

# Duke-NUS Medical School

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## **1 Faculty's Commitment**

Centrally located in a modern facility on the grounds of Singapore General Hospital, Duke-NUS is Singapore's first US-style graduate-entry medical school. We draw on the rich medical training and research at Duke University in North Carolina and the outstanding resources at the National University of Singapore (NUS). In addition, Duke-NUS partners with Singapore Healthcare Services (SingHealth) to form an Academic Medicine Institute which integrates three pillars of medicine - clinical care, education and research. We also collaborate with a number of strong research institutions in Singapore, including the National Cancer Centre, the National Heart Centre, the National Eye Centre, the National Neurosciences Institute, and the Agency for Science, Technology and Research (A\*STAR).

Offering innovative MD, PhD, and MD-PhD programmes with a focus on medical research, Duke-NUS prepares doctors who are not only skilled in patient care, but who are also well equipped to practise in the rapidly changing world of medicine. We prepare physician leaders who are problem solvers committed to improving the health of individuals and communities through research. At Duke-NUS, we are committed to helping our graduates transform medicine in the 21st century. The Duke-NUS MD degree is jointly awarded by Duke University and the National University of Singapore, while the PhD degree is awarded by the National University of Singapore.

For more information, please visit our website at: <https://www.duke-nus.edu.sg/about>

## 2 Key Contact Information

### Senior Management

| TITLE & NAME                 | DESIGNATION/RESPONSIBILITY                                  | EMAIL<br>(XXXX@NULLNUS.EDU.SG) |
|------------------------------|---|--------------------------------|
| Prof. Thomas M.<br>COFFMAN   | Dean  | gmsthoma                       |
| Prof. Patrick J.<br>CASEY    | Senior Vice Dean (Research)                                 | gmscp                          |
| Prof. SOO Khee<br>Chee       | Senior Advisor  | gmsskc                         |
| Prof. Ian<br>CURRAN          | Vice Dean (Education) & Co-Director of AM.EI                | gmscie                         |
| Prof. WONG Tien<br>Yin       | Vice Dean (Academic & Clinical Development)                 | gmswty                         |
| Ms. CHANG Lee<br>Cheng Karen | Group Director and Senior Vice Dean<br>(Corporate Services) | gmsclck                        |
| Dr David Michael<br>EPSTEIN  | Vice Dean (Innovation & Entrepreneurship)                   | gmsdme                         |

### Admissions

| TITLE & NAME                    | DESIGNATION/RESPONSIBILITY                                  | TELEPHONE | EMAIL (XXXX@NULLNUS.EDU.SG)   |
|---------------------------------|---|-----------|---|
| General Information             | Admissions Office   | 6516 5550 | For MD & MD-PhD: info@nullduke-nus.edu.sg<br>For PhD: infophd@nullduke-nus.edu.sg |
| General Information             | Financial Aid   |           | financialaid@nullduke-nus.edu.sg  |
| Prof OOI Peng Jin London Lucien | Associate Dean (Recruitment,<br>Admissions & Financial Aid) | 6516 4050 | gmsopjll  |
| Mr. LEE Chee How Chris          | Manager (Recruitment)                                       | 6516 8810 | gmslech   |
| Ms. Tammie ZHU                  | Senior Manager (Admissions)                                 | 6516 8512 | gmszmt  |
| Mr. CHIM Suan Yew               | Senior Manager (Financial Aid)                              | 6516 7248 | gmscopy   |

## Student Affairs & Alumni Relations

| <b>TITLE &amp; NAME</b>    | <b>DESIGNATION/RESPONSIBILITY</b> | <b>TELEPHONE</b> | <b>EMAIL<br/>(XXXX@NULLNUS.EDU.SG)</b> |
|----------------------------|-----------------------------------|------------------|--|
| General Information        | Student Affairs                   |                  | studentaffairs@nullduke-nus.edu.sg     |
| Dr. Mara Catherine MCADAMS | Associate Dean (Student Affairs)  | 6516 7739        | gmismcm                                |
| Ms. Maria TAN              | Senior Manager (Student Affairs)  | 6601 1300        | gmstscm                                |

## MD Programme

| <b>TITLE &amp; NAME</b> | <b>DESIGNATION/RESPONSIBILITY</b>   | <b>TELEPHONE</b> | <b>EMAIL<br/>(XXXX@NULLNUS.EDU.SG)</b> |
|-------------------------|-------------------------------------|------------------|--|
| Prof. Sandy COOK        | Senior Associate Dean               | 6516 8722        | gmscs                                  |
| Prof. LIM Soon Thye     | Associate Dean                      | 6516 8058        | gmstimst                               |
| Ms. GOH Sok Hong        | Senior Associate Director           | 6516 7016        | gmshgsh                                |
| Ms. Bibiana TEH         | Senior Manager (Registrar Services) | 6516 6388        | gmshatai                               |

## Graduate Studies (PhD & Accredited Programmes)

| <b>TITLE &amp; NAME</b> | <b>DESIGNATION/RESPONSIBILITY</b> | <b>TELEPHONE</b> | <b>EMAIL<br/>(XXXX@NULLNUS.EDU.SG)</b> |
|-------------------------|-----------------------------------|------------------|--|
| Dr. Silke VOGEL         | Associate Dean (Graduate Studies) | 6601 2496        | gmssv                                  |
| Ms. Megahwani Catherine | Assistant Manager                 | 6601 3019        | gmshmsc                                |

## Assessment & Progression

| <b>TITLE &amp; NAME</b>          | <b>DESIGNATION/RESPONSIBILITY</b> | <b>TELEPHONE</b> | <b>EMAIL<br/>(XXXX@NULLNUS.EDU.SG)</b> |
|----------------------------------|-----------------------------------|------------------|--|
| Assoc.<br>Prof. Scott<br>COMPTON | Associate Dean                    | 6601 1565        | gmssac                                 |
| Mr. TAN Poh<br>Huat Calvin       | Senior Education Specialist       | 6516 7955        | gmstph                                 |

## Quality Assurance & Accreditation

| <b>TITLE &amp; NAME</b>          | <b>DESIGNATION/RESPONSIBILITY</b> | <b>TELEPHONE</b> | <b>EMAIL<br/>(XXXX@NULLNUS.EDU.SG)</b> |
|----------------------------------|-----------------------------------|------------------|--|
| Assoc.<br>Prof. Scott<br>COMPTON | Associate Dean                    | 6601 1565        | gmssac                                 |

## Technology Enhanced Learning & Innovation

| <b>TITLE &amp; NAME</b>   | <b>DESIGNATION/RESPONSIBILITY</b> | <b>TELEPHONE</b> | <b>EMAIL<br/>(XXXX@NULLNUS.EDU.SG)</b> |
|---------------------------|-----------------------------------|------------------|--|
| Dr. Shiva<br>Sarraf-Yazdi | Associate Dean                    | 6516 2285        | gmsssy                                 |

## Planning & Business Management

| <b>TITLE &amp;<br/>NAME</b>       | <b>DESIGNATION/RESPONSIBILITY</b> | <b>TELEPHONE</b> | <b>EMAIL<br/>(XXXX@NULLNUS.EDU.SG)</b> |
|-----------------------------------|-----------------------------------|------------------|--|
| Ms. Norrita<br>Bte Abdul<br>Ghani | Senior Associate Director         | 6516 5688        | gmscmlnb                               |

## **3 Graduate Education**

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## **3.1 Degrees Offered**

Duke-NUS Medical School offers the following programmes:

### **1. MD Programme**

The Duke-NUS MD programme is distinctively designed to prepare physician leaders in medical research, education, and patient care. This programme spans 4 years, and graduates are awarded the degree of Doctor of Medicine (MD) jointly by Duke University and NUS.

For more information on our MD programme, please click [here](#).

### **2. MD-PhD Programme**

Duke-NUS also offers a combined MD-PhD programme that is unique to Singapore. This option is most appropriate for students who are committed to intensive research-oriented careers, combining biomedical research with the practice of clinical medicine. The duration of the MD-PhD programme varies, but is approximately 7 years. MD-PhD students start their PhD component after completing the 2<sup>nd</sup> year of the MD programme. Upon completion of PhD, students will complete the final (4<sup>th</sup>) year of the MD programme.

For more information on our MD-PhD programme, please click [here](#).

### **3. PhD Programme in Integrated Biology and Medicine (IBM)**

The Duke-NUS PhD programme in Integrated Biology and Medicine provides training in translational bioscience, covering a broad spectrum of disciplines including cell and molecular biology, biochemistry, physiology, and health policy. The main research areas that are offered include cancer stem cells, neuroscience, cardiovascular and metabolic disorders and infectious disease. The goal of this programme is to train PhD scientists across multiple disciplines with the skills and ambitions of translating basic scientific discoveries into useful therapies for patients. The education and training of the students is supported by award-winning research faculty. Students in the IBM programme will be awarded a joint PhD degree from Duke University and the National University of Singapore.

For more information on our PhD programme in Integrated Biology and Medicine (IBM), please click [here](#).

### **4. PhD Programme in Integrated Biostatistics and Bioinformatics (IBB)**



Biostatistics and bioinformatics are increasingly important areas for advancement of biomedical research. There is high demand for trained professionals in these areas, locally and internationally.

Biostatistics is responsible for experimental design, data analysis, and evidence synthesis and interpretation for answering questions in translational, clinical, epidemiological and health services research. Recent years have seen major changes in the medical landscape, such as the needs for rapid responses to infectious diseases, personalised medicine, and the availability and connectivity of big data. They demand innovative approaches to statistical problem solving. Some examples include adaptive clinical trial designs, dynamic treatment regimes, and high-dimensional data analysis methods.

Bioinformatics is an integration of data analytics, statistics, machine learning, modelling, software engineering, and computer science to answer questions in basic and translational biomedical research. The explosion of demand for bioinformatics in the last five years has been driven partly by huge decreases in the cost of next generation DNA sequencing, which is 10,000 times cheaper than it was in 2006. As a result, next-generation sequencing is now a foundational technology for much of biological research. The rapid development of many other high throughput technologies is also driving demand for bioinformatics experts.

Duke-NUS will launch its inaugural PhD programme in Integrated Biostatistics and Bioinformatics (IBB) in August 2017. The programme distinguishes itself from others by focusing on issues in modern biomedical research and preparing researchers to take their skills to advance medicine.

Students will complete their training in Duke-NUS' Center for Quantitative Medicine (biostatistics) and Center for Computational Biology (bioinformatics).

The degree, which will take on average 4 to 5 years to complete, culminates with the development of a written thesis and a successful oral dissertation defense.

For more information on our PhD programme in Integrated Biostatistics and Bioinformatics (IBB), please click [here](#).

## **5. PhD Programme in Clinical Sciences (CS)**

The aim of the PhD Programme in Clinical Sciences (PhD CS) is to educate and train medical doctors and other health science professionals to perform clinical and translational research. The proposed programme will focus on the interface between clinical, biological and social research methods by bringing together experts in quantitative sciences (biostatistics, epidemiology, and bioinformatics), biological basic sciences (genomics, immunomics, metabolomics), ethics, clinical therapeutics, health services and systems research.

For more information on our PhD programme in Clinical Sciences (CS), please click [here](#).

## **3.2 Curriculum Information (MD Programme)**

### **MD Programme**

The Doctor of Medicine (MD) programme at Duke-NUS is a 4-year course comprising of the following phases: pre-clerkship, clerkship, research and advanced clinical.

The programme begins with the pre-clerkship curriculum, introducing students to basic sciences and the fundamentals of patient care. Courses cover the basic science content fundamental to clinical core, including: biochemistry, genetics, cell biology, microanatomy, anatomy, physiology, neurobiology, behavioural sciences, pharmacology, microbiology, pathology and immunology. The pre-clerkship curriculum is covered in one year.

In their second year, students go through a series of clerkship rotations, gaining broad exposure to core specialties such as Paediatrics, Obstetrics and Gynaecology, Neurology, Psychiatry, Surgery and Medicine. Students are required to complete 5 blocks of 8-week clerkship rotations.

The research and advanced clinical phases span the third and fourth years of the MD programme.

Students spend approximately 8 months on scholarly research activities. They get to select a research area of their interest and carry out a research or scholarship project in that area under the supervision of a research mentor. At the end of the research experience, they are required to submit a thesis based on their research or scholarship project. Students may carry out their research or scholarship locally or at our affiliated institution, Duke University.

The advanced clinical rotations in the final two years of the MD programme provides students with opportunities to participate in patient care with increased responsibilities. Besides core specialties such as Emergency Medicine, Surgery, Medicine, Musculoskeletal and Critical Care, students are also given elective time to explore areas based on their career interest.

Below is a more detailed breakdown of our MD curriculum.

|        |  |
|--------|--|
| Year 1 | <ul style="list-style-type: none"><li>• C.A.R.E 1: Joining the Medical Profession</li><li>• Molecules, Cells &amp; Tissues</li><li>• Human Structure &amp; Function</li><li>• Brain &amp; Behaviour</li><li>• Body &amp; Disease</li><li>• Fundamentals of Clinical Practice</li></ul> Other Year 1 modules since 2007: <ul style="list-style-type: none"><li>• Investigative Methods &amp; Tools</li><li>• Evidence Based Medicine</li><li>• Normal Body</li><li>• Practice Course 1</li><li>• Foundations Course</li></ul> |
|--------|--|

|  |   |
|--|---|
| <p>Year 2</p>                              | <ul style="list-style-type: none"> <li>• C.A.R.E 2: Learning From &amp; For Patients</li> <li>• Medicine Clerkship</li> <li>• Surgery Clerkship</li> <li>• Paediatrics Clerkship</li> <li>• Obstetrics &amp; Gynaecology Clerkship</li> <li>• Neurology Clerkship</li> <li>• Psychiatry Clerkship</li> <li>• Geriatrics Medicine</li> <li>• Fundamentals of Family Medicine</li> <li>• Fundamentals of Research and Scholarship</li> <li>• Innovation &amp; Design Thinking</li> </ul> <p>Other Year 2 modules since 2008:</p> <ul style="list-style-type: none"> <li>• Integrated Anaesthesia Programme</li> <li>• Anaesthesiology Programme</li> <li>• Clinical Core 1 to 5</li> <li>• Cardiology Programme</li> <li>• Radiology Programme</li> <li>• Musculoskeletal Year 2 Programme</li> <li>• Clinical Reflections</li> <li>• Geriatric Medicine/Medical Oncology/Palliative Care</li> <li>• Oncology, Geriatric Medicine &amp; Palliative Care Programme</li> <li>• Geriatrics &amp; Nutrition</li> <li>• Clinical Oncology</li> <li>• Longitudinal Integrated Clerkship</li> <li>• Orientation to Clinical Year</li> <li>• Practice Course 2</li> </ul> |
| <p>Year 3 and 4 (Research/Scholarship)</p> | <ul style="list-style-type: none"> <li>• Research/Scholarship (Part 1)</li> <li>• Research/Scholarship (Part 2)</li> <li>• Research/Scholarship Thesis</li> </ul> <p>Other Research modules since 2009:</p> <ul style="list-style-type: none"> <li>• Orientation to Research Year</li> <li>• Research Methods and Analysis</li> <li>• IRB Modules</li> </ul>  |

|                                  |   |
|----------------------------------|---|
| Year 3 and 4 (Advanced Clinical) | <ul style="list-style-type: none"><li>• Advanced Medicine</li><li>• Advanced Surgery</li><li>• Musculoskeletal Rotation</li><li>• Critical Care Rotation</li><li>• Emergency Medicine</li><li>• Family Medicine Clerkship</li><li>• Student-In-Practice (Medicine)</li><li>• Student-In-Practice (Surgery)</li><li>• Practice Course 3</li><li>• Capstone Course</li><li>• Student as Future Educator</li></ul> <p>Other Advanced Clinical modules since 2010:</p> <ul style="list-style-type: none"><li>• Practice Course 4</li><li>• Independent Study</li><li>• Advanced Clinical Practice</li></ul> |
|----------------------------------|---|

### 3.3 Curriculum Information (MD-PhD Programme)

Duke-NUS offers a combined MD-PhD programme to students who wish to further their academic training. The programme combines medical education with research training to develop clinician-scientists who interface between medicine and science. Students embark on the PhD component after completing their second year of the MD programme. Upon completion of the PhD component, students will complete the final (fourth) year of the MD programme. Students admitted into the programme will be offered a full scholarship for the PhD component, as well as financial support to cover the tuition fee for their final year of MD training. Interested students can either apply directly to the MD-PhD programme at the time of initial application or after matriculation into the MD programme. Every year, approximately 15-20% of the MD cohort may be offered a place in the MD-PhD programme.

All applicants for the MD-PhD programme are required to sit for the MCAT. This programme does not accept GRE scores. Assuming successful fulfillment of requirements, students in the MD program will be awarded a joint Doctor of Medicine (MD) degree from Duke University and the National University of Singapore. For those having completed the MD-PhD option, the PhD degree will be awarded by the National University of Singapore.

| Duke-NUS MD-PhD Option               |        |           |                                  |
|--------------------------------------|--------|-----------|----------------------------------|
|                                      | YEAR 1 | MD        | Basic Science                    |
|                                      | YEAR 2 | MD        | Clinical Rotations               |
| In lieu of MD Year 3<br>ResearchYear | YEAR 3 | Start PhD | Coursework, Labs, Choose Mentor  |
|                                      | YEAR 4 | PhD       | Identify Thesis, Qualifying Exam |
|                                      | YEAR 5 | PhD       | Research                         |
|                                      | YEAR 6 | PhD       | Research                         |
|                                      | YEAR 7 | MD        | Clinical Rotations               |

### **3.4 Curriculum Information (PhD Programme in Integrated Biology and Medicine)**

#### **PhD Programme in Integrated Biology and Medicine**

The Duke-NUS PhD programme in Integrated Biology and Medicine provides training in translational bioscience, covering a broad spectrum of disciplines including cell and molecular biology, biochemistry, physiology, and health policy. During the first semester students complete a core course entitled “Molecules to Medicines” where they learn fundamentals in biomedical research, while simultaneously conducting two laboratory rotations. Subsequently, students choose a thesis mentor and complete their advanced training in one of five specialty tracks:

- Cancer and Stem Cell Biology
- Emerging Infectious Diseases
- Cardiovascular and Metabolic Disorders
- Neuroscience and Behavioral Disorders
- Health Services and Systems Research

The degree, which will take on average 4 to 5 years to complete, culminates with the development of a written thesis and a successful oral dissertation defense.

Like the Duke-NUS MD programme, the Ph.D. core course incorporates a novel education strategy which rapidly transitions students to a mode of learning better suited for a lifelong career in biomedical research. From the first week in the programme, students are introduced to scientific literature searches, evaluation and critique of seminal scientific papers. The core curriculum is delivered in a small group collaborative learning environment that reinforces critical thinking and public debate. An overview of the curriculum follows.



| YEAR 1                            |                |                |                           |
|-----------------------------------|----------------|----------------|---------------------------|
| Semester 1                        |                |                | Semester 2                |
| Lab Rotation 1                    | Lab Rotation 2 | Lab Rotation 3 | Start of Thesis Research  |
| IBM Class: Molecules to Medicines |                |                | SRP Specific Courses      |
|                                   |                |                | Student Research Seminars |

| YEAR 2                    |                           |
|---------------------------|---------------------------|
| Semester 1                | Semester 2                |
| Thesis Research           | Thesis Research           |
| SRP Specific Courses      | PhD Qualifying Exam (PQE) |
| Student Research Seminars | Student Research Seminars |

| YEARS 3-5                 |                           |                                 |
|---------------------------|---------------------------|---------------------------------|
| Semester 1                | Semester 2                | Completion of PhD               |
| Thesis Research           | Thesis Research           | Successful Dissertation Defense |
| Student Research Seminars | Student Research Seminars |                                 |

## Year 1 - Required coursework and lab rotations

All PhD candidates participate in the 15-week core course called “Molecules to Medicines” during their first semester of the PhD programme. This course introduces students to translational research, and provides training on experimental models, methods and mechanisms that drive current investigations into human disease. Scientific ethics training is woven throughout the course. This course is taught by a range of Duke-NUS faculty and staff who introduce their expertise to the students. This is not a lecture course, but an interactive learning course that requires significant preparation and participation.

Students will also conduct three 6-week lab rotations from among the Duke-NUS Signature Research Programmes. Mentors for the rotations must be regular ranked faculty and be on the approved mentor list. These rotations are structured to provide students with first hand exposure to the labs where they may choose to conduct their PhD research. At the end of the rotations, students will be asked to commit to a thesis mentor and a specialty discipline.

During the second semester, students may continue with coursework and/or begin primary research.

Specifics will be dependent on the specialty areas students choose to pursue.

## **Year 2 - Developing a thesis and qualifying exam**

At the start of the second year, students will work toward developing their thesis projects. Students may or may not continue with formal coursework, however, all PhD candidates are expected to actively participate in Duke-NUS research seminars and Journal Clubs sponsored by their Signature Research Programmes. These seminars provide students with a forum to give oral presentations, evaluate literature, analyze competitive science, and share ideas on major breakthroughs and future directions for their research field. This activity provides a critical foundation for a career in translational research.

In the first semester, all PhD students take a qualifying or preliminary exam. Successful students will defend a mock grant proposal, providing the faculty with the opportunity to evaluate their fundamental knowledge and ability to pursue hypothesis-based research.

## **Years 3 & 4 - Research and thesis**

After the qualifying exam, the remainder of the PhD training consists of the execution of the thesis project and regular participation in Research Seminars and Journal Clubs. The thesis mentor will guide the student and act as the chair of the student's Graduate Thesis Advisory Committee. Success of the thesis will be judged by the publication or anticipated publication of two quality first author papers, with the emphasis being on quality.

# Curriculum Information (PhD Programme in Integrated Biostatistics and Bioinformatics)

## PhD Programme in Integrated Biostatistics and Bioinformatics

The Duke-NUS PhD program in Integrated Biostatistics and Bioinformatics provides training in quantitative methods in biomedical sciences, covering a broad spectrum of disciplines including molecular and cell biology, genetics and genomics, and modern clinical trials and epidemiology methods. Students choose one of two concentrations and a thesis mentor

- [Biostatistics](#)
- [Bioinformatics](#)

During the first semester students complete a core course entitled “Molecules to Medicines” where they learn fundamentals in biomedical research. During the first two years, students will also complete a core set of courses entitled “Core Concepts in Biostatistics” and “Core Concepts in Bioinformatics”. The degree, which will take on average 4 to 5 years to complete, culminates with the development of a written thesis and a successful oral dissertation defense. An overview of the curriculum follows.

### **Biostatistics Concentration**

|               | <b>Semester 1</b>   | <b>Semester 2</b>  |
|---------------|---|--|
| <b>Year 1</b> | <ul style="list-style-type: none"> <li>• Research Methods from Medicine to Population Health (GMS6801, 4 MC)</li> <li>• Core Concepts in Biostatistics (GMS6820, 4 MC)</li> <li>• R-Programming (non-credit)</li> </ul> | <ul style="list-style-type: none"> <li>• Core Concepts in Bioinformatics (GMS6850, 4 MC)</li> <li>• Analysis of Complex Biomedical Data (GMS6802, 4 MC)</li> <li>• Design and Analysis of Modern Clinical Studies (GMS6803, 4 MC)</li> </ul> |
| <b>Year 2</b> | <ul style="list-style-type: none"> <li>• Thesis Research (4 MC)</li> <li>• Elective (4 MC)*</li> <li>• Integrated Biostatistics and Bioinformatics Journal Club (GMS6800, 1 MC)**</li> </ul>                            | <ul style="list-style-type: none"> <li>• Thesis Research (4 MC)</li> <li>• Biomedical Research Internship (GMS6804, 4 MC)*</li> <li>• Integrated Biostatistics and Bioinformatics Journal Club (GMS6800, 1 MC)**</li> </ul>                  |
| <b>Year 3</b> | <ul style="list-style-type: none"> <li>• Thesis Research (5 MC)</li> </ul>  | <ul style="list-style-type: none"> <li>• Thesis Research (5 MC)</li> </ul>   |

|               |   |   |
|---------------|---|---|
| <b>Year 4</b> | <ul style="list-style-type: none"> <li>• Thesis Research (5 MC)</li> <li>• Integrated Biostatistics and Bioinformatics</li> <li>Journal Club (GMS6800, 1 MC)**</li> </ul> | <ul style="list-style-type: none"> <li>• Thesis Research (5 MC)</li> <li>• Integrated Biostatistics and Bioinformatics</li> <li>Journal Club (GMS6800, 1 MC)**</li> </ul> |
|---------------|---|---|

\*Electives may include (non-exhaustive list and not open every year): Computer Intensive Statistical Methods and Statistical Models: Theory/Applications.

\*\* Journal Club will open in alternate years. The 2017 intakes will attend journal club in their years 2 and 4, the 2018 will attend in their years 1 and 3, etc. Total 4 MC.

**Year 1 - Required Coursework**

All PhD IBB Biostatistics Track students participate in the core course called “Research Methods from Medicine to Population Health” during their first semester of the program. This course introduces students to concepts, study designs and analytic issues that are commonly encountered in research on human subjects.

Students will also complete “Core Concepts in Biostatistics” in semester 1 and “Core Concepts in Bioinformatics”, “Analysis of Complex Biomedical Data” and “Design and Analysis of Modern Clinical Trials” in the second semester.

**Year 2 - Developing a Thesis and Qualifying Exam**

Students will take one elective course on advanced statistics. Some sample elective courses (non-exhaustive and may not open every year) include “Computer Intensive Statistical Methods” and “Statistical Models: Theory/Applications”.

Collaboration and consultation is an important part of the career of biostatisticians. During the second year, the students will participate in an internship in a clinical center or biomedical research institute. This will provide the opportunities to experience and practice in real-life research and stimulate thinking for methodological development.

At the start of the second year, students will work toward developing their thesis projects. All PhD students take a qualifying examination, which includes submission and defense of a research proposal.

**Years 3 & 4 - Research and Thesis**

After the qualifying exam, the remainder of the PhD training consists of the execution of the thesis project. The thesis mentor will guide the student and act as the chair of the student’s Graduate Thesis

Advisory Committee. Success of the thesis will be judged by the publication or anticipated publication of quality first author paper(s), with the emphasis being on quality.

In addition, all Duke-NUS PhD candidates are expected to actively participate in student research seminars and journal clubs. These activities provide students with a forum to give oral presentations, evaluate literature, analyze competitive science, and share ideas on major breakthroughs and future directions for their research field.

### **Bioinformatics Concentration**

|               | <b>Semester 1</b>   | <b>Semester 2</b>  |
|---------------|---|--|
| <b>Year 1</b> | <ul style="list-style-type: none"> <li>• Molecules to Medicines (GMS6901, 4 MC)</li> <li>• Laboratory rotations X2 (4 MC total)</li> </ul>  | <ul style="list-style-type: none"> <li>• Core Concepts in Bioinformatics (GMS6850, 4 MC)</li> <li>• Student Research Seminars (GMS6900, 0.5 MC)</li> </ul>   |
| <b>Year 2</b> | <ul style="list-style-type: none"> <li>• Core Concepts in Biostatistics (GMS6820, 4 MC)</li> <li>• Thesis Research (6 MC)</li> <li>• Student Research Seminars (GMS6900, 0.5 MC)</li> <li>• Integrated Biostatistics and Bioinformatics Journal Club (GMS6800, 1 MC)**</li> </ul> | <ul style="list-style-type: none"> <li>• Thesis Research (6 MC)</li> <li>• Elective (4 MC)</li> <li>• Student Research Seminars (GMS6900, 0.5 MC)</li> <li>• Integrated Biostatistics and Bioinformatics Journal Club (GMS6800, 1 MC)**</li> </ul> |
| <b>Year 3</b> | <ul style="list-style-type: none"> <li>• Thesis Research (6 MC)</li> <li>• Student Research Seminars (GMS6900, 0.5 MC)</li> </ul>   | <ul style="list-style-type: none"> <li>• Thesis Research (6 MC)</li> <li>• Student Research Seminars (GMS6900, 0.5 MC)</li> </ul>  |
| <b>Year 4</b> | <ul style="list-style-type: none"> <li>• Thesis Research (6 MC)</li> <li>• Student Research Seminars (GMS6900, 0.5 MC)</li> <li>• Integrated Biostatistics and Bioinformatics Journal Club (GMS6800, 1 MC)**</li> </ul>   | <ul style="list-style-type: none"> <li>• Thesis Research (6 MC)</li> <li>• Student Research Seminars (GMS6900, 0.5 MC)</li> <li>• Integrated Biostatistics and Bioinformatics Journal Club (GMS6800, 1 MC)**</li> </ul>                            |

\*\* Journal Club will open in alternate years. The 2017 intakes will attend journal club in their years 2 and 4, the 2018 will attend in their years 1 and 3, etc. Total 4 MC.

### **Year 1 - Required Coursework**

All PhD students participate in the 15-week core course called “Molecules to Medicines” during their first semester of the program. This course introduces students to biomedical research, and provides training on experimental models, methods and mechanisms that drive current investigations into human diseases. This course is taught by a range of Duke-NUS faculty and staff who introduce their expertise to the students. This is not a lecture course, but an interactive learning course that requires significant preparation and participation.

Students will also complete “Core Concepts in Biostatistics” in semester 1 and attend New Student Research Seminars in semester 2. The major landmark at the end of Year 1 is the identification of a thesis research mentor and a research area to work on.

## **Year 2 - Developing a Thesis and Qualifying Exam**

In Year 2, students will be required to complete any remaining coursework, and pass the PhD Qualifying Examination (PQE) in the form of submission and successful defense of a research proposal, to qualify for PhD candidature. To train students in writing competitive grant proposals, the research proposal for the PQE will need to be written in the format of a grant proposal following the guidelines of the National Medical Research Council (NMRC), Singapore; however the students will not be expected to bring in grant funding at this stage to start their thesis research.

## **Year 3 - Research and Thesis**

After the qualifying exam, the remainder of the PhD training consists of the execution of the thesis project. The thesis mentor will guide the student and act as the chair of the student’s Graduate Thesis Advisory Committee. Success of the thesis will be judged by the publication or anticipated publication of quality first author paper(s), with the emphasis being on quality.

In addition, all Duke-NUS PhD candidates are expected to actively participate in student research seminars and journal clubs. These activities provide students with a forum to give oral presentations, evaluate literature, analyze competitive science, and share ideas on major breakthroughs and future directions for their research field.

## **Year 4 - Research and Thesis**

In Year 4, the thesis research is to be completed, written up, and defended. The thesis should demonstrate scholarship and the student’s ability to perform original, independent research, be pre-approved by the mentor and the programme director, and be evaluated by at least 3 reviewers in the field. The thesis should therefore contain published or publishable work in international peer-reviewed journals.

## Elective Modules

Students in the bioinformatics concentration are required to take one elective module to fulfil their coursework requirements. In general, suitable modules offered by Duke-NUS or elsewhere in NUS can be taken as elective, subject to the thesis research mentor's approval. In particular, students in the bioinformatics concentration can choose one of the biostatistics courses (other than the 'Core Concepts in Biostatistics' which they are already required to take) offered by the CQM as their elective. Some additional sample elective modules are listed below (but this list is not exhaustive).

| <b>Module Number</b> | <b>Module Name</b>                       | <b>MC</b> | <b>Offered By:</b>                            |
|----------------------|--|-----------|---|
| ST 4231              | Computer Intensive Statistical Methods   | 4         | DSAP, Faculty of Science, NUS                 |
| ST 5217              | Statistical Methods for Genetic Analysis | 4         | DSAP, Faculty of Science, NUS                 |
| CDN 5101             | Fundamentals of Cancer Biology           | 4         | Cancer Science Institute of Singapore,<br>NUS |
| GMS 6904             | Principles of Infectious Diseases        | 4         | Duke-NUS                                      |

### 3.4 Curriculum Information (PhD Programme in Clinical Sciences)

#### PhD Programme in Clinical Sciences (CS)

The aim of the PhD Programme in Clinical Sciences (PhD CS) is to educate and train medical doctors and other health science professionals to perform clinical and translational research. The proposed programme will focus on the interface between clinical, biological and social research methods by bringing together experts in quantitative sciences (biostatistics, epidemiology, and bioinformatics), biological basic sciences (genomics, immunomics, metabolomics), ethics, clinical therapeutics, health services and systems research.

The goal is that clinician scientists trained in this PhD programme will lead research efforts in Singapore in the future and will enhance Singapore's international reputation in medical research.

Candidates may be admitted on a 3-year full-time or 4-year part-time basis. The programme is self-supporting and the candidates are encouraged to apply for [NMRC Research Training Fellowship](#).

#### Mentorship

Each student will be supervised and guided by one main mentor who is an established clinician-scientist. The mentor will provide the research environment and research support to the student. Further, a thesis advisory committee (TAC) comprised of up to four faculty will meet with the student and mentor on a regular basis to provide expert guidance

#### Mentor Eligibility

1. Medically qualified and leads a successful research programme in translational and/or clinical research.
2. Evidence of national competitive funding such as NMRC Clinician-Scientist Awards (STaR, CSA, IRG)
3. Sufficient funding to support the students' research project
4. Provide track record of peer-review publications in international journals.
5. Faculty appointment with Duke-NUS

#### Curriculum

|        |                                      |  |  |
|--------|--------------------------------------|--|--|
|        | 1. Principles of Clinical Research   | 1. Research Methods from Medicine to Population Health | <b>Coursework</b>  |
|        | 2. Foundations of Precision Medicine | 2. Protocol Submission                                 | <b>Thesis research (start)</b>                                   |
| Year 1 | 3. Forums/Workshops                  | 3. Research grant application for thesis project       | <b>PhD Qualifying Exam (PQE)</b><br>(either in Year 1 or Year 2) |
|        | 4. Good Clinical Practice Course     | 4. Graduate Seminar                                    |  |
|        | 5. Graduate Seminar                  |  |  |
|        |                                      | 1. Elective  |  |
| Year 2 | 1. Study Initiation Visit            | 2. Forums and Workshops                                | <b>Thesis research (continued)</b>                               |
|        | 2. Graduate Seminar                  | 3. Attend 2 IRB meetings                               | <b>Coursework</b>  |
|        |                                      | 4. Graduate Seminar                                    |  |



Year 3 1. Attend 2 IRB and 2 grant review  
committee meetings  
2. Graduate Seminar

1. Assist in reviewing 2 grants under  
the mentorship of the official reviewer  
2. Graduate Seminar

**Thesis research (continued)**  
**Preparation of Manuscript**  
**Successful Dissertation**  
**Defense**

## **4 Admissions and Financial Aid**

4.1 [Admissions](#)

4.2 [Financial Aid and Awards](#)

## 4.1 Admissions

At Duke-NUS, we utilize a holistic admissions review process that is individualized to each applicant. Broadly speaking, the admissions process takes into account a combination of personal attributes, experiences, and academic accomplishments. In keeping with our School's mission, as well as our Academic Medicine partnership with SingHealth, our ambition is to make significant contributions to improving the practice of medicine in Singapore and beyond. As such, we enthusiastically look forward to having promising applicants from diverse academic backgrounds join our community and help realise our vision.

For details on the admission requirements for our MD, MD-PhD, or PhD programmes, please visit <https://www.duke-nus.edu.sg/admissions/admission-requirements>

## 4.2 Financial Aid and Awards

To ensure that financial difficulties or economic circumstances do not hinder students from applying to Duke-NUS, we provide financial aid to our students in the form of merit scholarships, need-based scholarships (bursaries) and loans. Details on financial aid can be found [here](#).