Umeå Plant Science Centre **071221**
Department of Plant Physiology, Umeå University
Department of Forest Genetics and Plant Physiology, SLU Umeå

SCHEDULE

Plant Biotechnology and Molecular Breeding, 15 ECTS

21/1 2008 – 20/3 2008
VT 2008

Main teacher UmU: Maria Eriksson ME 5801 maria.eriksson@plantphys.umu.se
Main teacher SLU: Rishi Bhalerao RB 8488 rishi.bhalerao@genfys.slu.se

Lab assistants	**Practicals**
Benjamin Bollhoner (BB)	LAB1 Transformation of *Arabidopsis thaliana*
	LAB2 Transformation of *Populus*
Lars Björkén (LB)	LAB1 Transformation of *Arabidopsis thaliana*
	LAB2 Transformation of *Populus*
Madeleine Englund (MEn)	LAB3 Organogenesis in tissue culture
Anna Petterle (AP)	LAB3 Organogenesis in tissue culture
NN, UmU	LAB4 Gene mining practical
Erin Johnson (EJ)	LAB5 Protein expression in *E. Coli*
Nicolas Navrot (NN)	LAB5 Protein expression in *E. Coli*
Marie Holmgren (MH)	LAB6 Biofuels (EtOH)
Lars Björkén (LB)	LAB6 Biofuels (hydrogen)
Jon Hallander (JH)	Quantitative genomics (computer lab)
Sara Abrahamsson (SA)	Population genetics and QTL mapping (computer lab)
Jon Hallander (JH)	Association mapping and phylogenetics (computer lab)
LAB IPR1 (PG)	Writing a patent
LAB IPR2 (PG)	Studying patent history and landscapes
LAB IPR3 (PG)	Is an innovation novel and inventive?
LAB IPR4 (PG)	Evolution of Biotech/Gene patent 1987-2007: Claim structures

The four components of the course
I. Lectures
II. Laboratory exercises: Compulsory, lab reports are written for all practicals
III. Oral student seminars: Attendance compulsory
IV. Paper discussions: Attendance compulsory

Course literature
Plant Biotechnology –The genetic manipulation of plant; Slater, Scott and Fowler

Examination: Written exam 29 February 9.00-15.00, 2007
Grading is Underkänt, Godkänt or Väl godkänt

Lecturers:

Rishi Bhalerao	RB	8488	Rishi.Bhalerao@genfys.slu.se
Staffan Eklöf	SE		Jordbruksverket
Maria Eriksson	MEr	5108	Maria.Eriksson@plantphys.umu.se
Rosario Garcia	RG	8599	M.Rosario.Garcia@genfys.slu.se
Petter Gustafsson	PG	5159	Petter.Gustafsson@plantphys.umu.se
Pär Ingvarsson	PI	7414	Par.Ingvarsson@emg.umu.se
Stefan Jansson	SJ	5354	Stefan.Jansson@plantphys.umu.se
Erin Johnson	EJ		Erin.Johnson@genfys.slu.se
Brian Jones	BJ	6918	Brian.Jones@plantphys.umu.se
Mikael Karlsson	MK		Naturskyddsföreningen
Torgny Näsholm	TN	8431	Torgny.Näsholm@genfys.slu.se
Wolfgang Schuch	WS		
Anita Sellstedt	AS	7756	Anita.Sellstedt@plantphys.umu.se
Sten Stymne	SS		Sveriges lantbruksuniversitet
Kristofer Vamling	KV		Plant Sciences, BASF
Patrik Waldmann	PW	5209	Patrik.Waldmann@genfys.slu.se

Course assistants:

Sara Abrahamsson	SA	Sara.Abrahamsson@genfys.slu.se
Benjamin Bollhoner	BB	Benjamin.Bollhoner@plantphys.umu.se
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Madeleine Englund	MEn	Madeleine.Englund@genfys.slu.se
Marie Holmgren	MH	Marie.Holmgren@plantphys.umu.se
Jon Hallander	JH	Jon.Hallander@genfys.slu.se
Erin Johnson	EJ	Erin.Johnson@genfys.slu.se
Nicolas Navrot	NN	Nicolas.Navrot@genfys.slu.se
Anna Petterle	AP	Anna.Petterle@genfys.slu.se

List of all lectures

GENETIC TRANSFORMATION, PROPAGATION AND BIOTECHNOLOGY

21/1 Plant tissue culture
21/1 Techniques for plant transformation
22/1 Organization of plant genomes
23/1 Binary vectors and selectable markers
23/1 Modulation of gene expression
24/1 Gene mining
25/1 Plant biotechnology I, Existing traits Agriculture
28/1 Plant biotechnology II, New traits- Agriculture
30/1 Plants as bioreactors
31/1 Invited lecture, lipids
1/2 Workshop
4/2 Molecular farming, protein targeting
6/2 Bio-fuels (ethanol)
7/2 Bio-fuels (hydrogen)
8/2 Ag Biotech, an industrial perspective

PLANT BREEDING

11/2 Introduction to genetics and population genetics
12/2 Molecular population genetics
13/2 Quantitative genetics
14/2 Quantitative genetics, contd
15/2 QTL mapping
18/2 Association mapping
19/2 Phylogenetics/Molecular evolution
20/2 Phylogenetics/Molecular evolution, contd.
21/2 Marker assisted selection
22/2 Visit to Skogforsk
27/2 Preparation for exam
28/2 Preparation for exam
29/2 EXAM

GMO/PATENTS

3/3 Securing intellectual properties and the patenting process
4/3 Environmental issues
6/3 The patenting process
6/3 Launching the GMO Tomato: An interesting Ag Biotech case
7/3 Regulatory issues, Agriculture and Forestry in Sweden
10/3 Status of Plant Biotech
11/3 Forestry Biotech and Mass Propagation
12/3 The next big thing: Bioenergy
13/3 Discussion: Regulation/Public acceptance EU vs. US vs the World
17/3 Evolution of Biotech/Gene patent 1987-2007: Claim structures
18/3 To be anounced
20/3 To be anounced

Course literature

Plant Biotechnology –The genetic manipulation of plant; Slater, Scott and Fowler
Principles of Population Genetics", Fourth Edition, 2006, D.L. Hartl and A.G. Clarke

Paper discussions/Cases (list will be updated)

I Selectable marker genes in transgenic plants: applications, alternatives and biosafety. Brian Miki, and Sylvia McHugh.Journal of Biotechnology 107 (2004) 193–232
II Production of ethanol from wood hydrolyzate by yeasts. H.K. Sreenatha, T.W. Je.ries. Bioresource Technology 72 (2000) 253-260
III Hydrogen production. Green algae as a source of energy. Anastasios Melis and Thomas Happe. Plant Physiol 127 (2001) 470-478

Week 4 __GENETIC TRANSFORMATION, PROPAGATION AND BIOTECHNOLOGY

Monday 21/1			*location*
9.00-11.00	Course introduction, Plant tissue culture	MEr	KB4C10
12.00-14.00	Techniques for plant transformation	SJ	KB4C10
14.00-16.00	LAB1 Transformation of Arabidopsis (day 1)	BB, LB	KB4C9

Tuesday 22/1			
9.00-11.00	Organization of plant genomes	SJ	KB4C10
12.00-16.00	LAB1 Transformation of Arabidopsis (day 5) LAB2 Transformation of *Populus* (day 1)	BB, LB	KB4C9

Preparation for tomorrows lecture, Paper 1: Selectable marker genes in transgenic plants: applications, alternatives and biosafety. Brian Miki, and Sylvia McHugh.Journal of Biotechnology 107 (2004) 193–232.

Wednesday 23/1			
9.00-11.00	Binary vectors and selectable markers Discussion of paper 1	TN	KB4C10
12.00-14.00	Modulation of gene expression	BJ	KB4C10
14.00-17.00	LAB3 Organogenesis	AP, Men	KB4C10/KB4C9 sterile hoods

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Thursday 24/1			
9.00-11.00	Gene mining	RB	KB4C10
12.00-16.00	LAB1 Arabidopsis transformation (day 7) LAB2 Transformation of *Populus* (day 3)	BB, LB	KB4C9 Sterile hoods

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Friday 25/1			
9.00-11.00	Plant biotechnology I, Existing traits Agriculture	PG	KB4C10
12.00-16.00	Gene mining and reverse genetics practicals (LAB 4)		KB5C1 (computer lab)

Preparative studies, Paper 2

Week 5

Monday 28/1

9.00-12.00	Plant biotechnology II, New traits- Agriculture	PG	KB4C10
13.00-14.00	Paper discussion	PG	KB4C10

Tuesday 29/1 *UNIADEN* (free day)

Wednesday 30/1

9.00-11.00	Plants as bioreactors	EJ	KB4C10
12.00-16.00	Protein expression in *E.coli* LAB 5	EJ, NN	KB4C9

Thursday 31/1

10.00-12.00	Fresh oil instead of fossil – Genetic engineering of plant oils for material and biofuel.	SS	KB4C10
13.00-16.00	LAB 5, cntd	EJ,NN	KB4C9

Friday 1/2

9.00-16.00 Workshop: from genes to genomes

Week 6

Monday 4/2

9.00- 11.00	Molecular farming	RB	KB4C10
12.00-14.00	LAB3 Organogenesis	AP, MEn	KB4C9

Tuesday 5/2 Student sports day (free day)

Wednesday 6/2

9.00-10.00	Bio-fuels (ethanol)	AS	KB4C10
10.00-12.00	LAB6	MH	KB4C9
13.00-14.00	Bio-fuels (ethanol) ctnd.	AS	KB4C10
14.00-16.00	Discussion Paper 3 (ethanol)	AS	KB4C10

Thursday 7/2

9.00-11.00	Bio-fuels (hydrogen)	AS	KB4C10
11.00- 16.00	LAB6/Discussion paper 4 (hydrogen)	AS	fysbot/KB4C10

Friday 8/2

9.00- 11.00	Ag Biotech, an industrial perspective?	KV?	KB4C10
12.00- 13.00	Reflections, course part I and II	MEr	KB4C10
13.00-16.00	LAB1 Arabidopsis transformation (Day 22)	BB, LB	KB4C9/sterile hoods
	LAB2 Populus transformation (Day 18)	BB, LB	

Week 7 PLANT BREEDING

Monday 11/2			
9.00-12.00	Introduction to genetics and population genetics	PI	KB4C10
13.00-16.00	Literature studies		KB4C10
Tuesday 12/2			
9.00-12.00	Molecular population genetics	RG	KB4C10
13.00-16.00	Computer lab	SA	NC346?
Wednesday 13/2			
9.00 -12.00	Quantitative genetics	PW	KB4C10
13.00-16.00	Computer lab		NC346?
Thursday 14/2			
9.00- 12.00	Quantitative genetics	PW	KB4C10
13.00-16.00	Computer lab/Literature discussion	PW	NC346?
Friday 15/2			
9.00-12.00	QTL mapping	RG	KB4C10
13.00-16.00	Literature discussion/Computer Lab	SA	NC346?

Week 8

Monday 18/2

9.00-12.00	Association mapping	PI	KB4C10
13.00-16.00	Literature discussion	PI	KB4C10

Tuesday 19/2

9.00-12.00	Phylogenetics/Molecular evolution	PI	KB4C10
13.00-16.00	Computer lab	JH	NC346?

Wednesday 20/2

09.00-12.00	Phylogenetics/Molecular evolution, contd.	PI	KB4C10
13.00-16.00	Literature discussion	PI	KB4C10

Thursday 21/2

09.00-12.00	Marker assisted selection	PW	KB4C10
13.00-16.00	Literature discussion	PW	KB4C10

Friday 22/2

09.00- 12.00	Skogforsk visit	PW	KB4C10
13.00-16.00	Skogforsk visit	PW	

Week 9

Monday 25/2

DEADLINE delivery of lab report LAB 4, and 5

09.00-12.00	LAB1 Transformation of *Arabidopsis* (check plants)	BB, MK	KB4C9
13.00-16.00	LAB2 Transformation of *Populus* (check plants)	BB, MK	KB4C9

Tuesday 26/2

09.00-12.00	LAB3 Check results	AK,MEn	KB4C10

Wednesday 27/2

DEADLINE delivery of lab report LAB1, 2 and 3

9.00-12.00	Questions about the exam	KB4C10

Thursday 28/2

Prepare for exam

Friday 29/2

Exam !

Week 10

Monday 3/3

9.00-11.00	Launching the GMO Tomato: An interesting Ag Biotech case	WS	KB4C10
12.30-13.30	LAB IPR 1: Writing a patent: Presentation of the LAB, the background information and some hints how to start the process.	PG	KB4C10
14.00-17.00	LAB IPR 1: Writing a patent. Reading the scientific article, the patent application provided an the info from EPO and USPTO. Working out the basic structure of the patent application and a claims structure.	PG	KB5C1

Tuesday 4/3

9.00-11.00	Status of Plant Biotech	WS	KB4C10
13.00-14.00	LAB IPR 1: Writing a patent: Discussion about the innovation and a possible claim structure	PG	KB4C10
14.00-17.00	LAB IPR 1: Writing a patent: Start to write the patent application	PG	KB5C1

Wednesday 5/3

9.00-11.00	Biotech Companies	WS	KB4C10
12.00-17.00	LAB IPR 1: Writing a patent: Write the patent application	PG	KB5C1
	LAB IPR 2: Patent history and landscape: Presentation of the LAB	PG	KB4C10
	LAB IPR 2: Patent history and landscape: Searching the databases	PG	KB5C1

Thursday 6/3

9.00-11.00	Forestry Biotech and Mass Propagation	WS	KB4C10
13.00-17.00	LAB IPR 1: Writing a patent: Finishing the patent application	PG	KB4C10
	LAB IPR 2: Patent history and landscape: Continue, comparing claims		PG/WS

Friday 7/3

9.00-11.00	The next big thing: Bioenergy	WS	KB4C10
12.00-15.00	Regulatory issues, Agriculture and Forestry in Sweden	SE	KB4C10
or			
12.00-16.00	LAB IPR 2: Patent history and landscape: Finishing the LAB		KB5C1

Week 11

Monday 10/3

9.00-11.00	Regulatory issues, Agriculture and Forestry in Sweden	SE	KB4C10
or			
Securing intellectual properties and the patenting process		PG	KB4C10
12.30-14.30	LAB IPR 3: Is an innovation novel and inventive: Introduction	PG	KB4C10
14.30 – 16.00	LAB IPR 1: Writing a patent: Summary of the LAB	PG	KB4C10
	LAB IPR 3: Is an innovation novel and inventive: Searching the databases		

Tuesday 11/3

?9.00-12.00	Environmental issues	MK	KB4C10
12.30-13.30	LAB IPR 2: Patent history and landscape: Summary of the lab	PG	
	The story behind the invention and patent history	PG/WS	KB4C10
14.30 – 17.00	LAB IPR 3: Is an innovation novel and inventive: Searching the databases		

Wednesday 12/3

12.30-17.0	LAB IPR 3: Is an innovation novel and inventive: Finishing the LAB	KB5C10

Thursday 13/3

(9.00-11.00	Discussion: Regulation/Public acceptance EU vs. US vs the World	WS	KB4C10
12.30-16.00	Summary of LAB IPR 2 and LAB IPR 3		KB4C10

Friday 14/3

9.00-17.00 Evolution of Biotech/Gene patent 1987-2007: Claim structures

Week 12

Monday 17/3
To be announced

Tuesday 18/3
To be announced

Wednesday 19/3
To be announced

Thursday 20/3
To be announced

EASTER BREAK AND END OF COURSE