/secondary metabolites
- h. Prerequisite(s), if any:
two semesters of organic chemistry
- i. Will this course be offered through Distance Learning? YES NO
If YES, please identify one of the methods below that reflects how the majority of the course content will be delivered:
- Internet/Web-based Interactive video Extended campus Kentucky Educational Television (KET/teleweb) Other
- Please describe "Other": _____
3. Teaching method: N/A or Community-Based Experience Service Learning Component Both
4. To be cross-listed as: BCH 620, PLS 624
Prefix and Number 
Signature of chair of cross-listing department
5. Requested effective date (term/year): Fall / 2008

APPLICATION FOR NEW COURSE

6. Course to be offered (please check all that apply): Fall Spring Summer
7. Will the course be offered every year? YES NO
If NO, please explain: N/A

8. Why is this course needed?

To introduce graduate students to the source of natural products, many of which are used as pharmaceuticals

9. a. By whom will the course be taught? Watt (Medicine), Rohr and Crooks (Pharmacy), Chappell (Agriculture)
- b. Are facilities for teaching the course now available? YES NO
If NO, what plans have been made for providing them?
N/A

10. What yearly enrollment may be reasonably anticipated?
10 students / year

11. a. Will this course serve students primarily within the department? Yes No
- b. Will it be of interest to a significant number of students outside the department? YES NO
If YES, please explain.

Students principally in pharmacy, agricultural sciences, and medical sciences will take this course.

12. Will the course serve as a University Studies Program course[†]? YES NO
If YES, under what Area? N/A

[†]AS OF SPRING 2007, THERE IS A MORATORIUM ON APPROVAL OF NEW COURSES FOR USP.

13. Check the category most applicable to this course:

- traditional – offered in corresponding departments at universities elsewhere
- relatively new – now being widely established
- not yet to be found in many (or any) other universities

14. Is this course applicable to the requirements for at least one degree or certificate at UK? Yes No
15. Is this course part of a proposed new program? YES NO
If YES, please name: N/A

16. Will adding this course change the degree requirements for ANY program on campus? YES NO
If YES[†], list below the programs that will require this course:

N/A

[†]In order to change the program(s), a program change form(s) must also be submitted.

APPLICATION FOR NEW COURSE

17. The major teaching objectives of the proposed course, syllabus and/or reference list to be used are attached.
18. Check box if course is 400G or 500. If the course is 400G- or 500-level, *you must include a syllabus showing differentiation* for undergraduate and graduate students by (i) requiring additional assignments by the graduate students; and/or (ii) the establishment of different grading criteria in the course for graduate students. (See *SR 3.1.4*)

19. Within the department, who should be contacted for further information about the proposed new course?

Name: Janice Buss, Ph.D. Phone: 3.0094 Email: jbuss2@email.uky.edu

20. Signatures to report approvals:

DATE of Approval by Department Faculty	Patrick J. McNamara <small>printed name</small>	/	see attached page for original signatures Reported by Department Chair	signature
DATE of Approval by College Faculty	Kenneth B. Roberts <small>printed name</small>	/	see attached page for original signatures Reported by College Dean	signature
* DATE of Approval by Undergraduate Council	<small>printed name</small>	/	Reported by Undergraduate Council Chair	signature
* DATE of Approval by Graduate Council	<small>printed name</small>	/	Reported by Graduate Council Chair	signature
* DATE of Approval by Health Care Colleges Council (HCCC)	<small>printed name</small>	/	Reported by Health Care Colleges Council Chair	signature
* DATE of Approval by Senate Council	Reported by Office of the Senate Council			
* DATE of Approval by University Senate	Reported by Office of the Senate Council			

*If applicable, as provided by the *University Senate Rules*

APPLICATION FOR NEW COURSE

Signatures of Approval:

May 24, 2007

Date of Approval by Department Faculty

May 15, 2007

Date of Approval by College Faculty

*Date of Approval by Undergraduate Council

*Date of Approval by Graduate Council


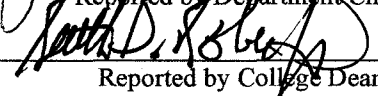
7/15/08

*Date of Approval by Health Care Colleges Council (HCCC)

*Date of Approval by Senate Council


*Date of Approval by University Senate

*If applicable, as provided by the Rules of the University Senate


Reported by Department Chair
Reported by College Dean

Reported by Undergraduate Council Chair

Reported by Graduate Council Chair


Reported by HCCC Chair

Reported by Senate Council Office

Reported by Senate Council Office

APPROVAL OF NEW COURSE:
PHR 620 BIOSYNTHESIS OF NATURAL PRODUCTS

SUMMARY OF BALLOTS

COP Faculty

<i>Approve</i>	<i>Disapprove</i>
25	0

Dept of Pharmaceutical Sciences Executive Committee

<i>Approve</i>	<i>Disapprove</i>
7	0

COP Graduate Program Committee

<i>Approve</i>	<i>Disapprove</i>
4	0

Associate Dean of Research and Graduate Education

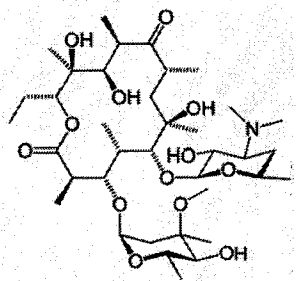
Approve Yes

Course Description
Biosynthesis of Natural Products
BCH620/PHR620/PLS624
(PHR760-011; BCH780-001; PLS697-002 for the Fall 2007 semester)

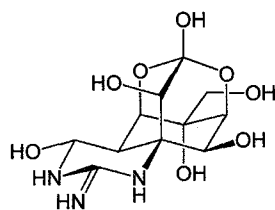
Last revised 11-16-07

Course objectives: Apart from the four general classes of biomolecules that appear in living systems, plants and microorganisms produce molecules unique to a particular species. These compounds, called “natural products”, possess a dazzling array of biological activities that are the basis for diverse industries ranging from fragrances to pharmaceuticals. For example,

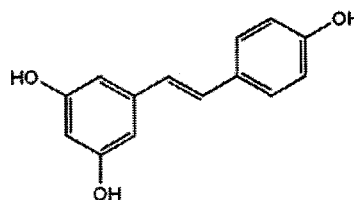
- The widely used antibiotic, erythromycin, is produced from a strain of the actinomycete bacteria, *Saccharopolyspora erythraea*.
- The skin and certain internal organs of many “puffer” fish in the Tetraodontidae family contain tetrodotoxin, an alkaloid that is highly toxic to humans. Nevertheless, these fish are considered a delicacy in both Japan and Korea.
- Resveratrol is found in the skin of red grapes and is a constituent of red wine and is implicated in the “French paradox”: coronary heart disease is relatively low in southern France despite high dietary intake of saturated fats.



erythromycin



tetrodotoxin



resveratrol

Students who take this course will be able to recognize the family to which a newly discovered natural product belongs and predict the likely source materials and pathways that gives rise to this natural product. Specifically, students will understand the shikimate, polyketide, mevalonate, and alkaloid pathways.

Course description: This course, entitled “Biosynthesis of Natural Products,” is designed for graduate students in chemistry, biochemistry and pharmacy. Introductory general chemistry, organic chemistry, and biochemistry courses are prerequisites for enrollment. Undergraduates may enroll in this course with the permission of the course director. This course will introduce students to the general families of secondary metabolites, typically called “natural products” and their biosynthesis as well as techniques used to study these compounds.

Course Director: A course director will be selected among Jurgen Rohr, Peter Crooks, Joseph Chappell and David Watt for a two-year term. The initial course director is David Watt.

David Watt
Department of Molecular and Cellular Biochemistry
Biomedical Biological Science Research Building, Room B181
telephone: 257-3945
email: dwatt@uky.edu

Class meeting: The course will meet on Monday and Wednesday at 10:00 AM to 11:30 AM in Room 206 of the College of Pharmacy Building. Students are urged to attend class. The lectures will highlight important concepts covered in the textbook and emphasize the material that will be covered on the examinations.

Office Hours: Tuesday, 3:00-5:00 PM, Biomedical Biological Science Research Building, Room B181. Access to this building can be somewhat problematic. You are advised to come across the bridge on Limestone that leads into this building. If you are unable to gain access through the double-doors that lead into the building, please call D. Watt at 257-3945 from the telephone outside the security door.

Textbook: P. M. Dewick, *Medicinal Natural Products: A Biosynthetic Approach*, 2nd edition, John Wiley and Sons

Blackboard: Copies of lecture notes will be posted on a BB site. Students should print copies of the slides and bring them to class. Students will need to get an account in order to gain access to this site. Only students registered in the course will be able to access these materials.

Examinations: Students will take three examinations. Two examinations (each of which is 90 minutes in length) will be administered during class periods designed in the syllabus and listed below. A comprehensive final examination (120 minutes in length) will be administered at the end of the course. For the Fall 2007 semester, these dates are as follows:

Examination 1, Monday, October 8 from 10:00-11:30AM
Examination 2, Monday, November 5 from 10:00-11:30AM
Final examination, Wednesday, December 12 from 8:00-10:00AM

"Make up" Examinations: Students who miss an hour examination for whatever reason will be tested on the material covered in that section of the course on the final examination. The final examination will serve as the "make up" examination. That is, if a student missed the first hour exam and received grades of 85, and 70 on the second, and final examinations, respectively, the

student's overall performance in the course would be determined by grades of 70 (final examination also counting as the first examination), 85 (second hour examination), and 70 (final examination).

Auditors: Students who wish to audit this course should see the instructor.

Grading: Grades will be determined on the basis of two hour examinations, and a comprehensive final examination.

Each of the hour examinations and the final examination will be worth 100 points. Students who fail to take an hour examination, for whatever reason, will have the final examination count more toward their final grade. That is, if a student missed the first hour exam and received grades of 85, and 70 on the second and final examinations, respectively, the student's overall performance in the course would be determined by grades of 70 (final examination also counting as the first examination), 85 (second hour examination), and 70 (final examination). Students are strongly encouraged to take all of the hour examinations. Students *must* take the final examination to receive a grade in this course.

Standards will be used to convert these overall numerical scores into letter grades: 90-100% is an A; 80-89% is a B; 70-79% is a C; and scores less than 70% are an E. These standards may be adjusted downward if this works to the students' benefit.

Regrading examinations: Students who believe that a mistake was made in the grading of an hour examination should re-submit the examination and a *signed note* that describes briefly which problem they want to have re-graded to the *course director*. Requests for re-grading of a particular hour examination must be submitted before the next hour examination. The examinations will be re-evaluated and returned with the subsequent hour examination. Students should be aware that a random number of examinations will be copied prior to returning them to the class.

Cheating: No form of cheating will be tolerated. Students are encouraged to read the Student Rights and Responsibilities with regard to cheating and plagiarism (<http://www.uky.edu/StudentAffairs/Code/part2-6.html>)

course description-fall 2007.doc

Course Topics
Biosynthesis of Natural Products
Last revised 4-30-07

**INITIAL OFFERING IN FALL 2007 WILL BE AS PHR760-011, BCH780-001
and PLS697-002**

Introduction (3 lectures; Watt)

- Primary and secondary metabolites: definitions
- Historical context
- Principal pathways
 - Biochemistry: an overview
 - Key players in "secondary metabolism": acetyl CoA, shikimate, γ,γ -dimethylallyl pyrophosphate, and amino acids
- Brief overview of botanical classification
- Conventions for writing mechanisms for organic chemical reactions
- An overview of stereoisomerism: general understanding of the terms stereogenic centers, enantiomers, diastereomers, meso compounds, epimers and anomers
 - Fisher projections
 - R/S, D/L, d/l and (+)/(-) conventions
- Conformational analysis: Haworth projections, chairs, envelopes

Carbohydrates (4 lectures; Rohr)

- Glucose: structure and biosynthesis
 - Brief review of photosynthesis
 - Brief review of glycolysis/gluconeogenesis, the citric acid cycle and the glucose shunt (C_5 carbohydrates)
 - Deoxysugar and aminosugar biosynthesis
- Other monosaccharides
- Polysaccharides

Shikimate pathways (6 lectures; Watt)

- Biosynthesis of shikimic acid and aromatic amino acids
- Redox reactions in biosynthesis: hydroxylation, peroxidation and epoxidation as recurring themes
- Phe-derived natural products
 - Cinnamic and benzoic acids
 - Coumarins
 - Quinones
 - Lignins

Polyketide pathways (6 lectures; Rohr)

- Fatty acid anabolism/catabolism
- Even and odd-numbered chains
- Unsaturated fatty acids

Polyketides: Type 1 (erythromycin), type 2 (anthraquinones and tetracyclins), type 3 (chalcones, stilbenes)
Oxidative coupling of phenols: biphenyls and diphenyl ethers
Further modifications of carbon skeletons

Mevalonate pathways (10 lectures; Chappell)

Mevalonate biosynthesis
Biosynthesis of acyclic isoprenoids
Monoterpenes
Sesquiterpenes
Diterpenes
Steroids
Higher-order terpenes

Alkaloids and amino-acid derived natural products (10 lectures; Crooks)

Biosynthesis of amino acids (an overview)
Natural products derived from Ser and Cys
Natural products derived from Val, Leu and Ile
Natural products derived from aromatic amino acids
 β -lactam biosynthesis
Alkaloids derived from ornithine and lysine
Alkaloids derived from aromatic amino acids and anthranilic acid
Pyrimidines, purines and pteridines
Pyrroles and porphyrins
Corrins

Syllabus for Fall 2007
PHR760-011, BCH780-001 and PLS697-002

Lecture	Day	Date	Reading	Topic
1	W	22-Aug	Ch 1 and 2	Introduction
2	M	27-Aug	Ch 1 and 2	Introduction
3	W	29-Aug	Ch 8	Carbohydrates
4	M	29-Aug	Ch 8	Carbohydrates
	M	3-Sep		LABOR DAY HOLIDAY
5	W	5-Sep	Ch 8	Carbohydrates
6	M	10-Sep	Ch 4	Shikimate Pathway
7	W	12-Sep	Ch 4	Shikimate Pathway
8	M	17-Sep	Ch 4	Shikimate Pathway
9	W	19-Sep	Ch 4	Shikimate Pathway
10	M	24-Sep	Ch 3	Polyketides
11	W	26-Sep	Ch 3	Polyketides
12	M	1-Oct	Ch 3	Polyketides
13	W	3-Oct	Ch 3	Polyketides
	M	8-Oct		EXAMINATION 1
14	W	10-Oct	Ch 5	Mevalonate Pathways
15	M	15-Oct	Ch 5	Mevalonate Pathways
16	W	17-Oct	Ch 5	Mevalonate Pathways
17	M	22-Oct	Ch 5	Mevalonate Pathways
18	W	24-Oct	Ch 5	Mevalonate Pathways
19	M	29-Oct	Ch 5	Mevalonate Pathways
20	W	31-Oct	Ch 5	Mevalonate Pathways
	M	5-Nov		EXAMINATION 2
21	W	7-Nov	Ch 6 and 7	Alkaloids
22	M	12-Nov	Ch 6 and 7	Alkaloids
23	W	14-Nov	Ch 6 and 7	Alkaloids
24	M	19-Nov	Ch 6 and 7	Alkaloids
25	W	21-Nov	Ch 6 and 7	Alkaloids
26	M	26-Nov	Ch 6 and 7	Alkaloids
27	W	28-Nov	Ch 6 and 7	Alkaloids
28	M	3-Dec	Ch 6 and 7	Alkaloids
29	W	5-Dec	All	Summary