

## Curriculum Vitæ for Karin Stensjö

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**Research interests:** I am an Associate professor at Microbial Chemistry, Department of Chemistry – Ångström, Uppsala University. My group is focussed on how micro algae adjust their metabolism to environmental cues and oxidative stress, and how this knowledge could be used to design cyanobacteria for biotechnological applications.

**PhD degree** 2000, Ph.D. at the Department of Plant Biology, Swedish University of Agricultural Sciences, Uppsala.

**Docent degree** 2010, Appointed Docent in Chemistry, Microbial Chemistry, at Uppsala University.

**Present employment** Since 2012, Senior Lecturer at Uppsala University, Dept. of Chemistry-Ångström Laboratory.

**Previous employments** 2007-2012: Assistant Professor at Uppsala University, Department of Photochemistry and Molecular Science.  
2003-2007: Research Scientist at Uppsala University, Department of Evolution, Genomics and Systematics.

**Postdoctoral position** 2001-2002, Postdoc at The Royal Veterinary and Agricultural University of Denmark.  
2000-2001, Postdoc at the Genetic Centre, SLU, Sweden.  
Oct, 1994 to June 1995, Researcher at Dept of Plant Physiology, SLU, Sweden

**Visiting scientist** 1994 (3 months) with Prof Jeff Elhai, Florida International University, USA

**Interruption in research** 2001-2009 Parental leave with three children, in total 28 months.

**Supervision**

*PhD students* Xin Li, (2018) main supervisor, Åsa Agervald, (2010) co-supervisor, Marie Holmqvist, (2010) co-supervisor, Ellenor Devine, (2011) co-supervisor.

*Licentiate* Christoph Howe (2017) main supervisor.

*Present PhD students* Christoph Howe, (2013-2018) (main supervisor) and Adam Wegelius (2015-2019) (co-supervisor).

*Post-doctoral fellows* Dr Martin Ekman 2011-2012, Dr Anja Nenninger 2011-2013, Dr. Gustaf Sand 2012-2015, Dr. Vamsi Moparthi 2014-2016. Henna Mustila 2018-2020

*Master of Science Thesis* I have supervised 20 MSc thesis projects in biology, biotechnology and chemistry, 2008-2018.

**External funding and awards**

2017 Grant from NordForsk for Nordic Centre of Excellence project “Towards versatility of aquatic production platforms: unlocking the value of Nordic bioresources” (NordAqua), co-PI, total 30 MNOK

2017	Grant from the Swedish Energy Agency “Light-induced couplings of bio-generated gaseous hydrocarbons to liquid jet fuels, co-applicant, tot. 5.5 MSEK
2017	Grant from Magnus Bergvall Foundation, 50 000 SEK.
2013-2016	Four years research project grant from the Swedish Energy Agency “Direkta processer för solbränsle - från naturlig till artificiell fotosyntes”, co-applicant, tot. 38 MSEK.
2015-2016	Grant from Sven and Lilly Lawski Foundation, for a 2 year postdoc 480 000 SEK.
2014	Grant from Richert Foundation for research project, 232 000 SEK.
2012	Grant from Carl Tryggers Foundation, for a postdoc, 240 000 SEK.
2011	Grant from Carl Tryggers Foundation, for a postdoc 240 000 SEK and 140 000 SEK research funding.
2008-2012	Magnus Bergvall Foundation in total, 450 000 SEK.
2006	Benzeliusbelöningen från Kungl. Vetenskaps societeten, Uppsala, Sweden.
2001-2002	Post Doc Grant from SJFR, 270 000 SEK.

### Publications in peer reviewed journals

\*= The five most important papers for the present grant application were selected to highlight my expertise The citation numbers were obtained through Google Scholar (Sept 9, 2018).

Citations 1354  
H-index 18

1. Howe C, Ho F, Nenninger A, Raleiras P, **Stensjö K.** (2018) Differential biochemical properties of three canonical Dps proteins from the cyanobacterium *Nostoc punctiforme* suggest distinct cellular functions. *J Biol Chem.* Aug 31. doi: 10.1074/jbc.RA118.002425. [Epub ahead of print] PubMed PMID: 30171072.
2. Adam Wegelius, Xin Li, Federico Turco and **Karin Stensjö** (2018) Design and characterization of a synthetic minimal promoter for heterocyst-specific expression in filamentous cyanobacteria. Accepted for publication in *PLOS One* PLoS One. 2018 Sep 11;13(9):e0203898.
3. Li X, Mustila H, Magnuson A, **Stensjö K.** (2018) Homologous overexpression of NpDps2 and NpDps5 increases the tolerance for oxidative stress in the multicellular cyanobacterium *Nostoc punctiforme*. *FEMS Microbiol Lett.* Sep 1;365(18).
4. **Stensjö K,** Vavitsas K, Tyystjärvi T. (2018) Harnessing transcription for bioproduction in cyanobacteria. *Physiol Plant* 162(2):148-155. Number of citations: 3.
5. Moparthy VK, Li X, Vavitsas K, Dzhgyr I, Sandh G, Magnuson A and **Stensjö K.** (2016) The two Dps proteins, NpDps2 and NpDps5, are involved in light-induced oxidative stress tolerance in the N<sub>2</sub>-fixing cyanobacterium *Nostoc punctiforme*. *Biochem. Biophys Acta* 1857: 1766-1776. Number of citations: 4.
6. Moirangthem LD, Ibrahim KS, Vanlalsangi R, **Stensjö K,** Lindblad P, Bhattacharya J. (2015) Molecular Cloning and Biochemical Characterization of the Iron Superoxide Dismutase from the Cyanobacterium *Nostoc punctiforme* ATCC 29133 and Its Response to Methyl Viologen-Induced Oxidative Stress. *Mol Biotechnol.* 57(11-12): 1003-9. Number of citations: 4.
7. Li X, Sandh G, Nenninger A, Muro-Pastor AM and **Stensjö K** (2015) Differential transcriptional regulation of orthologous *dps* genes from two closely related heterocyst-forming cyanobacteria *FEMS Microbiol Lett.* 362(6) Number of citations: 4.
8. \*Sandh G, Ramström M and **Stensjö K** (2014) Analysis of the early heterocyst Cys-proteome in the multicellular cyanobacterium *Nostoc punctiforme* reveals novel insights into the division of labor within diazotrophic filaments. *BMC Genomics,* 15: 1064. Number of citations: 13.
9. \*Ekman M, Sandh G, Nenninger A, Oliveira P, **Stensjö K.** (2014) Cellular and functional specificity among ferritin-like proteins in the multicellular cyanobacterium *Nostoc punctiforme*. *Environ Microbiol.* 16(3): 829-44. Number of citations: 17.

10. Moirangthem LD, Bhattacharya S, **Stensjö K**, Lindblad P, Bhattacharya J. (2014) A high constitutive catalase activity confers resistance to methyl viologen-promoted oxidative stress in a mutant of the cyanobacterium *Nostoc punctiforme* ATCC 29133. *Appl Microbiol Biotechnol* 98: 3809-3818. Number of citations: 10.
11. Englund E, Pattanaik B, Ubhayasekera SJ, Stensjö K, Bergquist J, Lindberg P. (2014) Production of Squalene in *Synechocystis* sp. PCC 6803. *PLoS One*. 13:9(3): e90270. Number of citations: 49.
12. Lindblad P, Lindberg P, Oliveira P, **Stensjö K**, Heidorn T (2012) Design, engineering and construction of photosynthetic microbial cell factories for renewable solar fuel production *AMBIO*, 41:163-168 Number of citations: 49.
13. Agervald Å, Camsund D, **Stensjö K**, Lindblad P (2012) CRISPR in the extended hyp-operon of the cyanobacterium *Nostoc* sp. strain PCC 7120, characteristics and putative function(s) *Int J Hydrogen Energy*, 37:8828-8833. Number of citations: 2.
14. Lindberg P, Devine E, **Stensjö K**, and Lindblad P (2012) The Protease HupW Cleaves the Uptake Hydrogenase in the Cyanobacterium *Nostoc* sp. strain PCC 7120. *Appl Environ Microbiol*. 78(1):273-276. Number of citations: 16.
15. \*Ekman M, Ow SY, Holmqvist M, Zhang X, vanWagenen J, Wright P and **Stensjö K** (2011) Metabolic adaptations in a H<sub>2</sub> producing cyanobacterium: Potentials and implications for biological engineering. *J Proteome Res* 10(4):1772-1784. Number of citations: 28.
16. Magnuson A, Krassen H, **Stensjö K**, Ho FM, Styring S (2011) Modeling Photosystem I with the alternative reaction center protein PsaB2 in the nitrogen fixing cyanobacterium *Nostoc punctiforme*. *BBA - Bioenergetics* 1807:1152-1161. Number of citations: 6.
17. Holmqvist M, Lindberg P, Agervald Å, **Stensjö K**, Lindblad P (2011) Transcript Analysis of the Extended hyp-operon in the Cyanobacteria *Nostoc* sp. strain PCC 7120 and *Nostoc punctiforme* ATCC 29133. *BMC Res Notes* 4:186. Number of citations: 2.
18. T Heidorn, D Camsund, H-H Huang, P Lindberg, P Oliveira, **K Stensjö**, P Lindblad (2011) Synthetic Biology in cyanobacteria: Engineering and analyzing novel functions. *Method Enzymol*. 2011;497:539-79. Number of citations: 155.
19. Camsund D, Devine E, Holmqvist M, Yohanoun P, Lindblad P, **Stensjö K** (2011) A HupS–GFP fusion protein demonstrates a heterocyst-specific localization of the uptake hydrogenase in *Nostoc punctiforme*. *FEMS Microbiol Lett* 316(2):152-9. Number of citations: 6.
20. Agervald, Å., Baebprasert, W....Incharoensakdi, A., Lindblad, P. and **Stensjö K** (2010) The CyAbrB transcription factor CalA regulates the iron superoxide dismutase in *Nostoc* sp. strain PCC 7120. *Environ Microbiol* 12: 2826–2837. Number of citations: 22.
21. Agervald Å, Zhang X, Stensjö K, Devine E, Lindblad P. (2010) CalA, a cyanobacterial AbrB protein, interacts with the upstream region of *hypC* and acts as a repressor of its transcription in the cyanobacterium *Nostoc* sp. strain PCC 7120. *Appl Environ Microbiol*. 76:880-90. Number of citations: 24.
22. Magnuson A, Anderlund M, ... Polivka T, Ott S, **Stensjö K**, Styring S, Sundström V and Hammarström L. (2009) Biomimetic and Microbial Approaches to Solar Fuel Generation. *Acc Chem Res*. 21:1899-909. Number of citations: 352.
23. Cardona T, Battchikova N, Zhang P, **Stensjö K**, Aro E.-M, Lindblad P, Magnuson A,(2009) Electron Transfer proteins in the Thylakoid Membranes of Isolated Heterocysts from the Cyanobacterium *Nostoc punctiforme*. *Biochim Biophys Acta* 1787: 252-263. Number of citations: 36.
24. Devine E., Holmqvist M., **Stensjö K.**, Lindblad P. (2009) Diversity and transcription of proteases involved in the maturation of hydrogenases in *Nostoc* sp. strain PCC 7120 and *Nostoc punctiforme* ATCC 29133. *BMC Microbiology* Mar 11;9(1):53. 14. Number of citations: 19.
25. Holmqvist M, **Stensjö K**, Lindberg P, Oliveira P, Lindblad P (2009) Characterization of the *hupSL* promoter activity in *Nostoc punctiforme* ATCC 29133. *BMC Microbiology* 11;9:54. Number of citations: 23.
26. Ow SY, J Noirel, T Cardona, A Taton, P Lindblad, **K Stensjö\*** and P C. Wright\* (2009) Quantitative overview of N<sub>2</sub> fixation in *Nostoc punctiforme* ATCC 29133 through cellular enrichments and iTRAQ shotgun proteomics. *J Proteome Res* 8: 187–198. Number of citations: 68.

27. Allahverdiyeva Y, Sairanen I, **Stensjö, K.**, Lindblad P, Aro, EM. (2008): Photosynthetic electron transport properties of an uptake hydrogenase deletion mutant of *Nostoc punctiforme* PCC 73102. In: Photosynthesis. Energy from the Sun. Allen, J.F., Gantt, E., Golbeck, J.H., Osmond, B. (eds.). Springer, Heidelberg, ISBN: 978-1-4020-6707-5, 3-5. Number of citations: 14.
28. Agervald Å., **Stensjö K.**, Holmqvist M., Lindblad P. (2008) Transcription of the extended hyp- operon in *Nostoc* sp. strain PCC 7120. *BMC Microbiol* 28:69. Number of citations: 22.
29. \*Ow, S. Y., Cardona T., Magnusson A, Lindblad, P., **Stensjö, K\***, Wright, P.C. (2008) Quantitative Shotgun Proteomics of Enriched Heterocysts from *Nostoc* sp. PCC 7120 Using 8-Plex Isobaric Peptide Tags. *J Proteome Res* 4:1615-1628. Number of citations: 113.
30. **Stensjö, K.**, Ow, S. Y., Barrios-Llerena, M., Lindblad, P., Wright, P.C. (2007) An iTRAQ-Based Quantitative Analysis To Elaborate the Proteomic Response of *Nostoc* sp. PCC 7120 under N<sub>2</sub> Fixing Conditions. *J Proteome Res* 6:621-35. Number of citations: 63.
31. Nielsen KA, Hrmova M, Nielsen JN, **Forslund K**, Ebert S, Olsen CE, Fincher GB, Møller BL (2006) Reconstitution of cyanogenesis in barley (*Hordeum vulgare* L.) and its implications for resistance against the barley powdery mildew fungus. *Planta* 223:1010-1023. Number of citations: 39.
32. **Forslund K**, Morant M, Jørgensen B, Olsen CE, Asamizu E, Sato S, Tabata S, Bak S. (2004) Biosynthesis of the nitrile glucosides rhodiocyanoside A and D and the cyanogenic glucosides lotaustralin and linamarin in *Lotus japonicus*. *Plant Physiol* 135(1): 71-84. Number of citations: 91.
33. **Forslund K**, Pettersson J, Bryngelsson T, Jonsson L. (2000) Aphid infestation induces PR-proteins differently in barley susceptible or resistant to the birdcherry-oat aphid (*Rhopalosiphum padi*). *Physiol Plantarum* 110(4): 496-502. Number of citations: 65
34. **Forslund K**, Pettersson J, Ahmed E, Jonsson L (1998) Settling behaviour of *Rhopalosiphum padi* (L.) in relation to cyanogenic glycosides and gramine contents in Barley, *Acta Agricult Scand*, Section B 48:2, 107-112. Number of citations: 9.
35. **Forslund K**, Jonsson L (1997) Cyanogenic glycosides and their metabolic enzymes in barley, in relation to nitrogen levels 101(2): 367-372. Number of citations: 28.

#### Book chapters and refereed conference contributions

Antal, T.E. Krendeleva, V.Z. Pashchenko, A.B. Rubin, **K. Stensjö**, E. Tyystjärvi, S. Ramakrishna, D.A. Los, R. Carpentier, H. Nishihara and S.I. Allakhverdiev *Photosynthetic Hydrogen Production: Mechanisms and Approaches*. N. Azbar, D. Levin (Eds.), in State of the art and progress in production of biohydrogen, Bentham Science Publishers, Canada (2012), Ch3, pp. 25–53. Number of citations: 13.

**Stensjö K**, Ow SY Global quantitative proteomic analyses of *Nostoc punctiforme* PCC 73102 under diazotrophic conditions using iTRAQ and label-free techniques 56th ASMS Conference on Mass Spectrometry (2008)

**Talks at International Conferences** 2011-2018, in total more than 20 invited lectures.

- Linnean Centre network meeting, Odalgården 18-19, Oct 2018.
- 3<sup>rd</sup> SPPS ECPI-meeting in Tromsø, 21-23 Nov, 2016. “Cyanobacteria as a platform for production”. Invited
- 2nd SPPS ECPI-meeting Sigtuna, Sweden, 2015, main organizer of conference.
- 9th European Workshop on the Molecular Biology of, Cyanobacteria, 7-11 Sept 2014 Texel, The Netherlands.
- 1st SPPS Early Career PI meeting Naantali, Finland 25-26 Nov, 2014. Invited
- ChELSI Conference, Chemical Engineering at the Life Science Interface, Sheffield; UK, 2012. Invited
- 14th Int. Symposium on Phototrophic Prokaryotes (ISPP), Porto, Portugal, 2012.
- SolarH2 workshop. Sigtuna Sweden, 2011. Invited
- ESF-EMBO conference, Spain, 2011.

**Evaluator of international research grant applications:**

- Expert Reviewer for German Federal Ministry of Education and Research (BMBF) (2018) “Taylor-made bio-based ingredients for a competitive bioeconomy2”.
- Expert Reviewer for The French National Research Agency (ANR), three applications for the panel CE20 Animal biology, plant biology, and micro-organism biology / Biotechnologies (2017).
- Expert Reviewer for German Federal Ministry of Education and Research (BMBF) (2016) “Taylor-made bio-based ingredients for a competitive bioeconomy”.
- Formas, External evaluator Dnr 2015-939 (2015)
- Binational Agricultural Research and Development Fund (BARD) Israel-US (2012)

**Associated Editor:** Journal of Integrated Omics (2011-).

**Reviewer for Journals:** Regular for: FEBS letters, Microbiology, Plant Physiology, Current Proteomics, Metabolic engineering, J Biotechnol, J Proteome Res (ACS), Proteome Sci, J Proteomics, Life, PlosONE (In total more than ten journals).

#### **External examiner PhD dissertation**

- 2010 Ralitzia Alexova, University of New South Wales, Australia
- 2010 Karin Van Elburg, University of Sheffield, UK
- 2012 Sumathy Shunmugam, University of Turku, Finland
- 2017 Linda Vuorijoki, University of Turku, Finland
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#### **Evaluation board of PhD thesis,**

Sara Beier, Uppsala University, 2010  
Johannes Sjöholm, UU, 2012  
Usman Arif, SLU, 2013  
Marcus Kjellander, UU, 2013  
Fredrik Mokvist, UU, 2014  
Jonas Roos SLU, 2014  
Frida Ståhlberg, Gothenburg University, 2014  
Shashidar Asari, SLU, 2015  
Lotta Berntzon, Stockholm University, 2015  
Denis Warshan, Stockholm University, 2017  
Diana Deyanova, Stockholm University, 2018  
Hilde-Marléne Bergman, Uppsala University, 2018,

#### **Commission of trust**

- Member of Department Board at Physiological Botany UU, 2005-2007.
- Coordinator of PhD education Dept. of Photochemistry and Molecular Science, 2007-2009.
- Member of Equal opportunity committee, UU, 2009-2011. (Chair FotoMol, UU)
- Member of the board for election of vice chancellor at Uppsala University 2011.
- Member of Steering board Junior Faculty 2007-2011: For JF-UU I have organised a number of seminars such as “how to become a docent”, “new strategies for academic careers”, “how to build a research group” and Uppsala Creativity Day 2009, 2010.
- Vice chairperson of the Equal Opportunities Committee, at the domain of Science and Technology, UU with 10% accounting, 2012-2017, where I have initiated and received funding (TekNat) for mentor programs at UU, 2012-2018.
- Member of the Board of Swedish Consortium for Artificial Photosynthesis 2012-present.
- Member of the Board for Kemiska Sällskapet Uppsala 2012-2018.
- Member of Equal Opportunity Advisory Board at Uppsala University, 2013-present
- Representative of Faculty of Science and Technology in the Equal Opportunity Advisory Board at Uppsala University 2015-2018.
- Member of the Academic Senate, at Uppsala University, 2014 –2017
- Member of the Electoral Assembly for the Faculty of Science and Technology, Uppsala University, 2014-2016

- Member of the Electoral Assembly for the Faculty of Science and Technology, UU, 2017-2019.
- Member of the Electoral Assembly for election of vice chancellor at Uppsala University, 2017.
- Chair of Equal Opportunities Committee, at the Faculty of Science and Technology, Uppsala University, 2018-2020.
- Member of the Nomination committee for the Faculty of Science and Technology, UU (2018-2019).

### **Experience of disseminating results to stakeholders/end users**

- Main-organizer of Uppsala Creativity Day (2009, 2010) a JF-UU event.
- Co-organizer of the opening of the International Year of Chemistry 2011 at Ångström Laboratory, Uppsala University.
- Main organizer of the Chemistry workshop for the society “Energy and Environment” at Biotopia, Uppsala, 26-27<sup>th</sup> March 2011.
- Invited speaker “Gymnasiedagarna” UU (2011-2012).
- Sci Fest organizer (Gröna fabriker...) 2014, 2015.
- Lectures for teachers (kemilyftet); Lectures for Secondary School students, 2007-2011.
- Supervisor of “gymnasiearbeten” in biochemistry and biotechnology, 2007-2016.
- Key invited speaker “Science Conference for Students” Uppsala University, 2013.
- Invited lecture to The Swedish Gene Technology Advisory Board “Biobränslen direkt från sol, vatten & CO<sub>2</sub>”, 2016.
- Invited science lecture for the County Administrative Board, Uppsala, 2016.
- Member of Referee Jury “Unga Forskare”, 2017.
- Expert Scientist for UpTech, Uppsala University at SciFest, Uppsala, April, 2017
- Lecture “biofuels” for the building company NCC, 2017
- Invited research lecture (Biofuels from sun and water) at ”Day of Chemistry” at Gustavianum, Uppsala, Oct, 2017
- Organizing committee for Outreach activities at “Day of Chemistry” at Gustavianum, Uppsala, Oct, 2018.
- Popular science presentation delegate from “Skara Stift” Oct, 2018.

### **Organizer of conferences**

- Chair of conference and main organizer of 2nd Scandinavian Plant Physiology Society, Early career principal investigator meeting (SPPS ECPI) in Sigtuna, Sweden, 23-24 Nov, 2015,
- Member of organization committee for 1<sup>st</sup> International solar fuels conference (ISF-1) April 26 – May 1, 2015, Uppsala, Sweden. Responsible for conference grant applications, and to attract sponsors and funding.
- Member of organization committee (Session chair) for 13th European Nitrogen Fixation Conference (ENFC), Stockholm, Sweden 2018.

### **Scientific expert in media**

#### **Television**

- Dokument inifrån: Klimaträddarna SVT2, 2007. Programserien Hållbart: Utbildnings Radion. Kunskapskanalen, 2007.
- UNT 24, Interview and science discussion, 2012.

#### **Radio**

- Vetenskapsradion: Interview to use cyanobacteria as future biofuel producers 2010.
- P4 Uppland: Interview “Researcher of the week” "Fantasin är det som begränsar vad vi kan producera", 2015,
- Forskarpodden, Uppsala University, 2015.

#### **Popular Science Journals**

- Interview for article in ERGO, UU, student journal, 2010
- UNT, 2012.

- Interview in New Horizons, UU journal, 2012:2.
- Interview in Ny Teknik: Världsklass Uppsala 4:1, 2012.
- Forskning och Utveckling 2015.
- Interview in Naturvetaren no3 2015, “Solbelysta provrör är framtidens bränslefabrik“.

Short list of the last 6 years of teaching activities (more to come, I have 25% teaching in my position)

### **Responsibilities at course program level**

Since 2016 I am the coordinator of the profile “Molecular biotechnology for production”, which runs year four and five in the molecular biotechnology engineering program. I was also involved in the establishment of the three profiles which are now implemented in the program.

### **Design and implementation of new courses at Uppsala University**

2012-2017, Molecular biotechnology for renewable energy (15hp, 5<sup>th</sup> year students on molecular biotechnology engineering program, and master students in Applied Biotechnology and Molecular biotechnology),

2018, Molecular biotechnology for production (15hp 5<sup>th</sup> year students on molecular biotechnology engineering program)

### **Course responsible teacher**

2012-2017, Molecular biotechnology for renewable energy (1KB764, 15hp, 5<sup>th</sup> year students on molecular biotechnology engineering program, and master students in Applied Biotechnology and Molecular biotechnology),

2018 Molecular biotechnology for production (1KB769, 15hp 5<sup>th</sup> year students on molecular biotechnology engineering program)

2012-2018 Teacher and examiner for Independent project for Molecular biotechnology engineering (15hp, 3d year),

### **Teaching (Lectures and seminars) in:**

Trends in Molecular Biology and Biotechnology, (15 hp, master students),

Protein biotechnology (10 hp, 4th year students),

Chemistry for renewable energy – profile course (5hp, 4th year master students),

Chemistry 1 (10hp), in Science and Technology Foundation Year Programme

Independent projects for Engineer students in:

- (i) Environmental and water engineering,
- (ii) Chemical engineering,
- (iii) Engineering physics (materials) (15 hp, 3d year),

Biochemistry with Molecular biology (34 hp, 1st year BMA -students),

Degree projects for master program in Chemistry, Molecular biotechnology/Applied biotechnology and Molecular biotechnology engineering, (30 or 45 hp, 5th year)