

2024-09-03

Course schedule for Genetic diversity and Plant breeding (BI1103), 2024

Yellow = Lectures

Blue = Sem (compulsory)

Green = Lab (compulsory)

Course leader:

Adrien Sicard (AS) adrien.sicard@slu.se , 018 67 3231

Course assistants/teachers:

Kevin Sartori (KS) kevin.sartori@slu.se

Alessandra Lombardi (AL) alessandra.lombardi@slu.se

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Teachers , e-mail to SLU teachers: first name.surname@slu.se:

AK=Anders Kvarnheden

AW=Anna Westerbergh

CD=Christina Dixelius

JS=Jens Sundström

KL = Katarina Landberg

MS=Mohammad Sameri,

MRA = Martha Rendón Anaya

PS= Per Sandin

KS = Kevin Sartori

Guest teachers:

AC= Alf Ceplitis, Lantmännen

HH= Henrik Hallingbäck, Skogforsk

AnC= Annelie Carlsbecker , The Swedish Gene Technology Advisory Board

MSa=Martin Sandberg, National Food Agency (study visit at the Swedish food agency)

SM= Salla Marttila

Please note that: all seminars (rows filled with blue) and Labs (rows filled with green) are compulsory.

Day	(No in Canvas) Kind ¹ : Room/building ²	Time: Subject (teacher)	Literature
Introduction			
Week 44			
Mon-4/11	(1) Sem – Sal C216, Biocentrum	9:15-10:00: Roll call & introduction (AS)	
	(Lit.1) Sem: Sal C216, Biocentrum	10:15-12:00 Literature project - Introduction (KL)	
	(Pract.1) Lab: BOL1	13:15-15:15: Introduction to the lab practicals & lab safety & transplanting RILS (AS, KS)	
Tue-5/11	(2) Lect: Sal A132, Ulls hus A-bloeket	10:15-12:00: Intro to Breeding (AS)	³ Ch 1, 2
	(3) Lect: Sal C216, Biocentrum	13:15-15:00: Genetic diversity - basic concepts (MRA)	⁴ Ch 21
Wed-6/11	(4) Lect: Sal C216, Biocentrum	10:15-12:00 10:15-12:00 Plant domestication (AW)	Article 1
	Self-studies		
Statistical genetics			
Thu 7/11	(6) Sem: Sal A132, Ulls hus A-bloeket	10:15 – 12:00: JC - Plant domestication (AW)	Article 1
	(7) Lect: Sal C216, Biocentrum	13:15-15:00 Statistics in Genetic analyses (KS)	
Friday 8/11	(8) Lect: Sal A132, Ulls hus A-bloeket	9:15-12:00: Quantitative genetics; concepts (AS)	³ Ch 4 & 26
	(6) Sem: Sal Z, Ulls hus D-bloeket	13:15-15:00 Genetic diversity, exercises (MRA)	⁴ Ch 21
Week 46			
Mon 11/11	Sal C212, Biocentrum	9:00-9:15: Questions to Adrien	
	(9) Sem: Sal C212, Biocentrum	9:15-12:00 Quantitative genetics, exercises (AS)	³ Ch 4, 26
	(10) Sem: Sal C213, Biocentrum	13:15-16:00 Quantitative genetics, exercises (AS)	⁴ Ch 21
Tue 12/11	(Lit.2) Sem: Sal C212, Biocentrum	10:15-12:00 Check point: presentations of lit. project outline (KL)	
	(Pract.3) Lab: Sal C216, Biocentrum	13:15-15:00 Crossings intro (LM, SY, KS, MS)	
Wed 13/11	(11) Sem: Sal C216, Biocentrum	10:15-12:00 Genetic diversity exercises (MRA)	⁴ Ch 21

	Self-studies	Literature project	
Thu 14/11	(Pract.4) Lab: BÖL 2, Biocentrum	8:15-16:00 Molecular lab: DNA extraction, PCR run – (KS)	
Fri 15/11	(Pract.5) Lab: BÖL 2, Biocentrum	8:15-16:00 Molecular lab: DNA extraction, PCR & gel run – Questions & discussion Questions, group discussions (LM, SY, KS)	
Week 47			
Mon 18/11	Zoom	9:00-9:30: Questions to Adrien	
	Self-studies		
Tue 19/11	Self-studies		
Wed 20/11	Exam I: Tentamenssal 2, Undervisningshuset	13:00 - 17:00 Examination 1: Population genetics, quantitative genetics and domestication	
Traditional breeding methods and regulation			
Thu 21/11	(12) Lect: Sal C212, Biocentrum	10:15-12:00 Breeding method: self- & cross-pollinating species (MRA)	³ Ch 16, 17
	(13) Lect: Sal C213, Biocentrum	13:15-16:00 Hybrid breeding and Polyploidy and breeding (AS)	³ Ch 18, 24 Article 2,3
Fri 22/11	Self Studies	Breeding methods, group discussions	
	Self Studies	Breeding methods, group discussions	
Week 48			
Mon 25/11	Self studies	Preparation literature project: Preparation of 1 st draft.	
	Self studies	Preparation literature project: Preparation of 1 st draft.	
Tue 26/11	(14) Sem: Sal C213, Biocentrum	10:15-12:00: Breeding method: self- & cross-pollinating species: Presentations (MRA)	³ Ch 16, 17
	(Pract.6) Lab: Datorsal 1 and 2 Biblioteket, Ultunabiblioteket	13:15-17:00: Introduction to computational genomics (KS)	
Wed 27/11	(15) Lect: Sal C212, Biocentrum	10:15-12:00: Seed certification, production and legislation (CD)	
	Deadline	Half-time course evaluation	
Phenotype-genotype associations			

Thu 28/11	(16) Lect: Sal C216, Biocentrum	9:15-12:00 Introduction to Genomic data: concepts and discussion (AS)	Article 5,6
	Self-studies	Preparation literature project: Preparation of 1 st draft.	
Fri 29/11	(Pract.7) Lab: BÖL 2, Biocentrum	9:15-16:00 Phenotyping & mapping - (LM, SY, KS)	
Week 49			
Mon 2/12	(17) Lect: Sal C216, Biocentrum	10:15-12:00 Genotype – phenotype associations (MRA)	Article 4 ³ Ch 21, 22
	Self-studies	Preparation literature project: Preparation of 1 st draft.	
	Deadline	sending 1st draft of literature studies for peer-review.	
Tue 3/12	(18) Lect: Sal C216, Biocentrum	9:15-12:00 Next generation breeding: concepts and discussion (AS)	Article 5,6
	(19) Lect: Sal C216, Biocentrum	13:15-16:00 Genomic selection: concepts and discussion (AS)	Article 5,6
Wed 4/12	(Pract.8) Lab: Datorsal Hugin, VHC hus 5/ Datorsal Munin, VHC hus 5	8:15-14:00 Computer lab: QTL-mapping (KS+AS)	Article 4
	(Lit.4) Group studies	Perform peer review of literature studies	
Thu 5/12	(Pract.9) Lab: Datorsal 2 Biblioteket, Ultunabiblioteket	9:15-17:15 Computer lab: Genomics (KS+AS)	
Biotechnological applications and considerations in plant breeding			
Fri 6/12	(20) Lect: Sal C212, Biocentrum	10:15-12:00 Generation of transgenic plants (JS)	
	(21) Lect: Sal C212, Biocentrum	13:15-15:00 New breeding technologies (JS)	
	(Lit.4) Self-studies/ Deadline	24:00: Deadline for sending in peer-review of literature studies.	
Week 50			
Mon 9/12	Zoom	9:00-9:30 Questions to Adrien	
	(22) Sem: Guest lect: Sal C216, Biocentrum	9:15-12:00 Ethics and Genetic modifications + discussion (PS)	Article 7
	(23) Sem: Guest Lect: Sal C216, Biocentrum	13:15-15:00 Science and politics – The controversial story of GM-crops (AnC)	
Phenotypic and developmental targets in plant Breeding			
Tue 10/12	(24) Lect: Loftets hörsal, Loftet (Ladugården)	10:15-12:00 Breeding for disease resistance (CD)	³ Ch 14 + Articles 8, 9

	(25) Lect: Sal C213, Biocentrum	13:15-15:00 Breeding for virus resistance (AK)	⁴ Ch 14 + Article 10
Wed 11/12	(22) Sem: Visit and Guest lect: National Food Agency (Livsmedelsverket) - Self-studies	10:15-12:00 National Food Agency (MSa)	
Thu 12/12	(27) lect: (29) Sem: Guest lect: Sal C212, Biocentrum	10:15-12:00 Breeding for abiotic stress (MS) Sal A132, Ulls hus A-blocket 13:15-15:00 Tree breeding at Skogforsk (HH)	Articles 11, 12, 13
Fri 13/12	(28) Sem: Guest lect: Sal C216, Biocentrum	10:15-12:00 Breeding at DLF beet seed (PSn)	
	(31) Sem: Guest lect: Sal C216, Biocentrum	13:15-15:00 Lantmännen and their oat breeding (AC)	
Week 51			
Mon 16/12	(32) Sem: Sal C213, Biocentrum Self-studies	10:15-12:00 Journal club/discusion - genotype-phenotype associations genomics (MRA)	Articles to be determined
Tues 17/12	Self-studies Self-studies		
Wed 18/12	Lect: Zoom Self-studies	9.15-11.00: Questions to teachers	
Thu 19/12	Self-studies		
Frid 20/12	Exam II: entamenssal 2, Undervisningshuset (Pract. 10) and (Lit.5) Optional, Zoom	8:00-12:00 Examination II 13:15 -15:00 Optional: Lab and literature report - individual discussion with teachers (AS, KL, KS)	
Christmas break!			
Week 2, 2024			
Mon 6/1	-	-	
Tue 7/1	Self-studies	Work with literature project	
Wed 8/1	(Lit.6) Deadline	24:00: Send in literature project to opponent and to KL+AS for comments	
Thu 9/1	Self-studies	Work with Lab report	

Fri 10/1	Self-studies	Work with Lab report	
	(Pract.11) Deadline Self-studies	Deadline, 24:00: submission of Lab report	
Week 3			
Mon 13/1	Self-studies	Work with literature project presentation & opposition	
Tue 14/1	(Lit.7) Sem: Sal C216, Biocentrum	9:15-16:00 Presentations and opposition of literature projects (KL+AS)	
Wed 15/1	Self-studies	Work with literature project presentation & opposition	
Thu 16/1	Self-studies	Work with literature project presentation & opposition	
Frid 17/1	(Lit.8) Self-studies/ Deadline	Deadline 24:00: Final send-in of literature project	

¹ **Lect = Lecture**; **Sem = Seminar (compulsory)**; **Lab = Laboratory practical (compulsory)**;

² Biocentrum = BioCentre SLU, Lennart Kennes sal is in BioC, Sal O2 is in the main teaching building, Bibliotekets datorsal 1 & 2 = computer room 1, 2 at the SLU library.

Course literature:

Book chapters:

³ Acquaah George: Principles of Plant Genetics and Breeding, Second Edition, Wiley-Blackwell Publishing, 2012, chapters 1, 2, 4, 14, 16, 17, 18, 21, 22, 26

⁴ Russel, Peter J. iGenetics. A molecular approach, (Pearson international edition), chapter 21, Population genetics, pp: 603-649

Articles:

¹ Doebly, J. F., Brandon, S. G., Smith B. D. 2006. The molecular genetics of crop domestication. Cell 127:

² Lloyd, A., Bomblies, K. 2016. Meiosis in autopolyploid and allopolyploid Arabidopsis. Curr. Opi. Plant Biol. 30:116-122.

³ Sattler, M. C, Carvalho, C. R., Clarindo, W. R. 2015. The polyploidy and its key role in plant breeding. Planta 243:281-296.

- ⁴ Collard, B.C.Y., Jahufer, M.Z.Z., Brouwer, J.B., Pang, E.C.K. 2005. An introduction to markers, quantitative trait loci (QTL) mapping and marker-assisted selection for crop improvement: The basic concepts. *Euphytica* 142: 169-196.
- ⁵ Varshney RK, Terauchi R, McCouch SR (2014) Harvesting the Promising Fruits of Genomics: Applying Genome Sequencing Technologies to Crop Breeding. *PLOS Biology* 12(6): e1001883. <https://doi.org/10.1371/journal.pbio.1001883>.
- ⁶ Gelli, M., Konda, A. R., et al. 2017. Validation of QTL mapping and transcriptome profiling for identification of candidate genes associated with nitrogen stress tolerance in sorghum. *BMC Plant Biology* 17:123.
- ⁷ Siipi, H. 2015. Is genetically modified food unnatural? *J Agric Environ Ethics*. 28:807-816.
- ⁸ McDonald, B., Linde, C. 2002. Pathogen population genetics, evolutionary potential, and durable resistance. *Annu. Rev. Phytopathology*. 40: 349-79.
- ⁹ Nelson, R., Wiesner-Hanks, T., Wisser, R., Balint-Kurti, P. 2018. Navigating complexity to breed disease-resistant crops. *Nat. Rev. Genet.* Vol. 19:21-33. doi:10.1038/nrg.2017.82
- ¹⁰ Gómez, P., Rodríguez-Hernández, A.M., Moury, B., Aranda, M.A. 2009. Genetic resistance for the sustainable control of plant virus diseases: breeding, mechanisms and durability. *European Journal of Plant Pathology* 125: 1-22.
- ¹¹ Sameri, M., *et al.* 2009. A quantitative trait locus for reduced culm internode length in barley segregates as a Mendelian gene. *TAG*: 118:643–652.
- ¹² Fritsche-Neto, R., Do Vale J.C. A. 2012. Breeding for stress-tolerance or resource-use efficiency? In *Plant Breeding for abiotic stress tolerance*. Eds: Fritsche-Neto, R., Borém, A. DOI: 10.1007/978-3-642-30553-5_2
- ¹³ Pourkheirandish, M., *et al.* 2015. Evolution of the grain dispersal system in barley. *Cell* 162, 527–539.