Introduction

The first polytechnic, Singapore Polytechnic was established in 1954 to train technologists and professionals to support the industrial and economic development of Singapore.

Since then, four other polytechnics, Ngee Ann (1963), Temasek (1990), Nanyang (1992) and Republic (2002) have been set up. The development and success of the five polytechnics are congruent and parallel to that of the nation. The polytechnics offer diploma, post-diploma and short courses in engineering, design, business management, accountancy, health sciences, chemical & life sciences, media IT, landscape architecture and others. They provide relevant, balanced and value added curricula ensuring that diploma holders can fit into and adapt instantly to current industry needs and practices.

The polytechnics also contribute effectively to continuing education through their part-time or full-time courses. Some of the courses are designed for particular industry sectors or even customized for specific clients.

The polytechnics offer a number of life sciences diploma programmes that train individuals for middle management technical positions in the biomedical sciences industry. The early diplomas in biotechnology were launched by Ngee Ann Polytechnic and Singapore Polytechnic in the late 1980s in response to the Economic Development Board’s (EDB) National Biotechnology Plan. Currently all five polytechnics offer biotechnology diplomas with their own distinctive flavours and focus.

With Singapore’s commitment to make the Biomedical Sciences industry its fourth pillar of the economy and with the support of the EDB’s Biomedical Science Group and the Biomedical Research Council of the Agency for Science Technology & Research (A*STAR), the polytechnics’ respective Schools of Chemical & Life Sciences have expanded their diploma programmes.

Within the context of the polytechnic, the term ‘life sciences’ is broadly defined and encumbers all biological and chemical sciences. The diploma programmes offered by the polytechnics are
Biomedical Sciences (NP, RP, TP, SP), Pharmaceutical Sciences (NP, NYP, RP), Chemical Engineering (NP, NYP, SP, TP), Environmental Science (RP), Material Science (RP), Optometry (SP), Veterinary Technology (TP) and Food Sciences (SP, NYP, TP). The intent of these programmes is to train diploma holders who can contribute to all aspects of the industry as technical support staff/research assistants, medical technologists, sales, marketing officers and others. They would have enough knowledge and skills to support and contribute to the organization under some supervision. In time, they would be able to lead and supervise others. Other diplomas of relevance to the Biomedical Sciences industry would be those in the Health Sciences category as well as the Biomedical Engineering Diploma which is in the Engineering category.

Appendix A shows various diploma programmes clustered under Chemical & Life Sciences and Health Sciences in accordance to the Ministry of Education’s 2007 Joint Admission Exercise booklet.

Appendix B lists the Specialist and Advanced Diplomas in the Life and Health Sciences cluster.

For a potential employer of diploma holders, it is important to understand the curriculum of the various diplomas. It is useful to note the emphasis and focus of the programmes e.g. some may have a pharmaceutical focus including cGMP and validation while others may concentrate on genomics and proteomics or offer electives or specialisations in bioprocess technology or bioentrepreneurship.

The Profile of Students
The profile of students entering polytechnics has changed remarkably over the years and especially...
so for the life science diplomas. A good percentage of these 16-17 year old ‘O’ Level holders are eligible to undertake the ‘A’ Levels at a junior college but choose to pursue a life science diploma. These students are motivated individuals with aspirations to further their studies beyond the diploma. Many such diploma holders have gone on to pursue science, engineering and other undergraduate and post-graduate programmes at local and overseas universities.

The challenge for employers is to devise schemes to keep their motivated diploma holders. Some organizations have put in place professional development schemes. Others offer scholarships, bursaries or loans for further studies that are tied to a compulsory work requirement or bond upon completion of the studies.

Value Added Curriculum

Practice Oriented
Polytechnic diplomas are designed with the end point in mind. Input from the industry and academia is an integral part of curriculum design and development.

The hallmark of the curriculum would be the hands-on or practical component which could make up to sixty percent of the curriculum hours of a particular subject (or module as it is called). An integrated mode of teaching and assessment is increasingly popular. In some diplomas, an experiment could be designed based on information and techniques from two or three modules. Similarly, integrated assessments whereby the focus is on a few modules, challenge the students, dispels the
compartmentalization of knowledge and encourages vertical and lateral knowledge assimilation. Problem based and project based pedagogies are also emphasized where applicable, hence encouraging learner-centric learning, teamwork and communication skills. Overall, the curriculum empowers and boosts the self confidence of the students.

Industrial Attachments

Another feature is the two to six months industrial attachment in the 2nd or 3rd year of the diploma programme whereby students are exposed to the real world work environment. This experience has also worked in the favour of potential employers who are able to assess the capabilities and attitude of the students. Some diplomas have the attachment in the final semester leading to immediate employment, thereby eliminating workplace ‘culture shock’.

The final year project which could span four to nine months is perhaps the most challenging. It is the climax of the learning curve and students are put to test all the knowledge and skills that they acquired and honed over the three years. Often the projects are in collaboration with companies or research organizations and they could result in journal publications, conference presentations and patents.

Common Questions

What is the industry feedback on life science diploma holders?

They are said to be ‘hardworking’, ‘dedicated’, ‘gung ho’, ‘street smart’, ‘resourceful’, ‘versatile’, ‘flexible’ with good technical knowledge and hands-on skills. The lacks have been said to be depth of knowledge, communication skills and general etiquette. The polytechnics solicit feedback from employers on a regular basis and all feedback is taken very seriously and reviewed during the course evaluation cycles which are triggered every three to five years. Curriculum has been beefed up to remedy the lacks and enrichment workshops organized to improve social etiquette and confidence. A slate of non-
disciplinary modules in areas such as humanities, business, communications or language are also available for life science students to give them the soft skills necessary at the workplace.

How much does it cost to employ a life science diploma holder?
Starting monthly salary could be anything from $1,600 upwards.

How do you go about employing a diploma holder?
A good route is to check out the websites to assess the curriculum of the various diplomas, choose the course that is relevant to your needs and call or e-mail the Course Co-ordinator/Manager or the Director of the respective School/Department and explain your needs. Most of the Departments would have a database of their alumni and would be happy to assist their graduates in job hunting. Or, one could contact the respective Student Service Units to register their request.

To quote industry, polytechnic diploma holders have made a positive difference to the overall industry landscape and it is proving true for the biomedical industry as well.

Contributed by Dr Sushila Chang, Senior Director and Director School of Life Sciences & Chemical Technology, Ngee Ann Polytechnic
## FULL-TIME DIPLOMA PROGRAMMES

<table>
<thead>
<tr>
<th>Tertiary Institution</th>
<th>Full-Time Diploma Programme</th>
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<tbody>
<tr>
<td><strong>Singapore Polytechnic</strong></td>
<td>• Biomedical Science (80)*</td>
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<tr>
<td></td>
<td>• Biotechnology (100)</td>
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<tr>
<td></td>
<td>• Optometry (100)</td>
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<tr>
<td></td>
<td>• Chemical Engineering (120)</td>
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<tr>
<td></td>
<td>• Chemical Process Technology (250)</td>
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<tr>
<td><strong>Ngee Ann Polytechnic</strong></td>
<td>• Biomedical Laboratory Technology (110)</td>
</tr>
<tr>
<td></td>
<td>• Horticulture &amp; Landscape Management (55)</td>
</tr>
<tr>
<td></td>
<td>• Molecular Biotechnology (95)</td>
</tr>
<tr>
<td></td>
<td>• Pharmacy Science (40)</td>
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<tr>
<td></td>
<td>• Chemical &amp; Biomolecular Engineering (120)</td>
</tr>
<tr>
<td><strong>Temasek Polytechnic</strong></td>
<td>• Nutrition (100)</td>
</tr>
<tr>
<td></td>
<td>• Baking and Culinary Science (40)</td>
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<tr>
<td></td>
<td>• Biomedical Science (125)</td>
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<tr>
<td></td>
<td>• Biotechnology (100)</td>
</tr>
<tr>
<td></td>
<td>• Chemical Engineering (120)</td>
</tr>
<tr>
<td></td>
<td>• Veterinary Technology (30)</td>
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<tr>
<td><strong>Nanyang Polytechnic</strong></td>
<td>• Chemical &amp; Pharmaceutical Technology (130)</td>
</tr>
<tr>
<td></td>
<td>• Food Science (65)</td>
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<tr>
<td></td>
<td>• Molecular Biotechnology (120)</td>
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<tr>
<td></td>
<td>• Pharmaceutical Sciences (45)</td>
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<tr>
<td><strong>Republic Polytechnic</strong></td>
<td>• Biomedical Sciences (225)</td>
</tr>
<tr>
<td></td>
<td>• Biotechnology (150)</td>
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<tr>
<td></td>
<td>• Environmental Science (50)</td>
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<td></td>
<td>• Materials Science (200)</td>
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<tr>
<td></td>
<td>• Pharmaceutical Sciences (150)</td>
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</tbody>
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* Figures in brackets and italics are the intake number for 2007 (as of Feb 07) and are subject to change (before MOE’s revised targets for Life Sciences cluster)
## SPECIALIST AND ADVANCED DIPLOMA PROGRAMMES

<table>
<thead>
<tr>
<th>Tertiary Institution</th>
<th>Specialist Diploma Programmes</th>
<th>Advanced Diploma Programmes</th>
</tr>
</thead>
</table>
| **Singapore Polytechnic** | • Biotechnology  
• Biomedical Engineering  
• Microbiology  
• Pharmaceutical Secondary Manufacturing  
• Pharmaceutical Technology | • Optometry  
• Food Technology |
| **Ngee Ann Polytechnic** | • Molecular Biotechnology  
• Applied Microbiology  
• Infection Control | • Infection Control |
| **Nanyang Polytechnic** | • Nursing (Management)  
• Case Management  
• Sonography  
• Health Sciences (Palliative Care)  
• Nursing (Diabetes Nurse Educator)  
• Nursing (Community Health)  
• Nursing (Critical Care)  
• Nursing (Emergency)  
• Nursing (Gerontology)  
• Nursing (Mental Health)  
• Nursing (Medical-Surgical)  
• Nursing (Midwifery)  
• Nursing (Nephro-Urology)  
• Nursing (Neuroscience)  
• Nursing (Oncology)  
• Nursing (Ophthalmic)  
• Nursing (Orthopaedics)  
• Nursing (Paediatrics)  
• Nursing (Perioperative) |
## Appendix C

### SHORT COURSES

<table>
<thead>
<tr>
<th>Tertiary Institution</th>
<th>Programmes</th>
</tr>
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| **Singapore Polytechnic** | • A Practical Approach to Food Safety – Hazard Analysis Critical Control Point (HACCP)  
• Workplace Safety & Health Officers Training Course  
• Safe Practices in Food Manufacturing  
• Safety Practices in Food Manufacturing: Pre-Requisites to HACCP |
| **Ngee Ann Polytechnic** | • Advances in Genomics  
• Analytical Biochemistry  
• Applied Molecular Microbiology  
• Bioinformatics  
• Cell Biology  
• Cell Culture  
• cGMP & Pharmaceutical Microbiology  
• Drug Discovery & Development cGMP  
• Environmental Monitoring & control 2005  
• Food Safety & HACCP  
• Immunology & Hybridoma Technology  
• Introductory Bioinformatics  
• Laboratory Quality Management  
• Microbiology  
• Microbiology Principles & Practice  
• Molecular Biology  
• Outbreak Management in Infection Control  
• Patient Care Practices in Infection Control  
• Pharmaceutical Technology 2005  
• Proteomics |
| **Republic Polytechnic** | • Basics of Traditional Chinese Medicine (in Mandarin)  
• Basics of Traditional Chinese Medicine (in English) |