

BIOLOGY 146 Module Framework 2022

For BSc/BSc Agric (EDP) Students

Presented by the Department of Botany & Zoology

2nd Semester, 16 Credits

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Instructor Information

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General Information

Expectations and Outcomes

By the end of this module students will be familiar with a range of principles and concepts in biology, including:

- Life: Domains and Kingdoms/Groups
- The chemical basis of life
- Biological molecules
 - Carbohydrates
 - Lipids
 - Proteins
 - Nucleic Acids
 - Replication
 - Transcription
 - Translation
- Biological membranes: Structure and transport
- Cell structure and function in pro- and eukaryotes, and plant and animal cells
- Vertebrate phylogeny
- Mendel, Genes and Inheritance

Time Table and Venues

Lectures: Time and Venues	Practicals: Time and Venue
Group 1 & 2: Tue 8:00, NS 3005 Wed 12:00, NS 3005 Thu 12:00, NS 3005	Mon 10:00 – 12:30 NS 2025
Group 3: Mon 8:00, Math Sci 2002 Tue 10:00, M de Vries 1040 Thu 09:00, Math Sci 2002	Mon 10:00 – 12:30 NS 2025

Lecture and Study Schedule

We will have face-2-face classes and practicals, unless communicated otherwise (e.g. some flipped classroom activities) – please check the following schedules:

WEEK	DATES	THEME & CHAPTER	CONTENT
1	18-22 Jul	Introduction (Chapter 1) Water (Chapter 2)	Introduction: Biological Concepts Water: Basis of Life
2	25-29 Jul	Biological molecules (Chapter 3)	Biological molecules: Carbohydrates
3	1-5 Aug	Biological molecules (Chapter 3)	Biological molecules: Lipids and Proteins
4	8-12 Aug (NO class on 8 and 9 Aug)	Biological molecules (Chapter 3) Biological membrane structure (Chapter 5)	Biological molecules: Nucleic Acids Structure of biological membranes
5	15-19 Aug	Cells (Chapter 4)	Introduction: Chapter 4 Prokaryotic cells Eukaryotic cells
6	22-26 Aug	Cells (Chapter 4)	Eukaryotic cells ECM and Cell Junctions PROJECT: Educate you Aunt
7	29 Aug-2 Sept	TEST 1 (30 Aug); Biological membranes (Chapter 5)	Transport across biological membranes
RECESS	5-9 Sept		
8	12-16 Sept	Animal phylogeny and Vertebrate life (Chapter 27 and 29 in Openstax; Chapters 31 and 32 in Russell et al.)	Animal phylogeny and Vertebrate life
9	19-23 Sept	Vertebrate life (Chapter 29 in Openstax; Chapter 32 in Russell et al.32)	Vertebrate life
10	26-30 Sept	TEST 2; Mendel, Genes and Inheritance (Chapter 12 in Russell et al.)	Mendelian Genetics
11	3-7 Oct	DNA structure and replication (Chapter 14)	DNA replication
12	10-14 Oct	From DNA to protein: Transcription and Translation (Chapter 15)	Transcription Protein synthesis
13	17-21 Oct	TUT & Revision	

Practicals

Attendance/completing of Practical classes is compulsory (no choice)! Please check when practicals are online, in the Laboratory (2025) or elsewhere. No labcoat is required. See the following schedule:

WEEK	DATE	THEME	PRACTICUM AND TITLE
1	18 Jul	-	No Practical
2	25 Jul	Biodiversity	Online Practical: Classification of Life on Earth
3	1 Aug	Cells	Online Practical: VIDEO (BBC): The Cell
4	8 Aug	-	No Practical
5	15 Aug	Cells	Laboratory Practical: Microscopy- Unicellular and Multicellular micro-organisms
6	22 Aug	Cells	Laboratory Practical: Microscopy - Plant & Animal cells. Structure & Function
7	29 Aug	Organism	Laboratory Practical: Vertebrate Life (1) - Agnathostomata to Amphibia
	5 Sept		RECESS
8	12 Sept	Organism	Laboratory Practical: Vertebrate Life (2) - Reptilia to Mammalia
9	19 Sept	Organism	Excursion to the Two Oceans Aquarium
10	26 Sept	-	Test 2 (no practical)
11	3 Oct	Molecular biology	Tutorial
12	10 Oct	Molecular biology	Tutorial
13	17 Oct	Molecular biology	Tutorial

Assessments

This module follows a **flexible assessment** approach. Students **need to complete ALL assessments** to pass the module. Compulsory assessments:

- A series of **three tests** (see table with dates below), contributing to **75%** of the final mark.
- **Online assessments (Quizzes), assignments, and practicals** contributing to **25%** of the final mark.

MAIN TEST ASSESSMENTS	DAY	DATE	TIME	DURATION
Semester Test 1	Tuesday	30 August 2022	To be announced	2 hours
Semester Test 2*	Monday	26 September 2022	10:00 (during Prac time)	2 hours
Semester Test 3 (in SU exam time)	Tuesday	8 November 2022	14:00	2 hours

*Additional test not on the SU system.

Composition of Test Papers

Papers will consist of multiple-choice questions and written questions. The portion of work covered by the test or exam will be announced prior to the test. It is the responsibility of the student to acquaint him/herself with the content and *time and date of each test*.

Medical Certificates & Leave of Absence

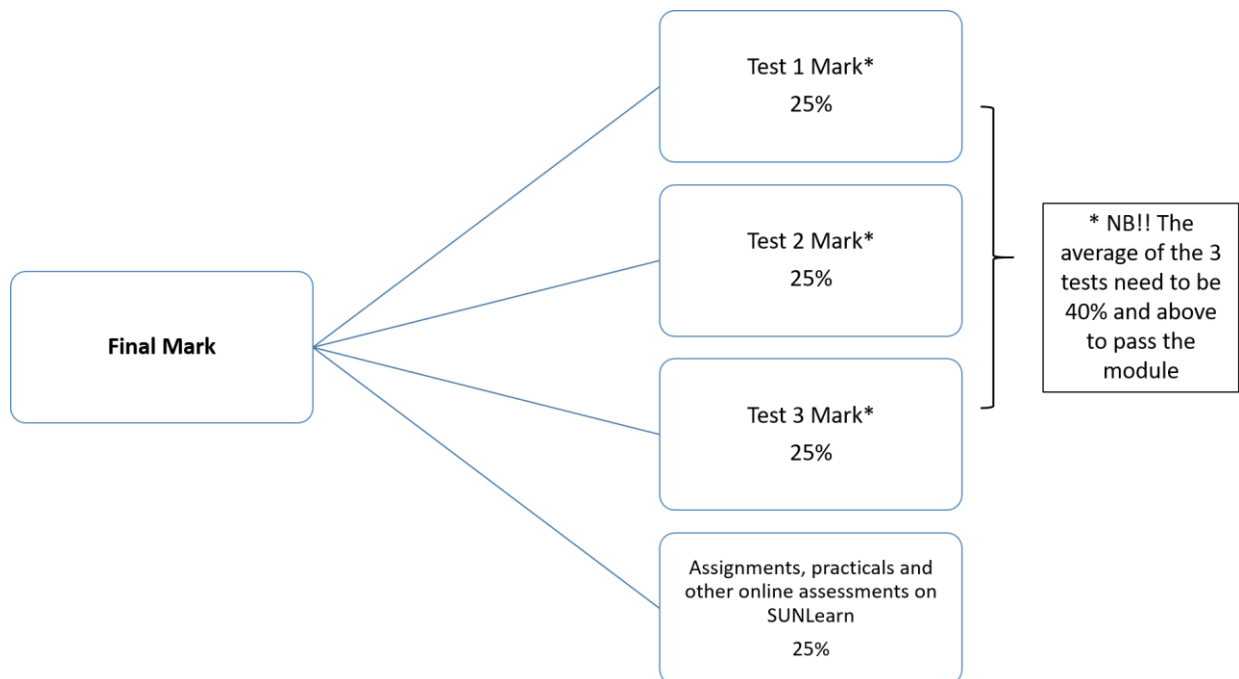
If a **test, practical or deadline is missed by a student**, a valid original medical certificate is required and has to be handed in at *Ms. Gordon* within one week of the test or hand-in date. In the case of other unforeseen circumstances, such as participation in provincial or national sporting events, we require a letter from the organization or sporting body involved. In these instances, granting of permission to miss tests or deadlines is at the lecturer's discretion, and *is not automatic*. **Sickness tests will in the form of an oral examination which must be arranged with Dr. Mouton.**

Calculation of Marks

The Final Mark (PP) of a student will consist of the marks you achieve in the **three semester tests and a series of other assessments/assignments**. If assignments are not handed in, a 0% mark will be awarded and if late, a reduced mark. Failure to complete assessments may lead to students not passing the module.

Please take note that in order to pass this module a final mark of at least 50% is needed, as well as an average of $\geq 40\%$ for the three semester tests (contributing to $\pm 75\%$ of the final mark).

Consult the examination section (p132) of the 2016 University Yearbook 1 (General) regarding other rules relevant to assessment and exams.



Course Materials

Required Textbook/s

- **Biology. The Dynamic Science.** Fifth Edition (2019). Eds. J. Russell, P.E. Hertz and B. McMillan.

- **Biology. Openstax College.** <http://openstaxcollege.org>.

Additional Learning Material

- All learning content is available on SUNLearn. Look for each week's content.
- The slides of the lectures represent only a **summary** and should be used as such.

Language Implementation for this Module

The Department of Botany and Zoology recognizes English as the international academic language and a medium through which science can be communicated. It is thus our endeavor to ensure that each and every one of our students are proficient to communicate through the medium of English. We will, however, accommodate our Afrikaans students to the best of our ability.

The following language option will be implemented in this biology module: **Lectures will be offered in English and Afrikaans (separate classes).**

The materials for learning will be made available as follows:

- Module frameworks/ study guides will be available in Afrikaans and English.
- All compulsory reading material will be provided in English. Compulsory reading material (excluding published material) will also be provided in Afrikaans unless it is not reasonably practicable to do so.
- Question papers for tests, examinations and other summative assessments will be available in Afrikaans and English. Students may answer all assessments and submit all written work in either Afrikaans or English.

Summary of Course Content and Chapters

Russell et al. 2019 – 5th Edition

Chapter 1: Introduction to Biological Concepts p 1-23

1. What is life? p 2
2. Characteristics of living organisms p 2-7
3. Biological evolution p 7-10
4. Biodiversity and the Tree of Life p 10-14
5. Biological Research 14-23 Self-study.

Chapter 2: Life, Chemistry and Water p 24-42

1. Self-study: p 24-34
2. Hydrogen bonds and the Properties of Water p 35-41

Chapter 3: Biological Molecules: The Carbon Compounds of Life p 43

1. Formation and Modification of Biological Molecules p 44-48
2. Carbohydrates p 48-51
3. Lipids p 52-56
4. Proteins p 56-64
5. Nucleotides and Nucleic Acids p 65-69

Chapter 4: The Cell: An Overview p 72

1. Basic Features of Cell Structure and Function p 73-78
2. Prokaryotic cells p 79-80
3. Eukaryotic cells p 80-102

Chapter 5: Membranes and Transport p 104

1. Membrane Structure and Function p 105-111
2. Functions of Membranes in Transport: Passive Transport p 111-116

3. Active Transport p 116-119
4. Exocytosis and Endocytosis p 119-121

Chapter 12: Mendel, Genes and Inheritance p 244

1. The beginnings of Genetics: Mendel's Garden Peas p 245-255

Chapter 14: DNA Structure and Replication p 290

1. DNA structure p 294-296 Self study
2. DNA Replication p 297-309

Chapter 15: From DNA to Protein p 312

1. The connection between DNA, RNA and Protein p 313-319
2. Transcription: DNA directed RNA synthesis p 319-320
3. Production of mRNA's in Eukaryotes p 320-324
4. Translation: mRNA-Directed Polypeptide Synthesis p324-333

Chapter 31: Animal Phylogeny p 682

1. What is an animal? p 683-685
2. Key Innovations in Animal Evolution p 685-687
3. An Overview of Animal Phylogeny and Classification p 687-690
4. Animals without Tissues: Parazoa p 690-691

Chapter 32: Deuterostomes: Vertebrates and their closest Relatives p 718

1. Invertebrate Deuterostomes p 719-722
2. Overview of the Phylum Chordata p 722-724
3. The Origin and Diversification of Vertebrates p 724-726
4. 'Agnathans' p 726-729
5. Gnathostomata: The evolution of Jaws p 729-734
6. Tetrapoda: The Evolution of Limbs p 734-737
7. Amniota: The Evolution of Fully Terrestrial Vertebrates p 737-739
8. Living Lepidosaurs: Shenodontis and Squamates p 739-741
9. Living Archelosaurs: Turtles, Crocodilians and Birds p 742-746
10. Mammalia: Monotreme, Marsupials and Placentals p 746-748

Russell et al. 2017 – 4th Edition

Chapter 1: Introduction to Biological Concepts p 1-23

6. What is life? p 2
7. Characteristics of living organisms p 2-7
8. Biological evolution p 7-9
9. Biodiversity and the Tree of Life p 9-14
10. Biological Research 14-23 Self-study.

Chapter 2: Life, Chemistry and Water p 24-43

3. Self study: p 24-34
4. Hydrogen bonds and the Properties of Water p 35-41

Chapter 3: Biological Molecules: The Carbon Compounds of Life p 44

6. Formation and Modification of Biological Molecules p 44-49
7. Carbohydrates p 49-52
8. Lipids p 52-56
9. Proteins p 57-64
10. Nucleotides and Nucleic Acids p 65-69

Chapter 4: The Cell: An Overview p 73

4. Basic Features of Cell Structure and Function p 74-78
5. Prokaryotic cells p 78-79
6. Eukaryotic cells p 79-100

Chapter 5: Membranes and Transport p 104

5. Membrane Structure and Function p 105-111
6. Functions of Membranes in Transport: Passive Transport p 111-116

- 7. Active Transport p 116-118
- 8. Exocytosis and Endocytosis p 119-122
- Chapter 12: Mendel, Genes and Inheritance p 251
- 2. The beginnings of Genetics: Mendel's Garden Peas p 252-264
- Chapter 14: DNA Structure and Replication p 300
- 3. DNA structure p 304-306 Self study
- 4. DNA Replication p 306-318
- Chapter 15: From DNA to Protein p 323
- 5. The connection between DNA, RNA and Protein p 324-329
- 6. Transcription: DNA directed RNA synthesis p 329-331
- 7. Production of mRNA's in Eukaryotes p 331-336
- 8. Translation: mRNA-Directed Polypeptide Synthesis p336-345
- Chapter 31: Animal Phylogeny p 706
- 5. What is an animal? p 707-708
- 6. Key Innovations in Animal Evolution p 708-711
- 7. An Overview of Animal Phylogeny and Classification p 711-713
- 8. Animals without Tissues: Parazoa p 713-714
- Chapter 32: Deuterostomes: Vertebrates and their closest Relatives p 743
- 11. Invertebrate Deuterostomes p 744-746
- 12. Overview of the Phylum Chordata p 747-749
- 13. The Origin and Diversification of Vertebrates p 749-752
- 14. 'Agnathans' p 752-754
- 15. Gnathostomata: The evolution of Jaws p 754-759
- 16. Tetrapoda: The Evolution of Limbs p 759-762
- 17. Amniota: The Evolution of Fully Terrestrial Vertebrates p 762-764
- 18. Living Lepidosaurs: Shenodontis and Squamates p 764-766
- 19. Living Archelosaurs: Turtles, Crocodilians and Birds p 767-770
- 20. Mammalia: Monotreme, Marsupials and Placentals p 770-773

Russell et al. 2014 – 3rd Edition

- Chapter 1: Introduction to Biological Concepts p 1-21
- 1. What is life? p 2
- 2. Characteristics of living organisms p 2-6
- 3. Biological evolution p 6-8
- 4. Biodiversity and the Tree of Life p 8-12
- 5. Biological Research 12-21 Self-study.
- Chapter 2: Life, Chemistry and Water p 22-41
- 1. Self study: p 22-32.
- 2. Hydrogen bonds and the Properties of Water p 32-41
- Chapter 3: Biological Molecules: The Carbon Compounds of Life p 42
- 1. Formation and Modification of Biological Molecules p 42-47
- 2. Carbohydrates p 47-50
- 3. Lipids p 50-55
- 4. Proteins p 55-63
- 5. Nucleotides and Nucleic Acids p 63-70
- Chapter 4: Energy, Enzymes and Biological Reactions p 71
- 1. The role of enzymes in Biological Reaction p 78-81
- 2. RNA-based Biological Catalysts: Ribozymes p 85-86
- Chapter 5: The Cell: An Overview p 90
- 1. Basic Features of Cell Structure and Function p 91-94
- 2. Prokaryotic cells p 95-97
- 3. Eukaryotic cells p 97-118

Chapter 6: Membranes and Transport p 119

1. Membrane Structure and Function p 120-126
2. Functions of Membranes in Transport: Passive Transport p 126-131
3. Active Transport p 131-134
4. Exocytosis and Endocytosis p 134-140

Chapter 12: Mendel, Genes and Inheritance p 239

1. The beginnings of Genetics: Mendel's Garden Peas p 240-251

Chapter 14: DNA Structure, Replication and Organization p 286

1. DNA structure p 290-293 Self study
2. DNA Replication p 293-303
3. DNA Organization in Eukaryotes and Prokaryotes p 304-309

Chapter 15: From DNA to Protein p 310

1. The connection between DNA, RNA and Protein p 311-317
2. Transcription: DNA directed RNA synthesis p 317-318
3. Production of mRNA's in Eukaryotes p 318-321
4. Translation: mRNA-Directed Polypeptide Synthesis p321-331

Chapter 31: Animal Phylogeny p 670

1. What is an animal? p 671-672
2. Key Innovations in Animal Evolution p 672-675
3. An Overview of Animal Phylogeny and Classification p 675-677
4. Animals without Tissues: Parazoa p 677-678

Chapter 32: Deuterostomes: Vertebrates and their closest Relatives p 706

1. Invertebrate Deuterostomes p 707-710
2. Overview of the Phylum Chordata p 710-712
3. The Origin and Diversification of Vertebrates p 712-715
4. 'Agnathans' p 715-716
5. Gnathostomata: The evolution of Jaws p 717-721
6. Tetrapoda: The Evolution of Limbs p 721-723
7. Amniota: The Evolution of Fully Terrestrial Vertebrates p 723-726
8. Testudines: Turtles p 726-727
9. Living Lepidosaurs: Shenodontis and Squamates p 727-728
10. Living Archosaurs: Crocodilians and Birds p 728-732
11. Mammalia: Monotreme, Marsupials and Placentals p 732-734