Learning and development in employment after graduation.

*[**TUTOR'S NOTES**.*
Graduates and university teachers may be surprised to know that learning does not stop after graduation and employment. Large companies employing graduate bioscientists have effective and progressive learning and development programs to develop new and established graduates. Tutors and students may be interested to know the objectives, structure and content of such programs since this gives in-sight into what is required of graduates and valued by their employers.

It is worthwhile noting that the detailed content of these programs has evolved to equip graduates with the skills and knowledge which some of them HAVE NOT ACQUIRED SATISFACTORILY in their university courses.

USE BY TUTORS AND STUDENTS
This document can be used in several ways as it stands as indicated below. Alternatively, tutors may wish to obtain details of graduate development programs run by those who are major employers of their graduates which will provide a focus appropriate to their subject area and employers needs..

1. *Used by tutors and their course teams to examine the extent to which their courses produce graduates already equipped with the knowledge/skills emphasised in the industrial learning and development program.*
2. *Used by tutors to demonstrate to students the importance of particular aspects of their course as seen from the point of view of a large employer of bioscience graduates.*
3. *Used by tutors to help students appreciate that continuous self-development is a vital aspect of graduate behaviour and that they should set aside time to apply this principle in their degree course as well as their graduate career.]*

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Program details

1. Aims and Objectives

- To develop highly flexible scientists who can produce high quality experimental work, contribute to a multidisciplinary team and are able to move readily as required between work areas and teams.
- To bring all new graduates up to the same level with regard to essential IT and laboratory skills;
- To ensure graduates are aware of the safety requirements of working in an industrial environment;
- To strengthen the value placed on self-development and build a self-development culture.

2. Delivery

The modules are delivered as time-tabled and there is also a mentoring aspects as each participant will have a more experienced scientist to act as a mentor to help guide their development and career. Formal and informal meetings with your mentor will be built into the program.

3. Core areas

A. Induction
This module allows graduates to build an awareness of the nature of the business of the company, its scope and products and the contribution made by different areas. It allows graduates to start to build a network of contacts within the company by bringing them into contact with scientists in different areas.

B. Safety
This module emphasises the importance of safe working and starts to build a safety culture. Graduates are made aware of the full range of safety procedures, how to access them and the importance of their observation in all circumstances. Graduates must understand the importance of their personal commitment to their own safety and the safety of others. They must appreciate and involve themselves in 'near miss' reporting as a way of reducing the risk of accidents.

C. Information technology
This module ensures the graduate is proficient with both the in-house methods and supported tools involving leading edge information technology and the commercially available tools which are available to perform basic data manipulation tasks and are aware of the more advanced training that is available.

D. Laboratory skills
Several modules (SEE BELOW) are available which will clearly reflect the major business of the bioscience company. Basic laboratory skills 1 (pipetting, pH and buffers, laboratory instrumentation, electronic records, experimental design, awareness of in vivo animal use); Basic laboratory skills 2 (molecular biology, tissue culture, transfection, enzyme kinetics, drug receptors, protein purification).

E. Personal effectiveness
This module strengthens personal learning, self-development and career management skills. Particularly team working in different contexts, communication and organisational skills are emphasised. Action learning is a key principle upon which personal development is based.

F. Business driven skills
This module (or group of modules) may be taken at different times and develop core business skills. For example, project management skills would be developed early in a graduates career. Later, leadership skills, change management skills, international awareness and language skills may be developed as needed.

G. Professional development
These modules ensure graduates receive the maximum professional development and if appropriate financial support to obtain additional qualifications.

Basic laboratory skills I

1) Pipetting skills
Half day session. Overview of the use of pipette types readily available. Topics will include the different types of pipettes, pipetting methods for reliable liquid handling, when to use different techniques (e.g. reverse pipetting), pipetting a variety of liquids, and accuracy of

pipetting. Skills will be assessed by a short practicals looking at precision of pipetting by the determination of unknown protein concentrations and the masses of various liquids.

2) pH and buffering
Half day session. The module will cover pH, buffers and calculations and will involve theory and practical work. The module is divided into 3 sections:

- Definition of acids and bases, pH and pK, buffers and buffering followed by revision of calculations involving moles, molarity and percent solutions.
- Graduates will carry out calculations in order to make up a buffer of a certain pH.
- The pH electrode: calibration, care and maintenance.

3) Laboratory instrumentation
This course is designed to provide hands-on training in the use of a number of instruments commonly found within the laboratory.
Spectrophotometers/Fluorimeters/Luminometers (1 day); Centrifuges (0.5 day); HPLC (0.5 day); Radioactivity (0.5 day).
The use of more general lab equipment including microwaves, incubators, shakers etc. will also be covered.

4) E-Book writing
This module will take one half day plus a 2 short follow-up sessions.
The content will include: types of E-book, why bother writing up, what needs to be included in a write up plus worked examples. Feedback and coaching will also be offered on write-ups from the other basic lab skills modules.

5) Experimental design
One day session. The aim of this course is to introduce the concepts involved in designing a 'good' experiment and how to ensure that optimum and consistent assay conditions apply.

- Exercise using pre-prepared experimental data. This will highlight the importance of data analysis when calculating results
- Presentation by a Statistician to introduce the concepts of factorial experimental design, variability, validation and monitoring data.
- Group exercise using pre-prepared data from a high-throughput screen which will highlight some of the points covered above.

6) In vivo awareness: Use of animals in drug discovery
This module will follow sessions covering the drug discovery process and in-vitro techniques commonly used in this process. The session aims to explain in more detail the importance of in-vivo experiments in drug discovery and will cover efficacy testing, disease models, pharmacokinetics and toxicology. An outline of relevant Home Office legislation will also be given.
The training will be theoretical rather than practical.

Basic laboratory skills II

1) Molecular Biology - Reporter gene expression construct
6 days of molecular biology practical work with the aim of generating a reporter gene expression construct which can be used for mammalian cell transfection studies.

- Basic manipulation of DNA, restriction enzyme analysis and agarose gel electrophoresis.

- Preparation of DNA fragments and vectors for subcloning experiments, ligation of DNA and bacterial transformation.
- Analysis of recombinant DNA by PCR, large scale plasmid DNA preparation and DNA sequence analysis.

2) Cell biology

5 day module including:

- aseptic technique
- basic cell culture theory (containment, media selection and cell types)
- counting, growth conditions and cryopreservation of an adherent and suspension cell line
- microscopy
- use and safe operation of Class II Microbiological Cabinets, incubators and liquid nitrogen
- cell cytotoxicity assay and preparation of cytospins

3) Cell biology - Transfected mammalian cells

4 day module. Participants will transfect CHO cells with pGEN IRES-neo GFP and lacZ plasmids using (1) Lipofectamine PLUS reagent from Gibco BRL/Life Technologies (2) electroporation and (3) calcium phosphate and check for transfection efficiency and protein expression by microscopy, FACS analysis and B-gal assay.

Participants will gain experience/knowledge in:

- use of different transfection methods - how they work, pros and cons of each method
- the appropriate use of different methods - cell types (suspension or adherent) stable or transient expression requirements
- how to measure transfection efficiency and protein expression levels

4) Introduction to pharmacology

5 day module aiming to introduce the principles of ligand-receptor interaction and address the basic experiments, in developing a receptor antagonist assay. The basic theory of Scintillation Proximity assay technology will also be covered and applied in practice.

- membrane preparation and protein estimation
- setting up a radioligand binding assay
- determination of ligand affinity by saturation studies
- determination of ligand potency by competition studies
- determination of functional agonism or antagonism using a reporter gene (intact cell) assay
- use of Origin to determine affinity / potency parameters

5) Protein purification and enzymology

5 day module aims to follow the progress of a typical target-based project using a protein phosphatase as an example. It will focus on the expression, purification and characterisation of an enzyme prior to entry into High throughput screening (HTS).

Participants will gain experience in the following techniques:

- protein expression in *E.coli*
- enzyme purification
- Western blotting
- enzyme assay and derivation of kinetic constants.