

# **NUS Graduate School for Integrative Sciences and Engineering**

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# 1 Faculty's Commitment

**NGS** - The home of cutting-edge, cross-disciplinary PhD research and graduate education.

The NUS Graduate School for Integrative Sciences and Engineering (NGS) was established in 2003 to spearhead and promote integrative PhD research and education that transcend traditional disciplinary boundaries.

- Our multi-disciplinary environment affords exceptionally gifted, motivated students tremendous flexibility. If they choose to, students can explore the possibility of dipping into fields of study and research different from the disciplines they originate from.
- Our students have access to a world-class infrastructure, and receive research supervision from distinguished academics from two (or more) different fields of their choosing and interests.
- And, the curriculum is tailored by and to each individual student's needs and interests, and affords ample opportunities to ensure and enhance integrative learning.

Such a totality in research and education effectively sharpen their critical thinking skills, and help them to design their PhD projects in creative and interesting ways.

NGS has tight links with the relevant Faculties/Schools at NUS, and the various research institutes of the Agency for Science, Technology and Research (A\*STAR). NGS also taps into NUS' web of synergistic, complementary partnerships with a select number of world-leading overseas research institutes and knowledge organisations in the USA, the UK, Continental Europe, Japan, China, South Korea, Australia etc. Thus, NGS is able to offer gifted students the opportunity to engage in globally progressive research in superb research facilities both within Singapore and further afield.

## NGS Philosophy

NGS recognises that raising and solving many of the most challenging problems in science, engineering, computing and bio-medicine require integrative research approaches. Students are encouraged to transcend traditional discipline boundaries in their PhD research projects to elevate progress to new levels. For example, the skill sets of computational scientists, mathematicians or physicists can be deployed to model complex biological systems, engineers can draw on their specialist knowledge to devise novel methods for wound-healing or drug delivery, and life scientists can apply their knowledge of cell structures and functions to the study of artificial membranes.

## NGS Mission

Our mission is to provide world-leading integrative graduate education and research in science, engineering, computing, and related aspects of medicine.

NGS is a talent programme with two thrusts:

- NGS offers top-quality students opportunities in inter-disciplinary research with eminent researchers,

leading to breakthroughs at the intersection of disciplines.

- NGS provides a cross-disciplinary, broad-based graduate education which is tailored to individual needs and interests.

### **NGS Vision**

NGS aspires to be a leading graduate school, developing creative thinkers with excellent communication skills and strong ethics, who will go on to be leaders in their respective domains, and in society.

## **2 Key Contact Information**

Please refer to [ngs.nus.edu.sg/contact\\_us.html](http://ngs.nus.edu.sg/contact_us.html) for the most updated key contact information.

### 3 Graduate Education

Why pursue a PhD?

- Enables you to tackle difficult challenges in exciting research areas
- Deepens your knowledge base, and broadens your horizons
- Affords enhanced job prospects in our global knowledge-based economy

Why choose NGS?

- NGS: flexible and student-centred.
- All NGS students have the opportunity to transcend traditional discipline boundaries, and apply their knowledge and skills in novel ways.
- NGS PhD supervisors have been carefully selected on the basis of strong publication record, commitment to graduate education, and an interest in tackling tough research problems in innovative ways. Our supervisors make NGS special.
- Students can conduct their research with supervisors from two (or more) different fields. Multiple supervisory combinations, that cross faculties and/or involve individuals working in NUS and in the research institutes, are possible.
- NGS offers a unique core curriculum with emphasis on cross-disciplinary learning, in combination with elective modules, that can be tailored to/by each student according to one's interests and needs.
- Students can explore venturing into entirely new fields of study to enhance their critical thinking skills, and design their PhD projects in interesting ways.
- The NGS research environment is vibrant, intensive, and multi-cultural.

NGS is looking for students who:

- possess a keen interest in integrative research
- enjoy taking an analytical approach to problems
- seek to deepen their knowledge
- are curious about major issues in related subject areas
- will adhere to the highest ethical standards in research
- appreciate the importance of developing excellent communication skills
- can function well as part of a team
- will serve as role models to future generations of researchers

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### **3.1 Research Programmes**

NGS encourages research in or at the intersection of any of the following areas:

Engineering:

Biomolecular, Chemical, Computer, Electrical, Environmental, Manufacturing, Mechanical, Materials, Nanotechnology, Robotics

Information Technology:

Bioinformatics, Computational Biology, Data Mining, Infocommunications, Interactive and Digital Media

Life Sciences:

Biochemistry, Cancer Research, Cell and Molecular Biology, Developmental Biology, Genetics, Genomics, and Proteomics, Immunology, Lipidomics, Pharmacology, Physiology, Regenerative Medicine, Stem Cell Research, Structural Biology

Physical Sciences:

Biological Physics, Chemistry, Soft-condensed Matter Physics, Nonlinear Dynamics and Complex Systems, Nano- and Molecular Electronics, Photonics, Phononics, Thermoelectrics, Quantum Information and Quantum Computation

Please visit: <http://www.nus.edu.sg/ngs/research.html> for comprehensive information.

In addition, we offer research specialisation via the following networked groups

1. [Biological Imaging](#)
2. [Computational Biology](#)
3. Data Science – under [PhD \(Data Science\)](#)
4. [Environmental Life Sciences Engineering](#)
5. [Global Health Research and Technology](#)
6. [Interactive and Digital Media](#)
7. Neuroscience – under [Graduate Programme in Neuroscience](#)
8. [Mechanobiology](#) – run independently by [Mechanobiology Institute](#)
9. [Quantum Technologies](#) – run independently by [Centre for Quantum Technologies](#)

Please visit [http://www.nus.edu.sg/ngs/NGS\\_Networked\\_Grps.html](http://www.nus.edu.sg/ngs/NGS_Networked_Grps.html) for details.

NGS encourages flexible thinking. Through courses and laboratory rotations early in the degree, students have the opportunities to acquire new knowledge, tools and skills pertinent and related to their PhD projects.

### **3.2 Degrees/Programmes Offered**

NGS offers the following full-time graduate degree by research:

- Doctor of Philosophy (in Integrative Sciences and Engineering)

We also offer the following full-time graduate degree programmes:

- Joint NUS-Karolinska Institute (KI) PhD

This programme caters to students with research interests in/across bio-medicine and bioengineering. It is especially suitable for those whose research will reap maximum benefits from the collaborative research between NUS and KI.

Students will be based in NGS, and will commence their PhD in NGS. During the PhD candidature, students will spend

1. at least 18 months of their PhD candidature at NGS working on research and completing their required NGS modules;
2. at least 12 months in KI and complete the module requirement prescribed by KI.

On completion of the joint PhD Programme, degrees will be conferred by both NUS and KI, issued as separate degree certificates. The certificate will state that the degree is awarded within a joint PhD programme of Doctor of Philosophy between the National University of Singapore and Karolinska Institutet, Sweden.

Refer to: [http://www.nus.edu.sg/ngs/NUS\\_Karolinska\\_Institute\\_programme.html](http://www.nus.edu.sg/ngs/NUS_Karolinska_Institute_programme.html)

- NUS PhD-MBA

Students in the unique programme work on a PhD in science, engineering, computing or bio-medicine, and an MBA concurrently.

Successful applicants will be offered a scholarship covering the tuition fees for both the PhD and the MBA. During the PhD candidature, they will also be offered a stipend for living expenses, as well as allowances for books, a computer and conferences, all tax free, for 4 years. Please refer to [NGS Scholarship](#) for information.

In the 1st year, students typically do course work related to their PhD. Students also finish course work and sit for their PhD Qualifying Examination, as well as selecting two advisers, one of whom should be from NGS, while the other may be in any NUS department or school. Students then start their MBA in the

1st semester of the 3rd year of study. They do this as full time students in the NUS Business School, along with all other full-time MBA students.

From the 2nd semester of the 3rd year onward, students continue their PhD research full-time and finish course work related to their MBA in part time mode.

Upon successful defense of a thesis and the fulfillment of the requirements for the MBA, students are conferred a PhD and an MBA degree. Students may graduate with only a PhD, but not with only an MBA. The PhD-MBA is designed to take students between 4 to 5 years to complete.

Refer to: <http://www.phd-mba.nusnni.nus.edu.sg/>

### 3.3 Degree Requirements

The **NGS Scholarship (NGSS)** PhD Scholarship is awarded to talented students with an aptitude for innovative, high-calibre PhD research.

#### Terms

- Five-year PhD programme
- Four-year PhD-only award
- All university fees, except one-time registration fee charged upon enrolment
- Monthly stipend, up to 4 years of PhD OR up to date of graduation, whichever is earlier, of
- S\$3,500 for Singapore Citizens, plus Central Provident Fund (CPF) contributions at a rate pegged to the prevailing employer's contribution rate set by CPF
- S\$3,200 for Singapore Permanent Residents
- S\$3,000 for International students
- Allowances for ITware, books and conferences
- Cross-disciplinary research at the forefront of science, engineering, computing, and bio-medicine
- Opportunities for research projects based both in Singapore, and the USA/Europe/Japan/China/Australia/etc

#### Eligibility

Open worldwide to graduates

- with excellent research potential, and at least a very good 2nd Upper Honours, or equivalent qualifications
- from all branches of life, physical, computer and engineering sciences, and medicine

#### Other Conditions

- Students are not eligible for the President's Graduate Fellowship (PGF).
- Award is renewable, subject to satisfactory academic performance of  $CAP \geq 3.8$  at the end of every semester.
- GRE is compulsory for all applicants, except NUS, NTU and SUTD Bachelor degree holders.
- TOEFL/IELTS is compulsory for applicants whose native tongue or medium of undergraduate instruction is not English.

The **A\*STAR Graduate Scholarship (AGS)** is a collaboration between the A\*STAR Graduate Academy (A\*GA) and NGS. It comprises a four-year PhD study tenable at NUS and the PhD degree is awarded by NUS.

#### Terms

- Monthly stipend up to 4 years of the PhD studies, or up to date of graduation, whichever is earlier
- Payment of full tuition fees or up to date of graduation, whichever is earlier
- Allowances for computer, thesis, books and conference
- Opportunities for overseas attachment

## **Eligibility**

- Applicants must satisfy criteria for and seek admission into NUS PhD programme.
- Applicants must have obtained at least a Second Upper Class Honours Degree or its equivalent in relevant disciplines.
- Applicants with a strong interest in a research career are preferred.
- Applicants may submit GRE scores (if available) to be included in the overall assessment of their scholarship application.

## **Other Conditions**

- Students may not hold concurrently any other scholarship or fellowship
- Singaporeans (at the point of award): no service commitment
- Non-Singaporeans (at the point of award): 2-year service in Singapore-based companies without commitment to any specific organisation. The area of work should preferably be in Biomedical Sciences, Physical Sciences or Engineering
- AGS NUS graduates who are subsequently awarded the AGS PDF for overseas post-doctoral training: 1 year service commitment after the PDF stint with A\*STAR

Refer to our website: <http://www.nus.edu.sg/ngs/AGS.html> for Scholarship details.

## **Coursework Requirements**

The coursework requirements are applicable to all AGS and NGSS students, comprising the following:

### **(a) Coursework**

All students are required to undertake a one-year equivalent coursework (min 30 MCs) to be conducted by NUS faculties/schools and /or RIs.

- Students are to undertake the 3 compulsory NGS courses:

GS6001 (Research Ethics and Scientific Integrity), to be read latest by the 3rd semester upon enrolment,

GS5002 (Academic Professional Skills and Techniques) to be read latest by the 3rd semester upon enrolment, and

GS6883A (Interface Sciences and Engineering) to be read latest by the 4th semester upon enrolment

- All modules taken must be level 5000 or 6000.
- Levels 1000 – 4000 are undergraduate modules and can only be read as “AUDIT”. Students who audit a module will not receive a final grade. Audited modules will not appear on the student’s transcript / result slip. No record of attendance will be issued to auditors of a module. Note that it is subject to the host Faculty’s approval whether students are allowed to audit a module.
- In special cases, NGS may give approval to Level 4000 modules to be taken as S/U, but only in instances where the background of the students require this. E.g. a student with excellent qualifications in Physics who needs to undertake basic training in Cell Biology to carry out his thesis project.
- Graduate modules classified as S/U

1. This is applicable to all NGS students who wish to take graduate modules outside their main undergraduate discipline, to be graded on a S/U system and NOT count towards the CAP.
2. Student may request for up to 3 modules (12 MCs), with the support of their main supervisor at the start of each semester.
3. The application has to be submitted within the 1st month from the commencement of the module.
4. Any request for changes to the modules after the examination results release such as changing grading basis from S/U to grade, grade to S/U or deleting a module is NOT allowed.

## **(b) Undergraduate Teaching / Research Supervision**

1. International Students awarded the Scholarship, admitted from AY2014/2015, must perform teaching or laboratory supervision duties to fulfil the requirements of the Graduate Assistantship Programme as set out in the table below.

Total Hours Required to Serve during Candidature
312 hours

The awardee is to note that:

- The total time spent on work done under the Graduate Assistantship Programme and any other form of paid or unpaid work, should not exceed 16 hours a week;
- The awardee must ensure that the total hours required under the Graduate Assistantship Programme is completed before thesis submission or six (6) months before the expiry of the scholarship, whichever is earlier;
- The awardee shall be remunerated for performing teaching/research duties and developmental work at a rate in accordance to the Part-Time Appointment Scheme, for work done in excess of the Graduate Assistantship Programme.
- The awardee should work with the supervisor(s) on the plan to fulfil the required hours on a yearly (Academic Year) basis.
- If the required hours are not met according to the annual plan or the quality of the work done is unsatisfactory, NGS has the right to reduce the stipend, withhold, suspend and/or terminate the Scholarship.
- If the total required hours are not met by the time the thesis is submitted for examination, the awardee will have his/her transcript (both unofficial and official), student status letter, conferment letter and degree scroll (for graduating student) withheld until the fulfilment of the requirement.

2. Awardees who are Singaporeans or Singaporean Permanent Residents are required to assist in undergraduate teaching, fulfilling a minimum of 40hrs, usually to be completed by the end of the second year of enrolment at NGS. At least 20 hours should involve demonstrating/lecturing/tutorials only. The rest may be completed by mentoring peers or by supervision of UROP /Honours/JC Students. Note that marking hours cannot be clocked to fulfill the teaching requirement.

## **(c) Laboratory Rotation**

- Only for students who have not nominated their main supervisor.
- Prior approval has to be obtained from NGS before the start of a rotation.
- NGS reserves the right to reject any laboratory rotation request if prior approval has not been obtained.
- 2 MCs per rotation in laboratories outside that of the supervisor, co-supervisor or TAC members.
- The rotation has to last for at least 2 months and the student's performance is certified as satisfactory.

#### **(d) NGS PhD Thesis Seminars**

- Students may clock a maximum of 5 hours (or to attend 5 seminars) for their participation. These 5 hours may be used to fulfill the mandatory 40 hours of teaching requirement.
- To be awarded the hours, students have to sign in their attendance at each seminar and after each session, to submit to NGS a PhD Oral Defense Seminar Report Form (as attached) to share what they have learnt.

#### **(e) NGS Buddy System**

It is mandatory for students to participate in the Buddy System. For example, students from the earlier August intake will take on the roles of senior buddies to the freshmen of the subsequent August intake, while students from the earlier January intake will be the senior buddies to the freshmen of the subsequent January intake.

Seniors must meet with the freshmen at least 2 times in that academic year (once or more per semester) and obtain satisfactory feedback from the freshmen (Note: only 10 hours can be claimed regardless of how many freshmen the senior has). Both the senior buddy and the freshman have to report their meetings in a [log / feedback form](#), 2 times per academic year (once per semester) and submit the completed forms to the NGS office. (The deadline for submission of feedback form is 1 December for Semester 1 and 1 July for Semester 2).

#### **(f) Criteria for candidature and graduation:**

1. Coursework grades should not fall below a Cumulative Average Point (CAP) of 3.8. Higher grades in certain modules may be required.
2. Students whose CAP falls below 3.8 will be issued with a warning letter at the end of that semester for poor performance. The letter will state that the students' candidature may be terminated at the end of the following semester if his/her CAP remains below 3.8. Students will be counselled by members of SAGE.
3. To graduate, a student must obtain a CAP of 3.8 and above.

#### **(g) CAP Requirements and Policies**

1. CAP review for students will be done at the end of every Semester 1 & 2 of the Academic Year after the official release of the examination results (excluding Special Term 3 & 4).
2. NGS does not practice the Best CAP Calculation policy. All modules read will be used for the computation of the students' CAP, unless the module(s) is graded as S/U or CS/CU.
3. Students whose performance is under review by NGS are required to read at least 1 module every semester.
4. For students who fail to meet the CAP requirement of 3.80 for every semester, appropriate actions will be taken as follows:

##### 1st academic warning:

1. A warning letter will be issued via email (cc. supervisor).

##### 2nd academic warning:

1. A warning letter will be issued via email (cc. supervisor).

2. The Educational Allowances (EA) will be suspended.

**3rd academic warning:**

1. A warning letter will be issued via email (cc. supervisor).
2. The Educational Allowances (EA) will be suspended.
3. For students with:

**1. CAP between 3.50 - 3.79**

Reduction of Research Scholarship (RS) stipend to faculty level:  
S\$2000 per month for International Student  
S\$2200 per month for Singapore Permanent Resident  
S\$2300 per month for Singapore Citizen

**2. CAP below 3.50**

Termination of RS and Candidature by Registrar's Office (RO)

*\* NGS will not consider any appeal from students under the 2nd and 3rd academic warnings for waiver of any penalty as stated above.*

For students who have already been warned 3 times (with CAP between 3.50 - 3.79 and RS stipend at Faculty level) and achieve a CAP of less than 3.80 in the 4th semester:

1. Termination of RS and Candidature by Registrar's Office (RO)

The RO will send a dismissal letter to student (cc to supervisor).

Notes:

1. The suspension of the EA and the reduction of RS stipend will take effect from the date of release of the exam results of the previous semester to the date of release of the next exam results in the following semester of the academic year.
2. For students who are funded by other sources - the NGS will notify the relevant funding body to recommend similar penalties.

Appeal Procedures for Re-instatement of Candidature - applicable to only dismissed/terminated students with CAP between 3.50 - 3.79

1. Students who were dismissed from their candidature due to poor academic standing and who wish to appeal for re-instatement, should submit their appeal to NGS (within two calendar weeks of the last day of the release of each semester's examination results with support from supervisor, providing information on research performance, publications list and any other relevant information to support the appeal). NGS will not consider any appeals after that.
2. Students with potential to be considered for re-instatement will be asked to attend an interview.
3. Students will be notified of decision by NGS. RO will write to inform the student on the re-instatement of candidature and the student must accept the offer for re-instatement and reply to RO by the deadline given in the letter, failure of which will cause the offer to lapse.

Conditions for Re-instatement of Candidature

1. NGS will not provide Research Scholarship (RS) stipend.
2. NGS will not provide Tuition Fee (TF) subsidy.
3. NGS will not provide Educational Allowances (EA).
4. Students who are re-instated should still be reading course(s) in the current semester to improve on their CAP to >3.8, failure of which will result in a 2nd dismissal (with no appeal for second re-

instatement). The student will have to achieve the minimum CAP required for continuation and graduation in the current semester.

\* For students who have improved their CAP to  $>3.8$ , NGS will consider on a case by case basis to reinstate their RS/TF/EA.

## **Grading System and the Cumulative Average Point**

Grades and their respective grade points given are as follows:

GRADE	GRADE POINT
A+	5.0
A	5.0
A-	4.5
B+	4.0
B	3.5
B-	3.0
C+	2.5
C	2.0
D+	1.5
D	1.0
F	0.0

### **3.4 Financial Assistance and Awards**

Students who are offered a place in our School will be offered a scholarship, either through

- NGS Scholarship (NGSS)
- A\*STAR Graduate Scholarship (AGS)

The following are the **terms** of the respective Scholarships:

#### **For NGSS:**

- Monthly stipend, up to 4 years of PhD OR up to date of graduation, whichever is earlier, of
- S\$3,500 for Singapore Citizens, plus Central Provident Fund (CPF) contributions at a rate pegged to the prevailing employer's contribution rate set by CPF
- S\$3,200 for Singapore Permanent Residents
- S\$3,000 for International students
- All university fees, except one-time registration fee charged upon enrolment
- Other allowances including
  1. Computer
  2. Books
  3. Conferences
- Not eligible for President's Graduate Fellowship (PGF)
- Student must commit to PhD from the outset, cannot exit with MSc

Successful candidates will be given support for up to four years of academic pursuit, leading to a PhD. Award is renewable on an annual basis, subject to good progress.

Please refer to <http://ngs.nus.edu.sg/NGSS.html> for the most updated information.

#### **For AGS:**

- Monthly stipend up to 4 years of PhD studies, or up to date of graduation, whichever is earlier
- Full tuition fees
- Other allowances including
  1. Computer
  2. Thesis
  3. Books
  4. Conferences
- Opportunities for overseas attachment

Successful candidates will be given support for up to four years of academic pursuit, leading to a PhD. Award is renewable on an annual basis, subject to good progress.

Please refer to <http://ngs.nus.edu.sg/AGS.html> for the most updated information.

### **3.5 Other Administrative Information**

For **A\*STAR Graduate Scholarship (AGS)**, refer to

- <http://www.nus.edu.sg/ngs/AGS.html> for general information
- [http://www.nus.edu.sg/ngs/apply\\_proc\\_AGS.html](http://www.nus.edu.sg/ngs/apply_proc_AGS.html) for application matters.

For **NGS Scholarship**, refer to

- <http://www.nus.edu.sg/ngs/NGSS.html> for general information
- [http://www.nus.edu.sg/ngs/Instruction\\_on\\_application\\_submission\\_to\\_NGS.html](http://www.nus.edu.sg/ngs/Instruction_on_application_submission_to_NGS.html) for application matters.

#### Admission Interview

To assess their eligibility for the scholarships, short-listed applicants are expected to attend at least one round of interview.