Biodiversity and Ecology (BDE) 244: Principles of Evolution

16 credits, second semester

Lecturers:
Prof Conrad Matthee (Room 4007; cam@sun.ac.za) – Course Co-ordinator
Dr Victor Rambau (Room 4005; rvr2@sun.ac.za)
Prof Bruce Anderson (Room 2006, bca@sun.ac.za)
Dr Genevieve Theron (gltheron@sun.ac.za)

Course assistant: Janette Hutton (Room 1006; janette@sun.ac.za)

Aims: "Nothing in biology makes sense except in the light of evolution." These were the famous words of Theodosius Dobzhansky who succinctly verbalized the ramifications of Darwin's most ground-breaking idea. Evolution is the only theory that can claim to unite all biological disciplines and in this course we aim to make sure that you understand how evolution works, so that you can claim to be a biologist. In particular, we demonstrate how the study of evolution itself has evolved with the discovery of Mendelian genetics and inheritance. Armed with the mechanisms of inheritance we journey through some of the most influential evolutionary theory on adaptive landscapes and shifting balance and how this influences the way in which the traits of organisms are able to evolve. We explore how relentless discrimination against individuals with slightly less "perfect" traits (natural selection) has through time sculpted our bodies in tiny steps. Natural selection has led to adaptation where the morphology of organisms is apparently matched to the environment in seemingly impossible "perfection." But because environments change in space and time, the organisms within those environments change and diverge in response. We explore the processes leading to speciation and try to navigate the quagmire of literature that attempts to explain the deceptively simple question of "what is a species?" From simple beginnings, we help you to understand how you came to exist.

Recommended text book:
Ridley M 2005. Evolution. 3rd ed. Blackwell publishing

Recommended additional reading:
Coyne JA and Orr HA 2004. Speciation. Sinauer
Dawkins R. 2009. The Greatest show on earth. Bantam Press
Dawkins R. 1996. Climbing Mount Improbable. Penguin
Schluter D. 2000. The Ecology of Adaptive radiation. Oxford University Press.

Language implementation for this module:

The Department of Botany and Zoology recognises English as the international academic language and the primary medium through which science is communicated. It is thus our endeavour to ensure that our students are proficient at communicating 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 BDE module:

- Lectures will be offered in English only.

The materials for learning will be made available as follows:

- 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.
- Module frameworks/study guides will be available in Afrikaans and English.
- 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.

Lecture programme: The course consists of 39 lectures, which will be held on Mondays (08h00-08h50), Wednesdays (09h00-09h50) and Fridays (10h00-10h50) in room 1030 of the Natural Sciences Building. **This module will be offered on campus with no simultaneous live streaming**

Lecture	Date	Day	Subject	Lecturer	Chapters
1	18-Jul	Mon	pre-Darwin, Darwin	VR	1, 3
2	20-Jul	Wed	Darwin, Wallis & the Modern synthesis	VR	1, 3
3	22-Jul	Fri	Supporting evidence	VR	1, 3
4	25-Jul	Mon	Mendelian genetics and inheritance	CAM	2, 5-7
5	27-Jul	Wed	The theory of natural selection	CAM	2, 5-7
6	29-Jul	Fri	The theory of natural selection	CAM	2, 5-7
7	01-Aug	Mon	Random events	CAM	2, 5-7
8	03-Aug	Wed	Population genetic models	CAM	2, 5-7
9	05-Aug	Fri	Population genetic models	CAM	2, 5-7
10	08-Aug	Mon	Selection vs Drift	CAM	2, 5-7
11	10-Aug	Wed	Selection vs Drift	CAM	2, 5-7
12	12-Aug	Fri	Selection vs Drift	CAM	
13	15-Aug	Mon	Continuous traits & quantitative genetics	BA	2, 5-7
14	17-Aug	Wed	Continuous traits & quantitative genetics	BA	2, 5-7
15	19-Aug	Fri	Adaptive landscapes & shifting balance	BA	8, 10, 11
16	22-Aug	Mon	Adaptive landscapes & shifting balance	BA	8, 10, 11
17	24-Aug	Wed	Natural selection & adaptation	BA	8, 10, 11
18	26-Aug	Fri	Natural selection & adaptation	BA	8, 10, 11
19	29-Aug	Mon	The adaptionist paradigm	BA	8, 10, 11
20	31-Aug	Wed	Constraints on adaptation	BA	8, 10, 11
21	02-Sep	Fri	Genetics of adaptation	BA	8, 10, 11
University Recess 05-Sep – 09-Sep					
22	12-Sep	Mon	Units of selection	BA	8, 10, 11
23	14-Sep	Wed	Identifying adaptation	BA	8, 10, 11
24	16-Sep	Fri	Identifying adaptation	BA	8, 10, 11
25	19-Sep	Mon	Measuring selection	BA	8, 10, 11
26	21-Sep	Wed	Conclusions	BA	8, 10, 11
27	23-Sep	Fri	Conclusions	BA	8, 10, 11
28	26-Sep	Mon	Phenetic species concepts	GLT	13, 14, 18, 23
29	28-Sep	Wed	Biological species concept	GLT	13, 14, 18, 23
30	30-Sep	Fri	Phylogenetic species concept	GLT	13, 14, 18, 23
31	03-Oct	Mon	Mutation and speciation	GLT	13, 14, 18, 23
32	05-Oct	Wed	Geneflow and speciation	GLT	13, 14, 18, 23
33	07-Oct	Fri	Selection and speciation in allopatry	GLT	13, 14, 18, 23
34	10-Oct	Mon	Selection and speciation in sympatry	GLT	13, 14, 18, 23
35	12-Oct	Wed	Reinforcement	GLT	13, 14, 18, 23
36	14-Oct	Fri	Coevolution	GLT	13, 14, 18, 23
37	17-Oct	Mon	Sexual selection and speciation	GLT	13, 14, 18, 23
38	19-Oct	Wed	Diversifying coevolution and speciation	GLT	13, 14, 18, 23
39	21-Oct	Fri	Speciation in community context	GLT	13, 14, 18, 23

Practical programme: There are 12 practical sessions, which will be held on Tuesdays (14h00-16h50) either in the field or in the undergraduate laboratory (room 2025) in the Natural Sciences Building. Meet in 2025 for all practicals.

Prac	Date	Subject	Lecturer
1	19-Jul	History & evidence	VR
2	26-Jul	Intelligent design	CAM
3	02-Aug	Natural selection	CAM
	09-Aug	**National Women's Day**	
4	16-Aug	Selection vs drift	CAM
5	23-Aug	Climbing Mt Improbable with dice	BA
6	30-Aug	The adaptationist paradigm	BA
University Recess: 05 – 09-.09			
7	13-Sep	Measuring natural selection	BA
8	20-Sep	Measuring natural selection	BA
9	27-Sep	Speciation	GLT
10	04-Oct	Speciation	GLT
11	11-Oct	Speciation	GLT
12	18-Oct	Speciation	GLT

Assessment: The **semester test** will be on **22 Sep** (time and venue to be announced). The examination covers topics which are discussed in class and during practicals. The **first examination** will be on **5 Nov, 09:00**, and the **second examination** will be on **29 Nov, 14:00** (venues to be announced). You will complete several practical write-ups during the semester and we will use one mark from each section in order to arrive at your practical mark (50%).

Class mark: *50%*

Practical write-ups (50%)
Test (50%)

Exam mark: *50%*

= Final mark *100%*

Deadlines: Reports must be handed in to Janette Hutton by 12h00 on the day of the deadline, or submitted online when requested by the lecturer. Reports handed in late will have marks deducted at a rate of 5% per day. Assignments handed in later than a week or more will not be marked. In instances where a deadline or practical is missed, an original doctor's certificate is required within one week. If a practical is missed for medical reasons, the student still needs to complete the practical in their own time.