

BDE (Biodiversity & Ecology) 354 **Evolutionary Patterns and Processes Year 2024**

BDE (Biodiversiteit & Ekologie) 354 **Evolusionêre patrone en prosesse Jaar 2024**

Short description of the module

During this module the evolutionary patterns and processes impacting living organism are studied with the use of molecular methods such as DNA sequencing, chromosomes en next generation DNA using animals as examples. The evolutionary relationships between populations and species levels are investigated with the aid of selected methods to understand the evolutionary drivers of cladogenesis and population genetic structure.

Kort beskrywing van die module

In hierdie module word die evolusionere patrone en prosesse van lewende organismer bestudeer met behulp van molekulere metodes soos DNS basisbepaling, chromosome en volgende generasie DNS tegnieke met die gebruik van hierdie voorbeelde. Die evolusionere verwantskappe op populasie en spesies vlakke word ondersoek met behulp van geselekteerde metodes om evolusionere dryfvere van kladogenese en populasie genetiese struktuur te onderskrag.

Module summary

Name	BDE 354: Evolutionary Patterns and Processes
Duration	2 nd semester
Academic commitment*	16 credits = 6 contact hours per week
Scheduled learning opportunities	3 lectures per week 1 practical per week
<u>Assessment option</u>	Option 4 (continuous assessment)
<u>Language option</u>	Option 3a
Mode of offering	Face-2-Face
Corequisites / Prerequisites / Pass prerequisites*(PP)*	PP – any three of the following six modules: Biodiversity and Ecology 212, 214, 224, 244, 254 and 264

**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 354: Evolusionêre patrone en prosesse
Duur	2de semester
Akademie verbintenis*	16 krediete 6 kontakure per week
Geskeduleerde leergeleenthede	3 lesings per week 1 prakties per week
<u>Assesseringsopsie</u>	Opsie 4 (deurlopende evaluering)
<u>Taalopsie</u>	Opsie 3a
Modus van aanbieding	In persoon
Nowereveistes / Voorveistes / Slaagvoorveistes (SV)**	SV -. Enige drie van die volgende ses modules: Biodiversiteit en Ekologie: 212, 214, 224, 244, 254 en 264

**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 voorveistes van die module voldoen.*

Outcomes

On completion of this module you should be familiar with the following concepts:

- grasp the fundamentals of phylogenetics which is the way biologists reconstruct the pattern of events that have led to the distribution and diversity of life
- be able to collect, analyse and interpret morphological and genetic data for species identification and phylogeny reconstruction
- understand the underlying evolutionary processes that gave rise to biodiversity
- understand eukaryotic nuclear genome composition
- understand the processes and consequence of chromosomal evolution.
- understand phylogenetic reconstruction using different methods
- understand the combination of events associated with the origin, diversification, extinction, and interactions of organisms which produced the species that currently inhabit the Earth.

Uitkomst

Na voltooiing van hierdie module behoort jy bekend te wees met die volgende konsepte:

- begryp die beginsels van filogenetiese werk in biologie wat die manier is wat n bioloog gebruik om verwantskappe te rekonstrueer en wat lei tot diversiteit
- ontwikkel die vermoë om morfologiese en genetiese data te interpreteer vir spesies identifisering en filogenie-bou
- begryp die beginsels van evolusie op biodiversiteit
- verstaan eukariotiese genoom samestelling
- verstaan die prosesse van chromosoom evolusie.
- verstaan dat filogenie kan gebou word deur verskillende metodes
- begryp die gebeure wat lei tot diversiteit en uitsterwing en interaksies van lewe op aarde

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. See timetable below.

Practicals

All practical sessions and discussion are compulsory and may not be missed without excuse. See timetable below.

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. Sien rooster hieronder

Praktika

Alle praktiese sessies en besprekings is verpligtend en mag nie gemis word sonder 'n verskoning nie. Sien rooster hieronder.

Study material No prescribe text book. Published research articles will be provided by the lecturer.	Studiemateriaal Geen voorgeskrewe handboek nie. Gepubliseerde navorsingartikels sal voorsien word deur die lektor.
Lecturers Prof. Savel Daniels (SRD) - course coordinator; srd@sun.ac.za, Rm 4006, Nat Sci building Dr Victor Rambau (RVR) – rvr2@sun.ac.za, Rm 4005 Prof. Sophie Von der Heyden (SvdH) – svdh@sun.ac.za Rm 3043 Course assistant Ms. Fawzia Gordon (FG) – fg1@sun.ac.za, Room 3056, NatSci Building	Dosente Prof. Savel Daniels (SRD) – kursuskoördineerder srd@sun.ac.za, Kamer 4006, NatWet gebou Dr Victor Rambau (RVR) – rvr2@sun.ac.za, Kamer 4005 Prof. Sophie Von der Heyden (SvdH) – svdh@sun.ac.za, Kamer 3043 Kursus assistent Me. Fawzia Gordon (FG) – fg1@sun.ac.za , Kamer 3056, NatWet gebou

Assessment

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

Method of assessment	Description	#	Allocated marks	Dates	Criteria
A1 assessment	Semester test on work covered in lectures by SRD	1	30%	27 Aug, Tue @ 10h00	All tests and assignments must be written and handed in AND you need a min of 50% for your FINAL Mark (FM) to pass the module,
A2 assessment	Test in the "exam period" will cover work from SvdH & RVR	2	40%	05 Nov, Tue @ 09h00	
Prac Assignment 1& Spot Tests	Daniels	3	12.5%	TBA	
Prac Assignment 2& spot Test	Rambau Heyden	4	7.5%	TBA	
Prac Assignment 3 & Spot Test	Von der heyden	5	10%	TBA	

All tests and assignments must be written and handed in AND you need a min of 50% for your FINAL Mark (FM) to pass the module,

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

Assesserings

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

Metode van Assessering	Beskrywing	#	Punte toegeken	Datums	Kriteria
A1 assessering	Semestertoets oor werk behandel in lesings deur SRD	1	30%	27 Aug Dins @ 10h00	Alle toetse en werksopdragte moet geskryf en ingehandig en jy benodig n min van 50% vir jou FINALE PUNT (FM) om die module te slaag
A2 assessment	Toets in die "eksamenperiode" handoe oor werk behandel inlesings van SvdH & RVR	2	40%	05 Nov, Dins @ 09h00	
Praktiese Opdrag 1 & Klein toetsies	Daniels	3	12.5%	"	
Praktiese Opdrag 2 & klein toetsies	Rambau	4	7.5%		
Praktiese Opdrag 3 & kien toetsies	Von der Heyden	5	10.0%	*	

Alle toetse en werksopdragte moet geskryf en ingehandig en jy benodig n min van 50% vir jou FINALE PUNT (FM) om die module te slaag .

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

Calculation of final marks

A1 Class test 1 (27 Aug): 30%
 A2 Class test 2 (05 Nov) 40%
 Practical Reports & Spot Tests: 30%

 Final mark 100%

Berekening van finale punte

A1 Klastoets 1 (27 Aug) 30%
 A2 Klastoets 2 (05 Nov) : 40%
 Praktiese Verslae & Kort Toetsies: 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. All practical sessions and discussion/guest lectures are compulsory and may not be missed without excuse. In instances where a test or deadline is missed, a valid original doctor certificate is required within five working days after the test/deadline. In special circumstances (e.g. participation in provincial or national sporting events) a letter is required from the sporting body. In these instances, granting of permission to miss tests or deadlines is at the discretion of the course coordinator and is not automatic.

If you are unable to make scheduled lectures, practicals or any of the deadlines you should contact **Prof Savel Daniels** in advance to make alternative arrangements.

Documentation must be handed in to Ms Fawzia Gordon and a sick test (oral) will normally be held one week (five working days) after the original test date. It is the student's responsibility to determine the time and place of this test. No time extensions will be allowed for handing in practical reports and reports handed in late will not be marked (or a marks penalty will be applied).

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, Alle praktiese sessies en bespreking/gaslesings is verpligtend en mag nie sonder verskoning gemis word nie. In gevalle waar 'n toets of sperdatum gemis word, word 'n geldige oorspronklike doktersertifikaat binne vyf werksdae na die toets/ sperdatum vereis. In spesiale omstandighede (bv. deelname aan provinsiale of nasionale sportbyeenkomste) word 'n brief van die sportliggaam vereis. In hierdie gevalle is die toekenning van toestemming om toetse of sperdatums mis te loop na goeddunke van die kursuskoördineerder en is dit nie outomaties nie. Indien u nie geskeduleerde lesings, praktiese of enige van die sperdatums kan maak nie, moet u **Prof Savel Daniels** vooraf kontak om alternatiewe reëlins te tref.

Dokumentasie moet by me Fawzia Gordon ingehandig word. 'n Siekte toets ('n mondeling) sal normaalweg een week (vyf werksdae) na die oorspronklike toetsdatum gehou word. Dit is die student se verantwoordelikheid om die tyd en plek van hierdie toets te bepaal. Geen tyduitbreidings sal toegelaat word om praktiese verslae in te handig nie en verslae wat laat ingehandig word, sal nie gemerk word nie (of 'n punteboete sal toegepas word).

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 srd@sun.ac.za / fg1@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: srd@sun.ac.za / fg1@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 [Dissiplinêre kode vir studente van die Universiteit Stellenbosch](#). Die "[SU Policy on Plagiarism](#)" definieer plagiaat as die gebruik van die idees of materiaal van ander [insluitend "AI" produserende hulpmiddels, soos ChatGPT of Bing] sonder toepaslike erkenning daarvan, of die hergebruik van 'n persoon se eie voorheen- geassesseerde of gepubliseerde materiaal sonder erkenning (self-plagiaat). Toepaslike erkenning sal verwysings insluit na die bron van voorheen uitgedrukte idees of gepubliseerde materiaal, of erkenning van bv. die "AI" hulpmiddel, soos gestipuleer vir 'n spesifieke assessering of opdrag.

Plagiaat 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 plagiaat](#). Minder ernstige gevalle word deur die modulekoördineerder en betrokke departement hanteer soos uiteengesit in die fakulteitsprosedures.

Repeaters

Must repeat all practicals and attend all lectures.

Herhalers

Moet alle praktika en lesings bywoon.

Lecture programme:

Lecture times:

- Mondays: 12h10 -13h00
- Wednesdays: 08h10 – 09h00
- Fridays: 09h10 – 10h00

Venue: Natural Science Building, Room 2020 .

Week #/ Lecture #	Date	Lecture Topic	Lecturer
Week 1/ 1	22/07	Molecular Markers I	SRD 1
Week 1/ 2	24/07	Molecular Markers II	SRD 2
Week 1/ 3	26/07	Phylogenetic terminology I	SRD 3
Week 2/ 4	29/07	Phylogenetic terminology II	SRD 4
Week 2/ 5	31/07	Sources of phylogenetic information	SRD 5
Week 2/ 6	02/08	Tree building methods I: Distance	SRD 6
Week 3/ 7	05*/ 08	Tree building methods II: Parsimony	SRD 7
Week 3/ 8	07/08	Tree building methods III: Likelihood	SRD 8
Week 3/ 9	09/08	No Class – Public Holiday	
Week 4/ 9	12/08	Tree building methods IV: Bayesian analyses	SRD 9
Week 4/ 10	14/08	Confidence intervals in phylogenetics	SRD 10
Week 4/ 11	16/08	Divergence time estimations	SRD 11

Week 5/ 12	19/08	Testing Biogeographic patterning	SRD 12
Week 5/ 13	21/08	Case Study I	SRD 13
Week 5/ 14	23/08	Case Study II	SRD 14
Week 6/ 15	26/08	Eukaryotic Chromosomes	RVR 1
Week 6/ 16	28/08	Chromosomal Fusions as isolating mechanisms	RVR 2
Week 6/ 17	30/08	Chromosomal Inversions as isolating mechanisms	RVR 3
Week 7/ 18	02/09	Neutral Genome Changes	RVR 4
Week 7/ 19	04/09	Intra-chromosome variation and Speciation	RVR 5
Week 7/ 20	06/09	Chromosome Polymorphisms	RVR 6
		07-15 Sep :US Vacation	
Week 8/ 21	16/09	Inter species chromosome comparison I	RVR 7
Week 8/ 22	18/09	Inter species chromosome comparisons II	RVR 8
Week 8/ 23	20/09	Hybrid Sterility vs Chromosome Suppression	RVR 9
Week 10/ 27	30/09	Cytogenetics and Conservation	RVR 10
Week 10/ 28	02/10	Cytogenetics and Conservation Plus Revisions	RVR 11
Week 10/ 29	04/10	Revision	RVR 12
Week 10/ 27	30/09	Introduction to phylogeography and population genetics	SvdH 1
Week 10/ 28	02/10	Markers for phylogeographic studies	SvdH 2
Week 10/ 29	04/10	Spatio-temporal patterns of populations	SvdH 3

Week 11/30	07/10	Can habitat explain phylogeographic patterns and genetic diversity?	SvdH 4
Week 11/31	09/10	Multidimensional drivers and genetic diversity	SvdH 5
Week 11/32	11/10	Demographic change 1	SvdH 6
Week 12/33	14/10	Demographic change II	SvdH 7
Week 12/34	16/10	Next generation sequencing: neutral versus outlier signals	SvdH 8
Week 12/35	18/10	RAD-seq: multi-species patterns and environmental drivers of structure	SvdH 9
Week 13/36	21/10	Environmental DNA as a tool for studying populations	SvdH 10
Week 13/37	23/10	Consolidate reading for lectures 9 & 10	SvdH 11
Week 13/38	25/10	Differential gene expression and environmental stress	SvdH 12

***05 August, Monday follows a Friday roster**

Practical programme: This module consists of 11 practical contact sessions – one of these is designated for the semester test. Practicals are always in person and will be held every **Tuesday from 10h10 – 13h00** in Lab 2025, or in NARGA B (Rm 2087, Admin A). :

Prac #	Date	Topic	Lecturer
	23/07	No Practical	'-
1	30/07	Phylogenetics 1 [L]	SRD 1
2	06/08	Phylogenetics 2 [N]	SRD 2
3	13/08	Phylogenetics 3 [L/N]	SRD 3
4	20/08	Phylogenetics 4 [L]	SRD 4
5	27/08	Theory TEST 1 (A1) [L]	SRD
6	03/09	Karyotyping [L] RVR 1	RVR 1
	10/09	No Prac - US Vacation	
7	17/09	Chromosome Evolution [L/N]	RVR 2
	24/09	NO PRAC: Public Holiday	
08	03/10	AMOVA & Phi-st [N]	SvdH 1
09	08/10	Exploring demographic change [N]	SvdH 2
10	15/10	Estimating gene flow [N]	SvdH 3
11	22/10	Work on Assignment	SvdH 4

Prac Reports:

Hand in date will be set by each lecturer.

1. Daniels: TBA
2. von der Heyden: TBA
3. Rambau: TBA

Lesingsprogram:

Lesingtye:

- Maandag: 12h10 – 13h00
- Woensdag: 08h10 – 09h00
- Vrydag: 09h10 – 10h00

Lokaal: Natuurwetenskappe gebou, Kamer 2020.

Week #/ Lesing #	Dat um	Onderwerpc	Dosent
Week 1/ 1	22/ 07	Molekulere Merkers I.	SRD 1
Week 1/ 2	24/ 07	Molekulere Merkers II	SRD 2
Week 1/ 3	26/ 07	Filogenetiese terminologie I	SRD 3
Week 2/ 4	29/ 07	Filogenetiese terminologie II	SRD 4
Week 2/ 5	31/ 07	Bronne v Filogenetiese inligting	SRD 5
Week 2/ 6	02/ 08	Boombou metodes I "Distance"	SRD 6
Week 3/ 7	05* 08	Boombou metodes II "Parsimony"	SRD 7
Week 3/ 8	07/ 08	Boombou metodes III "Likelihood"	SRD 8
Week 3/ 9	09/ 08	Geen Klas – Publieke Vakansiedag	
Week 4/ 9	12/ 08	Boombou metodes IV "Bayesian analyses"	SRD 9
Week 4/ 10	14/ 08	"Confidence intervals in phylogenetics"	SRD 10
Week 4/ 11	16/ 08	Toetsing van biogeografiese patrone	SRD 11
Week 5/ 12	19/ 08	Studie I	SRD 12

Week 5/ 13	21/ 08	Studie II	SRD 13
Week 5/ 14	23/ 08	Studie III	SRD 14
Week 6/ 15	26/ 08	Eukariotiese Chromosome	RVR 1
Week 6/ 16	28/ 08	Chromosomale Fusies as isolerende meganisme I	RVR 2
Week 6/ 17	30/ 08	Chromosomale inversies as isolerende meganisme II	RVR 3
Week 7/ 18	02/ 09	Neutrale genoom veranderinge	RVR 4
Week 7/ 19	04/ 09	Intra-chromosoom variasie en spesiasie	RVR 5
Week 7/ 20	06/ 09	Chromosoom polimorfisme	RVR 6
		07-15 Sep :US Vakansie	
Week 8/ 21	16/ 09	Interspesies chromosoom vergelykings I	RVR 7
Week 8/ 22	18/ 09	Interspesies chromosoom vergelykings II	RVR 8
Week 8/ 23	20/ 09	Hibried steriliteit vs Chromosoom onderdrukking	RVR 9
Week 9/ 24	23/ 09	Sitogenetika -Bewaring	RVR 10
Week 9/ 25	25/ 09	Sitogenetika – Bewaring	RVR 11
Week 9/ 26	27/ 09*	Hersiening	RVR 12
Week 10/ 27	30/ 09	Inleiding tot filogeografie en populasiegenetika I	SvdH 1
Week 10/ 28	02/ 10	Merkers vir filogeografiese studies	SvdH 2
Week 10/ 29	04/ 10	Spatio-temporale patrone van populasies"	SvdH 3

Week 11/30	07/10	Kan habitat verduidelik filogeografiese patrone en genetiese diversiteit?	SvdH 4
Week 11/31	09/10	Multidimensionele drywers v genetiese diversiteit in plante & diere	SvdH 5
Week 11/32	11/10	Demografiese veranderinge I	SvdH 6
Week 12/33	14/10	Demografiese veranderinge II	SvdH 7
Week 12/34	16/10	Volgende generasie sekwensie: "neutral vs "outlier signals"	SvdH 8
Week 12/35	18/10	RAD-seq: multi spesies patrone & omgewings drywers v strukture	SvdH 9
Week 13/36	21/10	OmgewingsDNA: Populasie te studeer	SvdH 10
Week 13/37	23/10	Konsilideer leeswerk vir Lesing 9 en 10s	SvdH 11
Week 13/38	25/10	Differensiele geenuitdrukking en omgewing stres	SvdH 12

***5 Augustus (Maandag) volg Vrydag rooster**

Praktiese program: Hiedie module bevat 11 praktiese kontakssessies – een waarvan toegewys is aan die semestertoets. Praktika sal elke Dinsdag van 10:10 – 13:00 in Lab 2025 [L], in NARGA B (Room 2087, Admin A) [N] o, soos hieronder aangedui

Prac	Date	Topic	Lecturer
	23/07	Geen Prakties	
1	30/07	Filogenetika 1 [L]	SRD 1
2	06/08	Filogenetika 2 [N]	SRD 2
3	13/08	Filogenetika 3 [L/N]	SRD 3
4	20/08	Filogenetika 4 [L]	SRD 4
5	27/08	TEORIE TOETS 1 (A1) [L]	SRD
6	03/09	"Karyotyping" [L]	RVR 1
	10/09	Geen prakties_US Vakansie	
7	17/09	Chromosoom evolusie [L/N]	RVR 2
	24/09	GEEN PRAKTIES: Publieke Vakansiedag	
8	01/10	AMOVA & Phi-st [N]	SvdH 1
9	08/10	Ondersoek Demografiese veranderinge [N]	SvdH 2
,10	15/10	Geenvloei [N]	SvdH 3
11	22/10	Werk aan Werkstuk	SvdH 4

Praktiese Werkstukke: :

1. Daniels: Sal aangekondig word
2. Von der Heyden: Sal aangekondig word
3. Rambau: Sal aangekondig word