Biological & Biomedical Sciences
2018-19

www.biology.cam.ac.uk/undergrads/nst/bbs
Natural Sciences Tripos
Part II
Biological and Biomedical Sciences
2018-19

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www.biology.cam.ac.uk/undergrads/nst/bbs
1. INTRODUCTION

The aim of NST Part II Biological and Biomedical Sciences (called NST Part II BBS) is to provide a rigorous and intellectually challenging alternative to a single biological Part II subject for both third year Natural Scientists and Medical and Veterinary Science students.

NST Part II BBS allows students to maintain some breadth in their study at Part II, rather than specialising in a single subject, and requires the submission of a dissertation rather than a practical laboratory-based research project.

NST Part II BBS is therefore suited to Natural Science students who wish to pursue career paths in, for example, teaching, management or consultancy, rather than those who wish to continue in a research career. It is also suited to Medical and Veterinary Science students who wish to remain in the Faculty of Biology at Part II, but who do not wish to take a single subject NST Part II.

Additional information about the course is available on the Faculty of Biology website at:  
www.biology.cam.ac.uk/undergrads/nst/bbs
2. COURSE AIMS AND LEARNING OUTCOMES

Aims

The course aims to:

- Provide a route for students who would prefer to follow a broader biological curriculum than that offered in single subject Part II courses
- Provide an education of the highest calibre in biosciences, leading to graduates of the quality sought by the medical and veterinary professions, the public service, industry and teaching
- Provide an intellectually stimulating and challenging learning environment in which students have the opportunity to develop their skills and interests to the best of their potential
- Provide training in scientific principles and experience in evaluation of research
- Contribute to the national need for practitioners and leaders in the medical and veterinary professions

Learning Outcomes

The course will provide:

- Advanced, in depth, understanding of the core principles and their experimental basis of a chosen Major Subject
- Additional advanced understanding of the more limited area of a chosen Minor Subject
- Experience of independent work, including an introduction to aspects of scientific research skills
- Development of skills in analysis of arguments and data from research papers
- Development of skills of reasoned argument in written and oral presentations of scientific investigations
- Verbal and written communication skills
3. COURSE MANAGEMENT

NST Part II BBS is managed by the Biological Sciences Committee for the Faculty of Biology.

The current overall Course Coordinator is Dr Catherine Lindon, who is a member of the Department of Pharmacology. The administration of the course is undertaken by Dr Chad Pillinger in the Faculty Board Office, which is located at 17 Mill Lane. If you have any administrative problems with the course, which cannot be solved within a particular department or by your College Director of Studies, please contact the Faculty Office (tel: (7)66899 or FacBiol@admin.cam.ac.uk).

In addition, Departmental Course Organisers are responsible for the detailed arrangements of the individual Major and Minor Subjects. A current list of Departmental Course Organisers, together with their contact details, are available on the Part II BBS website.

You should contact the Course Organiser for the Major/Minor Subject if you need any information about the arrangements of lectures, dissertations or examinations.

Departments will provide the same infrastructure for student support, departmental access, use of facilities, and supervision arrangements as they provide for their single subject students.

4. COURSE STRUCTURE

The course has three main components

- A ‘Major’ Subject, which will typically draw on the core teaching of a single Part II subject, but may draw on modules offered by more than one department. The ‘Major’ Subject will involve a minimum of 96 contact hours (excluding supervisions)
- A ‘Minor’ Subject, normally provided by another department, which will involve 24-30 contact hours (excluding supervisions)
- A dissertation of up to 6,000 words
5. Registration Procedure

Registration for NST Part II BBS is through the Part II Allocations Procedure used by biological departments for selection of students. You can indicate your preferred choice of department directly through the on-line portal in CamSIS, specifying that you wish to take the NST Part II BBS (dissertation) route. Details are available on the NST Part II website at:

www.natsci.tripos.cam.ac.uk/students/third/ii-subject-allocation

The deadline for submission of choices through CamSIS is 7 May 2018

6. Examinations

The maximum marks allocated for the course components are as follows:

- Major Subject: 64
- Minor Subject: 16
- Dissertation: 20
- Total: 100

The papers offered will normally be the same as those for the single Major Subject. For most Minor Subjects the paper is borrowed from another Tripos. There is a separate class list for NST Part II BBS.

The Faculty Board’s marking criteria are available on the web at:

www.biology.cam.ac.uk/undergrads/exams/marking-part-ii-dissertations/markings-diss

7. Major and Minor Subjects and Permissible Combinations

The Major Subjects (Papers 402 - 428) and the Minor Subjects (Papers 103 - 129) available in 2018-19 are shown on the following tables.

The permissible combinations of Major Subjects and Minor Subjects are also shown. Please note that subjects and combinations offered are subject to change - these will be detailed in the Reporter. An more detailed table of compatible subject combinations is available on the Faculty of Biology website (www.biology.cam.ac.uk/undergrads/nst/bbs/subject-combinations)

You will need to consult the Department or Reporter Lecture List for detailed timetables when they are published.
<table>
<thead>
<tr>
<th>Paper</th>
<th>Major Subjects</th>
<th>Permissible Minor Subjects</th>
</tr>
</thead>
<tbody>
<tr>
<td>409</td>
<td>Psychology</td>
<td>107, 109, 115, 116, 122, 123, 124, 125, 127, 128. Students may choose additional Minor Subjects that do not have lecture clashes with the Psychology modules chosen – please consult the relevant lecture timetables.</td>
</tr>
<tr>
<td>Paper</td>
<td>Major Subjects</td>
<td>Permissible Minor Subjects</td>
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</tr>
<tr>
<td>414</td>
<td>Genetics</td>
<td>104, 107, 108, 113, 114, 115, 119, 120, 121, 122, 124, 128. Students may choose additional Minor Subjects that do not have lecture clashes with the Genetics modules chosen – please consult the relevant lecture timetables.</td>
</tr>
<tr>
<td></td>
<td><em>Maximum 10 candidates</em></td>
<td></td>
</tr>
<tr>
<td>415</td>
<td>Physiology, Development &amp; Neuroscience</td>
<td>Students may choose Minor Subjects that do not have lecture clashes with the PDN modules chosen – please consult the relevant lecture timetables.</td>
</tr>
<tr>
<td></td>
<td><em>Max 22 candidates</em></td>
<td></td>
</tr>
<tr>
<td>424</td>
<td>Pathology (B&amp;E)</td>
<td>103, 104, 107, 108, 109, 113, 114, 116, 117, 118, 119, 120, 122, 123, 124, 125, 128, 129.</td>
</tr>
<tr>
<td>426</td>
<td>Pathology (D&amp;E)</td>
<td>103, 104, 107, 108, 109, 113, 114, 116, 117, 118, 119, 120, 122, 123, 124, 125, 128, 129.</td>
</tr>
<tr>
<td>427</td>
<td>Zoology</td>
<td>105. Students may choose Minor Subjects that do not have lecture clashes with the Zoology modules chosen – please consult the relevant lecture timetables.</td>
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<tr>
<td></td>
<td><em>Maximum 25 candidates</em></td>
<td></td>
</tr>
<tr>
<td>428</td>
<td>Psychology, Neuroscience &amp; Behaviour</td>
<td>106, 107, 108, 109, 111, 118, 122, 124, 128. Students may choose Minor Subjects that do not have lecture clashes with the PNB modules chosen – please consult the relevant lecture timetables.</td>
</tr>
</tbody>
</table>

Further Major Subject information is available at the NST Part II BBS website at: [www.biology.cam.ac.uk/undergrads/nst/bbs/MajorSubjects](http://www.biology.cam.ac.uk/undergrads/nst/bbs/MajorSubjects)

Detailed information about permissible subject combinations is also available online at: [www.biology.cam.ac.uk/undergrads/nst/bbs/subject-combinations](http://www.biology.cam.ac.uk/undergrads/nst/bbs/subject-combinations)
<table>
<thead>
<tr>
<th>Paper</th>
<th>Minor Subjects</th>
</tr>
</thead>
<tbody>
<tr>
<td>103</td>
<td>Health and Disease (HSPS Paper BAN8) <em>Maximum 20 candidates</em></td>
</tr>
<tr>
<td>104</td>
<td>Human Evolution and Palaeolithic Archaeology (HSPS Paper BAN3) <em>Maximum 20 candidates</em></td>
</tr>
<tr>
<td>105</td>
<td>Social Networks and Behavioural Ecology (HSPS Paper BAN2) <em>Maximum 20 candidates</em></td>
</tr>
<tr>
<td>106</td>
<td>Neural Degeneration and Regeneration (PDN Module N5) <em>Maximum 15 candidates</em></td>
</tr>
<tr>
<td>107</td>
<td>Philosophy &amp; Ethics of Medicine (HPS) <em>Maximum 50 candidates</em></td>
</tr>
<tr>
<td>108</td>
<td>Health, Medicine, and Society (HSPS Paper Soc 13)</td>
</tr>
<tr>
<td>109</td>
<td>The Family (PBS 9) - Limited Spaces</td>
</tr>
<tr>
<td>111</td>
<td>Central Mechanisms of Reward, Punishment and Emotion (PDN Module N6) <em>Maximum 15 candidates</em></td>
</tr>
<tr>
<td>113</td>
<td>Early Medicine (HPS) <em>Maximum 12 candidates</em></td>
</tr>
<tr>
<td>114</td>
<td>Modern Medicine &amp; Biomedical Sciences (HPS) <em>Maximum 12 candidates</em></td>
</tr>
<tr>
<td>115</td>
<td>Psychology of Education (Education) <em>Maximum 10 candidates</em></td>
</tr>
<tr>
<td>116</td>
<td>Sociology of Education (Education)</td>
</tr>
<tr>
<td>117</td>
<td>Philosophy of Education (Education)</td>
</tr>
<tr>
<td>118</td>
<td>History of Education (Education)</td>
</tr>
<tr>
<td>Paper</td>
<td>Minor Subjects</td>
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<td>-------</td>
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</tr>
<tr>
<td>119</td>
<td>Plant and Microbial Genetics (Genetics Module 2)</td>
</tr>
<tr>
<td>120</td>
<td>Human Genetics, Genomics &amp; Systems Biology (Genetics Module 4)</td>
</tr>
<tr>
<td>121</td>
<td>Evolutionary Genetics (Genetics Module 5)</td>
</tr>
<tr>
<td>122</td>
<td>EnterpriseTECH (Judge Business School)</td>
</tr>
<tr>
<td>123</td>
<td>Development and Psychopathology (PBS 6) <em>Limited Spaces</em></td>
</tr>
<tr>
<td>124</td>
<td>Psychology and Social Issues (PBS 7) - <em>Limited Spaces</em></td>
</tr>
<tr>
<td>125</td>
<td>Gender Development: Biological, Psychological and Clinical Perspectives (PBS 8) - <em>Limited Spaces</em></td>
</tr>
<tr>
<td>126</td>
<td>Exploring Music Psychology (Music Paper 17) <em>Maximum 3 candidate</em> – <em>candidates must demonstrate some musical knowledge to be permitted to study this option</em></td>
</tr>
<tr>
<td>127</td>
<td>Conservation Science (Zoology Module M2)</td>
</tr>
<tr>
<td>128</td>
<td>Bioinformatics <em>Maximum 46 candidates</em></td>
</tr>
<tr>
<td>129</td>
<td>General Practice and Primary Care Research (Primary Care Unit) <em>Maximum 8 candidates</em></td>
</tr>
</tbody>
</table>

PBS: Psychology and Behavioural Sciences  
HPS: History and Philosophy of Sciences  
HSPS: Human, Social and Political Sciences  

Further Minor Subject information is available at the NST Part II BBS website at:  
[www.biology.cam.ac.uk/undergrads/nst/bbs/Minors](http://www.biology.cam.ac.uk/undergrads/nst/bbs/Minors)
8. COURSE DESCRIPTIONS BY DEPARTMENT

Detailed course descriptions are available on the web and in course handbooks: the following brief outline gives a basic introduction to course content for the Major Subjects.

8.1. PATHOLOGY

The department offers nine Major Subjects.

Papers 402 - 407 & 424 - 426 Pathology

Students are able to take various combinations of two single subject modules:

Module A  Cancer and Genetic Diseases
Module B  Immunology
Module C  Microbiology and Parasitology
Module D  Virology
Module E  Dynamics of Infectious Diseases

Note that the combinations of modules A and E is not possible.

For further information see:

www.path.cam.ac.uk/undergraduate/third_year/NST-PartII-BBS
8.2. Pharmacology

The department offers one Major Subject.

Paper 408  Pharmacology

Students follow the same lectures as for the single subject. The course is divided into two sections and typically covers:

<table>
<thead>
<tr>
<th>Systems Pharmacology</th>
<th>Molecular and Cellular Pharmacology</th>
</tr>
</thead>
<tbody>
<tr>
<td>Pharmacology of Transporting Epithelia</td>
<td>Signalling by Cyclic AMP</td>
</tr>
<tr>
<td>Cardiovascular Pharmacology</td>
<td>G-Protein Coupled Receptors &amp; G Proteins</td>
</tr>
<tr>
<td>Cholesterol and Diabetes</td>
<td>Ca2+ Signalling</td>
</tr>
<tr>
<td>Pancreatic Islet and Gut Hormones</td>
<td>Ca2+ Signalling in The Heart</td>
</tr>
<tr>
<td>Inflammation and Angiogenesis</td>
<td>Adipose Tissue Development and Function</td>
</tr>
<tr>
<td>Circadian Rhythms in Pharmacology</td>
<td>Inositolde Signalling</td>
</tr>
<tr>
<td>Pharmacology of Psychiatric Disorders</td>
<td>Voltage-Gated Ion channels</td>
</tr>
<tr>
<td>Drug Discovery</td>
<td>Synaptic Mechanisms</td>
</tr>
<tr>
<td>Stem Cells</td>
<td>Nociception</td>
</tr>
<tr>
<td>Thrombosis and G Protein-Coupled Receptors</td>
<td>Glutamatergic Transmission</td>
</tr>
<tr>
<td>Hypertension, NO and Endothelium</td>
<td>Cys-Loop Family of Ligand-Gated Ion Channels</td>
</tr>
<tr>
<td>Cancer Therapies</td>
<td>Molecular Aspects of Multidrug Transport</td>
</tr>
</tbody>
</table>

For further information see: [www.phar.cam.ac.uk/undergrads/bbs](http://www.phar.cam.ac.uk/undergrads/bbs)
8.3. Psychology

The department offers one Major Subject.

**Paper 409 Psychology**

Students take the same lectures and exam papers as for the single subject. The course provides students with the conceptual tools and background knowledge required to understand developments in the sciences of mind and brain, including appreciation of the range of behavioural and physiological sources of evidence and multiple levels of theoretical analysis.

The examination format is as follows:

Paper 1 is subdivided into three sections:
- Statistics;
- Methodology and experimental design;
- Essay questions that address conceptual and historical issues.

Papers 2, 3, and 4 are divided into one section each
- Section A. Cognitive and Experimental Psychology (Paper 2);
- Section B. Behavioural and Cognitive Neuroscience (Paper 3);

Each Section contains several lecture courses that range from 4 to 24 lectures in length, with all lectures taking place in the Michaelmas and Lent terms only.

*Students must have taken MVST Part IB or NST Part IB Experimental Psychology to take this Major Subject.*

For further information see:

[www.psychol.cam.ac.uk/undergrads/ug/nst-ii/info](http://www.psychol.cam.ac.uk/undergrads/ug/nst-ii/info)
8.4 BIOCHEMISTRY

The department offers one Major Subject.

**Paper 411  Biochemistry**

The course is grouped into four 24 lecture modules, one of which has a branched structure to provide internal choice. In addition there is a series of methods and skills sessions and students are expected to attend the Departmental Research Seminar Series.

Module A: Structural and Chemical Biology
Module B: From Genome to Proteome
Module C: Stem - The Dynamic Cell
   plus either:
   Branch 1 - Bioenergy OR
   Branch 2 - Molecular Microbiology of Infectious Disease
Module D: Cell Cycle, Signalling and Cancer

Essential Methods and Skills : These feature key methods such as bioinformatics. Also included are data handling classes using past examination papers as core material to study approaches to data analysis and interpretation. Teaching of transferable laboratory and communication skills (such as graphic illustration, record keeping, data analysis, database searching and essay and report writing) are embedded in the course.

For more information see:

[www.bioc.cam.ac.uk/teaching/third-year/biochemistry/part-ii-biochemistry](http://www.bioc.cam.ac.uk/teaching/third-year/biochemistry/part-ii-biochemistry)
8.5. PLANT SCIENCES

The department offers two Major Subjects.

Paper 412  Plant Sciences - Cellular

This comprises the following modules from the single subject:
PLM1  Plant Signalling Networks
PLM2  Microbes: Evolution, Genomes and Lifestyle
PLL1  Plant Genomes and Synthetic Biology
PLL3  Exploiting Plant Metabolism

Paper 413  Plant Sciences - Ecological

This comprises modules from Plant Sciences and from Zoology:
PLM3  Evolution and Ecosystem Dynamics
ZM2   Conservation Science (Zoology)
PLL2  Responses to Global Change
ZL4   Applied Ecology (Zoology)

For further information see: www.plantsci.cam.ac.uk/teaching/plants
8.6. Genetics

The department offers one Major Subject.

Paper 414 Genetics

Students take four of the five modules offered for the single subject:
Module 1 Chromosomes and the Cell Cycle
Module 2 Plant and Microbial Genetics
Module 3 Developmental Genetics
Module 4 Human Genetics, Genomics and Systems Biology
Module 5 Evolutionary Genetics

The fifth module may be offered as a Minor Subject by students taking Major Subject Genetics.
Modules 2, 4 and 5 are offered as Minor Subjects to students who are not taking Major Subject Genetics.

For further information see:
www.gen.cam.ac.uk/undergraduate/nst2-genetics-overview
8.7. Physiology, Development and Neuroscience

The department offers one Major Subject.

**Paper 415 Physiology, Development and Neuroscience**

Choose any four modules from:

**Michaelmas:**
- N1 Developmental Neurobiology
- N2 Molecular and Cellular Neuroscience
- N4 Sensory Transduction
- P1 Cellular Physiology
- P3 Fetal & Placental Physiology
- P4 Development: Patterning the Embryo
- P9 Cell Assembly and Interactions

**Lent:**
- N3 Control of Action
- N5 Neural Degeneration and Regeneration
- N6 Central Mechanisms of Reward, Punishment and Emotion
- N7 Local Circuits and Neural Networks
- P2 Pluripotency and Differentiation
- P5 Bioinformatics
- P6 Development: Cell Differentiation & Organogenesis
- P7 Pathophysiology of Cancer
- P8 Systems and Clinical Physiology

Students must specify to the department which 4 modules they intend to take.

If a student chooses Minor Subject 106, 111 or 128, they may not take that module for their Major Subject.

For further information see:
www.pdn.cam.ac.uk/undergraduate-1/part-ii-courses
8.8. ZOOLOGY

The department offers a single Major Subject made up of modules offered in the single subject, and some modules offered by Plant Sciences and Genetics.

**Paper 427  Zoology**

Two modules from:
- Module M1  Topics in Vertebrate Evolution
- Module M2  Conservation Science
- Module M3  Human Evolutionary Ecology
- Module M4  Neuroethology: The Neural Basis of Adaptive Behaviour
- Module M5  Evolution and Behaviour: Genes and Individuals
- Module M6  Cell Assembly and Interactions
- Module M7  From Genome to Proteome
- Module M8  Development: Patterning the Embryo

Plant Sciences M3  Evolution and Ecosystem Dynamics

and two from:
- Module L1  Mammalian Evolution and Faunal History
- Module L2  Responses to Global Change
- Module L3  Evolution and Behaviour: Populations and Societies
- Module L4  Applied Ecology
- Module L5  Genetics, Development and Animal Diversity
- Module L6  Development: Cell Differentiation and Organogenesis
- Module L7  Cell Cycle, Signalling and Cancer
- Genetics Module 5  Evolutionary Genetics

*A limited number of module combinations are not possible. Please check the timetable and see further information at:*

[www.zoo.cam.ac.uk/undergraduates/NST-II-Zoology](http://www.zoo.cam.ac.uk/undergraduates/NST-II-Zoology)
8.9. Psychology, Neuroscience and Behaviour

The course offers a single Major Subject made up of modules offered by Psychology, PDN and Zoology.

**Paper 428 Psychology, Neuroscience and Behaviour**

Choose any four modules from the list below, which will be offered by the Departments of Psychology, PDN and Zoology:

- **PNB 1** Motivation, Judgement and Decision Making (Psychology)
- **PNB 2** Evolution and Behaviour: Genes and Individuals (Zoology)
- **PNB 3** Neuroethology: The Neural Basis of Adaptive Behaviour (Zoology)
- **PNB 4** Developmental Neurobiology (PDN)
- **PNB 5** Molecular and Cellular Neuroscience (PDN)
- **PNB 6** Sensory Transduction (PDN)
- **PNB 7** Control of Action (PDN)
- **PNB 8** Memory (Psychology)
- **PNB 9** Neural Degeneration and Regeneration (PDN)
- **PNB 10** Central Mechanisms of Reward, Punishment and Emotion (PDN)
- **PNB 11** Local Circuits and Neural Networks (PDN)

If a student chooses Minor Subject 106 or 111, they may not take that module for their Major Subject.

*For further information see: [www.psychol.cam.ac.uk/undergrads/ug/nst-ii/info](http://www.psychol.cam.ac.uk/undergrads/ug/nst-ii/info)*
9. Dissertations

You will be required to write a dissertation on a topic related to either your Major or Minor Subject, of up to 6,000 words excluding appendices, tables, figures, footnotes and bibliography. You will be required to submit your title (chosen from a list offered by the Departmental Course Organiser or suggested by you) by Division of Michaelmas Full Term. Your title is approved by your Supervisor, the Departmental Course Organiser, and then returned to the Faculty Office for final approval by the BBS Course Coordinator, who will also establish that all students taking the course have submitted an appropriate title. Your dissertations must be submitted to the Departmental Course Organiser by the first Friday of the Easter Full Term.

The purpose of the dissertation is to give you an opportunity to produce a substantial piece of original work. It should be an extended account of a topic or question that lies broadly within the field of either your Major or Minor Subject. In producing your dissertation, you will be expected to show skills in researching primary literature, critically evaluating published information, and marshalling arguments to produce a structured critical assessment of a defined topic. Detailed guidance for both students and supervisors is available on the BBS website.

You can expect to receive a maximum of four supervisions with your Dissertation Supervisor to provide guidance on your dissertation.
10. EXAMPLE DISSERTATION TITLES
Below are examples of dissertation titles proposed in the past:

- An insight into cation-pi interactions involved in structure and signalling in the plasma membrane. (Biochemistry)
- How can genomic data be used to understand cancer evolution and to assist with cancer therapy? (Genetics)
- New insights into the molecular basis of hereditary haemochromatosis. (Pathology)
- Corticotrophin-releasing factor system as a potential target to treat affective disorders. (Pharmacology)
- The nature and treatment of cognitive deficits in schizophrenia. (Psychology)
- The neurobiology of placebo analgesia. (PDN)
- The physiological risks of ultra-endurance events. (PDN)
- Is diversity the spice of life? Exploring the relationship between nature, biodiversity and psychological well-being. (Zoology)
- Transcriptional signature matching strategies in computational drug discovery and repositioning. (Bioinformatics)
- The ethics of global research funding. (History and Philosophy of Sciences)
- A Biopsychosocial Model of Gender Identity and Dysphoria. (Psychological and Behavioural Sciences)

11. STUDENT SUPPORT
The department in which you are taking your Major Subject will be designated as your “home” department. If your Major Subject comprises modules offered by more than one department, one of these departments will be assigned as your “home”; this will usually be the department in which you are doing your dissertation. As an NST Part II BBS student you will have access to the same resources and support in your home department as single subject NST Part II students.