SECOND INTERNATIONAL MEETING OF ACADEMIC INSTITUTIONS AND ORGANIZATIONS INVOLVED IN BIOSAFETY EDUCATION AND TRAINING
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EDUCATION AND TRAINING IN BIOSAFETY: STRATEGIES FOR PROMOTING THE DEVELOPMENT AND/OR EXPANSION OF ACADEMIC PROGRAMMES IN BIOSAFETY PARTICULARLY AT THE DEGREE AND DIPLOMA LEVEL

Note by the Executive Secretary

I. INTRODUCTION

1. In its decision BS-III/3, paragraph 11, the Conference of the Parties serving as the meeting of the Parties to the Cartagena Protocol on Biosafety (COP-MOP) emphasized the need to develop core expertise in biosafety, *inter alia*, through training-of-trainers programmes, long-term formal training and/or attachment of personnel to specialized institutions or centres of excellence.

2. In paragraphs 16 and 17 of decision BS-III/11, the Parties to the Protocol specifically encouraged Parties and other Governments to invite universities and colleges to develop and/or expand degree-granting programmes that focus on training biosafety professionals. It also encouraged the development of exchange and scholarship programmes for biosafety.

3. A number of biosafety capacity-building project evaluation reports have also highlighted the need to promote formal education and training in biosafety. For example, the evaluation report of the Global Environment Facility (GEF) support to biosafety, which was published in 2006, noted that biosafety is a highly technical and specialized area in which systematic and longer term training of staff is required.1 It further noted that at the global level most of the recent human resources development activities have focused on short term (one week) intensive specialists' training workshops whose coverage is often general and introductory in nature. It concluded that ultimately more specialized types of collegiate and postgraduate training will be needed in many countries. In this regard, one of the five core recommendations of the report was that the GEF should consider providing longer term training for building and sustaining specialist capacity in areas such as risk assessment and risk management.

4. Furthermore, a report on the "Assessment of Ongoing Efforts to Build Capacity for Biotechnology and Biosafety" which was conducted by the United Nations University Institute of Advanced Studies (UNU-IAS) between 2005-2006, noted that there are few projects that support long term training in biosafety. Accordingly, one of its recommendations is to put more focus on long term training and support. It also underscores the need to assess the actual depth of training required by

1/ See copy of the report at: http://gefweb.org/Documents/Council_Documents/GEF_C28/documents/GEFME_C28-Inf1-Biosafety.pdf

/…

countries and to allocate adequate funds and time to explore creative and effective ways of promoting "training of trainers" and "learning by doing" approaches.

5. This paper describes the current status of biosafety education and training, including a review of existing biosafety-related courses. It highlights key issues/questions that need to be considered in developing programmatic and institutional strategies to assist relevant universities and institutions to develop and/or expand academic programmes in biosafety, particularly at the degree and diploma level. Finally, the paper proposes the development of regional programmes to assist interested universities and relevant institutions to develop academically-accredited biosafety courses and/or to improve the scope, quality and delivery of existing courses, taking into account the needs and priorities of countries.

II. THE CURRENT STATUS OF BIOSAFETY EDUCATION AND TRAINING: A REVIEW OF EXISTING BIOSAFETY COURSES

6. Biosafety is a relatively new field of academic study. Currently, there are few formal academic programmes/courses in biosafety relating to living modified organisms (see examples of existing biosafety courses in Annex 1). According to the information available in the compendium of biosafety courses, which is accessible through in the Biosafety Clearing-House2, currently there are twenty nine (29) known biosafety courses being offered on a regular basis. These include two dedicated masters-degree programmes in biosafety, namely:

(a) Masters Degree in Biological Safety at the National Center for Biological Safety and the Faculty of Biology, University of Havana (Cuba); and

(b) International e-Masters Course in Biosafety in Plant Biotechnology at the Institute of Plant Biotechnology for Developing Countries (IPBO), Ghent University (Belgium), supported though a technical cooperation project under the aegis of the United Nations Industrial Development Organization (UNIDO).

7. In addition, there are three Masters degree programmes and one doctoral programme which include a number of biosafety-related courses units. These are:

(a) Master of Arts in Biotechnological Law and Ethics (MABLE) at the Faculty of Law, University of Sheffield (UK); and

(b) Master of Laws (LL.M.) in Biotechnology and Genomics at Arizona State University (USA);

(c) Master's Programme in Agrobiosciences offered by the AGROMIP Toulouse Agri Campus in France ; and

(d) Doctoral programme in Advanced Plant Biotechnology at Moi University (Kenya) which, *inter alia*, covers the following areas: gene structure and function, prokaryotic and eukaryotic genes, genetic engineering (cDNA, genomic libraries, gene transfer, transgenic organisms), environmental implications of GMOs, biosafety regulations, intellectual property rights, social and economic implications of global biotechnology and bioethics.

8. Furthermore, four universities are offering 12-month post-graduate diplomas in biosafety, with support from a technical cooperation project under the aegis of the United Nations Industrial Development Organization (UNIDO). These include: (i) the Pontifical Catholic University of Minas Gerais (PUC Minas) in Brazil, (ii) Universidad de Concepción (UDEC) in Chile, (iii) Ancona Marche

2/ The Compendium of Academically-Accredited Biosatety Courses can be accessed through the BCH at: http://bch.biodiv.org/capacitybuilding/programmes.shtml

Polytechnic University in Italy and University of Malaya (UM) in Malaysia. InWEnt (Capacity Building International, Germany), an agency of the German Federal Government, also offers a 12-month International Training Course on Development-oriented Plant Biotechnology and Biosafety.[3]

9. There are also several institutions offering short-term intensive biosafety courses that are not necessarily part of a degree or diploma programme. They range from 1 week to 3 months and lead to an award of a certificate of attendance. Examples include the :

(a) Genøk Course: Holistic Foundations for Assessment and Regulation of Genetic Engineering and Genetically Modified Organisms by the Norwegian Institute of Gene Ecology (Genøk) and University of Tromsø (2 weeks and the new online course - 20 weeks/300 hours);

(b) Interdisciplinary Course in Biosafety for Francophone Africa (CIBAF) in Mali offered by the University of Bamako and the Biosafety Interdisciplinary Network (RIBios) – 3 months;

(c) GM crops risk analysis assessment and evaluation protocols course run by the Natural Resources Institute and the Law Department, University of Greenwich (3 weeks);

(d) International Short Course in Environmental Aspects of Agricultural Biotechnology, Michigan State University, Institute of International Agriculture (2 weeks);

(e) Summer course on Biosafety Assessment and Regulation of Agricultural Biotechnology, Institute of Plant Biotechnology for Developing Countries (IPBO), Ghent University (2 weeks).

10. Other universities are offering course units on biosafety as part of a graduate degree program in other fields such as agronomy, environmental studies, etc. Examples include: (i) Biosafety Science and Policy course unit offered by the Institute for Social, Economic, and Ecological Sustainability at the University of Minnesota; and (ii) the Biosafety and Intellectual Property Rights course unit (35 hours) offered by the Department of Biochemistry, Kenyatta University.

11. From the brief review above, it is clear that the majority of existing biosafety training programmes (60%) are short-term intensive courses, either in biosafety generally or in specific specialized fields of biosafety, and a large number of them are project-driven (i.e have been developed as part of specific projects). Few universities offer specialized or multidisciplinary degree or diploma programmes in biosafety. There is a need to encourage and support more universities and relevant institutions to start such programmes. The following sections highlight key programmatic and institutional issues and strategies that may be taken into account in this endeavour.

III: PROGRAMMATIC AND INSTITUTIONAL STRATEGIES FOR PROMOTING GRADUATE EDUCATION AND TRAINING IN BIOSAFETY

A. Programmatic considerations

12. There are a number of programmatic and institutional issues that need to be considered during the process of developing and/or expanding academic programmes in biosafety, particularly at the degree and diploma level. These include, *inter alia*, curriculum development, programme delivery, course evaluation and accreditation and quality control. Some of the key questions that need to be addressed from a programmatic point of view include the following:

(a) What is the level of demand for biosafety professionals?

3/ See details at: http://www.biodivnet.de/training.shtml

(b) What type of biosafety professionals are there (i.e. multidisciplinary experts, specialized professionals or technicians, etc.,)?;

(c) What should be taught (i.e. the syllabus/curriculum, including the core courses and electives, etc., - the content and scope of training required for one to qualify as a biosafety professional)?;

(d) To whom and by whom (i.e. target groups/learners and instructors, admission requirements, etc.,)?;

(e) At what level (i.e. technical, undergraduate, post-graduate: certificate, diploma, masters, doctoral and post-doctoral)?;

(f) How should it be taught?

(i) Delivery system (conventional residency/on-campus, distance/online, sandwich, etc.,);

(ii) Method (theoretical lectures, practical sessions, field visits or institutional attachments/ internships); and

(iii) Format (modular, non-modular, seminar); part of a degree program or standalone offering, etc.;

(g) When and over what period of time (duration, demarcation, time-table, etc.,)?;

(h) What type and system of accreditation should be adopted (certificate of attendance, professional certificate, diploma, Bachelor's degree, postgraduate certificate, postgraduate diploma or postgraduate degree, etc.,)?;

(i) What are the general objectives and expected outcomes of the programmes (level of knowledge, skills and competences to be acquired by the students)?

13. The development of an appropriate curriculum is one of the most critical elements in the process of developing and/or expanding academic programmes in biosafety. It is important to define core courses which all students pursuing a biosafety degree or diploma programme should be required to complete. Currently, most of the biosafety degree or diploma programmes provide a list of courses that have to be completed and many of them do not offer electives (see Annex 2). It is useful for different institutions offering biosafety degree and diploma programmes to agree upon a set of core courses that students would be required to complete while also making provision for optional courses from which students could choose in order to develop specific specializations (e.g. biosafety law, risk assessment, risk management, LMO detection, etc.) It is also important to have curricula and course materials peer-reviewed by a broad range of relevant experienced professionals and practioners in order to give greater credibility to the program.

14. It is essential to define clear minimum qualifications for admission to the programmes. Most of the current biosafety programmes target people with basic scientific or technical education in relevant fields. Many of them require students to have a diploma or undergraduate degree in relevant fields, e.g. life sciences (biology, bio-engineering, etc.), agronomy, law or social sciences as the minimum prerequisite for admission.

B. Institutional considerations

15. In addition to the programmatic issues highlighted above, a number of institutional aspects also need to be considered during the process of developing academic programmes in biosafety. An effective

academic programme not only requires well drawn-up course content and structure (curriculum) but also efficient and cost-effective delivery mechanisms. It also requires competent faculty, adequate infrastructure (facilities and equipment) and other resources.

16. Some of the key questions related to institutional issues that need to be considered in developing biosafety education and training programmes include the following:

(a) What are the most cost-effective delivery mechanisms (distance, sandwich, conventional, etc.)?

(b) What approaches could be taken? – e.g. expanding existing courses to include modules on biosafety, developing new standalone biosafety degree/diploma courses or both approaches depending on the situation of particular countries or regions;

(c) What are the resource requirements?

(i) Faculty and staff;

(ii) Facilities/ infrastructural requirements;

(iii) Course materials; and

(iv) Financial assistance (e.g. scholarships/ fellowships) for students;

(d) How can the programmes be sustained (sources of funding, sustainable resource mobilization mechanism, etc.)?

17. Participants are invited to consider the issues and questions highlighted above during their discussions on possible strategies for developing and/or expanding academic programmes in biosafety and make recommendations to assist interested universities and relevant institutions.

IV: REGIONAL PROGRAMMES TO PROMOTE GRADUATE EDUCATION AND TRAINING IN BIOSAFETY

18. In order to fast-track the development of academically-accredited biosafety courses in developing countries, it is necessary to mobilize funding and other resources to assist universities and relevant institutions that are interested and have the basic infrastructure to start such courses. In this regard, it is proposed that specific programmes/networks should be developed at the regional or subregional level.

19. The purpose of the regional programmes will be to catalyse, support and coordinate the development of degree programs in biosafety in institutions or universities of specific regions or subregions (including Africa, Asia-Pacific, Central and Eastern Europe and Latin America and the Caribbean). The programmes will assist participating universities and institions to develop joint curriculum for the biosafety courses through regional collaboration. The programmes will also help to foster linkages between the participating institutions and to facilitate in the exchange of faculty, joint instruction and supervision of students as well as the joint development and sharing of training materials.

20. A regional approach to promote the development and strengthening of biosafety academic programmes presents a number of benefits. For example, it will facilitate collective mobilization of resources and increase the visibility of the initiatives. It will also increase the pool and diversity of expertise and resources available to develop and deliver the courses. Furthermore, it will increase cost-effectiveness (e.g. through the joint development and sharing of course materials).

21. Participants are invited to discuss the feasibility and modalities of developing the programmes referred to above for the different regions. They are also invited to identify a lead institution and contact person(s) in each region to spearhead and coordinate the development of the programmes.

VI. CONCLUSION AND RECOMMENDATIONS

22. From the foregoing review, it is clear that currently there are few universities and institutions offering academically-accredited programmes in biosafety at the graduate, post-graduate degree or diploma level. A large number of the current training programmes are short-term and many of them are project-driven. There is a need for a concerted effort to foster the development of new biosafety degree and diploma programmes and/or expand existing ones. In this regard, this paper has proposed that regional programmes/initiatives should be developed to assist interested universities and relevant institutions to develop academically-accredited biosafety courses and/or to improve the scope, quality and delivery of existing courses. The paper has also highlighted key programmatic and institutional issues and strategies that would need to be taken into account in the development of those programmes.

23. Participants are invited to discuss and make recommendations on the issues highlighted in the paper, in particular the following:

(a) Modalities of promoting the development of academic programmes in biosafety, particularly at the degree and diploma level, and/or the expansion of existing ones (e.g. through regional initiatives/networks, twinning arrangements, etc);

(b) Curricula for degree and diploma programmes in biosafety, i.e. core course modules and possible electives for specific specializations;

(c) Programme delivery mechanisms and their pros and cons (including conventional residency courses, online/distance courses, etc.,);

(d) Resource requirements, including strategies for identifying and sharing experienced faculty and for mobilizing financial and technical resources; and

(e) Designation of a lead institution and contact person(s) in each region to spearhead and coordinate the development of the regional programmes to promote the development of biosafety degree and diploma courses.

ANNEX 1: A SAMPLE LIST OF EXISTING BIOSAFETY COURSES

GRADUATE AND POSTGRADUATE DEGREES/DIPLOMAS COURSES

Name of Institution/Venue	Title of Course	Duration of Course	Contact Point
1. Moi University, Kenya	Doctoral Programme in Advanced Plant Biotechnology; Courses covered: gene structure and function, prokaryotic and eukaryotic genes, genetic engineering (cDNA, genomic libraries, gene transfer, transgenic organisms), environmental implications of GMOs, biosafety regulations, intellectual property rights, social and economic implications of biotechnology and bioethics	N/A[4]	N/A
2. AGROMIP Toulouse Agri Campus, France	Master's Programme in Agrobiosciences (http://www.agromip.educagri.fr/perdu/?Langue=en&Page=srm&Num_Rub=&NoContenu)	2 years	Prof. Alain Boudet agromip@educagri.fr, toulouseagricampus@educagri.fr
3. University of Sheffield, Sheffield, UK	Master of Arts in Biotechnological Law and Ethics (http://www.mable.group.shef.ac.uk/)	1 year (full-time); 2 years (part time)	Ms Lilian Bloodworth L.Bloodworth@sheffield.ac.uk
4. Arizona State University, Tempe, USA	Master of Laws (LL.M.) in Biotechnology and Genomics (http://www.law.asu.edu/?id=8874)	1 year (full-time); 3 years (part-time)	Lewis Hutchison LLM-MLS.ADMISSIONS@ASU.EDU
5. Università Politecnica delle Marche, Ancona, Italy – Distance learning (online)	Second level distance learning Master in Biosafety in Plant Biotechnology (academic year 2006-2007) (http://ingweb.unian.it/Agraria/Engine/RAServePG.php/P/2769130200/M/2770130214)	46 weeks	Prof. Bruno Mezzetti b.mezzetti@univpm.it
6. University of Havana, Cuba	Masters Degree in Biological Safety	N/A	Dr. Esther Pelegrino Argote esther@cnsn.cu
7. University of Canterbury, Christchurch, New Zealand	Full Undergraduate to PhD level degree Programme in Biosafety/ Biosecurity	Full-time or part-time	Mr Jack Heinemann jack.heinemann@canterbury.ac.nz
8. Universidad de Concepci¢n, Chile	UNIDO Biosafety Diploma by Distance Learning (http://binas.unido.org/wiki/index.php?title=Universidad_de_Concepción_%28UDEC%29%2C_Chile)	1 year	Dra. Sof¡a Valenzuela sofvalen@udec.cl
9. University of Malaya (UM), Kuala	UNIDO Biosafety Diploma by Distance Learning (http://binas.unido.org/wiki/index.php?title=University_of_	1 year	Prof Rofina Yasmin Othman cebar@um.edu.my

[4] N/A = Not available

Name of Institution/Venue	Title of Course	Duration of Course	Contact Point
Lumpur, Malaysia	Malaya_%28UM%29)		
10. Instituto Superior De Tecnologias Y Ciencias Aplicadas, Havana, Cuba	Diplomado: Bioseguridad En El Diseno De Instalaciones Con Riesgo Biologico	N/A	Ing. Jose Rodriguez Duenas jrdguez@infomed.sld.cu
11. Ghent University, Institute of Plant Biotechnology for Developing Countries (IPBO), Ghent, Belgium	Postgraduate Certificate in Biosafety in Plant Biotechnology by Distance Learning (http://www.ipbo.ugent.be/activities/education/posgraduation.html)	1 year	Sylvia Burssens Sylvia.Burssens@UGent.be
12. University of Leeds, Leeds, UK	Training and Research in "Biotechnology and Development of Biosafe GM Crops" (http://www.plants.leeds.ac.uk/studentships.html)	N/A	Mrs R.A.E Wilkinson r.a.e.wilkinson@leeds.ac.uk
13. Burapha University, Chonburi, Thailand	Biosafety Science of Biotechnology[5]	1 semester	Dr. Wansuk Senanan wansuk@buu.ac.th
14. Kenyatta University, Nairobi, Kenya	Biosafety and Intellectual Property Rights	35 hours	Mr. Jesse Machuka machuka@mitsuminet.com

Short-term/Certificate Courses

Name of Institution/Venue	Title of Course	Duration of Course	Contact Point
15. InWEnt – Internationale Weiterbildung und Entwicklung (Capacity Building International, Germany), Leipzig-Zschortau, germany	International Training Course on Development-oriented Plant Biotechnology and Biosafety (http://www.biodivnet.de/training.shtml)	12.5 months	N/A
16. Norwegian Institute of Gene Ecology (GenØk), Tromso, Norway	Online Course: Holistic Foundations for Assessment and Regulation of Genetic Engineering and Genetically Modified Organisms, August 2007 (http://www.genok.org/english/lesartikkel.asp?article_id=1412&id2=cghIAJ2gFt5S7EsIMJYsrG5vC)	300 hours; Duration: 20 weeks; Term: Autumn 2007[6]	Mrs. Katrine Jaklin katrine@genok.org; biosafety@genok.org
17. Université de Bamako; Biosafety Interdisciplinary Network (RIBios), Bamako, Mali	Cours interdisciplinaire en biosecurite pour l'Afrique Francophone - Gestion durable des biotechnologies et de l'agrobiodiversité (http://www.ribios.ch/en/formation/index.html)	360 hours lasting 3 months[7]	Mr Andrea Zaninetti andrea.zaninetti@iued.unige.ch

[5] Bachelor's & postgraduate degrees

[6] European Community Course-Credit Transfer System (ECTS) credits: 10

[7] Offers a certificate and a postgraduate certificate.

Name of Institution/Venue	Title of Course	Duration of Course	Contact Point
18. University of Minnesota, Institute for Social, Economic and Ecological Sustainability (ISEES), St. Paul, Minnesota, USA	Biotechnology & Governance Program (http://fwcb.cfans.umn.edu/ISEES/biotmain.html)	1 semester	Dr. Anne R. Kapuscinski kapus001@umn.edu; isees@umn.edu
19. Vienna Biocenter (VBC), University of Vienna, Austria	Ecological implications of (genetic) biotechnology. Food production systems and risk assessment (http://online.univie.ac.at/pers?zuname=haslberger)	2hrs/ week, 15 weeks	Mr. Alexander Haslberger alexander.haslberger@univie.ac.at
20. University of Greenwich, Greenwich, UK	GM crops risk analysis assessment and evaluation protocols (http://www.nri.org/study/shortcourses.htm)	3 weeks	Dr. Susan Seal s.e.seal@gre.ac.uk
21. Norwegian Institute of Gene Ecology (GenØk) and University of Tromsø, Tromsø, Norway	Holistic Foundations for Assessment and Regulation of Genetic Engineering and Genetically Modified Organisms (http://www.genok.org/english/lesartikkel.asp?article_id=1517&id2=gbrGBBMxrx6rlSAvKwY39VIhV)	2 weeks	Ms. Katrine Jaklin katrine.jaklin@genok.org
22. Ghent University, Institute of Plant Biotechnology for Developing Countries (IPBO), Ghent, Belgium	Third summer course on Biosafety Assessment and Regulation of Agricultural Biotechnology (2006) (http://zephyr.ugent.be/courses/IPBO1/)	2 weeks	Dr. Nancy Terryn nancy.terryn@UGent.be, General: IPBO@psb.ugent.be
23. University of Minnesota, Institute for Social, Economic and Ecological Sustainability (ISEES), St. Paul, Minnesota, USA	Biosafety Science and Policy (http://fwcb.cfans.umn.edu/isees/courses/suststudy.htm)	45 hours in class[8]	Dr. Anne R. Kapuscinski kapus001@umn.edu; isees@umn.edu
24. Michigan State University, East Lansing, Michigan, USA	An International Short Course in Food Safety (http://www.iia.msu.edu/foodsafety-course05.htm)	1 week	Dr. K.M. Maredia kmaredia@msu.edu
25. Michigan State University, Institute of International Agriculture (IIA), , East Lansing, Michigan, USA	Biosafety - An International Short Course in Environmental Aspects of Agricultural Biotechnology	1 week	Dr. C. Weebadde weebadde@msu.edu Dr. K.M. Maredia kmaredia@msu.edu
26. Centre for Plant Sciences (CPS), University of Leeds, Leeds, UK	GM crops: Their detection, regulation & monitoring in the developing world	N/A	Prof. H.J. Atkinson H.J.Atkinson@leeds.ac.uk
27. Utah State University, Logan, USA	Biotechnology and Bioprocessing Training Program (http://www.biosystems.usu.edu/education/)	N/A	Ms Pamela Garcia pamk@cc.usu.edu
28. Gene Research Center, University of Tsukuba, Japan	Biotechnology-Biosafety Courses at the University of Tsukuba	N/A	Mrs. Ito Kazuko itkadu@sakura.cc.tsukuba.ac.jp

[8] Three course credits and grade; professional 'continuing education' credit possible.

ANNEX II

COURSE CONTENT OF SELECTED BIOSAFETY COURSES

POST-GRADUATE PROGRAMMES

1. **Masters Degree in Biological Safety, organized by the National Center for Biological Safety and sponsored by the Faculty of Biology of the University of Havana, and the Institute of Sciences and Nuclear Technologies**

- 655 hours (compulsory courses: 530 Hrs. and optional courses: 125 hrs) over 2 years
- The program encompasses 10 general courses (three of which are optional) and a thesis

Course coverage

- Current situation of biosafety in Cuba, and around the world, challenges and perspectives
- Projection to safety in biotechnology
- Three modules on human health, animal health and plant protection
- Management system in biosafety
- Biological risk analysis and risk management
- Legal aspects of biosafety
- Information access and public participation
- Elective courses (3)

2. **International e-Masters Course in Biosafety in Plant Biotechnology, Institute of Plant Biotechnology for Developing Countries (IPBO), Ghent University (Belgium)** in collaboration with the United Nations Industrial Development Organization (UNIDO)
http://www.ipbo.ugent.be/activities/education/posgraduation.html

Course modules
http://www.opleidingen.ugent.be/studiegids/2006/EN/FACULTY/WE/PGOP/CYBIOS/INDEX.HTM
http://www.opleidingen.ugent.be/studiegids/2006/EN/FACULTY/WE/PGOP/CYBIOS/000102/INDEX.HTM

- Introduction to plant biotechnology and its applications for agriculture and industry
- Theoretical and Practical Foundations of Biological Risk Assessment
- The basics of risk assessment and regulatory structures
- Food and feed safety assessment
- Environmental safety assessment
- Overview of national and international regulatory systems
- Risk perception and risk communication

3. **Post-graduate Diploma in Biosafety by Distance Learning offered by each of the following institutions, in collaboration with the United Nations Industrial Development Organization (UNIDO):** http://binas.unido.org/wiki/index.php/Main_Page

(a) Pontifical Catholic University of Minas Gerais (PUC Minas), Brazil
(b) Universidad de Concepción (UDEC), Chile
(c) Ancona Marche Polytechnic University, Italy
(d) University of Malaya (UM), Malaysia

Course content

- Introduction to Molecular Biology

- Applications of Biotechnology
- Food and feed safety
- Environmental safety
- National and international regulatory systems
- Risk assessment methods and applications
- Risk perception and risk communication
- Biotechnology applied to human and animal health
- Ethics in Science
- Intellectual Property

4. International Training Course on Development-oriented Plant Biotechnology and Biosafety offered by InWEnt (Capacity Building International, Germany) - 12 months

Course content

- Overview of the state-of-the-art methods and techniques used in biotechnology and biosafety
- Practical training in state-of-the-art methods and techniques used in biotechnology and biosafety, including Laboratory quality control and safety standards, Cell and molecular biology, tissue culture methods, methods of meristem preparation, micro-propagation, use of bioreactors, somatic embryo genesis, embryo rescue techniques, biochemical methods of analysis, DNA extraction and isolation, isotope methods, detection and diagnosis of plant pathogens, molecular markers and biosafety monitoring methods.
- Insights into biotechniology and genetic engineering in Germany
- Dealing with frame-conditions of biotechnology, genetic engineering and biosafety
- Improving management competence and teamwork ability skills

SHORT-TERM COURSES

1. Certificate of Ongoing Training in Biosafety (CFCB), Faculty of Sciences, University of Geneva (3 months): http://www.ribios.ch/en/formation/course_switzerland.html

Course modules

- Introduction à la biosécurité et aux biotechnologies
- Applications des OGM dans l'agriculture et l'alimentation
- Applications du génie génétique dans les domaines industriels et pharmaceutiques
- Réglementations nationales et internationales (agriculture/alimentation/pharma)
- Droits de propriété intellectuelle et responsabilité
- Traçabilité, étiquetage et droit à l'alimentation
- Analyse économique des biotechnologies
- Impact des biotechnologies sur l'éthique (principe de précaution, vision du monde)
- Approche interdisciplinaire des risques et de l'expertise – Participation citoyenne aux choix scientifiques et techniques

2. Interdisciplinary Course in Biosafety for Francophone Africa (CIBAF) in Mali, University of Bamako and the Biosafety Interdisciplinary Network (RIBios) – 3 months

Course modules

- Introduction à la biosécurité et aux biotechnologies
- Risques et avantages des plantes transgéniques, méthodes de détection
- Système et filière de production des semences paysannes et des semences transéniques

- La réglementation internationale : aspects de biodiversité, biosécurité et commerce
- Etude comparée des réglementations nationales
- Droits de propriété intellectuelle, accès aux ressources phytogénétiques et régime de responsabilité
- Implications éthiques et culturelles des biotechnologies
- Participation citoyenne et démocratisation des choix technologiques
- Aspects économiques des biotechnologies et de la biosécurité,

3. **GenØk Online Course: Holistic Foundations for Assessment and Regulation of Genetic Engineering and Genetically Modified Organisms (GMO biosafety),** by the Norwegian Institute of Gene Ecology (Genøk) and University of Tromsø; - 20 weeks (300 hours), http://www.genok.org/english/lesartikkel.asp?article_id=1412&id2=cghIAJ2gFt5S7EsIMJYsrG5vC http://www.e-newsmailer.com/uploads/76.w3X4wDdfl9sIBzsAZqC938oLP/biosafe_Course%20des.doc

- Holistic overview of genetics, genes and gene expression
- Genome sequencing, bioinformatics and functional genomics
- Horizontal gene transfer (HGT) from GMOs
- Various application areas for genetic engineering
- Various risk areas connected to GE applications/GMOs
- Economic and legal aspects of GE applications/GMOs
- Socio-cultural, ethical, and political issues in GE applications/GMOs
- Policy and regulatory issues, including capacity building and biosafety implementation
- Future and emerging GE applications
- Alternatives to GE/GMO applications and gene ecology
- Risk assessment review practicals of actual GMO applications

Module 1
Introduction to context and issues of the course.
- The Cartagena Protocol.
- Foundations of gene ecology
- The " holistic corridor"

Module 2
Introduction to genomics and molecular biology.
- The structure of DNA
- Function of genes and genomes
- The fall of the central dogma; DNA-RNA-protein
- Epigenomics
- Ethical perspectives on the science underpinning genetic engineering

Module 3
Biodiversity as source of genetic resources
- The ecosystem as a donor and recipient of genes
- Implications of intellectual property rights
- Genomics, commercialization and environmental knowlegde
- Biodiversity usage and the rights of indigenous peoples and local communities

Module *4*
Genes, DNA and vectors

- Methods for recombinant DNA technology and genetic engineering
- Changes in the genome, transcriptome, proteome and epigenome
- Horizontal and vertical gene transfer –where and how
- Present and potential future GMO and genetic engineering applications
- Risk concerns and knowledge gaps

Module 5
Risk assessment issues

- Contained use versus deliberate release of GMOs
- Ecological aspects; influence on ecosystem function and impact on biodiversity
- Health aspects; toxicology, allergenicity and cocarcinogenesis
- How to deal with risk, uncertainty and complexity

Module 6
The regulatory framework

- The precautionary principle
- Implementing sustainability, ethical and socio-economic concerns
- National biosafety policy and law
- The Cartagena Protocol on biosafety
- The WTO and other international agreements

Module 7
Risk management issues

- Monitoring strategies and methods for detecting GMOs
- The need, the methods and the mechanisms for public participation
- Biosafety forecast service

4. GM crops risk analysis assessment and evaluation protocols three week course run by the Natural Resources Institute and the Law Department, University of Greenwich

Course content

- Introduction to transgenic technologies
- Introduction to GM and Biosafety issues
- International legal and regulatory background to GMOs
- Examining international trade rules
- National legal framework for GMOs
- Analysis of current and draft legislation
- Regulating GMOs
- Action points on legislation for GMOs
- Risk assessment for release of GMOs
- Environmental risks: outcrossing, invasiveness
- Containment facilities
- Quarantine glasshouses
- Testing for GM contamination
- Procedures for release of approved GMOs
- Introductory aerobiology
- Pollen dispersal
- Case studies of suitability of GM Crops to target countries.
- Risks & Opportunities offered by GM technology for African countries

- Experiences with development and deployment of GM crops
- GM Food safety

1. Summer course on Biosafety Assessment and Regulation of Agricultural Biotechnology, Institute of Plant Biotechnology for Developing Countries (IPBO), Ghent University (2 weeks): http://zephyr.ugent.be/courses/IPBO1/

Course outline

- History of regulatory oversight in biotechnology
- Biosafety and biotechnology
- Biosafety evaluation in practice
- National biosafety framework development
- International platforms for biosafety regulation
- The EU biosafety regulations
- The Cartagena Protocol on Biosafety

1-WEEK COURSES

1. **Regional Biosafety (Biosefti) Course; August 15-23, 2005;** Honiara, Solomon Islands, conducted by New Zealand Institute of Gene Ecology (university of Canterbury) and the Island Knowledge Institute (Solomon Islands):
   http://www.inbi.canterbury.ac.nz/news/biosafety_solomons.shtml
   http://www.inbi.canterbury.ac.nz/Documents/Reports%20and%20others/website%20RBC.pdf

Course coverage

- Introduction to modern biotechnology and biosafety
- Biosafety-applied molecular biology and ecology
- Biodiversity and social impacts of GMOs
- Regulatory requirements of the Cartagena Protocol on Biosafety
- The role of public participation
- Techniques for detecting GMOs in food
- Risk identification and assesment using the GE Biosafety Forecast Service tool.

2. **South American Regional Biosafety Course: Holistic Foundations for Assessment and Regulation of Genetic Engineering and Genetically Modified Organisms (SARBioC)"; 19-24 March 2007**; Lima–Peru, organised by the Norwegian Institute of Gene Ecology (GenØk) in cooperation with the University of Tromsø, Universidad Nacional Agraria La Molina, Asociaciòn Desarrollo Medio Ambiental Sustentable (ASDMAS) and The Third World Network (TWN); http://www.genok.org/english/lesartikkel.asp?article_id=1480&id2=1jOid5GuaZs3rYKysPJMKMXCQ

   Course outline

- Introductory overview of GE
- GE/Biosafety developments in SA
- The role of science and the need for precautionary motivated research
- Genetic resources, traditional and indigenous knowledge, etc.
- Biodiversity and the rights of indigenous peoples and local communities.
- Biodiversity as source of genetic resources
- Models of science and policy.
- Transgenic organisms: Potential environmental and health impacts
- Transgenic organisms: Potential socio-economic, cultural, ethical impacts
- Principles and pitfalls of GMO detection and traceability.

- Liability and redress for damage resulting from GMOs.
- National biosafety policy, law and regulation.
- Norwegian Gene Technology Act.
- Integrating socio-economic considerations into biosafety decision making.
- Country reports.
- Cartagena Protocol on Biosafety: Rights and obligations.
- The linkage between the Cartagena Protocol, WTO and other international agreements.
- International standard setting: Codex Alimentarius, International Plant Protection Convention and OIE.

3. **International Short Course in Environmental Aspects of Agricultural Biotechnology, Michigan State University, Institute of International Agriculture**

Course outline

- Overview of Biotechnology and Biosafety Issues/Concerns Worldwide
- International Treaties/Agreements in Biosafety
- Principles of risk assessment, risk management and risk communication
- Factors Affecting Biodiversity, Invasiveness, and Gene Flow
- Possible Influences of Transgenic Crops on Non-target Organisms
- Pest Resistance Management
- Transgenic Safety Protocols and Field Testing Procedures.
- Key Elements and Components of Biosafety Systems
- Analysis and Building of Biosafety Regulatory Framework
- Economics of Biosafety - costs to develop and implement a Biosafety program and regulatory costs for GMO product approval and commercialization
- Visit to Transgenic Field Trials and Farmers growing GMOs
- Public perception, Communication and Outreach in Biosafety
- Capacity Building and Information Resources in Biosafety

4. **ICGEB Workshop "Biosafety and Risk Assessment for the Environmental Release of GMOs: Evaluation of Scientific Data in order to Produce an Environmental Impact Assessment Report",** 16-20 May 2005; ICGEB Biosafety Outstation, Ca' Tron di Roncade (TV), Italy
http://www.icgeb.embnet.org/MEETINGS/CRS05/CaTronProgramme.pdf

Course coverage

- An international perspective on GMO biosafety regulation
- National perspectives on GMO biosafety regulations
- Presentation and evaluation of dossiers on virus-resistant transgenic squash and on Bt cotton and soybean
- Gene flow studies from transgenic rice to the wild rice species Oryza glumaepatula and to weedy rice in Costa Rica.

5. **ICGEB Workshop on "Introduction to Risk Assessment for the Deliberate Release of GMOs: Assisting Decision-making in a Biosafety Framework";** 14-18 May 2007, ICGEB Biosafety Out station - Ca' Tron di Roncade, Italy; http://www.icgeb.trieste.it/MEETINGS/CRS07/BSF1_14_18_May.pdf

Course Topics

- General principles of risk assessment of genetically modified organisms (GMOs)
- Introduction to possible issues arising from the deliberate release of GMOs

- Assessment of impacts of GMOs: case studies
- Training and information sharing in biosafety
- International treaties and national regulations in biosafety

6. **Training Course on "The Analysis of Food and Feed Samples for the Presence of Genetically Modified Organisms",** University of Tunis Elmanar, Faculty of Sciences and the Joint Research Centre of the European Commission DG (1 week)
http://bch.biodiv.org/database/record.shtml?id=15789

Theoretical lectures:

- Overview of EU legislation on GMOs and specific requirements
- Experimental planning and sample preparation
- DNA extraction
- PCR principles
- GMO analysis by qualitative and quantitative PCR
- Information on protein based GMO detection
- Sampling concepts and recommended EU protocol
- Laboratory implementation and conduction of a GMO detection dedicated laboratory
- Method validation criteria and laboratory accreditation

Practical Experimental work:

- Experimental planning and sample preparation
- DNA extraction from raw and processed materials
- Simple and nested PCR for qualitative GMO analysis
- GMO quantitative analysis by real-time PCR
- Protein based GMO detection approaches