## Course description

| Obligatory course parameters | | |
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| 1 | Name | Course series: Future trends in sustainable plant protection: RNAi technology for insects<br>Course1 (Denmark): Future trends in sustainable plant protection in Nordic agriculture: RNAi technology for insects |
| 2 | Point (ECTS) | 5 |
| 3 | Course Level | MSc |
| 4 | Coordinator | Agroecology (Genetics also involved) |
| 5 | Course type | N/A |
| 6 | Qualification | The course aims to teach participants the principles, methods and techniques of gene silencing, how to test for side effects of the organisms generated, and how this affects insect pests, and their impact on some important cultivated plants in northern Europe. Sustainable integrated pest management (IPM) and environmental impact assessment connected to the RNAi technology will also be presented and discussed.<br><br>After the course participants, will have:<br>- learned the principle of gene silencing and how it applies to plant protection in general, and to IPM in particular<br>- learned how to design practical experiments to assess effects of the RNAi under laboratory conditions in plants and insects<br>- understood how this gene technology method can be integrated into IPM systems in Northern Europe<br>- the ability and knowledge to critically evaluate problems related to environmental/ecological impact assessment of transgenic organisms in agriculture.” |
| 7 | Academic pre-requisites | BSc in Biology or Agriculture<br>- biological sciences (including agriculture), bio-informatics, genetics, environmental sciences, agroecology, wild-life management, biology. |
| 8 | Teaching form | Lectures, practicals, self-study, discussions under supervision, assignment & presentation |
| 9 | Comments on teaching form | |
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| 10 | Period | |
| 11 | Min. no | 12 |

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| | **participants** | |
| **12** | **Max. no. participants** | 20 |
| **13** | **Language** | English |
| **14** | **Place** | Flakkebjerg RC |
| **15** | **Content** | The course will introduce you to the concept of manipulating pest insects by gene silencing/RNAi methods, and how this can be incorporated into sustainable integrated pest management systems under the conditions of northern agriculture. Special emphasis will be placed on the principles of environmental impact assessment with regard to this technology. The course starts with a preparatory module, is followed by a one-week intensive course with a combination of lectures, discussions, student presentations as well as practical sessions. After the training, two additional modules are to be completed, using the knowledge acquired at the course.<br>The exercises include how to detect effective outcome of the intended modifications, using plant and insect models, employing the standard qualitative and quantitative diagnostic methods. This will allow you to study specific subjects in more detail, as basis for analyses, data processing and reporting. |
| **16** | **Teachers** | Prof. Gabor Lövei, Aarhus University – local co-ordinator; Responsible for environmental impact assessment components of the course<br>Dr. Eva Vincze, Dept. Genetics & Molecular Biology, Aarhus Univ. – involved in lecturing on RNAi mechanisms, practical sessions<br>Dr. Giuseppe Dionisio, Dept. Genetic & Molecular Biology, Aarhus Univ. – lecturing and laboratory sessions<br>Dr. William Walker, Max-Planck Institute, Jena – lecturing in insect RNAi technology, producing background material, and involved in insect-related lab sessions<br>Prof. H. Hokkanen, Univ. Helsinki, Finland – lecturing and IPM aspects<br>Dr. I. Menzler-Hokkanen, Univ. Helsinki, Finland- co-ordinator of pre-and post-course distance learning modules, lecturing in IPM and entomological aspects of the course.<br>Prof. Velemir Ninkovic, SLU – lecturing in plant protection, IPM aspects |
| **17** | **Time: week/period** | Pre-course distance learning block, 1 April-25 April 2016:<br>Direct training week: early May 2016 – co-ordinator: G Lovei<br>Post-course distance learning block 1: 9 May - 16 May 2016, Submission of paper: 17 May to Ingeborg Menzler-HokkanenW.<br>Post-course distance learning block 2: 23 May – 30 May 2016, Submission of paper by 31 May to Dr.Walker<br>Post-course distance learning block 3: 5 -12 June 2016. Submission of paper by 15June 2016 to G. Lovei |
| **18** | **Literature** | Preparatory block literature/material:<br>1. Craig Mello, April 9, 2007, Google Technical Talks. Return to the RNAi World: Rethinking Gene Expression and Evolution https://www.youtube.com/watch?v=5ZE7o_bRekk Duration: 1 hour 8 min<br>EFSA document: RNAi report: preparing EFSA for the next generation of GMOs http://www.efsa.europa.eu/en/press/news/141204.htm<br>EFSA International scientific workshop 'Risk assessment considerations for RNAi-based GM plants'http://www.efsa.europa.eu/en/scdocs/doc/705e.pdf<br>Use of RNAi for Control of Insect Crop Pests. Luc Swevers and Guy Smagghe (2012). Ch 7 |

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| | | in: Guy Smagghe and Isabel Diaz, Arthropod-Plant Interactions. Progress in Biological Control 1410.1007/978-94-007-3873-7_7 Springer Science+Business Media B.V. 2012<br>1. Online Developmental Biology: Introduction to C. elegans Link: https://www.youtube.com/watch?v=zc1P7lGSzdU, 26 min 05 sec<br>2.Online Developmental Biology: Introduction to Drosophila Link: https://www.youtube.com/watch?v=ePBghFrPb7Y Duration: 27 minutes 48 sec<br>3. RNAi: How siRNA Molecules Inhibit mRNAs http://study.com/academy/lesson/sirna.html Course: Basic Genetics, By Betsy Chesnutt<br>Below the video please find the lesson transcript. Duration: 7 minutes<br>4. Nature Video, RNA interference (RNAi): by Nature Video, 5min 6 sec https://www.youtube.com/watch?v=cK-OGB1_ELE<br>5. Larval RNA Inference in the Red Flour Beetle, Tribolium castaneum http://www.jove.com/video/52059/larval-rna-interference-in-the-red-flour-beetle-tribolium-castaneum<br>6. RNAi Interference by ds RNA Injection into Drosophila Embryos http://www.jove.com/video/2477/rnai-interference-by-dsrna-injection-into-drosophila-embryos<br>Andow DA, & al. 2013. An ecologically-based method for selecting indicators for environmental risk assessment of genetically-engineered plants *Journal of Biosafety* 22, 141-156.<br>Andow DA, Lövei GL, Arpaia S. 2006.Bt transgenic crops, natural enemies and implications for environmental risk assessment. *Nature Biotechnology* 24, 749-751.<br>Lövei GL, Bøhn T, Hilbeck A. 2010. *Biodiversity, ecosystem services and genetically modified organisms.*Third World Network Biotechnology & Biosafty Series No. 10. Third World Network, Penang, Malaysia. ISBN 978-5412-13-4, 34 pp.<br>Incarbone, M. , Dunoyer, P. 2013. RNA silencing and its suppression: novel insights from in planta analyses. Trends in Plant Science 18: 382-392.<br>Carmen Simón-Mateo, C. , García, J-A. 2011. Antiviral strategies in plants based on RNA silencing. Biochimica et Biophysica Acta 1809: 722–731.<br>Hokkanen H. 2015. Integrated pest management at the crossroads: science, politics, or business (as usual)? Editorial. Plant-Animal Interactions, in press<br>Additionally, the NOVA application contains funding request to complete an e-book on RNAi in insects, parts of which have already been used in previous training in Helsinki, and can be used for the course. |
| **19** | **Selection possibilities** | |

| **Selection possibilities (form of exam)** | | |
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| **20** | **Censoring** | none |
| **21** | **Evaluation** | pass/fail |
| **22** | **Bemærkninger** | Participants have to present their homework assignment, oral discussion of presentation |
| **23** | **Forudsætninger for prøvedeltagelse** | Timely submission of pre-course assignments, personal participation at the one-week training |

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| | | course |
| **Prøveelement:** | | |
| **24** | **Form of exam** (Valgmulighed) | Presentation of personal assignment, participation at course & discussions |
| **25** | **Præcisering af eksamensform** (Kaldenavn) | N/A |
| **26** | **Preparation time** | N/A |
| **27** | **Exam length** | N/A |
| **28** | **Types of help at exam** | N/A |

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| *3: | Hvilken uddannelse er kurset primært knyttet til/udsprunget af? |
| *4: | Hvilket institut udbyder kurset? |
| *5: | Benyttes kun til sommerkursus, weekendkursus o.lign. |
| *6: | Her beskrives 1) formålet med kurset og 2) læringsmål efter solotaksonomien |
| *8: | Vælg imellem: Forelæsning, Holdundervisning, Praktisk, Selvstudium, Vejledning |
| *9: | Fx ”forelæsninger (2+2t/uge), holdøvelser (3t/uge)” eller ”der er ekskursion i uge 46, medbring vaders” eller ”kursushjemmeside” |
| *10: | Vælg kvarter |
| *11: | Anvendes deltager minimum skal udvælgelseskriterium angives |
| *12: | Anvendes deltager maksimum skal udvælgelseskriterium angives |
| *13: | Angiv undervisningssprog, på kandidatkurser angives oftest på engelsk |
| *14: | Angiv undervisningssted |
| *15: | Beskriv kursets indhold |
| *17: | Angiv timer pr. uge (evt. i antal uger (ca.)) |
| *18: | Den anvendte litteratur |
| *19: | Hvis der er tilknyttet flere valgmuligheder (eksamensformer) til kurset: Hvilke(n) valgmulighed(er) (eksamensformer) skal udbydes i det konkrete udbud? |
| *20: | Vælg imellem: Intern censur, ekstern censur (ingen censur = undervisningsdeltagelse) |
| *21: | Vælg imellem: 7-trinsskala, bestået/ikke bestået |
| *22: | Fx ”multiple choice” eller ”mundtligt eksamen på baggrund af rapport”<br>Her kan også angives tilladte hjælpemidler<br>Her angives også eksamensterminer |
| *23: | Fx ”aflevering og godkendelse af fem obligatoriske opgaver” |
| *24: | Vælg imellem: Hjemmeopgave, Mundtlig, PC, Praktisk, Skriftlig, Undervisningsdeltagelse |
| *25: | Vælg imellem: Bunden hjemmeopgave, Fri hjemmeopgave, Bunden mundtlig prøve, Fri mundtlig prøve (bruges formentlig aldrig), Skriftlig tilsynseksamen, Skriftlig tilsynseksamen m PC, Praktisk, Undervisningsdeltagelse |
| *26: | Hvis relevant: angiv tid til forberedelse |
| *27: | Angiv eksamens længde |
| *28: | Vælg imellem: Alle, ingen, anviste, PC |