

2021-10-14

## Course schedule for Genetic diversity and Plant breeding (BI1103), 2021

**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:

Anna Törnkvist (AT), [anna.tornkvist@slu.se](mailto:anna.tornkvist@slu.se), Irene Merino (IM), [irene.merino@slu.se](mailto:irene.merino@slu.se) ,  
Silvana Moreno (SM), [silvana.moreno@slu.se](mailto:silvana.moreno@slu.se)

**Teachers** (from Dept. of Plant Biology if not anything else indicated), e-mail to SLU teachers: first name.surname@slu.se:

ACRW=Ann Christin Rönnberg-Wästljung

AK=Anders Kvarnheden

AW=Anna Westerbergh

CD=Christina Dixelius

JS=Jens Sundström,

MS=Mohammad Sameri,

PI=Pär Ingvarsson,

PS= Per Sandin, Dept. of Ecology, SLU:

### Guest teachers:

AC= Alf Ceplitis, Lantmännen

HH= Henrik Hallingbäck, Skogforsk

ML= Matti Leino, Dept. of Archaeology and Classical Studies, Stockholm University

MN=Marie Nyman, The Swedish Gene Technology Advisory Board

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

LH=Louise Holmquist, Maribo-Hilleleshög:

PSn=Per Snell, Maribo-Hilleleshög

SM= Salla Marttila

Day	(No in Canvas) Kind <sup>1</sup> : Room <sup>2</sup>	Time: Subject (teacher)	Literature
<b>Introduction</b>			
<b>Week 45</b>			
Tue-2/11	(1) Sem - Sal C216 -biocentrum	9.00-10.00: Roll call & introduction ( <b>AS+AT+ IM +SM</b> )	
	(2) Lect: Sal C216 -biocentrum	10.00-12.00: Intro to Breeding ( <b>AS</b> )	<sup>3</sup> Ch 1, 2
	(3) Lab: BÖL 2- biocentrum	13-15: Introduction to the mapping lab & lab safety ( <b>AT+ IM +SM</b> )	
<b>Genetic diversity</b>			
Wed-3/11	(4) Lab: Greenhouse - biocentrum	8-11 (GroupA) 11-14 (groupB) : Transplanting of RILs - group discussion, ( <b>AT+ IM +SM</b> )	
	Self-studies		
Thu-4/11	(5) Lect; Sal C216 -biocentrum	9-11: Genetic diversity - basic concepts ( <b>PI</b> )	<sup>4</sup> Ch 21
	(6) Sem: Sal C216 -biocentrum	11-12: Genetic diversity, exercises ( <b>PI</b> )	
	(7) Guest lect: Zoom	13-15: Preservation of genetic resources ( <b>ML</b> )	<sup>5</sup> Article
Fri-5/11	(8) Lect; Zoom	<del>10-12: Plant domestication (<b>AW</b>)</del>	<sup>6</sup> Article
	(9) Sem: Zoom	13-16: Genetic diversity, exercises ( <b>PI</b> )	

Statistical genetics			
Week 46			
Mon 8/11	(10) Sem: Sal C216 -biocentrum	9:15-10: Questions to Adrien	
	(8) Self-studies	Video and Quiz - Plant domestication (AS)	
	(12) Lect Sal C216 -biocentrum	13-15 Statistics in Genetic analyses (AS)	
Tue 9/11	(13) Sem: Sal C216 -biocentrum	10-12: Literature project - topic decision (JS)	<sup>6</sup> Article
	Self-studies	Literature project	
Wed 10/11	(14) Lect Sal C216 -biocentrum	9-11: Quantitative genetics (ACRW)	<sup>3</sup> Ch 4, 26
	(15) Sem: Sal C216 -biocentrum	11-12: Quantitative genetics, exercises (ACRW)	
	Self-studies		
Thu 11/11	(16) Lab BÖL 2: - biocentrum	8-12: DNA extraction, PCR run – (AT+ IM +SM)	
	(11) Sem Zoom	14-16: Discussion Plant domestication (AS)	
Fri 12/11	(17) Lab: BÖL 2 - biocentrum	9-16: DNA extraction, PCR & gel run – Questions & discussion Questions, group discussions (AT+ IM +SM)	
Week 47			
Mon 15/11	(18) –meeting Sal C216	9:15-10: Questions to Adrien	
	(19) Sem: Sal C216 -biocentrum	10-12: Check point: presentations of lit. project outline (JS)	
	(20) Lab: BÖL 2 - biocentrum	13-15: Crossings intro (AT+ IM +SM+ MS)-	
Tue 16/11	(21) Sem: ZOOM	9-12: Quantitative genetics, exercises (ACRW)	<sup>3</sup> Ch 4, 26
	Self-studies		
Wed 17/11	Self-studies		

Thu 18/11	Self-studies		
Fri 19/11	(22) Exam: Tentamenssal 2	8-12: Examination 1: Population genetics, quantitative genetics and domestication	
<b>Traditional breeding</b>			
<b>Week 48</b>			
Mon 22/11	(23) meeting Sal C216 - biocentrum	9:15-10: Questions to Adrien	
	(24) ) Lect Zoom	10-12: Breeding of self- & cross-pollinating species (ACRW)	<sup>3</sup> Ch 16, 17
	(25) Sem: Zoom	13-15: Breeding methods, group discussions (ACRW)	<sup>3</sup> Ch 16, 17
Tue 23/11	(26) Sem: Zoom	10-12: Discussion, breeding methods (ACRW)	<sup>3</sup> Ch 16, 17
	(27) Sem: Zoom	13-13:30: Seed certification, production and legislation: intro (CD) 13.30-16: Work with seed certifications	
Wed 24/11	(28) Sem: Zoom	10-12: Presentations; seed certification, production and legislation (CD)	
	Self studies		
Thu 25/11	(29) Lect Zoom	10-12: CMS/hybrid breeding (HH)	<sup>3</sup> Ch 18
	(30) Lect Zoom	13-15: Polyploidy and breeding (AS)	<sup>7, 8, 9, 10</sup> Article
Fri 26/11	Self studies		
	(31) Deadline	Half-time course evaluation	
	Self studies	17:00: Deadline send in literature project for comments from other students	
<b>Phenotype-genotype associations</b>			

<b>Week 49</b>			
Mon 29/11	(32) - meeting <b>Zoom</b>	9:15-10: Questions to Adrien	
	(33) <b>Lect Zoom</b>	10-12 Genotype – phenotype associations ( <b>ACRW</b> )	<sup>12</sup> Article <sup>3</sup> Ch 21, 22
	Group studies	Perform peer review of literature studies ( <b>JS</b> )	
Tue 30/11	(34) <b>Lab: BÖL 2 - biocentrum</b>	8-15: Phenotyping & mapping - intro, group work, summary ( <b>AT+ IM +SM</b> )	
Wed 1/12	(35a) <b>Lect: Sal C216 -biocentrum</b>	10-12: Introduction to Genomic data ( <b>AS</b> )	<sup>23, 24, 25</sup> Article
	Self-studies		
Thu 2/12	(35b) <b>Lect Sal C216 -biocentrum</b>	10-12: Next generation breeding ( <b>AS</b> )	<sup>23, 24, 25</sup> Article
	(35c) <b>Lect Sal C216 -biocentrum</b>	13-15: Genomic selection ( <b>AS</b> )	<sup>23, 24, 25</sup> Article
Fri 3/12	(37) <b>Lab: Library Datorsal 1 &amp; 2</b>	10-15: Computer lab: QTL-mapping ( <b>AT+ IM +SM</b> )	<sup>12</sup> Article
	Self-studies	24:00: Deadline for sending in peer-review of literature studies.	
<b>Week 50</b>			
Mon 6/12	(38) <b>Lab: Library Datorsal 1 &amp; 2</b>	10-15: Computer lab: Genomics ( <b>AT+ IM +SM</b> )	
<b>Biotechnological applications and considerations in plant breeding</b>			
Tue 7/12	(39) - meeting Sal C216 -biocentrum	9:15-10: Questions to Adrien	

	(40) <b>Lect: Sal C216 -biocentrum</b>	10-12: Generation of transgenic plants ( <b>JS</b> )	<sup>21</sup> Article
	(41) <b>Lect: Sal C216 -biocentrum</b>	13-15: New breeding technologies ( <b>JS</b> )	<sup>21</sup> Article
Wed 8/12	(42) <b>Guest lect: National Food Agency (Livsmedelsverket) Zoom</b>	9-ca10: National Food Agency ( <b>MSa</b> )	
	(43) <b>Lect: Zoom</b>	10-12: Breeding for abiotic stress ( <b>MS</b> )	<sup>18, 19,</sup> <sup>20</sup> Articles
	Self-studies		
Thu 9/12	(44) <b>Guest lect: Zoom</b>	10-12: Science and politics – The controversial story of GM-crops ( <b>MN</b> )	
	(36) <b>Sem: Zoom</b>	13-15: Discussion genomics ( <b>AS</b> )	
<b>Week 51</b>			
<b>Phenotypic and developmental targets in plant Breeding</b>			
Fri 10/12	(47) <b>Lect: Sal C216 -biocentrum</b>	10-12: Breeding for disease resistance ( <b>CD</b> )	<sup>3</sup> Ch 14 + 15, 16 Articles
	(48) <b>Lect: Sal C216 -biocentrum</b>	13-15: Breeding for virus resistance ( <b>AK</b> )	<sup>4</sup> Ch 14 + <sup>17</sup> Article
Mon 13/12	(46) - Zoom	9:15-10: Questions to Adrien	
	(49) <b>Sem: Zoom</b>	10-12: Journal club - genotype-phenotype associations ( <b>ACRW</b> )	<sup>18, 19,</sup> <sup>20</sup> Articles
	(50) <b>Guest lect: Zoom</b>	13-15: Lantmännen and their oat breeding ( <b>AC</b> )	
Tue 14/12	(51) <b>Guest lect: Zoom</b>	10-12: Breeding at MariboHilleshög ( <b>LH – PSn</b> )	
	(52) <b>Guest lect: Zoom</b>	13-15: Tree breeding at Skogforsk ( <b>HH</b> )	
	(53) <b>Guest lecture Zoom</b>	15-16 Grogrund project presentation (Salla Marttila)	
Wed 15/12	(54) Optional, <b>Zoom</b>	9-12: Optional: Lit. project - individual discussion with teachers ( <b>JS &amp; AS</b> )	
Thu 16/12	(55) Optional, <b>Zoom</b>	9-12: Optional: Lab report - individual discussion with teachers ( <b>AT+ IM +SM</b> )	

Fri 17/12	Self-studies	Work with lab report/literature project	
<b>Week 52</b>			
Mon 20/12	(56) –meeting <b>Zoom</b>	9:15-10: Questions to Adrien	
	Self-studies	Work with lab report/literature project	
Tue 21/12	Self-studies	Deadline, 24:00: Lab report send in	
<b>Christmas break!</b>			
<b>Week 1, 2021</b>			
Mon 3/1	Self-studies		
Tue 4/1	Self-studies	Deadline, 24:00: Send in literature project to opponent and to JS+AS for comments	
Wed 5/1	(57) <b>Lect: Zoom</b>	9.45-11.50: Questions to teachers	
Thu 6/1		<b>Holiday</b>	
Fri 7/1	(58) <b>Exam: Särimner</b>	8-12: Examination II	
<b>Week 2</b>			
Mon 10/1	<b>Exam: Sal N</b> Self-studies	8-12: Re-Exam I (only for those who need) Work with literature project presentation & opposition	
Tue 11/1	(59) <b>Sem: Sal C216 -biocentrum</b>	9-17: Presentations and opposition of literature projects ( <b>JS+AS</b> )	
Wed 12/1	(60) <b>Sem: Sal C216 -biocentrum</b>	9-13: Presentations and opposition of literature projects ( <b>JS+AS</b> )	
	(61) <b>Sem: Evald</b>	12: Course evaluation	
Thu 13/1	Self-studies	Work with literature project	

Fri 14/1	Self-studies	Deadline 24:00: Final send in of literature project	
----------	--------------	---	--

<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>5</sup> Dulloo, M. E., Rege, J.E.O., Ramirez, M. *et al.* 20xx. Conserving agricultural biodiversity for use in sustainable food systems. Chapter 5 in:

<sup>6</sup> Doebly, J. F., Brandon, S. G., Smith B. D. 2006. The molecular genetics of crop domestication. *Cell* 127: 1309-1321.

<sup>7</sup> Soltis, D. E., Visger, C. V., Marchant, D. B., Soltis, P. D. 2016. Polyploidy: Pitfalls and paths to a paradigm. *Am. J. Bot.* 103 (10): 1-21.

<sup>8</sup> De Storme, N., Geelen, D. 2013. Sexual polyploidization in plants – cytological mechanisms and molecular regulation. *New Phytologist* 198: 670-684.

<sup>9</sup> Lloyd, A., Bomblies, K. 2016. Meiosis in autopolyploid and allopolyploid *Arabidopsis*. *Curr. Opi. Plant Biol.* 30:116-122.

<sup>10</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>11</sup> Thornström, C-G. 2016. Dimensional analysis of international regulations of biological matter. Genetic resources and Agro-biodiversity. *Indian J. Plant Genet. Resour.* 29(3): 420-422.

<sup>12</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>13</sup> Carletti, C., Carra, A. et.al. 2016. QTLs for Wolly poplar aphid (*Phloeomyzus passerinii* L.) resistance detected in an interspecific *Populus deltoids* x *P. nigra* mapping population. *PLoS One*. DOI:10.1371



- <sup>14</sup> Frankenkrog, A.M., Neves, L.G., et al. 2016. Genome-wide association study reveals putative regulators of bioenergy traits in *Populus deltoides*. *New Phytologist*. DOI: 10.1111/nph.14154.
- <sup>15</sup> McDonald, B., Linde, C. 2002. Pathogen population genetics, evolutionary potential, and durable resistance. *Annu. Rev. Phytopathology*. 40: 349-79.
- <sup>16</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>17</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>18</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>19</sup> Pourkheirandish, M., et al. 2015. Evolution of the grain dispersal system in barley. *Cell* 162, 527–539.
- <sup>20</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>21</sup> To be decided
- <sup>22</sup> Siipi, H. 2015. Is genetically modified food unnatural? *J Agric Environ Ethics*. 28:807-816.
- <sup>23</sup> Weigel, D., Norborg, M. 2015. Genomics for understanding adaptation in wild plants species. *Annu Rev Genet*. 49:315-38.
- <sup>24</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>25</sup> Choquet, M., Smolina, I., et al. 2019. Towards population genomics in non-model species with large genomes: a case study of the marine zooplankton *Calanus finmarchicus*. *Ro. Soc. open sci.* 6:180608.