MODULE FRAMEWORK

11053 Biochemistry

354(16) Bio-organic chemistry

This module comprises three sections: Mechanism of enzyme catalysis, secondary metabolism and antimicrobial compounds. Different lecturers are responsible for the three sections but all the administration of the module is handled by the module convenor.

Lecturers:

Lecturer	Room*	Tel. No.	Email	Responsibility
Prof. J. Rohwer	108	(021) 808-5843	jr@sun.ac.za	Mechanisms of enzyme catalysis
Dr. M. Rautenbach	115	(021) 808-5872	mra@sun.ac.za	Antimicrobial compounds **Convenor**
Prof. P. Swart	121	(012) 808-5862	pswart@sun.ac.za	Secondary metabolism

***JC Smuts Bldg. A Block**

Study material

Mechanism of enzyme catalysis - handouts
Secondary plant products – Internet material and handouts
Antimicrobial compounds – Internet material and handouts

Time table and contact opportunities

Lectures
Monday: 08h00 – 09h00
Thursday: 12h00 –13h00
Friday: 09h00 – 10h00

Practicals/Tuturials/Problem sessions
Tuesday: 14h00 – 17h00
Appointments can be made with individual lecturers.

Assessment

Procedures
The outcomes of the module will be assessed on a **continuous** basis.

Mechanism of Enzyme Catalysis
One 2 hour open book written test (25%) and one problem test/assignment to be announced by the lecturer (8%).

Secondary Metabolism
Two assignments to be announced by the lecturer (16.7% each).

Mechanism of Antibiotic action
One problem based/practical report and one seminar to be announced by the lecturer.

Time and place of assessment
As the assessment is done on a continuous basis, each lecturer at the beginning of a section will announce the time and place of assessment. One test will, however, will be in time slot of the official semester test. The November exam time slot will not be used.

Feedback
Assignments and tests will be marked by lecturers and discussed with individual students should the need arise. Assessment will, if at all possible, be completed within three weeks after completion of the test or assignment.

Computation of class and module marks
As the module is assessed on a continuous basis there will only be one final pass mark. Each section will count 33.3% of the total module mark. See "assessment procedures" above for the composition of section marks.

Participation in tests
All tests and assignments are compulsory and participation is subject to the prerequisites as explained in the Year Book.

Special requirements
If you missed and assessment due to illness, you have to hand in a doctors certificate with the convenor of the module within 7 days to be considered for the supplementary test. Zero-tolerance towards plagiary in seminars and reports will be enforced.

Goals

- The unlocking and processing of subject information and knowledge in each of the three sections from traditional as well as electronic sources.
- The development of calculation skills needed for the analyses of experimental data relevant to the three sections.
- The development of interpretative skills for the critical evaluation of experimental data.
- The development of writing skills in terms of logical formulation and discussion through written projects.
- The development of presentation skills and scientific debating in an oral seminar.
- To obtain practical skills through the determination of antibiotic activity.
- Scientific reporting with regard to experimental data that was either collected or given.

Curriculum

Mechanism of Enzyme Catalysis

Lecture	Subject
1	General introduction and meeting
2	The formation of C-C bonds by aldolase
3	The mechanism of aldolase catalysis
4	Other mechanisms for the formation of C-C bonds: Claisen condensations: Thiolase and Coenzyme A
5	Citrate synthase, citrate lyase and ATP
6	Serine transhydroxymethylase; PALP, THF
7	Substrate specificity of proteases
8	Covalent catalysis
9	pH-dependence of histidine and imidazole as a putative nucleophilic catalyst
10	The mechanism of chymotripsin catalysis
11	Conformational changes during binding
12	Use of binding energy for catalysis by chymotripsin
13	Transition states
14	Summary and closing remarks

Tutorials

1. Revision of key concepts from Organic Chemistry
2. Problem session
3. Problem session
4. Problem session

Outcomes

After completion of this module the student should be able to do the following:

Mechanism of enzyme catalysis

- Given a detailed enzyme mechanism, be able to describe in words what each step of the mechanism entails;
- Given a verbal description of an enzyme mechanism, be able to write the mechanism according to accepted organic chemistry mechanisms;
- Given the experimental data of enzyme mechanistic study, explain the data and come to a conclusion about the mechanism;
- Given an enzyme mechanistic problem, be able to propose possible experiments to solve the problem;
- Can predict how site directed mutagenesis of amino acid residues in the active or binding sites of enzymes will influence activity or mechanism of catalysis;
- Given an example, can predict and explain how binding energy contributes to enzyme catalytic activity.

Antimicrobial compounds

Lecture	Subject
1	Introduction
2	Introduction contd. - antimicrobial targets
3	Bacterial ell walls
4	Cell walls as targets for antimicrobial compounds
5	Cell walls as targets for antimicrobial compounds (contd.)
6	Cell membranes
7	Membrane active antimicrobial compounds
8	Membrane active antimicrobial compounds (contd.)
9	Bacterial metabolism as target
10	Protein biosynthesis
11	Protein biosyntheses as target
12	Replication and reverse transcription
13	Antiviral drugs
14	Antibiotic resistance

Tutorials and Practical

1. How is antimicrobial activity determined?
2. Preparation and calculations for "practical"
3. Calculation of antimicrobial activity
4. Oral seminar presentations

Outcomes

After completion of this module the student should be able to do the following:

Antimicrobial compounds

- Explain what the difference between an antibiotic, a biocide/toxin and a chemotherapeutic compound is;
- Discern between specificity and selectivity of an antibiotic or toxin;
- Explain which cellular processes in prokaryotes are good targets for antibiotics;
- Explain how the chemical character of antimicrobial compounds are related to their;
- Explain the influence and mechanistic action of different antimicrobial compounds on specific cellular processes;
- Explain how bacteria develop resistance against different types of antimicrobial compounds and how this resistance can be retarded or prevented;
- Describe the ideal antibiotic/antimicrobial compound and defend your choice with logical arguments;
- Explain the mechanism of action of anti-retro viral compounds using an example;
- Critically evaluate and compare the activity of antimicrobial compounds;
- Process experimental data from an antimicrobial study and evaluate the results critically in a scientific report;
- Retrieve subject matter regarding anti microbial substances from electronic and traditional media, process the data and present it in either oral or written form.

Secondary Metabolism

Lecture	Subject
1	Introduction - Secondary Metabolism
2	Introduction- Link between secondary and primary metabolism
3	Reactions of importance to secondary metabolism - hydroxylation of saturated carbon atoms and aromatic compounds
4	Reactions of importance to secondary metabolism - oxidative coupling of phenols
5	Reactions of importance to secondary metabolism - methylation, condensation and group transfer reactions
6	Polyketides - definition, origin and biosynthesis
7	Polyketides - important pharmaceutical derivatives
8	Terpenes and steroids - definition and origin
9	Terpenes and steroids– cholesterol biosynthesis
10	Terpenes - important terpenes - physiological role in vision
11	The shikimic acid pathway - role in secondary metabolism
12	The shikimic acid pathway - important metabolites
13	Alkaloids - definition and origin
14	Alkaloids - biologically active alkaloids

Tutorials

1. Assignment discussion
2. Techniques used for the studying of secondary metabolism
3. Assignment discussion
4. Structure-activity relationship in biologically active secondary metabolites

Outcomes

After completion of this module the student should be able to do the following:

Secondary metabolism

- Explain what secondary metabolism is and how differs from primary metabolism and links up with it;
- List the most important starting compounds for secondary metabolites;
- Discuss how knowledge of the general characteristics of secondary metabolites influence our approach to this important group of compounds;
- Write the type reactions of importance for the biosynthesis of the different classes of natural products;
- Explain, using examples, what contribution natural products make to compounds used in the agricultural, pharmaceutical, and medical environments (current and present) with specific reference to antibiotics and contraceptives.