3.3.3.7 Pharmaceutical Science

Pharmaceutical Science is a branch of science that deals with aspects of the science and technology of medical products. This includes but is not limited to the discovery, development, manufacture, regulation, and utilisation of medical products. Pharmaceutical Science forms the foundational scientific basis of the physical, chemical, biological and the biomedical aspects of drug properties and actions.

Some examples of subjects that are classified under Pharmaceutical Science include Medicinal Chemistry, Pharmaceutics, Pharmaceutical Technology, Pharmaceutical Analysis, Pharmacokinetics, Pharmaceutical Biotechnology, Pharmacoconomics and Pharmacogenetics.

Advancements achieved in Pharmaceutical Science will impact drug discovery, drug formulation as well as the regulation and practice of Pharmacy.

Programme Structure and Curriculum Rationale

Students joining this landmark programme would be trained in a range of foundational sciences that culminates towards an understanding of drug discovery and development, as well as a mastery of the regulatory and commercial environment in the pharmaceutical industry.

The Pharmaceutical Science (PHS) programme is designed to optimize a flexibility in curriculum to allow students to take up second majors, minors, undergraduate internships, research projects and overseas exchange programmes, along with a multitude of elective modules available for all NUS students.

With a small class size by intent, students will benefit from a blended learning experience with various web-based online learning tools while having greater face-to-face contact for problem-based learning and student-teacher interactions. Students will also actively engage in experiential learning with teaching conducted by industry experts as well as internship opportunities with pharmaceutical companies in Singapore.

Pharmaceutical Science is a four-year programme. The degree in BSc (Pharmaceutical Science) with Honours will be awarded to candidates who have performed well throughout the course of study, as determined by their cumulative average points. Those who do not qualify for Honours degrees will be awarded a BSc (Pharmaceutical Science) degree.

Career Prospects

This comprehensive programme will equip students with a broad range of technical knowledge and skills
across the pharmaceutical sciences. Students will have excellent career prospects in areas as diverse as research and development, manufacturing, sales and marketing, regulatory affairs, quality management and clinical trial management. Depending on the students’ interests, students may also find employment in areas outside the pharmaceutical industry such as biotechnology, consumer healthcare, patenting and licensing, medical writing or be the next generation healthcare entrepreneurs.

Students interested to expand and deepen their knowledge beyond the undergraduate programme can also opt to pursue further postgraduate studies, such as a Masters in Pharmaceutical Science and Technology (MPST), or Doctor of Philosophy (PhD). Postgraduate studies would further enhance critical thinking skills to work towards careers in academia, research or management.

**Graduation Requirements**

To be awarded a B.Sc. or B.Sc. (Hons.) with a primary major in Pharmaceutical Science, candidates must satisfy the following:

<table>
<thead>
<tr>
<th>MODULE LEVEL</th>
<th>MAJOR REQUIREMENTS</th>
<th>CUMULATIVE MAJOR MCS</th>
</tr>
</thead>
<tbody>
<tr>
<td>Level-1000 (28 MCs)</td>
<td>Pass</td>
<td>28</td>
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<tr>
<td></td>
<td>• PR1110A Foundations for Medicinal Chemistry</td>
<td></td>
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<tr>
<td></td>
<td>• PR1111A Pharmaceutical Biochemistry</td>
<td></td>
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<tr>
<td></td>
<td>• PHS1120 Essential Topics in Pharmaceutical Chemistry</td>
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<tr>
<td></td>
<td>• PA1113 Basic Pharmacology</td>
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<tr>
<td></td>
<td>• AY1130 Human Anatomy &amp; Physiology I</td>
<td></td>
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<tr>
<td></td>
<td>• PY1131 Human Anatomy &amp; Physiology II</td>
<td></td>
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<td></td>
<td>• ST1232 Statistics for Life Sciences</td>
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<tr>
<td>MODULE LEVEL</td>
<td>MAJOR REQUIREMENTS</td>
<td>CUMULATIVE MAJOR MCS</td>
</tr>
<tr>
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</tbody>
</table>
| Level-2000 (28 MCs) | Pass  
- PHS2191 Laboratory Techniques in Pharmaceutical Science I  
- PR2114A Formulation & Technology I  
- PR2115A Medicinal Chemistry for Drug Design (new)  
- PHS2120 Drug Product Development & Lifecycle Management  
- PR2122 Biotechnology for Pharmacy  
- PHS2143 Analytical Techniques and Pharmaceutical Applications  
- LSM2241 Introductory Bioinformatics | 56 |
| Level-3000 (20 MCs) | Pass  
- PHS3191 Laboratory Techniques in Pharmaceutical Science II  
- PR3116 Concepts in Pharmacokinetics and Biopharmaceutics  
- PR3117 Formulation & Technology II  
- PHS3122 Pharmaceutical Quality Management  
- Pass any 1  
  - PR3204 Medicinal Natural Products  
  - LSM3223 Immunology  
  - LSM3224 Molecular Basis of Human Diseases  
  - LSM3231 Protein Structure and Function  
  - CM3242 Instrumental Analysis II  
  - SPH3102 Public Health Communication  
  - SPH3103 Public Health Economics | 76 |
<table>
<thead>
<tr>
<th>LEVEL</th>
<th>MAJOR REQUIREMENTS</th>
<th>CUMULATIVE MAJOR MCS</th>
</tr>
</thead>
</table>
| Level 4000 (24 MCs) | Pass  
- PHS4199 Honours Project in Pharmaceutical Science or PHS4299 Applied Project in Pharmaceutical Science (12 MC)  
- PHS4121 Regulation of Healthcare Products  
Pass any 2  
- PR4204 Special Drug Delivery  
- PR4207 Applied Pharmacokinetics and Toxicokinetics  
- PHS4220 Synthetic Strategies for Drug Substances  
- LSM4242 Protein Engineering  
- LSM4241 Functional Genomics  
- CM4241 Trace Analysis  
- CM4242 Advanced Analytical Techniques  
- CM4227 Chemical Biology  
- SP4263 Forensic Toxicology and Poisons  
- CS4220 Knowledge Discovery Methods in Bioinformatics | 100 |

**SUMMARY OF REQUIREMENTS**

<table>
<thead>
<tr>
<th>REQUIREMENTS</th>
<th>B.SC. (HONS.)</th>
</tr>
</thead>
<tbody>
<tr>
<td>University Requirements</td>
<td>20 MCs</td>
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<td>Faculty Requirements</td>
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<tr>
<td>Major Requirements</td>
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<tr>
<td>Unrestricted Elective Modules</td>
<td>32 MCs</td>
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<td>Total</td>
<td>160 MCs</td>
</tr>
</tbody>
</table>

*16 MCs of Faculty Requirements are needed for BSc (Hons) programmes. For the PHS programme, 8 MCs out of the 16 MCs are fulfilled through the reading of ST1232 and a PR coded module within the major requirements.*
The remaining 8 MCs of Faculty Requirement can be fulfilled as follows:

- 4 MCs from SP1541, a compulsory Faculty writing requirement for Science students, under the ‘Multidisciplinary and Interdisciplinary Sciences’ subject group
- 4 MCs from either the ‘Computing Sciences’ or the ‘Physical Sciences’ subject group

Please note that curricular content and graduation requirements may be subject to change.