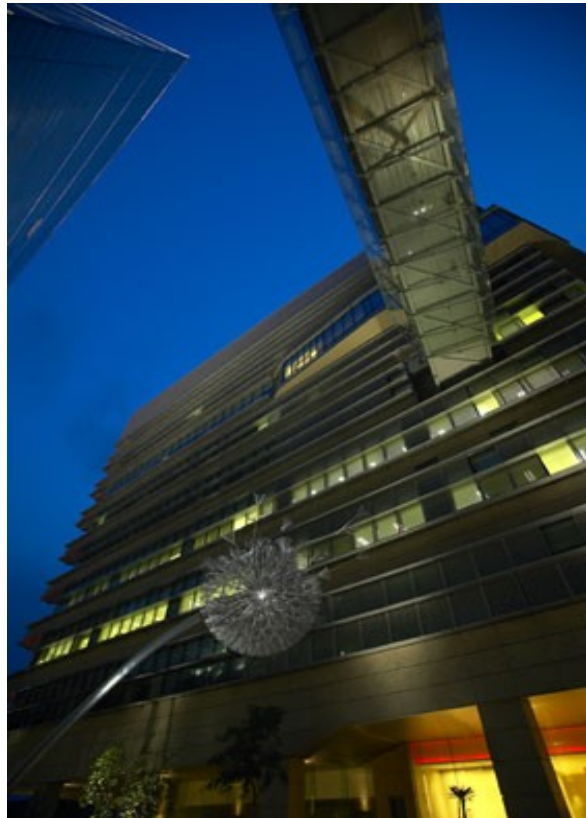




Bioprocess Internship Programme
January - June 2010 & July - December 2010



Bioprocessing Technology Institute

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Figure 1 Bioprocess Internship Programme

1.1 Introduction & Objective

During the past two decades, significant advances in molecular biology and manufacturing technologies have resulted in biopharmaceuticals (e.g. vaccines, recombinant proteins and monoclonal antibodies) for the prevention and treatment of many critical diseases. Reports estimate that about 35 biopharmaceutical products are currently in the market and 700 or more protein-based therapeutics are at various stages of clinical development, with 150 to 200 in late-stage trials. The biopharmaceutical industry is a rapidly growing sector with immense opportunities and implications for healthcare. In addition, it is predicted that there will continue to be a manufacturing gap between supply and demand of biotherapeutics.

In the last 6 years, there have been landmark announcements of companies like GSK Biologicals, Lonza, Genentech and Novartis setting up vaccine and protein-based therapeutics manufacturing in Singapore. To support the growth and maturing of the biopharmaceutical industry in Singapore, the Bioprocessing Technology Institute (BTI) is running the Bioprocess Internship Programme for the 6th consecutive year to develop manpower for this industry. The broad objective of this 6 month programme is to prepare science and engineering graduates for entry into the biopharmaceutical industry with advanced, specialized knowledge and practical skills in Expression Engineering, Good Manufacturing Practice (GMP), Bioprocessing Technology which includes Cell Culture and Downstream Processes, and Analytics for Bioprocessing.

The programme is challenging, stimulating and inter-disciplinary in nature, combining a problem-based learning approach with heavy emphasis on laboratory work. Interns will work in different teams in each of the 4 modules, with the opportunity to develop leadership and time management skills. Each team will plan and design their own experiments with guidance from supervisors. During the course of the internship, participants will have the opportunity to attend seminars and interact with eminent international speakers from academia and industry.

We hope that you will gain the maximum benefit from this programme. This guide provides information on programme requirements, structure, modules, schedules and contact persons.

1.2 Bioprocess Internship Information

- (i) Qualification:
Applicants should possess an Honours Degree or Diploma with working experience in the Biological/Chemical Sciences or Biochemical/Chemical Engineering.
- (ii) Sponsorship:
Successful candidates will be provided a stipend for the duration of the Internship.
- (iii) Period:
6 months, January to June 2010 and July to December 2010
- (iv) Post-Internship:
Upon completion, interns can work in the local pharmaceutical/biopharmaceutical industry; go on an overseas Strategic Attachment and Training (STRAT) Programme supported by EDB; join BTI as a research officer or pursue graduate studies under A*STAR Graduate Scholarships.
- (v) Application:
Write in or email resume with copies of education transcripts/certificates and names of 3 referees to:

Executive Director
Bioprocessing Technology Institute
20 Biopolis Way #06-01 Centros
Singapore 138668

Email: admin@bti.a-star.edu.sg
Website: www.bti.a-star.edu.sg

1.3 Programme Initiation

Date/Venue	Event	Lecturers	Time
January 4, 2010/ July 1, 2010	BTI Overview & Introduction of BTI staff and interns	Prof. Miranda Yap & BTI staff	9 am
6 th Floor Centros, Biopolis	Handouts & Description of schedule and BIP programme	Dr. Steve Oh	10am

1.4 Programme Curriculum (Refer Figure 1)

Courses	6 months period
Core Modules	
I. Expression Engineering	✓
II. Good Manufacturing Practice (GMP)	✓
III. Bioprocess Technology: Cell Culture and Downstream Processing	✓
IV. Analytics for Bioprocessing: Process and Product Monitoring	✓

A. Core Modules

The courses will take a problem-based learning approach. Lectures will be conducted in parallel with hands-on laboratory practicals to reinforce the knowledge gained. Interns will learn in:-

Module I. To clone and transfect the gene of interest into a host cell line and select for high producing single clones. Participants will acquire basic bioinformatics skill and molecular biology techniques required to create a recombinant protein expressing cell line.

Module II. To implement concepts of GMP, Quality Assurance and Quality Control. Practical will be conducted demonstrating personal hygiene, environmental monitoring of equipment, testing of water specifications and process aids such as filters. Interns will create User Requirement Specification (URS) for equipment; design, install and operate and qualify it following DQ, IQ, OQ and PQ guidelines. This process will then be repeated for a bioreactor. All documentations should be prepared according to Good Manufacturing Practice.

Module III. To apply chemical engineering principles of materials and energy balances, kinetics and transport to cell culture processes; employ aseptic techniques for cell culture and bioreactor operation; generate master and working cell banks; design media and optimise feeding strategies to improve culture viability and increase productivity; analyse product titre and substrate levels in culture media; recover and purify the recombinant protein using filtration and chromatographic separation processes.

Module IV. To use and develop analytical methods for lot release testings; product quantification, protein characterisation which will include physicochemical properties; product aggregates, glycosylation profiling and contamination (such as microbial, fungal, mycoplasma levels, endotoxins and residual host DNA) assessment.

**Figure 1. Bioprocess Internship Programme
(January - June 2010 and July – December 2010)**

Courses	1 st month	2 nd month	3 rd month	4 th month	5 th month	6 th month
Core Modules						
Module I						
Expression Engineering:						
Lecture Series/ Assignments	←→	←→				
Laboratory Practicals	←→					
Module II						
Good Manufacturing Practice (GMP)						
Lecture Series/ Assignments		←→	←→			
Laboratory Practicals		←→	←→		←→	←→
Module III						
Bioprocess Technology: Cell Culture and Downstream Processing						
Lecture Series/ Assignments / Design Project			←→	←→		
Laboratory Practicals		←→	←→	←→		
Module IV						
Analytics Bioprocessing: Process and Product Monitoring						
Lecture Series/ Assignments					←→	←→
Laboratory Practicals					←→	←→

1.5 Programme Appraisal/ Certificate of Accreditation

Appraisal of the Internship will comprise of the following:

- (i) Team and Individual Grades for the 4 Core Modules evaluated based on laboratory reports, presentations, continuous assessment (from problem sets)
- (ii) Supervisors' Grade – for participation in classes/seminars, initiative, teamwork, leadership, etc

A Certificate of Accreditation will be presented by the Bioprocessing Technology Institute upon successful completion of the Internship, together with a letter of reference which will include the grades awarded for the core modules undertaken.

2.0 Programme Contacts

These are the contacts of the Programme Manager and Programme Liaison Officer:-

Programme Manager	Contact No.	E-mail
Dr. Steve Oh	6407 0855	steve_oh@bti.a-star.edu.sg
Programme Liaison Officer		
Ms Lauren Ang	6407 0879	lauren_ang@bti.a-star.edu.sg