



Stellenbosch

UNIVERSITY
IYUNIVESITHI
UNIVERSITEIT

SCIENCE

EYENZULULWAZI NGEZENDALO

NATUURWETENSKAPPE

BDE 244 Principles of Evolution

Short description of the module

The principal evolutionary mechanisms which shape the biological world will be dealt with. It provides a historical perspective on the development of the major ideas in evolutionary thinking and tackles the interface between evolutionary research and the public's perception of it. Topics covered include theoretical genetic models which underlie modern molecular genetic approaches, natural selection and how it operates, the distinctions and links between micro- and macroevolution and how species are formed and lost. In addition to theoretical understanding, students will be exposed to the design and execution of experiments in evolution.

BDE 244 Beginsels van Evolusie

Kort beskrywing van die module

Die belangrikste evolusionêre meganismes wat die biologiese wêreld vorm, sal behandel word. Dit verskaf 'n historiese perspektief op die ontwikkeling van die belangrikste idees in evolusionêre denke en pak die raakvlak tussen evolusionêre navorsing en die publiek se persepsie daarvan aan. Onderwerpe wat gedek word, sluit in teoretiese genetiese modelle wat moderne molekulêre genetiese benaderings ten grondslag lê, natuurlike seleksie en hoe dit werk, die onderskeidings en skakels tussen mikro- en makro-evolusie en hoe spesies gevorm en verlore gaan. Benewens teoretiese begrip, sal studente blootgestel word aan die ontwerp en uitvoering van eksperimente in evolusie.

Module summary

Name	BDE244
Duration	2nd semester
Academic commitment*	16 credits = 160 notional hours 6 contact hours per week
Scheduled learning opportunities	3 lectures per week 1 practical per week
Assessment option	Option 4
Language option	Option 3
Mode of offering	Face-2-Face
Corequisites / Prerequisites / Pass prerequisites**	Prerequisite pass in Biology 124 or 144 and a final mark of at least 40% in the other Biology module

**Notional hours are the learning time that it would take an average learner to meet the outcomes of the module.*

***The onus is on the students to ensure that they meet the prerequisites of the module.*

Module-oorsig

Naam	BDE 244
Duur	2de semester
Akademiese verbintenis*	16 krediete = 120 veronderstelde ure 6 kontakure per week
Geskeduleerde leergeleenthede	3 lesings per week 1 prakties per week
Assesseringsopsie	Opsie 4
Taalopsie	Opsie 3
Modus van aanbieding	In persoon
Newe vereistes / Voorvereistes / Slaagvoorvereistes**	Slaagvoorvereiste in Biologie 124 of 144 en 'n finale punt van minstens 40% in die ander Biologie-module

**Veronderstelde leerure is die tyd wat die gemiddelde leerder aan die module sal moet spandeer om aan die uitkomst van die module te voldoen.*

***Die onus rus op die studente om te verseker dat hulle aan die voorvereistes van die module voldoen.*

Outcomes

After completion of this course you should know and understand the basics of evolutionary theory by making use of the following thought processes

- How the theory of evolution came about and how this gave rise to the modern synthesis.
- How molecular and mendelian genetics forms the basis for selection to operate
- How selection, drift, mutation, migration and species life history traits, together with ecology and abiotic factors, affect microevolutionary processes at the population level.
- The specific role of selection and drift in population genetics
- How continuous traits are selected for by making use of multilocus population genetics
- Quantitative genetics and the role of adaptations
- How selection operates
- Species as a product of selection
- Variation in nature and how species are formed

Uitkomst

Na voltooiing van hierdie kursus behoort u die basiese beginsels van die evolusionêre teorie te ken en te verstaan deur gebruik te maak van die volgende denkprosesse

- Hoe die evolusieteorie ontstaan het en hoe dit aanleiding gegee het tot die moderne sintese.
- Hoe molekulêre en mendeliese genetica die basis vorm vir seleksie om te funksioneer
- Hoe seleksie, drywing, mutasie, migrasie en die lewensgeskiedenis-eienskappe van spesies, tesame met ekologie en abiotiese faktore, mikro-evolutionêre prosesse op bevolkingsvlak beïnvloed.
- Die spesifieke rol van seleksie en drywing in bevolkingsgenetika
- Hoe vir kontinue eienskappe geselekteer word deur gebruik te maak kan multilokus bevolkingsgenetika
- Kwantitatiewe genetica en die rol van aanpassings
- Hoe seleksie funksioneer
- Spesies as 'n produk van seleksie
- Variasie in die natuur en hoe spesies gevorm word

Scheduled learning opportunities

The official timetable indicating all scheduled learning opportunities and their allocated venues can be accessed via [My.SUN](#).

Lectures

All lectures will be presented as live Powerpoint presentations, and these slides (non-narrated) will be made available on SunLearn for study purposes.

Practicals

All practicals are compulsory, and you will be expected to submit an assignment for each submodule's practicals

Geskeduleerde leergeleenthede

Die amptelike rooster wat al die geskeduleerde leergeleenthede en die toegewysde venues aandui, is beskikbaar by [My.SUN](#).

Lesings

Alle lesings sal as in persoon Powerpoint voordragte aangebied word, en hierdie notas (sonder stemopnames) sal op SunLearn beskikbaar gestel word vir studie doeleindes.

Praktika

Alle praktika is verpligtend en daar sal van jou verwag word om 'n werkopdrag vir elke submodule se praktika in te dien

Study material

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.

SUNLearn is the official learning management platform of Stellenbosch University. Each module has a dedicated page on this platform which can be accessed via this link: <https://learn.sun.ac.za/>

Studiemateriaal

Voorgestelde handboek:

Ridley M 2005. Evolution. 3rd ed. Blackwell publishing

Voorgestelde addisionele leesstof:

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

SUNLearn is die amptelike leerbestuursplatform van die Universiteit Stellenbosch. Elke module het 'n toegewysde blad op hierdie platform met toegang via hierdie skakel: <https://learn.sun.ac.za/>

Lecturers

Prof. C.A. Matthee (CAM) – course coordinator; cam@sun.ac.za
 Dr R.V. Rambau (RVR) – rvr2@sun.ac.za
 Prof. C.A. Pauw – apauw@sun.ac.za
 Prof. B.C. Anderson – bca@sun.ac.za

Course assistant

Mrs. Janette Hutton (JH) - janette@sun.ac.za

Dosente

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Kursus assistent

Mev. Janette Hutton (JH) - janette@sun.ac.za

Assessment

The dates for all centrally scheduled assessments are published on [My.SUN](#).

This module follows assessment option 4. Please see the [Faculty of Science's assessment guidelines](#) for more details.

Method of assessment	Description	#	Allocated marks	Dates	Criteria
Assignment RVR		1	12,5%	28.07	All tests and assignments must be written and handed in to pass the module, AND an average mark of 50% must be obtained.
Assignment CAM		2	12,5%	15.09	
A1 assessment		3	20%	26.09.	
Assignment ????		4	12,5%	26.09	
Assignment CAP		5	12,5%	24.10	
A2 assessment		6	30%	07.11	

Please see the assessments and promotion chapter in the [SU Calendar Part 1 \(General\)](#) for institutional rules regarding assessments.

Calculation of final marks

Practical Assignments	50%
A1 Class test:	20%
A2 Class test	30%

Final mark	100%

Assesserings

Die datums van alle sentraal geskeduleerde assesserings word op [My.SUN](#) gepubliseer.

Hierdie module volg assesseringsopsie 4. Raadpleeg die [Fakulteit Natuurwetenskappe se assesseringsriglyne](#) vir meer besonderhede.

Metode van assessering	Beskrywing	#	Punte toegeken	Datums	Kriteria
Taak RVR		1	12,5%	28.07	Alle toetse en werksopdragte moet geskryf en ingehandig word om hierdie module te slaag. EN 'n gemiddelde punt van 50% moet behaal word
Taak CAM		2	12,5%	15.09	
A1 assessering		3	20%	26.09	
Taak ????		4	12,5%	26.09	
Taak CAP		5	12,5%	24.10	
A2 assessering		6	30%	07.11	

Raadpleeg die hoofstuk oor assessering en promovering in [Deel 1 \(Algemeen\) van die US Jaarboek](#) vir institusionele reëls oor assesserings.

Berekening van finale punte

Praktiese take	50%
A1 Klastoets:	20%
A2 Klastoets:	30%

Finale punt	100%

Absenteeism (Missed opportunities)

Please see the section 11 of the [SU Calendar Part 1 \(General\)](#) for the institutional rules regarding absence from classes and or tests. Take note that for any absence from the university *for more than one* teaching, learning or assessment opportunity, for whatever reason, students need to apply for leave of absence from the Registrar's office.

In the event of missing a test or important deadline, a valid, original medical certificate must be handed to Mrs. Janette Hutton within 5 days after the test of the assignment hand-in date. A replacement oral test will be scheduled within one week (7 days) after the original test date. It is the responsibility of the student to establish the time and place of this oral. No postponement will be granted for the hand in of assignments or practical reports, and a penalty of 5% per day will be subtracted from all such assignments.

Afwesigheid (die misloop van 'n leergeleentheid)

Raadpleeg asseblief afdeling 11 in [Deel 1 \(Algemeen\) van die US Jaarboek](#) vir die institusionele reëls met betrekking tot afwesigheid van klasse en of toetse.

Neem kennis dat studente by die Registrateur moet aansoek doen vir verlof tot afwesigheid, vir watter rede ook al, van *meer as een* onderrig-, leer-, of assesseringsgeleentheid,

Indien jy 'n toets of belangrike sperdatum mis, moet 'n geldige, oorspronklike mediese sertifikaat aan Mev. Janette Hutton gegee word binne 5 dae na die toets of die werksopdrag inhandigingsdatum. 'n Vervangings mondelinge toets sal geskeduleer word binne een week (7dae) na die oorspronklike toetsdatum. Dit is die verantwoordelikheid van die student om vas te stel waar en wanneer die mondeling sal plaasvind. Geen uitstel sal verleen word vir die inhandiging van werksopdragte of praktiese verslae nie, en 'n straf van 5% per dag sal afgetrek word van al sulke werksopdragte.

Communication

The **announcement forum on the SUNLearn module page** is the only official platform that will be used to make announcements relevant to this module. Please check this regularly.

For communication with individual students, lecturers, support staff and peer-to-peer facilitators will only use students' official SUN email addresses.

Students are also requested to use their official **SUN email addresses** for all academic related communication to: cam@sun.ac.za

Kommunikasie

Die **aankondigingsforum op die SUNLearn moduleblad** is die enigste amptelike platform wat gebruik sal word om aankondigings, wat relevant is vir hierdie module, te maak. Kontroleer dit asseblief gereeld.

Vir kommunikasie met individuele studente, sal dosente, steunpersoneel en eweknie-fasiliteerders slegs studente se amptelike SUN-e-posadresse gebruik.

Studente word ook versoek om hul amptelike **SUN-e-posadresse** vir alle akademiese verwante kommunikasie te gebruik: cam@sun.ac.za

Addressing challenges

For any complaints, the first port of call is the class representative or the lecturer. If not satisfactorily resolved, it can be escalated to the Head of Department or [Coordinator: Academic and Student Affairs](#).

Hantering van uitdagings

Vir enige klagtes, is die klasvertegenwoordiger of dosent die eerste plek om hulp te soek. Indien die probleem nie bevredigend opgelos word nie, kan dit na die Departementshoof of [Koördineerder: Akademiese- en Studentesake](#) verwys word.

Academic Misconduct

Academic misconduct includes plagiarism, collusion, cheating and fabrication as stipulated in the [Disciplinary code for students of Stellenbosch University](#). The [SU Policy on Plagiarism](#) defines plagiarism as: "The use of the ideas or material of others [including AI generative tools, such as ChatGPT or Bing] without [appropriate] acknowledgement, or the re-use of one's own previously evaluated or published material without acknowledgement (self-plagiarism)." Such acknowledgement would include referencing the source of previously expressed ideas or published materials, or acknowledging the contribution of e.g. the AI tool, as stipulated for a specific assessment or assignment.

Plagiarism is regarded as a serious offence. More serious cases are handled as set out in the [Stellenbosch University procedure for the investigation and management of allegations of plagiarism document](#). Less serious cases are dealt with by the module coordinator and respective department as set out by the procedures of the faculty.

Akademiese Wangedrag

Akademiese wangedrag sluit plagiaat samespanning, bedrog en versinsel in, soos bepaal in die [Disiplinêre kode vir studente van die Universiteit Stellenbosch](#). Die [US Belied oor Plagiat](#) definieer plagiaat as: "Die gebruik van die idees of materiaal van ander [insluitend KI generatiewe gereedskap, soos ChatGPT of Bing] sonder [toepaslike] erkenning, of die hergebruik van 'n mens se eie voorheen geëvalueerde of gepubliseerde materiaal sonder erkenning (self- plagiaat)." Sodanige erkenning sal insluit die verwysing na die bron van voorheen uitgedrukte idees of gepubliseerde materiaal, of die erkenning van die bydrae van bv. die KI-instrument, soos bepaal vir 'n spesifieke assessering of opdrag.

Plagiat word as 'n ernstige oortreding beskou. Ernstiger gevalle word hanteer soos uiteengesit in die [Universiteit Stellenbosch se dokument oor die prosedure vir die ondersoek en bestuur van bewerings van plagiat](#). Minder ernstige gevalle word deur die modulekoördineerder en betrokke departement hanteer soos uiteengesit in die fakulteitsprosedures.

Lecture programme: The course consists of 37 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**

No	Date	Day	Subject	Lecturer	Chapters
1	24-Jul	Mon	pre-Darwin, Darwin	VR	1, 3
2	26-Jul	Wed	Darwin, Wallis & the Modern synthesis	VR	1, 3
3	28-Jul	Fri	Supporting evidence	VR	1, 3
4	31-Jul	Mon	Mendelian genetics and inheritance	CAM	2
5	02-Aug	Wed	The theory of natural selection	CAM	5
6	04-Aug	Fri	The theory of natural selection	CAM	5
7	07-Aug	Mon	The theory of natural selection	CAM	5
	09-Aug	Wed	National Women's Day		
8	11-Aug	Fri	Random events in population genetics	CAM	6
9	14-Aug	Mon	Random events in population genetics	CAM	6
10	16-Aug	wed	Selection vs Drift	CAM	7
11	18-Aug	Fri	Selection vs Drift	CAM	7
12	21-Aug	Mon	Selection vs Drift	CAM	7
13	23-Aug	Wed	Continuous traits & quantitative genetics	BCA	8, 10, 11
14	25-Aug	Fri	Continuous traits & quantitative genetics	BCA	8, 10, 11
15	28-Aug	Mon	Artificial selection	BCA	8, 10, 11
16	30-Aug	Wed	Adaptive landscapes & shifting balance	BCA	8, 10, 11
17	01-Sep	Fri	Pleiotropy & drift	BCA	8, 10, 11
18	04-Sep	Mon	History, scaling, allometry	GLT	8, 10, 11

19	06-Sep	Wed	Blind Watchmaker	GLT	8, 10, 11
20	08-Sep	Fri	Blind Watchmaker	GLT	8, 10, 11
University Recess 11-Sep – 15-Sep					
21	18-Sep	Mon	Genetics of adaptation	BCA	8, 10, 11
22	20-Sep	Wed	Studying adaptation	BCA	8, 10, 11
23	22-Sep	Fri	Studying adaptation	BCA	8, 10, 11
	25-Sep	Mon	Heritage Day		
24	27-Sep	Wed	Units of selection	BCA	8, 10, 11
25	29-Sep	Fri	Units of selection (Monday timetable)	BCA	8, 10, 11
26	02-Oct	Mon	Units of selection	BCA	8, 10, 11
27	04-Oct	Wed	Phenetic species concepts	CAP	13, 14, 18, 23
28	06-Oct	Fri	Biological species concept	CAP	13, 14, 18, 23
29	09-Oct	Mon	Phylogenetic species concept	CAP	13, 14, 18, 23
30	11-Oct	Wed	Mutation and speciation	CAP	13, 14, 18, 23
31	13-Oct	Fri	Geneflow and speciation	CAP	13, 14, 18, 23
32	16-Oct	Mon	Selection and speciation in allopatry	CAP	13, 14, 18, 23
33	18-Oct	Wed	Selection and speciation in sympatry	CAP	13, 14, 18, 23
34	20-Oct	Fri	Reinforcement	CAP	13, 14, 18, 23
35	23-Oct	Mon	Coevolution	CAP	13, 14, 18, 23
36	25-Oct	Wed	Sexual selection and speciation	CAP	13, 14, 18, 23
37	27-Oct	Fri	Diversifying coevolution and speciation	CAP	13, 14, 18, 23

Practical programme: There are 13 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	25-Jul	History & evidence	VR
2	01-Aug	No prac	-
3	08-Aug	Intelligent design	CAM
4	15-Aug	Natural selection	CAM
5	22-Aug	Selection vs drift	CAM
6	29-Aug	Climbing Mt Improbable with dice	BCA
7	05-Sep	The adaptationist paradigm	GLT
University Recess 11-Sep – 15-Sep			
8	19-Sep	Measuring natural selection	BCA
9	26-Sep	Measuring natural selection	BCA
10	03-Oct	Speciation	CAP
11	10-Oct	Speciation	CAP
12	17-Oct	Speciation	CAP
13	24-Oct	Speciation	CAP

Lesingsprogram: Die kursus bestaan uit 37 lesings wat op Maandae (08h00-08h50), Woensdae (09h00-09h50) en Vrydae (10h00-10h50) in kamer 1030 van die Natuurwetenskappegebou gehou word. Hierdie module sal op kampus aangebied word met geen gelyktydige geregistreerde uitsending nie

No	Datum	Dag	Onderwerp	Dosent	Hoofstukke
1	24-Jul	Ma	voor-Darwin, Darwin	VR	1, 3
2	26-Jul	Wo	Darwin, Wallis & die Moderne sintese	VR	1, 3
3	28-Jul	Vry	Ondersteunende bewyse	VR	1, 3
4	31-Jul	Ma	Mendelse genetica en oorerwing	CAM	2
5	02-Aug	Wo	Die teorie van natuurlike seleksie	CAM	5
6	04-Aug	Vry	Die teorie van natuurlike seleksie	CAM	5
7	07-Aug	Ma	Die teorie van natuurlike seleksie	CAM	5
	09-Aug	Wo	Nasionale Vrouedag		
8	11-Aug	Vry	Kans gebeure en bevolkingsgenetiese modelle	CAM	6
9	14-Aug	Ma	Kans gebeure en bevolkingsgenetiese modelle	CAM	6
10	16-Aug	Wo	Seleksie vs. drywing	CAM	7
11	18-Aug	Vry	Seleksie vs. drywing	CAM	7
12	21-Aug	Mo	Seleksie vs. drywing	CAM	7
13	23-Aug	Wo	Aaneenlopende kenmerke & kwantitatiewe genetica	BCA	2, 5-7
14	25-Aug	Vry	Aaneenlopende kenmerke & kwantitatiewe genetica	BCA	2, 5-7
15	28-Aug	Ma	Kunsmatige seleksie	BCA	8, 10, 11
16	30-Aug	Wo	Aanpassingslandskappe & skuiwende balans	BCA	8, 10, 11
17	01-Sep	Vry	Pleiotropie en drywing	BCA	8, 10, 11
18	04-Sep	Mo	Geskiedenis, skaal, allometrie	GLT	8, 10, 11

19	06-Sep	Wo	Blinde horlosiemaker	GLT	8, 10, 11
20	08-Sep	Vry	Blinde horlosiemaker	GLT	8, 10, 11
Universiteitsvakansie 11-Sep – 15-Sep					
21	18-Sep	Mo	Genetika van aanpassing	BCA	8, 10, 11
22	20-Sep	wo	Bestudeer aanpassing	BCA	8, 10, 11
23	22-Sep	Vry	Bestudeer aanpassing	BCA	8, 10, 11
	25-Sep	Mo	Erfinisdag		
24	27-Sep	Wo	Eenhede van seleksie	BCA	8, 10, 11
25	29-Sep	Vry	Eenhede van seleksie (Maandag rooster)	BCA	8, 10, 11
26	02-Okt	Mo	Eenhede van seleksie	BCA	8, 10, 11
27	04-Okt	Wo	Fenetiese Spesiekonsepte	CAP	8, 10, 11
28	06-Okt	Vry	Biologiese spesie konsep	CAP	13, 14, 18, 23
29	09-Okt	Mo	Filogenetiese spesie konsep	CAP	13, 14, 18, 23
30	11-Okt	Wo	Mutasie en spesiasie	CAP	13, 14, 18, 23
31	13-Okt	Vry	Gene vloei en spesiasie	CAP	13, 14, 18, 23
32	16-Okt	Mo	Seleksie en spesiasie in allopatérie	CAP	13, 14, 18, 23
33	18-Okt	Wo	Keuring en spesiasie in simpaterie	CAP	13, 14, 18, 23
34	20-Okt	Vry	Versterking	CAP	13, 14, 18, 23
35	23-Okt	Mo	Ko-evolusie	CAP	13, 14, 18, 23
36	25-Okt	Wo	Seksuele seleksie en spesiasie	CAP	13, 14, 18, 23
37	27-Okt	Vry	Diversifiserende ko-evolusie en spesiasie	CAP	13, 14, 18, 23

Praktiese program: Praktiese program: Daar is 13 praktiese sessies wat op Dinsdae (14h00-16h50) gehou sal word, hetsy in die veld of in die voorgraadse laboratorium (kamer 2025) in die Natuurwetenskappegebou. Ontmoet in 2025 vir alle praktika.

Prakties	Datum	Onderwerp	Dosent
1	25-Jul	Geskiedenis en bewys van evolusie	VR
2	01-Aug	Geen prakties	-
3	08-Aug	Intelligente ontwerp	CAM
4	15-Aug	Natuurlike seleksie	CAM
5	22-Aug	Seleksie vs. drywing	CAM
6	29-Aug	Climbing Mt Improbable met dobbelsteen	BCA
7	05-Sep	Die aanpassingsparadigma	GLT
Universiteitsvakansie 11-Sep – 15-Sep			
8	19-Sep	Meting van natuurlike seleksie	BCA
9	26-Sep	Meting van natuurlike seleksie	BCA
10	03-Oct	Spesiasie	CAP
11	10-Oct	Spesiasie	CAP
12	17-Oct	Spesiasie	CAP
13	24-Oct	Spesiasie	CAP