

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](mailto:adrien.sicard@slu.se) , 018 67 3231

### Course assistants/teachers:

Kevin Sartori (KS) [kevin.sartori@slu.se](mailto:kevin.sartori@slu.se)

Alessandra Lombardi (AL) [alessandra.lombardi@slu.se](mailto:alessandra.lombardi@slu.se)

Samuel Van Es (SVE) [sam.van.es@slu.se](mailto:sam.van.es@slu.se)

**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 <sup>1</sup> : Room/building <sup>2</sup>	Time: Subject (teacher)	Literature
<b>Introduction</b>			
<b>Week 44</b>			
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	13:15-17:15: Introduction to the lab practicals & lab safety & transplanting RILS (AS, KS)	
Tue-5/11	(2) Lect: Sal A132, Ulls hus A-blocket	10:15-12:00: Intro to Breeding (AS)	<sup>3</sup> Ch 1, 2
	(3) Lect: Sal C216, Biocentrum	13:15-15:00: Genetic diversity - basic concepts (MRA)	<sup>4</sup> 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		
<b>Statistical genetics</b>			
Thu 7/11	(5) Sem: Sal A132, Ulls hus A-blocket	10:15 – 12:00: JC - Plant domestication (AW)	Article 1
	(6) Lect: Sal C216, Biocentrum	13:15-15:00 Statistics in Genetic analyses (KS)	
Friday 8/11	(7) Lect: Sal A132, Ulls hus A-blocket	9:15-12:00: Quantitative genetics; concepts (AS)	<sup>3</sup> Ch 4 & 26
	(8) Sem: Sal Z, Ulls hus D-blocket	13:15-15:00 Genetic diversity, exercises (MRA)	<sup>4</sup> Ch 21
<b>Week 46</b>			
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)	<sup>3</sup> Ch 4, 26
	(10) Sem: Sal C213, Biocentrum	13:15-16:00 Quantitative genetics, exercises (AS)	<sup>4</sup> 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)	<sup>4</sup> Ch 21

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

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

	(25) Lect: Sal C213, Biocentrum	13:15-15:00 Breeding for virus resistance ( <b>AK</b> )	<sup>4</sup> Ch 14 + Article 10
Wed 11/12	(26) <b>Sem:</b> Visit and Guest lect: National Food Agency (Livsmedelsverket) - Self-studies	10:15-12:00 National Food Agency ( <b>MSa</b> )	
Thu 12/12	(27) lect: (28) Sem:Guest lect: Sal C212, Biocentrum	10:15-12:00 Breeding for abiotic stress ( <b>MS</b> ) Sal A132, Ulls hus A-blocket 13:15-15:00 Tree breeding at Skogforsk ( <b>HH</b> )	Articles 11, 12, 13
Fri 13/12	(29) Sem:Guest lect: Sal C216, Biocentrum	10:15-12:00 Lantmännen and their oat breeding ( <b>AC</b> )	
	(30) Sem:Guest lect: Sal C216, Biocentrum	10:15-12:00 Journal club/discusion - genotype-phenotype associations genomics ( <b>MRA</b> )	
<b>Week 51</b>			
Mon 16/12	Self-studies		
	Self-studies		
Tues 17/12	Self-studies		
	Self-studies		
Wed 18/12	Lect: <b>Zoom</b>	9.15-11.00: Questions to teachers	
	Self-studies		
Thu 19/12	Self-studies		
Frid 20/12	<b>Exam II:</b> Tentamenssal 2, Undervisningshuset	<b>8:00-12:00 Examination II</b>	
	(Pract. 10) and (Lit.5) Optional, <b>Zoom</b>	13:15 -15:00 Optional: Lab and literature report - individual discussion with teachers ( <b>AS, KL, KS</b> )	
<b>Christmas break!</b>			
<b>Week 2, 2024</b>			
Mon 6/1	-	-	
Tue 7/1	Self-studies	Work with literature project	
Wed 8/1	(Lit.6) <b>Deadline</b>	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) <b>Deadline</b> Self-studies	<b>Deadline, 24:00: submission of Lab report</b>	
<b>Week 3</b>			
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 ( <b>KL+AS</b> )	
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/ <b>Deadline</b>	<b>Deadline 24:00: Final send-in of literature project</b>	

<sup>1</sup> Lect = Lecture; Sem = Seminar (compulsory); Lab = Laboratory practical (compulsory).

<sup>2</sup> 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:

<sup>3</sup> 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

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

#### Articles:

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

<sup>2</sup> Lloyd, A., Bomblies, K. 2016. Meiosis in autopolyploid and allopolyploid Arabidopsis. Curr. Opin. Plant Biol. 30:116-122.

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

<sup>4</sup> 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.

- <sup>5</sup> 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>.
- <sup>6</sup> 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.
- <sup>7</sup> Siipi, H. 2015. Is genetically modified food unnatural? *J Agric Environ Ethics*. 28:807-816.
- <sup>8</sup> McDonald, B., Linde, C. 2002. Pathogen population genetics, evolutionary potential, and durable resistance. *Annu. Rev. Phytopathology*. 40: 349-79.
- <sup>9</sup> Nelson, R., Wiesner-Hanks, T., Wissner, 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
- <sup>10</sup> 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.
- <sup>11</sup> 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.
- <sup>12</sup> 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
- <sup>13</sup> Pourkheirandish, M., *et al.* 2015. Evolution of the grain dispersal system in barley. *Cell* 162, 527–539.