Contents

Cover Photo: Mazdak Radjainia

Kia Ora Welcome

to the School of Biological Sciences

Message from the Head of School

Dear prospective graduate student,
Now that you are approaching the end of your undergraduate programme, I welcome the opportunity to outline to you the many options available for training in Biological Sciences at the graduate level. The School of Biological Sciences covers a wide range of disciplines from plant and microbial biotechnology and biomedical science through marine biology, terrestrial ecology and evolution and behaviour. The School also incorporates the Maurice Wilkins Centre for Molecular Biodiscovery, the Bioinformatics Institute, the Centre for Microbial Innovation and the Centre for Biodiversity and Biosecurity at Tāmaki Innovation Campus. There are opportunities for work on projects jointly supervised by staff in other departments in the Faculty of Science, the Institute for Marine Science, the School of Environment, and in the Faculty of Medical and Health Sciences. Research can also be undertaken with our co-appointed CRI staff through the Joint Graduate Schools in Plant and Food Research (with Plant and Food Research), Biodiversity and Biosecurity (with

Landcare), Coastal and Marine Science (with NIWA) and Dairy (with Agresearch), Dairy NZ and Livestock Improvement Corporation. Research projects can also be undertaken by joint supervision with staff and industry colocaters (eg Comvita) in the Institute for Innovation in Biotechnology (IIB), the AgResearch Laboratory for Structural Biology (both located in the Thomas Building), or off-campus at various Crown Research Institutes (including Plant and Food Research, Scion, AgResearch, Landcare Research, NIWA, ESR), the Department of Conservation, the Auckland Museum, and other outside organisations.

We also offer specialist postgraduate programmes including the:
Postgraduate Diploma and Masters Degree in Bioscience Enterprise, which are jointly taught by the School of Biological Sciences, the Business School, and the Law School. The programme is tailored for science graduates who are interested in the business and legal aspects of science, including the protection of intellectual property and commercialisation of research. The programme also offers many networking opportunities with industry and business people through site visits, and tutorial and seminar activities.

Postgraduate Diploma of Science and Master of Science degree in Biosecurity and Conservation - a graduate programme combining biological and environmental sciences in a market-informed context. The programme is jointly presented by the School of Biological Sciences and the School of Environment in partnership with Landcare Research. Courses run from the Tāmaki Innovation Campus of the University of Auckland, in conjunction with the Centre for Biodiversity and Biosecurity.

I hope you find this prospectus a useful guide to the procedures involved in entering our graduate school. The exciting research environment at the School of Biological Sciences along with the wide range of skills and knowledge represented by our academic and general staff, provides excellent opportunities for students proceeding to graduate study. For some of the more detailed "nuts and bolts" of life as a graduate student, please consult our SBS Guide to Survival, which will be issued to you at the SBS Orientation Session for new PGDip/Masters/Honours students in the first week of Semester One.

Finally, we very much welcome your interest in our graduate programme. It can be hard work but it can also be fun. I think you will find our School provides excellent opportunities for both study and social interactions. I look forward to you joining us in 2015.

Professor Gillian Lewis
Head of School
School of Biological Sciences

September 2014

Introduction

The School provides two handbooks/guides for potential and enrolled graduate students.

1. **Postgraduate handbook**

   A new edition of this handbook will be available each October to assist students who are seriously thinking about enrolling in PGDipSci, MSc or BSc(Hons) in Biological Sciences in the coming year. Students who have more or less made the decision to enrol at the University of Auckland in the coming academic year and who need more detailed information on regulations, the content and structure of courses offered, possible research projects etc, will find this handbook useful.

2. **The SBS Guide to Survival**

   This booklet is produced in February each year. It is designed to help newly enrolled graduate students orient themselves "into the real world of life as a graduate student" in the School. It contains information of a more immediate and "in-house" nature.

Additional information may be found on the School's home page:

www.sbs.auckland.ac.nz
sbsinfo@auckland.ac.nz

The School of Biological Sciences

Teaching in the School at the graduate level is coordinated to provide students with a wide range of course options (in 2015, 34 fifteen-point courses are offered) and a variety of research topics. Research students affiliate with a principal supervisor in SBS, but interdisciplinary research projects are encouraged. A wide range of opportunities exist for collaborative research projects undertaken by the three Joint Graduate Schools and between SBS staff and the staff of the Faculty of Medical and Health Sciences, the Department of Statistics, School of Environment and Leigh Marine Laboratory, and the staff of the Crown Research Institutes.

Enrolment information

Important dates

Closing dates for applications for admission in 2015	
1 December 2014	Deadline for new students to submit Application for Admission if 2015 programme includes Summer School courses. Application for Admission also closes 1 December for all students applying to Sport and Exercise Science.
8 December 2014	Deadline for new students to submit Application for Admission if 2015 programme includes Semester One and Semester Two courses only.

If you are a new student, only one Application for Admission is required. This form is due on either 1 December or 8 December, depending on whether you want to take Summer School courses as well.

Applications received after these dates may be accepted if there are places available.

Academic dates

Semester One begins on Monday 2 March 2015. For a full list of the 2015 academic dates, visit **www.auckland.ac.nz/dates**

Admission and enrolment procedures

How to apply

For ALL students not enrolled at the University of Auckland in 2014, apply online at www.auckland.ac.nz/applynow

How to enrol

If you have accepted an offer of a place in a programme and are ready to enrol, or are a returning student, go to www.studentservices.auckland.ac.nz

Admission and enrolment guide

For a step-by-step guide to the admission and enrolment process, please see

www.auckland.ac.nz/admission-enrolment.

Further information

Student Information Centre	Faculty of Science Student Centre
Room 112, Ground Floor The ClockTower 22 Princes Street Auckland City Campus Phone: +64 9 923 1969 or 0800 61 62 63 Email: studentinfo@auckland.ac.nz www.auckland.ac.nz/ student-info-centre Open: Monday to Friday, 8am-6pm	Room G016, Ground Floor Building 303 38 Princes Street Auckland City Campus Phone: +64 9 923 7020 Email: scifac@auckland.ac.nz (undergraduate enquiries) or pgscience@auckland.ac.nz (post-graduate and PhD enquiries) www.science.auckland.ac.nz/ student-centre Open: Monday to Friday, 8.45am-5pm

Further information

This handbook is intended to answer questions about the School of Biological Sciences and to help students plan their degree programmes.

For specific enquiries about the School of Biological Sciences contact:

For general advice:

Deputy Head of School (Academic):
Dr Howard Ross
ext 86160
h.ross@auckland.ac.nz

MSc, BSc(Hons), Postgraduate Diploma enrolment

Academic Services Coordinator (City)
or Karen Jennings ext 87215
k.jennings@auckland.ac.nz

Academic Services Coordinator (Biosecurity & Conservation) (Tamaki)
Kharmin Sukhia ext 86887
k.sukhia@auckland.ac.nz

PhD enrolment

Academic Services Coordinator
Patricia Rood ext 85720
p.rood@auckland.ac.nz

For academic advice:

Postgraduate Coordinator (PhD Programme):
Professor Philip Harris ext 88366
p.harris@auckland.ac.nz

GradDipSci Adviser
Ms Libby Hitchings ext 88703
l.hitchings@auckland.ac.nz

Postgraduate Advisor (PGDipSci, BSc(Hons), MSc)
Dr Judy O'Brien ext 88764
j.obrien@auckland.ac.nz

Postgraduate Advisor (Bioinformatics):
Cristin Print ext 85062
c.print@auckland.ac.nz

Postgraduate Coordinator (Biomedicine):
Dr Judy O'Brien ext 88764
j.obrien@auckland.ac.nz

Postgraduate Coordinator (Biosecurity & Conservation):
Dr Margaret Stanley ext 86819
mc.stanley@auckland.ac.nz

Postgraduate Coordinator (Bioscience Enterprise):
Professor Mark Burgess ext 85110
m.burgess@auckland.ac.nz

Postgraduate Coordinator (Wine Science):
Randy Weaver ext 89969
r.weaver@auckland.ac.nz

GradDipSci, PGDipSci, MSc and BSc(Hons) admission

- If you have been enrolled at the University of Auckland and would like to change your existing programme (eg, to PGDipSci after completion of BSc or to MSc) you will be able to initiate your application in Student Services Online **www.auckland.ac.nz/applynow** *to* change your programme.
- If your academic qualification is from another New Zealand University or from an overseas University, and if you hold New Zealand Permanent Residency or Citizenship, you must apply for admission. You may apply online by going to **www.auckland.ac.nz/applynow.**
- If you are not a New Zealand Permanent Resident or Citizen, you will be classed as an international student. Information for prospective international students is available on the University website at **www.auckland.ac.nz/international** For information on international tuition fees and admission procedure, you should contact the Auckland International Office, Old Choral Hall, 7 Symonds Street **Phone:** +64 9 373 7513 **Email:** int-questions@auckland.ac.nz
- English qualification scores required for postgraduate Science are set out in the table below.

Test	Postgraduate (PG)
TOEFL-paper based	575
TOEFL-computer based	233
TWE	4.5
TOEFL-internet based	90
Writing	21
IELTS (Academic)	6.5

Purpose and Objectives of GradDipSci, BSc(Hons), PGDipSci and MSc

There are several paths that a student can follow in postgraduate study. The following is to assist in choosing the appropriate qualification for you.

Graduate Diploma in Science (GradDipSci)

The GradDipSci qualification is intended for those who wish to change their area of science specialisation or for those who need to develop skills and expertise commensurate with a BSc degree from the University of Auckland. By developing a personalised programme of study, students are able to acquire knowledge in their chosen subject. This qualification is usually taken as a bridging year, to prepare the student for admission to the PGDipSci.

Bachelor of Science (Honours) (BSc(Hons))

The Bachelor of Science (Honours) is a programme of 120 points, which can be completed in one full-time year or on a part-time basis over up to two years of continuous enrolment. Students who have a strong academic background and who seek the challenge of a research project should choose this degree. The BSc(Hons) degree is intended to give students who have achieved A grades (GPA>7) as undergraduates the opportunity to apply their theoretical knowledge to a research project. The degree will enable the student to develop skills in critical thinking and its application to the research process. They will gain a detailed knowledge of a specialised subject and will acquire practical skills for performing research in their given subject. It will also provide advanced knowledge and skills, which can enable entry to the professional workforce. The degree will prepare students for undertaking larger research projects.

Postgraduate Diploma in Science (PGDipSci)

The Postgraduate Diploma in Science is a programme of 120 points, which can be completed in one full-time year or on a part-time basis over up to four years of continuous enrolment. This qualification is intended for students who want to strengthen their theoretical knowledge and critical thinking skills in preparation for undertaking an MSc or who wish to complete their studies with advanced knowledge of a subject area in preparation for entry into the professional workforce. Students who wish to spread the workload of coursework or those who did not achieve high grades as undergraduates should choose this option. This qualification will enable students to gain a detailed knowledge of a specialised subject and to develop skills in critical thinking as applied to that knowledge. The qualification will prepare students to undertake a research project as part of an MSc.

Master of Science (MSc)

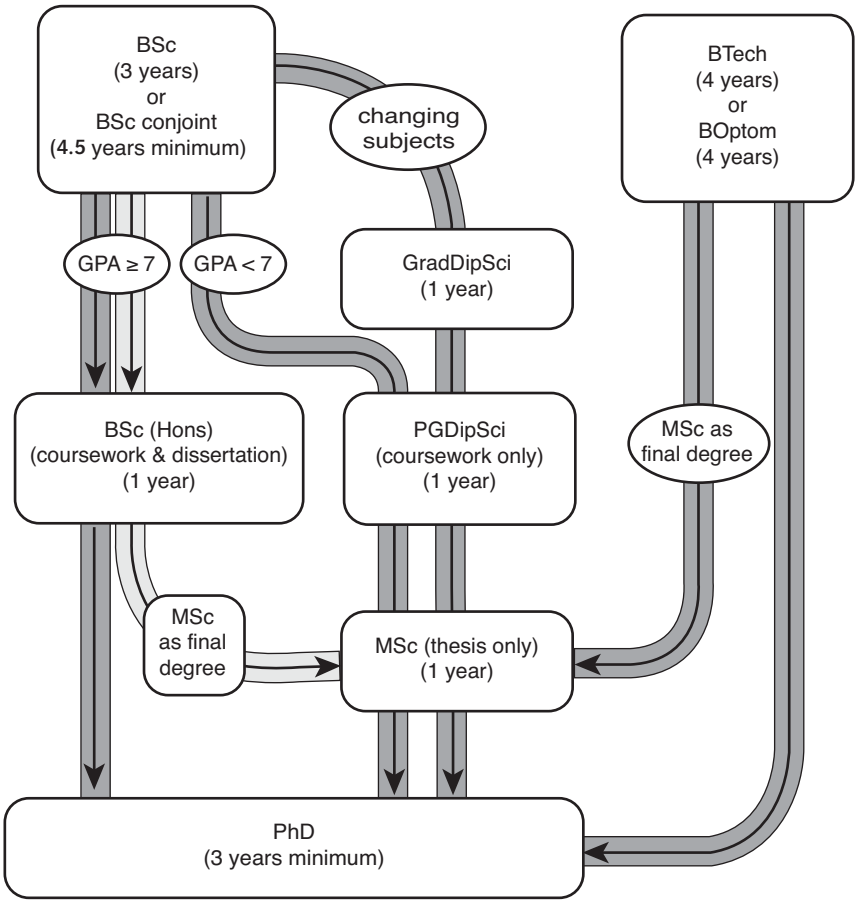
The MSc programme normally consists of a research project (worth 120 points) that is written up as a thesis. It is completed under the supervision of a staff member in one full-time year or on a part-time basis over up to two years of continuous enrolment.

The MSc gives students who have acquired advanced knowledge and skills in critical thinking in a subject, the opportunity to apply it to a research project. In doing so, they will gain skills in the development and execution of a research plan and the critical analysis of the results. They will gain practical skills in performing research in their given subject. This qualification will prepare students for entry to positions in the professional workforce that require these research skills.

Students who have completed a BSc(Hons), BTech or BOptom would normally take an MSc if they are seeking limited research experience prior to completing their studies or if they need to increase their class of honours to gain admission to a PhD. BSc(Hons) graduates with First Class Honours who are looking for more extensive research experience should move on directly to the PhD. The MSc prepares students who have completed a PGDipSci for more advanced research as part of the PhD. Generally the MSc is completed before advancing to the PhD, although if exemplary achievements are attained then the possibility exists in exceptional cases for it to be converted to a PhD programme.

Progression from undergraduate to postgraduate programmes

The following illustrates the normal pathways by which students at this University progress from an undergraduate degree to postgraduate study, including PhD, in the subject areas of Biological Sciences, Biomedical Science and Biosecurity & Conservation.



Prerequisites and requirements

The full regulations relating to these degrees and diplomas are contained in The University of Auckland 2015 Calendar available from the University Bookshop, in the Library, and on the University website www.auckland.ac.nz/calendar.

GradDipSci in Biological Sciences
The Graduate Diploma in Science, which involves the equivalent of one year of full-time study, is available to students who have either completed a BSc or attained an equivalent level of professional practical experience, provided they have either passed the relevant prerequisite courses or attained a level of competence equivalent to those prerequisites. Students enrolled for this diploma must pass 120 points above Stage I, including at least 75 points from courses at Stage III or above and including at least 45 points in Biological Sciences.

BSc(Hons) in Biological Sciences

Prerequisites:
Students entering this programme must have completed the requirements for a BSc, or an approved equivalent, with at least 90 points at Stage III and with a GPA of ≥5 including at least 45 points in Biological Sciences at Stage III. The permission of the Head of School is also required. This is a challenging degree and students with a GPA below 7 are advised to consider taking the PGDipSci followed by the 120-point MSc degree. Admission is at the discretion of the School's Postgraduate Coordinator.

Students should commence their dissertation project at the start of Semester One of their first year of BSc(Hons). Supervisors will make every effort to ensure that the project is organised and defined at the end of Semester Two of the third year of BSc. For this reason, students contemplating a BSc(Hons) should initiate discussions with potential supervisors during their last semester of enrolment in the BSc. For field-based projects it may be essential for the student to initiate some preliminary work as soon as their Stage III examinations are completed or over the summer vacation period.

Requirements:
The BSc(Hons) programme requires one year full-time study, including a research dissertation (BIOSCI 788) worth 45 points. The courses, worth a total of 75 points, must include BIOSCI 762 (worth 15 points); the remaining 60 points may be selected from BIOSCI 724-759 and BIOINF 701 (each worth 15 points). Up to 15 points may be substituted for a 700 level course in a related subject. The dissertation must be submitted by the last day of the final semester of enrolment in the programme. A student enrolled for this programme part-time must complete the requirements for the programme within 2 years of initial enrolment for the programme.

PGDipSci in Biological Sciences

Prerequisites:
Students entering this programme must have completed the requirements for a BSc, or an approved equivalent, with a GPA ≥3 in the best three BIOSCI courses at Stage III. For double majors, the entry GPA calculation is based on the best three courses at Stage III plus the best grade from the other major. Students with a GPA below 7 are advised to consider taking the PGDipSci followed by the one-year MSc degree.

Requirements:
For the PGDipSci, students must take courses worth 120 points, at least 90 points of which must be from BIOSCI 724-761 and BIOINF 701. Up to 30 points may be taken from 600 or 700 level courses in related subjects. The total

enrolment for the PGDipSci must not exceed 160 points. Class size limits have been imposed on some courses (BIOSCI 724, 725, 727, 731, 735, 736, 739, 741, 747, 748, 749, 755, 756, 757, 758, 759, BIOINF 701) and students who wish to enrol in these courses may be placed on a waitlist.

Students who know that they wish to proceed to the MSc programme on completion of their PGDipSci must enrol in the Thesis Proposal course (BIOSCI 761) as part of their PGDipSci programme, provided that they have achieved the required grades* and identified a thesis research topic in consultation with a member of the academic staff who has agreed to supervise the MSc project.

Because BIOSCI 761 is offered in both Semester One and Semester Two, confirmation of the research topic and supervision may be deferred until the start of the second semester of the student's PGDipSci.

*a GPA ≥ 4 in the Stage III courses of the undergraduate major or the 700-level courses taken for the PGDipSci.

MSc in Biological Sciences

Prerequisites:
A PGDipSci in Biological Sciences including BIOSCI 761 or equivalent, or a BSc(Hons) in Biological Sciences, with a GPA ≥ 4 in at least 90 points. At least 75 of these points must be in 700-level courses. Applications for admission to the MSc following the Bachelor of Technology (Biotechnology) will be considered on a case-by-case basis.

Requirements:
The MSc in Biological Sciences requires a thesis (BIOSCI 796) worth 120 points. If BIOSCI 761 was not completed as part of the PGDipSci students must obtain special permission to complete this course in the first semester of their MSc programme. Students whose qualifying programme was BSc(Hons) are not required to complete BIOSCI 761. Students who have passed ENVSCI 701 or MEDSCI 701 are not required to complete BIOSCI 761.

The programme may be taken on a full-time basis over two consecutive semesters, or on a part-time basis over no more than four consecutive semesters. Where appropriate, for example where seasonal field work is involved, and with the approval of the supervisor, thesis work may begin in the vacation before initial enrolment in the programme.

Thesis work provides the opportunity for students to learn how to carry out original scientific work, from the development of a topic, through the design and execution of experiments and data collection, to the analysis and writing up of the results as a thesis.

It is also possible that papers may be prepared for publication. Thesis research is the first chance most students have to do independent work, under the supervision of a member of staff whose broad research interests overlap with their own, and to develop their own ideas. However, in most cases, the research topic will be in an area where the supervisor or members of her/his research group have already carried out preliminary experimental or survey work (see "Possible Thesis Research Topics", pages 38-94).

BSc(Hons) in Bioinformatics

Prerequisite:
A specialisation in Bioinformatics and at least 90 points at Stage III.

Requirement:
45 points: BIOINF 702, 703, 704
45 points: BIOINF 789 Project
30 points from BIOSCI 733, 737, 752, 755-758, COMPSCI 715, 720, 732, 760, 767, MATHS

764, STATS 720, 721, 730, 731, 761, 783, 784

PGDipSci in Bioinformatics

Prerequisite:
A BSc with a major in Biological Sciences and COMPSCI 220, or equivalent as approved by the Programme Director.

Requirement:
- 45 points from BIOINF 702, 703, 704
- 75 points from BIOINF 701, 761, BIOSCI 733, 737, 752, 755-758, COMPSCI 715, 720, 732, 760, 767, MATHS 764, STATS 720, 721, 730, 731, 732, 761, 783, 784, or related 700 level courses, as approved by the Programme Director

MSc in Bioinformatics (One year programme, 120 points)

Prerequisite:
A BSc(Hons) in Bioinformatics, or a PGDipSci in Bioinformatics including BIOINF 761, or an equivalent qualification as approved by the Programme Director.

Requirement:
Research Masters
- 120 points: BIOINF 796 MSc Thesis in Bioinformatics

Taught Masters
- 120 points from BIOINF 701-704, BIOSCI 733, 737, 752, 755-758, COMPSCI 715, 720, 732, 760, 767, MATHS 764, STATS 720, 721, 730, 731, 732, 761, 783, 784, or related 700 level courses as approved by the Programme Director

MSc in Bioinformatics (Two year programme, 240 Points)

Prerequisite:
A BSc with a major in Biological Sciences and COMPSCI 220, or equivalent as approved by the Programme Director.

Requirement:
Research Masters
- 175 points: BIOINF 701, 702, 703, 704, 761
- 145 points from BIOSCI 733, 737, 752, 755-758, COMPSCI 715, 720, 732, 760, 767, MATHS 764, STATS 720, 721, 730, 731, 732, 761, 783, 784, or related 700 level course as approved by the Programme Director.
- 120 points: BIOINF 796 MSc Thesis in Bioinformatics

PGDipSci in Biomedical Sciences

Prerequisite:
A specialisation in Biomedical Science, or equivalent as approved by the Board of Studies (Biomedical Science).

Requirement:
At least 90 points from MEDSCI 703–723, 725-739, BIOINF 701, BIOSCI 728, 729, 733, 736, 737, 738, 741, 755–761, HLTHPSYC 716 and up to 30 points from other 600 or 700 level courses as approved by the Board of Studies (Biomedical Science).

MSc in Biomedical Sciences

Prerequisite:
A BSc(Hons) or a PGDipSci in Biomedical Science, or equivalent as approved by the Board of Studies (Biomedical Science).

Requirement:
The MSc in Biomedical Science requires the MSc thesis (BIOMED 796) worth 120 points.

PGDipSci in Biosecurity & Conservation

Prerequisite:
Students entering this programme must have completed the requirements for a BSc

(in Biosecurity & Conservation, or Biological Sciences, or Marine or Environmental Science), or an approved equivalent, with a GPA ≥ 3 in the best three courses approved for the major at Stage III (BIOSCI 320, 328, 330, 333, 335, 337, 394, 395, 396, ENVSCI 301, 311). For double majors, the entry GPA calculation is based on the best four courses at Stage III plus the best grade from the other major.

Requirement:
45 points from BIOSCI 747, 748, ENVSCI 733, 45 points from BIOSCI 761 or ENVSCI 701, BIOSCI 724, 730, 733, 734, 735, 738, 751, ENVMGT 742, 743, 746, ENVSCI 716, 734, 737 and up to 30 points from approved 700-level courses in the Faculty of Science.

MSc in Biosecurity & Conservation

Prerequisite:
PGDipSci in Biosecurity & Conservation, including BIOSCI 761 or ENVSCI 701, or equivalent, as approved by the Head of School, School of Biological Sciences with a GPA ≥ 4 in at least 90 points.

Requirement:
The MSc in Biosecurity & Conservation requires the MSc thesis (BIOSEC 796) worth 120 points.

Note for MSc & BSc(Hons) students

Before your enrolment can be approved, you will be required to have identified a thesis/dissertation research topic and to have come to an agreement with an academic staff member about supervision of your thesis/dissertation research. In areas where there is a wider choice of courses or where field work is involved, the advice of potential supervisors should be sought at an early stage. Students are encouraged to consider as wide a range of options as possible, and to consult a number of staff before reaching a final decision.

If you would like to have a preliminary discussion with the Postgraduate Coordinator, SBS, please telephone to make an appointment (Phone +64 9 373 7599) or for Biosecurity & Conservation, Dr Margaret Stanley (Phone +64 9 373 7599, ext 86819).
When choosing a research topic, be realistic about what can be achieved in the time available. Remember that you have a limited time to complete the research and to write up your thesis/dissertation.

For students engaged in field research, the closer the study area is to Auckland, the less time and expense will be spent on travel. The cost of the proposed research project (whether it involves expensive travel, or the use of sophisticated equipment) should also be taken into account.

If you do not have any pre-conceived ideas on topics, discuss general ideas with a number of staff and/or the SBS Postgraduate Coordinator, SBS, (Dr Margaret Stanley for Biosecurity & Conservation). Occasionally supervisors may have funds available for a particular research topic and this may help you financially. You might not find out about such possibilities if you do not consult a number of potential supervisors.

The "Form"

When you have reached a decision about your research topic and supervision, you need to complete the form on p.17 (for Biological Sciences, Biomedical Sciences) or p.19 for Biosecurity & Conservation). Forms are also online at www.sbs.auckland.ac.nz/pg_planning.

Ask your proposed supervisor to sign the form and submit it to the Student Resource Centre, Biology Building, for the attention of Academic Services Coordintor, or by email to k.jennings@auckland.ac.nz, or for Biosecurity & Conservation, to Kharmin Sukhia, School of Biological Sciences, Tāmaki Innovation Campus, cnr Morrin Road &

Merton Road, St Johns, Auckland, or email to k.sukhia@auckland.ac.nz.

Final approval will be given by the SBS Postgraduate Coordinator, who will take into account your proposed supervisor's comments as well as the number of students who have expressed a preference for working with that particular supervisor. Every effort will be made to accommodate students' first preferences. However, in some cases there may be limits on the availability of space and/or equipment and on the number of students that a particular staff member can effectively supervise.

When the SBS Postgraduate Coordinator, or Dr Margaret Stanley (Biosecurity & Conservation) has approved your choice of research topic and supervision, your admission and enrolment will be approved in Student Services Online (provided that you have already logged on and completed the application process).

Part-time study

Part-time study is defined as a student workload of fewer than 100 points over two semesters in one year or fewer than 50 points in one semester.

Enrolment in a thesis or research portfolio must commence on either 1 December, 1 March or 15 July and must be continuous. Enrolment may be partially full-time and partially part-time and satisfy the enrolment completion and submission requirements in the following table.

Date of initial enrolment	Time to complete degree		Due date for submission of thesis or research portfolio for one year full-time or two years part-time enrolment	Due date for submission of thesis or research portfolio for mixed full-time and part-time enrolment
120 degree points	Full-time	Part-time		
1 December	12 months	24 months	30 November	31 May
1 March	12 months	24 months	28 February	31 August
15 July	12 months	24 months	14 July	14 January

Note for students with qualifications from outside New Zealand:

Given the wide variation in tertiary qualifications across the world, the equivalence of your qualification to New Zealand qualifications will need to be individually assessed by The University of Auckland to determine the appropriate entry level for your postgraduate studies.

Applications for admission to PGDipSci, MSc or PhD from students who already hold a BSc, BSc(Hons) or MSc, or equivalents, from an overseas university will be considered on a case-by-case basis.

The deadline to submit an application for admission is 1 December 2014.

Research in the area of management of biological sciences

Students who are conducting research or intending to work professionally in the management of biological resources in New Zealand are strongly encouraged to take formal courses on Māori society and contemporary Māori issues.

School of Biological Sciences "the form"

Download at www.sbs.auckland.ac.nz/pg_planning

- **MSc and BSc(Hons) in Biological Sciences or Biomedical Sciences in SBS**
- **BIOSCI 761 for PGDipSci**

Confirmation of Research Topic and Supervision

Name in full: _____ Date: _____

Student ID number: _____

Address for correspondence: _____

_____

Phone number: _____ Phone number after exams, if different: _____

Email address: _____

My proposed enrolment for 2015 is:

Tick Box/es as appropriate

- BSc(Hons) Dissertation Proposal BIOSCI 762 ☐
- BSc(Hons) Dissertation BIOSCI 788 ☐
- MSc Thesis Proposal BIOSCI 761 ☐

or I have completed BIOSCI 761 ☐

or I have completed Bachelor's degree (Hons) ☐

- MSc Thesis BIOSCI 796 ☐

Please indicate if you would like to be associated with one of the following Joint Graduate Schools:

Biodiversity & Biosecurity ☐ Coastal & Marine ☐ Plant & Food ☐

Topic _____

Supervisor _____

Comment by proposed supervisor Date_____

_____

_____

_____ Signature of Supervisor

Submit completed form to:
Student Resource Centre, Biology Building. Attention: Academic Services Coordinator
or by email to: k.jennings@auckland.ac.nz.

School of Biological Sciences "the form"

Download at www.sbs.auckland.ac.nz/pg_planning

- **PGDipSci (Biosecurity & Conservation) Thesis Proposal Courses: BIOSCI 761 or ENVSCI 701**
- **MSc in Biosecurity & Conservation Thesis (BIOSEC 796)**

Confirmation of Research Topic and Supervision

Name in full: _____ Date: _____

Student ID number: _____

Address for correspondence: _____

_____

Phone number: _____ Phone number after exams, if different:: _____

Email address: _____

My proposed enrolment for 2015 is:
Tick Box/es as appropriate

MSc Thesis Proposal

- BIOSCI 761 for PGDipSci (Biosecurity & Conservation) ☐
  OR
- ENVSCI 701 for PGDipSci (Biosecurity & Conservation) ☐

NB: SBS supervisors prefer you enrol in BIOSCI 761

MSc Thesis

- BIOSEC 796 ☐

I have completed:

- ENVSCI 701 for PGDipSci (Biosecurity & Conservation) ☐
  OR
- BIOSCI 761 ☐

Please indicate if you would like to be associated with one of the following Joint Graduate Schools:

Biodiversity & Biosecurity ☐ Coastal & Marine ☐ Plant & Food ☐

Topic _____

Supervisor _____

Comment by proposed supervisor Date_____

_____

_____

_____ Signature of Supervisor

Submit completed form to:
Kharmin Sukhia, Building 733, Tāmaki Campus or mail to Kharmin Sukhia, School of Biological Sciences, Tamaki Campus, the University of Auckland, Private Bag 92019, Auckland 1142

NB: Supervision for BIOSCI 761 does not commit your 761 supervisor to supervising the MSc in Biosecurity & Conservation. This form must be re-submitted with supervision confirmation before enrolment in MSc in Biosecurity & Conservation.

Academic information

Academic year 2015	
Summer School – 2015	
Lectures begin	Tuesday 6 January
Deadline to withdraw from Summer School courses	1 week before the end of lectures
Auckland Anniversary	Monday 26 January
Waitangi Day	Friday 6 February
Lectures end	Friday 13 February
Exams*	Monday 16 February - Wednesday 18 February
Summer School ends	Wednesday 18 February
Semester One – 2015	
Semester One begins	Monday 2 March
Mid-Semester Break/Easter	Friday 3 April - Saturday 18 Aprill
ANZAC Day	Friday 27 April
Graduation	Monday 4 May, Wednesday 6 May, Friday 8 May
Deadline to withdraw from first semester courses	3 weeks before the end of lectures
Queen's Birthday	Monday 1 June
Lectures end	Friday 5 June
Study break/exams*	Saturday 6 June - Monday 29 June
Semester One ends	Monday 29 June
Inter-semester break	Tuesday 30 June – Saturday 18 July
Semester Two – 2015	
Semester Two begins	Monday 20 July
Mid-semester break	Monday 31 August – Saturday 12 September
Graduation	Tuesday 29 September
Deadline to withdraw from second semester courses	3 weeks before the end of lectures
Lectures end	Friday 23 October
Exams*	Thursday 29 October - Monday 16 November
Labour Day	Monday 26 October
Semester Two ends	Monday 16 November
Semester One – 2016	
Semester One begins	Monday 29 February 2016

**Aegrotat and Compassionate Applications must be submitted within 1 week of the date that the examination affected took place. The medical certificate must date to the day of the exam.*

Deadline for withdrawal from double semester courses is three weeks before the end of lectures in the second semester.

Courses for PGDipSci, BSc(Hons) and MSc

BIOINF 701 Bioinformatics

(15 points) (City) Semester One

An overview of the methods and applications of bioinformatics with specific reference to: Internet-accessible database technology, database mining, applications for gene and protein sequence analysis, phylogenetic analyses, three-dimensional protein prediction methods, and genome sequence analysis. The course involves basic programming using the Perl scripting language.

Prerequisite: 30 points from Stage II in Biological Sciences

Restriction: BIOINF 301, BIOSCI 359, BIOSCI 742

Course Coordinator: Dr Howard Ross

Assessment: 30% Examination

70% Coursework

Format: Assignments 5 x 10% (50%), Project (20%)

Class Limit: 25

BIOINF 702 Comparative Bioinformatics

(15 points) (City) Semester One

Much knowledge of biological systems is acquired by making comparisons with known systems. Several computational methods, including Markov models, HMMs and dynamic programming can be used in making these comparisons. Technical aspects of these methods and their application to biological problems will be discussed.

Prerequisite: A sound understanding of BIOINF 359 or 301 or equivalent is assumed. Students lacking this background must take BIOINF 701 as a co-requisite.

Course Coordinator: Associate Professor Shaun Lott

Assessment: 40% Examination

60% Coursework

Format: Assignments 5 x 10% (50%), In-course test (10%)

BIOINF 703 Genome Bioinformatics and Systems Biology

(15 points) (City) Semester Two

Advances in genetic sequencing technologies are rapidly changing our ability to determine the genome sequence and to explore the gene expression profiles of organisms. Relevant computational methods, including graph theory, string comparison and pattern matching will be discussed, along with their application to genome assembly, metagenomics, gene-gene interaction and systems biology.

Prerequisite: BIOINF 701 or equivalent

Course Coordinator: Dr David Welch, Department of Computer Science

Assessment: 40% Examination

60% Coursework

Format: Assignments 6 x 10% (60%)

BIOINF 704 Statistical Bioinformatics

(15 points) (City) Semester Two

BIOINF 704 provides (1) a detailed description of the statistical techniques required to analyse modern human genetic data (80%) and (2) an introduction to the analysis of gene-expression data (20%). The methods used to locate genomic regions involved in genetic diseases through the analysis of pedigree data are introduced. Central concepts in population genetics are also presented and a thorough description of genome-wide association studies (GWAS) is given. The limitations and ethical implications of GWAS are also discussed. The second part of the course focuses on the statistical analysis of microarray data and the methods that are used to make sense of the expression levels of thousands of genes measured in various experimental conditions.

BIOINF 704 is mainly aimed at statisticians, medical school students, computer scientists and biologists with a desire to understand the challenges brought by the deluge of genetic data available nowadays. It will provide them with the statistical techniques required to make sense of this type of information.

Course Coordinator: Dr Stéphane Guindon, Department of Statistics

Assessment: 40% Examination

60% Coursework

Format: Assignments 4 x 15% each (60%)

BIOSCI 724 Marine Ecology

(15 points) (City) Semester One

Current topics in marine ecology at the population, community, and ecosystem level. One focus is on ecology and evolution in a life-history context, including topics on fertilisation, larval development and population connectivity. At the community/ecosystem level we also consider the role of macroalgae, keystone species, the influence of climate change, terrestrial/marine comparisons and marine biosecurity. A sound understanding of BIOSCI 333 or equivalent is assumed.

Course Coordinator: Associate Professor Mary Sewell

Assessment: 40% Examination

60% Coursework

Format: 2 Short Essay/Assignments 30%, 10 Seminar Synopses 30%

Class Limit: 24

BIOSCI 725 Ecological Physiology

(15 points) (City) Semester One

Physiological and biochemical processes enable animals to occupy diverse habitats. Highly variable and extreme environments provide an opportunity to study the functional attributes of animals, particularly ectotherms, with respect to their metabolic, respiratory, and nutritional adaptations. A sound understanding of physiological and biochemical principles is required for this seminar series. A knowledge of BIOSCI 335 or equivalent is assumed.

Course Coordinator: Dr Tony Hickey

Assessment: 50% Examination

50% Coursework

Format: 2 assignments at 15% each, Synopsis 15%, 5% Seminar

Class Limit: 24

BIOSCI 727 Aquaculture

(15 Points)
(City) Semester Two

Current assessment of the national and global status of aquaculture, including consideration of future potential and prospects. Examples of invertebrate and fish aquaculture, and a review of general environmental and biological problems and the role of scientific knowledge in aquaculture management. Coverage of factors include analysis of significant New Zealand aquaculture industries, the role of hatchery technology, stock improvement via genetic programmes and issues surrounding the productivity, quality and welfare of fish. A sound understanding of BIOSCI 328 or equivalent is assumed.

Course Coordinator: Professor Andrew Jeffs, (Leigh Marine Laboratory)

Assessment 40% examination

60% Coursework

Format: 2 short reports 40%, Seminars 20%

Class Limit: 24

BIOSCI 728 Neuroethology

(15 points) (City) Semester One

The experimental study of the neural basis of behaviour, including current topics in sensory systems (eg vision, olfaction, audition, lateral line, electro- and magnetoreception) together with neural mechanisms underlying biological rhythms. The application of neuroethology to biomimetic systems will also be discussed. A sound understanding of BIOSCI 337 or equivalent is assumed.

Course Coordinator: Professor Michael Walker

Assessment: 60% Examination

40% Coursework

Format: Short critical reports on assigned readings; seminar presentation of an assigned reading.

BIOSCI 729 Evolutionary Biology

(15 points) (City) Semester Two

A contemporary approach to central issues in evolutionary biology. Topics covered include natural selection, speciation, macroevolution, sexual conflict and kin selection. A sound understanding of general evolutionary concepts (eg BIOSCI 322 or equivalent) is assumed.

Course Coordinator: Professor Kendall Clements

Assessment: 70% Examination

30% Coursework

Format: 2 x 15% Essays

BIOSCI 730 Entomology and Biosecurity

(15 points) (City) Semester Two

More than half of all described species are insects, and there are many times more species awaiting discovery and description. Insects at every trophic level above plants dominate terrestrial and freshwater food chains. This course will examine the evolution of insects, the importance of their role in terrestrial ecosystems, and the problems posed by insects as biosecurity

invaders in non-native environments.

Course Coordinator: Dr Greg Holwell

Assessment: 100% Coursework

Format: 15% Seminar, 20% Seminar, 40% Review, 15% Poster, 10% Review Outline,

This course assumes a prior knowledge of entomology at Stage III. Students are strongly recommended to have completed BIOSCI 320.

BIOSCI 731 Biogeography

(15 points) (City) Semester Two

This course examines the patterns of ecology and evolution at landscape scale, and the processes that influence these patterns. Topics covered include species diversity, species abundance, ecology and evolution in the community and speciation. A sound understanding of BIOSCI 395 or equivalent is assumed.

Course Coordinator: Dr Shane Wright

Assessment: 70% Examination

30% Courswork

Format: Essay 20%, Seminar 10%

Class Limit: 24

BIOSCI 733 Molecular Ecology and Evolution

(15 points) (City) Semester Two

A powerful and increasingly important way to address many ecological and evolutionary questions is by using the information stored in the molecular archive. This course provides a broad theoretical and practical basis for undertaking such studies in fields ranging from conservation genetics and connectivity, to phylogenetics and molecular evolution. Topics may include the neutral theory of molecular evolution, inbreeding depression, gene flow and population structure, coalescent analyses, molecular identification of species, phylogenetic analysis, selection at the molecular level, and the estimation of kinship. A sound understanding of BIOSCI 322 or equivalent is assumed. Three labs may be held on consecutive Mondays after mid semester break.

Course Coordinator: Dr Shane Lavery

Assessment: 40% Examination

60% Coursework

Format: Project 20%, Essay 20% & Seminar 20%

BIOSCI 734 Terrestrial Plant Ecology

(15 points) (City) Semester Two

Plants form the autotrophic basis of terrestrial food chains and their distribution, diversity and abundance is a critical determinant of ecosystem functioning. Topics covered include both plant population ecology - including population growth and structure, seed and seedling dynamics, and life history strategies - and community ecology - including vegetation structure, dynamics, and species interactions. Methods to survey, analyze, and model plant populations and communities will also be discussed. A sound understanding of BIOSCI 396 or equivalent is assumed. There will be a 2-3 day field trip with dates to be announced.

Course Coordinators: Dr Bruce Burns and Associate Professor George Perry

Assessment: 100% Coursework

Format: Essay 40%, Field Trip Report 30%, Seminar 20%, Participation 10%

BIOSCI 735 Advanced Behavioural Ecology

(15 points) (City) Semester One

Behavioural ecology explores the dynamic interplay between evolution, ecology and behaviour, focussing on proximate and ultimate mechanisms. This course develops professional skills in reading, researching, discussing, presenting, and writing about contemporary topics in behavioural ecology. We focus on critical analyses of concepts, research methods and publication styles, and assignments are tailored to student-directed inquiry. A sound understanding of BIOSCI 337 or equivalent is assumed. You are advised to consult the course co-ordinator regarding your academic preparation for this course.

Course Coordinator: Dr Anne Gaskett

Assessment: Coursework: 100%

Format: Weekly Synopses 30%, Presentation 20%, 1 Literature review 30%, Group Debate 10%, Class Participation 10%

Class Limit: 24

BIOSCI 736 Microbial Genomics and Metabolism

(15 points) (City) Semester Two

Cross-disciplinary issues involved in the understanding of microbial genome structure, gene regulation and metabolism. Topics may include: the genetic basis of microbial interactions and horizontal gene transfer, genomics-proteomics-metabolomics of microorganisms, the effect of the environment on microbial gene expression, metabolism and evolution and modern approaches used to link gene sequence to biological function and phenotypes. A sound understanding of BIOSCI 348 or equivalent is assumed.

Course Coordinator: Dr Augusto Barbosa

Assessment: 40% Examination

60% Coursework

Format: Three Essay/Seminar modules at 20% each

Class Limit: 24

BIOSCI 737 High Resolution Imaging of Biological Molecules.

(15 points) (City) Semester One

X-ray crystallography and electron microscopy are two of the principal techniques used by biologists to determine molecular structures. Taken together, their applicability extends over many orders of size – being capable of visualizing individual amino acids as well as the gigantic molecular complexes found within the cell. This course addresses the theory and practice of these two disciplines, and includes a laboratory component, where 3D structures are determined from experimental data. The course is designed to be accessible to students with a variety of backgrounds, including Biology, BioEngineering, Chemistry, Physics, Mathematics and Computer Science.

A sound understanding of BIOSCI 350 or equivalent is assumed. This course complements CHEM 738 and BIOSCI 757.

Course Coordinator: Associate Professor Alok Mitra

Assessment: 100% Coursework

Format: 35% Practical assignment, 30% Test, 35% coursework assignment.

BIOSCI 738 Advanced Biological Data Analysis

(15 points) (City) Semester One

Advanced biological data analysis, including analysis of variance with nested and random effects, analysis of covariance, cluster analysis, principal components analysis, multidimensional scaling, and randomization methods. There will be a practical component to this course involving the use of the R statistical software.

Prerequisite: 15 points from BIOSCI 209, STATS 201, 207, 208 or equivalent.

Course Coordinator: Dr Kathy Ruggiero

Assessment: 40% Examination 60% Coursework

Format: Six fortnightly assignments at 10% each. Workshop/Tutorial: Must attend 5 out of 6 to pass the course overall.

BIOSCI 739 Dialogues in Biology

(15 points) (City) Semester One

Cross-disciplinary issues in biology will be debated and explored including ethical and commercial issues underpinning science as a vocation; genetic engineering; development, and evolution; environmentalism, conservation and biodiversity, the history and philosophy of biological science.

Course Coordinator: Dr James Russell

Assessment: 40% Examination

60% Coursework

Format: Summaries x 2 at 20% each, Special Report 20%,

Class Limit: 24

BIOSCI 741 Applied Microbiology and Biotechnology

(15 points) (City) Semester One

This course covers the role of microbes in waste-water management, food products and bioremediation. We also consider microbial diversity as a rich source of novel enzymes which have wide-ranging applications in industry and biotechnology. As case studies of biotechnological applications, synthetic blood products and viral vaccine development are also covered. A sound understanding of BIOSCI 347 and/or 348 or equivalent is assumed.

Course Coordinator: Associate Professor Silas Villas-Boas

Assessment: Examination 60%

40% Coursework

Format: 2 Essays

Class Limit: 24

BIOSCI 747 Biosecurity and Invasion Biology

(15 points) (Tāmaki) Semester One

The science of invasion biology, including stages of the invasion process and ecological interactions between species. The impacts of invasive alien species in different ecosystems. Population and community ecology, in relation to biosecurity.

Course Coordinator: Dr Margaret Stanley

Assessment: 100% Coursework

Format: Test 30%, Report 30%, Exercise 10%, Essay 30%

Class Limit: 24

NB. If you are interested in enrolling in BIOSCI 747 and its companion course BIOSCI 748 you should be considering taking the PGDipSci in Biosecurity & Conservation.

BIOSCI 748 Weed and Pest Management

(15 points) (Tāmaki) Semester Two

Techniques for the management of invasive plants and animals (vertebrates and invertebrates) in different ecosystem types, including terrestrial and aquatic ecosystems. Approaches to the prevention, control and eradication of invasive species in different situations.

Course Coordinator: Dr Margaret Stanley

Assessment: 100% Coursework

Format: Management Plan Review 30%, Management Recommendations Report 35%, Research Proposal 35%

Class Limit: 24

NB. If you are interested in enrolling in BIOSCI 747 and its companion course BIOSCI 748 you should be considering taking the PGDipSci in Biosecurity & Conservation.

BIOSCI 749 Ecology of Microbial Interactions

(15 points) (City) Semester Two

Microorganisms are intimately associated with their immediate environment. This course considers those associations. Topics to be discussed will include microbial communities and their survival strategies in natural and artificial systems. A sound understanding of BIOSCI 347 or equivalent is assumed.

Course Coordinator: Dr Mike Taylor

Assessment: 60% Examination

40% Coursework

Format: Seminars 2x5%, Assignments 3x10%

Class Limit: 24

BIOSCI 751 Plant Microbial Interactions

(15 points) (City) Semester Two

This course addresses selected topics in plant microbial interactions. Modern research on issues relating to plant pathogens and biosecurity, plant disease spread (epidemiology) and plant microbial interactions (both pathogenic and mutualistic) will be investigated and discussed. A basic understanding of microbiology and molecular biology is assumed.

Course Coordinator:
Professor Mike Pearson

Assessment: 100% Coursework

Format: 2 or 3 Seminars 40%, 2 or 3 Written Assignments 60%

BIOSCI 752 Plant Genomics and Biotechnology

(15 points) (City) Semester One

How genomics and gene transfer technologies could be used to achieve improved plant growth and to develop food with new traits. Topics may include: plant genomics methods, engineering fruit color, control of fruit ripening and texture, biotechnology project design. A sound understanding of BIOSCI 354 or BIOSCI 340 or equivalent is assumed.

Course Coordinator: Dr Karine David

Assessment: 50 % Examination

50 % Coursework

Format: Essay 20%, 2 Seminars 30% total

BIOSCI 753 Synthesis of Plant Products and Foods

(15 points) (City) Semester Two

Aspects of the biosynthesis of plant products and foods: the biosynthesis of selected plant cell-wall components important in dietary fibre or biomass for the production of biofuels, including lignins, cellulose or non-cellulosic polysaccharides; the biosynthesis of antioxidant pigments in food plants and their possible impacts on human health; the manipulation of nitrogen assimilation in plants to increase the yield and quality of agricultural and horticultural plant products. A sound understanding of BIOSCI 340 or equivalent is assumed.

Course Coordinator: Professor Philip Harris

Assessment: 50% Examination

50% Coursework

Format: 3 essays (15% each), 3 seminars 5% total

BIOSCI 754 Plant Genomes and Gene Expression

(15 points) (City) Semester Two

This course focuses on regulation of gene expression in plants and how genes modulate plant responses. Original journal papers and research techniques common in plant molecular biology are analysed in detail. Topics include transcription factors, RNAi, epigenetics and post translational controls in the regulation of flowering time genes and genes regulated by plant hormones. The course consists of a mix of lectures, round table discussion groups and student seminars. A sound understanding of BioSci 354 and/or 340 is assumed.

Course Coordinator:

Associate Professor Joanna Putterill

Assessment: 50% Examination

50% Coursework

Format: 1 Essay 25%, 1 seminar and hand-in (25%)

BIOSCI 755 Genomics and Gene Expression

(15 points) (City) Semester One

This course will address the analysis of genomes and gene expression as a means of understanding biological processes. Aspects of functional and chemical genomics will be presented, as well as gene expression profiling using microarray technology. In terms of the latter, features of experimental design and data analysis will be discussed in the context of disease and developmental processes. A sound understanding of BIOSCI 351 or equivalent is assumed.

Course Coordinator: Dr Rob Young

Assessment: 70% Examination

30% Coursework

Format: Essay 15%, Seminar 15%

Class Limit: 24

BIOSCI 756 Proteomics and Protein Interactions

(15 points) (City) Semester One

Proteomics describes a field of research concerned with the large-scale study of protein expression and function. This course will highlight biochemical approaches used to link protein sequence and function. The application of proteomics to drug action, discovery and toxicology will be included together with a study

of methods employed to investigate protein-protein interactions. A sound understanding of BIOSCI 350 or equivalent is assumed.

Course Coordinator: Professor Tom Brittain

Assessment: 70% Examination

30% Coursework

Format: Either Essay 15%, Seminar 15%

or 2 Essays 15% each. Co-ordinator to advise.

Class Limit: 24

BIOSCI 757 Structural Biology

(15 points) (City) Semester Two

A selection of contemporary topics in the field of structure and function of important biomolecules and cellular activities. Topics may include: protein folding and targeting in the cell; vesicle transport and motor proteins; pathogen and immune system molecules; protein structure determination; protein structure and function from genomic data. A sound understanding of BIOSCI 350 or equivalent is assumed.

Course Coordinator:

Associate Professor Peter Metcalf

Assessment: 100% Coursework

Format: 1 Essay 34%, 2 Seminars @ 20% each, Class participation 26%

Class Limit: 24

BIOSCI 758 Development, Differentiation and Disease

(15 points) (City) Semester Two

Examples of normal and perturbed gene expression from selected model organisms and humans will be used to develop understanding of biological pathways that may span development, ageing, genetic diseases and cancer. A sound understanding of BIOSCI 356 or equivalent is assumed.

Course Coordinator: Associate Professor David Christie

Assessment: 60% Examination

40% Coursework

Format: 2 Essays at 12.5% each, Seminar 5%, Synopses 10%

Class Limit: 24

BIOSCI 759 Molecular Cell Biology and Biomedicine

(15 points) (City) Semester One

This course will explore recent advances in cell biology that have led to a greater understanding of a variety of cellular processes at the molecular level. Emphasis will be placed on biochemical and genetic approaches to understanding disease mechanisms at the cellular level. A sound understanding of one or more of BIOSCI 349, 353 or MEDSCI 314 or equivalent is assumed.

Course Coordinator:

(Semester One) Dr John Taylor

Assessment: 70% Examination

30% Coursework

Format: Essay 15%, Seminar 15%

Class Limit: 24

BIOSCI 759 Molecular Cell Biology and Biomedicine

(15 points) (City) Semester Two

This course will provide students with insight into several areas of current biomedical research with particular focus on immunology and molecular biology. We will examine some of the molecular events that regulate disease mechanisms and explore how we can exploit molecular and cellular processes for the treatment of disease. During this course you will learn how to critically evaluate the scientific literature and develop skills in researching, discussing and writing about biomedical research. A sound understanding of one or more of BIOSCI 349, 350, 353 or MEDSCI 314 or equivalent is assumed.

Course Coordinator:

(Semester Two) Dr Catherine Angel

Assessment: 55% Examination

45% Coursework

Format: Essay 15%, Seminar 15%, Research Paper Synopsis 10%, Class Participation 5%

Class Limit: 24

BIOSCI 761 MSc Thesis Proposal

(15 points) (City) Semester One
Semester Two

A detailed outline of the proposed thesis research and experimental design. The proposal must review current scientific literature and emphasise the relevance of the proposed study. Students will also be required to present their proposal as a seminar.

Course Coordinator:

Associate Professor Peter Metcalf (Semester One)

To Be Advised (Semester Two)

Restriction: BIOINF 761, ENVSCI 701, MEDSCI 701

Assessment: 100% Coursework including a Thesis Proposal and Seminar Presentation

Assessment: 100% Coursework

Format: Seminar report 10%, Seminar 20%, Proposal report 70%

Class Limit: (BIOSCI 761 FC + SC) 50

BIOSCI 762 BSc(Hons) Dissertation Proposal

(15 points)

A review of the literature associated with the dissertation topic and an outline of your proposed research and its significance to the research field. The dissertation proposal is to be completed in Semester One.

Course Coordinator:

Associate Professor Nigel Birch

Assessment: 100% Coursework including a written Dissertation Proposal (80%) and a Seminar Presentation (20%)

BIOSCI 788 A+B BSc(Hons) Dissertation in Biological Sciences

(45 points) (City) Semester One
Semester Two

Restriction: BIOSCI 789

BIOSCI 796 A+B MSc Thesis in Biological Sciences

(120 points) (City) Semester One
Semester Two

BIOSEC 796 A+B MSc Thesis in Biosecurity & Conservation

(120 points) (Tāmaki) Semester One
Semester Two

BIOINF 789 BSc(Hons) Project in Bioinformatics

(45 points) (City) Semester One
Semester Two

BIOINF 796 A+B MSc Thesis in Bioinformatics

(120 points) (City) Semester One
Semester Two

Academic honesty, cheating and plagiarism

Cheating is viewed as a serious academic offence by The University of Auckland. The University will not tolerate cheating, or assisting others to cheat. Penalties are set by the Discipline Committee of the Senate and may include suspension or expulsion from the University.

What is cheating?

Cheating, in the context of University coursework and examinations, is the act of attempting to gain an unfair advantage by violating the principle that lies behind all University work – that of intellectual and scholarly integrity.

Work students submit for grading – in coursework and examinations – must ultimately be their own work, reflecting each student's learning and performance. To cheat is to be intellectually dishonest by passing off as your own, work that has been done by someone else. It is also unjust in that it devalues the grades and qualifications gained legitimately by other students.

All staff and students have a responsibility to prevent, discourage and report cheating.

Examples of forms of cheating

- Copying from another student during a test or examination, whether or not there is collusion between the students involved.
- Using the work of other scholars or students when preparing coursework and pretending it is your own by not acknowledging where it came from. This is called plagiarism. Course coordinators, lecturers or tutors are the appropriate people with whom you should discuss how to use and acknowledge the work of others appropriately.
- Making up or fabricating data in research assignments, or the writing up of laboratory reports.
- Impersonating someone else in a test or examination, or arranging such impersonation.
- Submitting the same, or a substantially similar, assignment that you have done, for assessment in more than one course.
- Misrepresenting disability, temporary illness/injury or exceptional circumstances beyond one's control, then claiming special conditions.
- Using material obtained from commercial essay or assignment services, including web-based sources.

Group work

On the whole, the University requires assessment of the work of individual students. On those rare occasions where the work of a group of students is assessed, group members need to make sure that the workload is shared equally. Course coordinators will determine their own procedures for dealing with cases where the final piece of work reflects unequal participation and effort.

Student support

Typically students cheat because they are having difficulty managing workloads, feel that the course content is too difficult or experience difficulties with the language of the course. None of these reasons are justification for cheating. There are many people and services at the University to assist students. Options of people to approach include:

- the course convenor/coordinator, lecturer, tutorial head, lab demonstrator
- Head of Department
- faculty-level official
- Student Learning Centre or Library staff
- AUSA or other students' association representatives
- health and counselling services staff.

Students should also consult the University's major academic referencing resource: www.cite.auckland.ac.nz

The following website provides further information about the key principles and practices underlying academic honesty, and related resources:

www.auckland.ac.nz/honesty

Advice and support for students

To access the full range of support services available to students in the Faculty of Science, visit **www.science.auckland.ac.nz/support**

Awards of marks and grades

SBS Assessment Grades 2015

LETTER GRADE	%	GPA
A+	90-100	9
A	85-89	8
A-	80-84	7
B+	75-79	6
B	70-74	5
B-	65-69	4
C+	60-64	3
C	55-59	2
C-	50-54	1
D+	45-49	
D	40-44	
D-	0-39	

Honours GPA:	Grade Point Average
First Class:	GPA 7.0-9.0
Second Class (1st Div):	GPA 5.5-6.9
Second Class (2nd Div):	GPA 4.0-5.4

Timetable and coursework

Note: Attendance is required at all seminars. Any absence must be supported by a Medical Certificate.

- Times for seminars and associated classes may be viewed in Student Services Online.
- The format for SBS MSc and BSc (Hons) courses is generally as follows:

  16-20 formal contact hours for each 15-point course consisting of 2-hour seminars / lectures / tutorials / discussion groups. The purpose of this is to allow students greater flexibility in their choice of course combinations, and to ensure an even workload for all students throughout the teaching period.

Assignments: late policy

SBS policy is that assignments submitted up to 24 hours after the 4pm deadline on the due date receive an automatic penalty of 20% deduction of marks. After 24 hours, late assignments will NOT be accepted except with a medical or compassionate certificate.

Applications for aegrotat and compassionate consideration

An application may be made for aegrotat or compassionate consideration, by candidates who may have been prevented from being present at an examination, or who consider that their preparation for or performance in an examination has been seriously impaired by temporary illness or injury or exceptional circumstances beyond their control. This also applies to tests, but not assignments.

Application forms are available online, or from the relevant campus Student Health and Counselling Services and Examinations Office.

The application form must be submitted to the University Health and Counselling Service within one week of the date that the examination affected took place, or if more than one examination has been affected, then within one week of the last of those examinations.

Following the decision of Senate on an application for Aegrotat or Compassionate Consideration, a student may apply for reconsideration of that decision no later than four weeks after the student is notified of Senate's decision.

Please refer to The University of Auckland Calendar for the official regulations.

Missed examinations

Students who discover that they have missed an examination through their own mistake cannot sit the examination at another time unless it is for a Masters or Bachelors Honours degree. The student must contact the Examinations Office immediately and complete an application for Special Pass Consideration. Please refer to the Examination Regulations in the Calendar.

Scholarships and awards

The University of Auckland offers a number of Scholarships for PhD, MSc, BSc (Hons) and PG Diploma students who are New Zealand Citizens or Permanent Residents.

These include:

University-wide	Due Date
The University of Auckland Masters/Honours/PGDipSci Scholarships up to $10,000 plus compulsory fees	1 November
The University of Auckland Māori & Pacific Graduate Scholarships (Masters/Honours/ PGDipSci) up to $10,000 plus compulsory fees	1 November
The University of Auckland Doctoral Scholarships up to $25,000 plus compulsory fees	1 November

Detailed information about these and other scholarships is available at
www.auckland.ac.nz/scholarships

or from:

Scholarships Office

22 Princes Street

Phone: 373 7599 ext 87494

Email scholarships@auckland.ac.nz

Faculty of Science
Faculty of Science Masters Awards - up to $3,000 towards fees for Masters students specialising in a Science discipline

Information is available from the
Postgraduate and Research Administrator

Faculty of Science Office

23 Symonds St, Building 301

Phone: +64 9 373 7599 ext 84240

Email: scifac@auckland.ac.nz

www.science.auckland.ac.nz/pg-scholarships

Individual staff members may also be aware of other scholarships or awards that may be available in specific areas.

Financial support for research costs

The School contributes a sum of money each year to support each postgraduate student. (In 2014, this was $2,000 for research students towards each student's research costs.) These funds are under the supervisor's control.

Some outside institutions, such as Government Departments and Crown Research Institutes, may provide funding for particular projects. You should consult your supervisor about possible support of this nature.

Other potential sources of funds and income include:

1. Research grants available from sources such as Lottery Health Distribution Committees. Your supervisor will advise you about these.

2. SBS Contestable Travel Fund. Applications will generally be invited twice each year. An announcement will be made in the weekly SBS electronic news sheet *Bionews*, which you will receive by email each week.

3. Demonstrating in undergraduate teaching laboratories. You should approach relevant course coordinators for further information. Enquire at the Student Resource Centre in the Biology Building, and note advertisements in *Bionews* for Stage I Tutors and Demonstrators prior to the start of each semester.

4. Casual weekend/evening work in the Library.

5. Casual work in the Biological Sciences Student Resource Centre.

6. Casual work in the undergraduate laboratory preparation areas. Send your details to: sbs-casual-vacancies@auckland.ac.nz

Research

Research topics

Students are strongly advised to discuss their research interests with as many of the staff in their discipline (and closely related disciplines) as possible. This is partly because such discussions may give rise to alternatives that may not have previously been considered, and partly because it may not be possible for particular students to pursue their first choice of topic. This may arise if the staff member concerned is already fully committed, or if there are limitations, such as the availability of space or equipment.

Remember that you must have identified a thesis research topic and come to an agreement with an academic staff member about supervision of your research before you will be admitted to MSc or BSc(Hons).

The following topics and research areas are those suggested by the staff concerned as being suitable for thesis projects. They are not intended to be exclusive, and if you have ideas for projects not mentioned on the list, staff may be pleased to consider them. Joint supervision is often a possibility when a research topic does not fit neatly into one research programme, but appears to encompass elements of two (or more programmes).

Biomedical and Applied Biology Section

Academic Staff:

Dr Kate Angel
Dr Augusto Simoes-Barbosa
Associate Professor Nigel Birch
Professor Margaret Brimble
Professor Tom Brittain
Associate Professor David Christie
Professor Garth Cooper
Professor Rod Dunbar
Dr Tony Hickey
Associate Professor Kerry Loomes
Dr Nikki Moreland (Research Fellow)
Professor Sally Poppitt
Dr Anthony Phillips
Dr Hilary Sheppard
Professor Russell Snell
Dr John Taylor
Dr Mike Taylor

Human Cellular Immunology

Dr Kate Angel
Level 2, Thomas Bldg, Rm 228F
Ext: 81235
Email: c.angel@auckland.ac.nz

Antigen presenting cells (APCs) are the sentinel cells of the immune system. APCs have the capacity to detect invading pathogens and stimulate a tailored immune response. APCs are therefore often considered as potential therapeutic targets.

My team's research focus is the study of the APC populations in human tissues e.g. blood, skin, lymph node and the tissues of the central nervous system. We aim to determine the precise role that human APC subsets have in initiating and mediating immune responses, in particular T-lymphocyte responses to pathogens or vaccines.

We are also interested in the human lymph node; APCs drain from peripheral tissues into lymph nodes and it is here that they encounter and stimulate blood derived T-lymphocytes. We study how the cellular architecture of the lymph node (e.g. the fibroreticular and endothelial networks) helps orchestrate an immune response. In addition to these core projects, we are involved in related research programmes that we have established with collaborators.

We conduct our research using cells isolated from human tissue. This enables us to generate valuable human data relevant to immunologists and the pharmaceutical industry. We utilise a wide variety of techniques including novel cell isolation and culture procedures, fluorescent immunohistochemistry and flow cytometry.

As part of my research I supervise undergraduate and postgraduate students conducting research. I also teach undergraduate papers in BioSci-101 (Cell and Molecular Biology) and BioSci-356 (Cancer Metastasis), and teach and co-ordinate a Postgraduate Diploma in Science programme (BioSci-759, 2nd semester). I consider myself extremely fortunate as collectively these teaching opportunities have enabled me to share knowledge about subjects I am passionate about.

Molecular Parasitology

Dr Augusto Simoes Barbosa
Room 348B Thomas Building
Phone: +64 9 373 7599 Ext 85087
Email: a.barbosa@auckland.ac.nz

The central topic of research in our group is the molecular mechanisms that underlie gene expression and virulence in infectious microbes with emphasis on the human protozoan parasites *Trichomonas vaginalis* and *Giardia lamblia*. Protists are divergent unicellular eukaryotes and relevant organisms to understand eukaryotic evolution and some of them cause important diseases. Because gene expression is a key element to any form of life, we aim to understand how genes are expressed and regulated in these organisms and how this relates to the evolution of eukaryotes. We are also interested to characterize the involvement and the function of genes/proteins that play a role in the interaction of the parasites with the host and the surrounding microbes. Our current and potential research projects are:

1. The evolutionary significance of RNA structures controlling gene expression in deep-branching eukaryotes.
2. The outcomes and the molecular basis of *Lactobacillus* and *Trichomonas vaginalis* interaction.
3. Developing tools for genetic modification of *Trichomonas vaginalis* and *Giardia lamblia*.

Laboratory of Molecular Neuroscience, School of Biological Sciences and Centre for Brain Research

Associate Professor Nigel Birch

Room 228M Thomas Building

Phone: +64 9 373 7599 Ext 88239

Email: n.birch@auckland.ac.nz

Research Interests

- Cell communication and migration in the nervous and immune systems.
- Cell biology and biochemistry of synaptic plasticity, neuronal cell death and neurodegenerative disease.
- Health promoting and disease-preventive functions of plant phytochemicals.
- Protein-mediated drug delivery
- Target molecules: serpins, neuroproteases, membrane transporters, molecules associated with cell survival and cell death

Current Research Areas:

1. Neuroserpin and its role in neuronal function

   Neuroserpin is a member of the serine protease inhibitor or serpin superfamily that is synthesized and secreted from neurons. It is widely expressed in the developing nervous system but restricted to areas retaining synaptic plasticity in adults, supporting roles in both early neuronal growth and alteration of neuronal networks. Neuroserpin transgenic mice show altered behaviour and changes in neuroserpin expression may contribute to the pathogenesis of schizophrenia. We are interested in understanding the roles of neuroserpin in neurons, and are investigating the biology of neuroserpin at the cellular level using a range of biochemical and molecular approaches.

2. Defining roles for a neuronal serpin in the human immune system

   Effective immune responses are dependent on cell migration. Key immune cells called T cells search out foreign organisms by constantly migrating around the body, stopping to meet other immune cells in immune tissues such as lymph nodes. T cell motility ensures they can make multiple contacts with antigen presenting cells (APCs) that "present" them with fragments of foreign organisms, called "antigens". Once T cells recognise an antigen, their migratory behaviour changes dramatically. They stop crawling and remain in contact with the APC for several hours, forming a broad membrane contact zone called the immunological synapse, named to reflect functional homology with the neuronal synapse. This contact is crucial in initiating the activation and proliferation of the rare T cells that can recognize a particular microbial antigen. In collaboration with Professor Rod Dunbar and Dr Anna Brooks we are investigating the role of neuroserpin in regulating the movement and interactions of human T cells to enable an immune response.

3, Health promoting and disease-preventive functions of plant phytochemicals

   Dr. Arjan Sheepens is the lead researcher in the Mood Food programme at Plant and Food Research, Auckland, investigating foods and food components that improve mental well-being. We are working with Dr Scheepens' group to study the molecular mechanisms that underpin the health-promoting and disease-preventive effects of plant phytochemicals.

4. Protein Delivery into mammalian cells

   Associate Professor Shaun Lott, who leads the AgResearch Structural Biology Laboratory has recently identified a new type of bacterial delivery system used by ABC toxin complexes to deliver protein cargo into insect cells. We are working with Dr Lott's groupto see if a

similar mechanism of protein delivery is used to deliver proteins to human cells. Such a delivery system could be used to as a protein delivery vehicle for medical therapy.

Chemical Biology, Peptide, Glycopeptide and Peptidomimetic Chemistry

Distinguished Professor Margaret A. Brimble CNZM, FRSNZ

Room 731B Chemistry Building

School of Chemical Sciences and

Room 4008, Thomas Building Extension, School of Biological Sciences

Phone: +64 9 373 7599 Ext 88259

Email: m.brimble@auckland.ac.nz

Synthesis of (Glyco)peptides, Lipopeptides and peptide mimics as components for cancer vaccines (with Prof. Rod Dunbar, Maurice Wilkins Centre for Molecular Biodiscovery)

Our chemical biology group aims to use chemical techniques to answer many questions about the function, structure, affinity and location of important proteins within a living cell. One of our main areas of research is to use chemistry to understand the molecular and cellular interactions involved in immune response. The immune system often recognizes tumour cells and infectious agents from the unique peptides on their surfaces hence we are using chemistry to make synthetic peptides of similar structure that can be used as vaccines to stimulate the immune system. Promising compounds are tested in an in vitro assay using human skin to model responses to vaccines for human injection, allowing the best compounds to proceed to clinical trials.

Synthesis of antimicrobial peptides and peptide mimics

The synthesis of natural product peptides containing unnatural amino acids, depsipeptides, cyclic peptides and natural proteins that exhibit potent antimicrobial activity, is one theme in our peptide chemistry laboratory. Analogues of the natural peptides are then synthesised to either simplify or stabilise the molecule with the aim of producing a more potent analogue. The ability to combine contemporary organic reactions such as cross-metathesis, "peptide stapling," click chemistry, thiol-ene chemistry and the preparation of unnatural amino-acid building blocks with modern solid phase synthesis methods provides a powerful peptidomimetic platform to combat the problem of increasing resistance to existing antibiotics.

Synthesis of preptin analogues for the treatment of diabetes and osteoporosis (with Prof. Garth Cooper and Prof Jill Cornish, Maurice Wilkins Centre for Molecular Biodiscovery)

Preptin is a peptide hormone originally isolated from the secretory granules of cultured pancreatic islet cells. It was shown to be co-secreted with insulin and enhance glucose-induced secretion of insulin in rat islet cells. It is of considerable interest as this may comprise another means of controlling the elevated blood glucose seen in the diabetic state. The aim of this project is to engineer the native preptin peptide to improve its metabolic stability, improve peptide activity, enhance membrane permeability and enhance receptor selectivity. Cyclic preptin analogues will be prepared using Ring Closing Metathesis technology to provide robust, chemically inert and constrained "carba" bridge structures with improved pharmacological effects.

Recently, the importance of nutritional hormones in maintaining skeletal health has also been recognised. This is reflected in the lower

prevalence of osteoporosis in those with obesity. Preptin is known to have effects on bone cells in vitro and in vivo and is anabolic to osteoblasts hence analogues of preptin will also be tested for their ability to act as agonists for osteoblast formation.

Synthesis of glycocin F analogues to probe the mechanism of action of this rare class of S-linked bacterial glycopeptides (with Dr. Gillian Norris and Dr. Mark L. Patchett, Institute of Molecular Biosciences).

Glycocin F contains both an S- and O-linked sugar moieties and is one of only three bacterial glycopeptides exhibiting a carbohydrate moiety covalently linked to the sulfur atom of a cysteine residue; the first total synthesis of glycocin F was recently accomplished by the Brimble group. The enhanced stability of synthetic S-glycoside linkages has led to a recent boost in the already thriving area of therapeutic glycoproteins. To date, the mechanism of action of this rare group of S-linked glycopeptides largely remains unknown. The aim of this project is to develop analogues of glycocin F to gain insight into the inhibitory mechanism of this unique class of bacteriocin. Analogues will be prepared to investigate the biological rationale of the S-glycosidic linkage; the importance of the spacing between the two carbohydrate moieties will be evaluated by preparing analogues with flexible C-terminal tails of varying length and rigidity. The addition of lysine residues to provide analogues with increased inhibitory activity and/ or speed of action will also be undertaken. Analogues incorporating different sugar moieties may also be prepared to determine whether other sugar-specific PTS transporters can be targeted.

Selected Publications:

Kowalczyk R, Yang S, Brimble MA, Callon KE, Watson M, Park Y-E, Cornish J. "Synthesis of Truncated Analogues of Preptin-(1-16), and Investigation of their Ability to Stimulate Osteoblast Proliferation" Bioorganic and Medicinal Chemistry, 2014:22: 3565-3572.

Kamalov M, Harris PWR, Cooper GJS, Brimble MA. "Site-Specific Cross-linking of Collagen Peptides by Lysyl Advanced Glycation Endproducts" Chemical Communications, 2014:50: 4944-4946.

Harris PWR, Yang S-H, Molina A, Lopez G, Middleditch M, Brimble MA. "The First Total Chemical Synthesis of the Plant Antimicrobial Peptides Snakin-1 and Snakin-2" Chemistry – A European Journal, 2014:20: 5102-5110.

Wright TH, Brooks AES, Didsbury AJ, Williams GM, Harris PWR, Dunbar RP, Brimble MA. "Direct Peptide Lipidation through Thiol-ene Coupling Enables Rapid Synthesis and Evaluation of Self-adjuvanting Vaccine Candidates" Angewandte Chemie International Edition, 2013:52: 10616-10619.

Noisier AFM, Harris CS, Brimble MA, "Novel Preparation of Chiral alpha-Amino Acids using the Mitsunobu–Tsunoda Reaction" Chemical Communications, 2013:49: 7744-7746.

Wojnar JM, Lee DJ, Evans CW, Mandal K, Kent SB, Brimble MA. "Neoglycoprotein Synthesis using the Copper-Catalyzed Azide-Alkyne Click Reaction and Native Chemical Ligation" in Click Chemistry Approaches in Carbohydrate Chemistry, Wiley-VCH, Hoboken, New Jersey, 2013, p253-270. ISBN 978-1-118-27533-7 (Invited Book Chapter)

Heapy AM, Williams GM, Fraser JD, Brimble MA, "Synthesis of a Dicarba Analogue of Human beta-Defensin-1 using a Combined Ring Closing Metathesis-Native Chemical Ligation Strategy" Organic Letters, 2012:14: 878-881.

Dr Paul Harris
Dr Geoff Williams
Dr Renata Kowalczyk

Interests: Synthesis of peptides, glycopeptides, lipopeptides, and peptidomimetics as therapeutic agents and vaccine candidates

Metalloproteins

Professor Tom Brittain
Room 402B Thomas Building
Phone: +64 9 373 7599 Ext 88246
Email: t.brittain@auckland.ac.nz

Our lab is involved in the study of the structure and function of various metalo-proteins. These studies are targeted at developing an understanding of these important proteins in terms which range from the scientifically fundamental to the physiological. Such studies may require the application of a wide range of biological and physico-chemical techniques.

The area of particular interest is the study of neuroglobin and its control of apoptosis in neurons.

Membrane Transport Proteins

Associate Professor David Christie
Room 402C Thomas Building
Phone: +64 9 373 7599 Ext 88009
Email: d.christie@auckland.ac.nz

Membrane transporters are required for the uptake of neurotransmitters and nutrients in the brain. These proteins are molecular machines that move their substrates (sugars, nutrients, metabolites, neurotransmitters) across membranes, often against huge concentration gradients.

The main focus of current research is the creatine transporter, a member (SLC6A8) of the sodium- and chloride-dependent neurotransmitter transporter family. This transporter is important to maintain energy levels in the brain. Gene defects result in a novel type of X-linked intellectual disability, associated with severe developmental delays in speech and language and sometimes seizures. Similar Cerebral Creatine Deficiency disorders occur from absence of either of the two enzymes required to make creatine in the brain, but unlike defects in the creatine transporter, dietary supplementation of creatine brings about some improvements. Creatine is also neuroprotective in animal models of human neurological diseases and is being tested in clinical trials for treatment of Parkinson's and Huntington's disorders.

Our research goals are to understand how creatine is transported into neurons; how creatine preserves nerve cell function; and to resolve pathways for creatine uptake, synthesis and distribution within the brain. Our research involves use of primary cultures of neurons from rat brain; molecular biology and model cell systems; and through collaboration with the Centre for Brain Research, location of sites for creatine transport and synthesis within the human brain.

Creatine transport and brain function

Current projects:

1. Research that addresses the idea that creatine is important for mitochondrial function in neurons. Specifically we are studying whether 'creatine system proteins' (the creatine transporter, creatine kinases and the two creatine biosynthesis enzymes (AGAT and GAMT) are co-regulated with mitochondria in neurons.

2. We are also interested about the trafficking of proteins in neurons, particularly how the creatine transporter is transported into distal parts of dendrites. Specifically we want to know if the microtubule motor protein (kinesin 17) plays a role in this process.

There are opportunities for research projects, suitable for PhD, MSc or BSc(Hons) studies in these areas.

Molecular Basis of Metabolic Regulation

Professor Garth Cooper
Room 4004 Thomas Building
Phone: +64 9 373 7599 Ext 87239
Email: g.cooper@auckland.ac.nz

Professor Cooper previously discovered the pancreatic endocrine hormone amylin, which accumulates in the pancreatic islet amyloid of patients with Type 2 diabetes mellitus. The overall aim of our research programme has been to develop rigorous molecular explanations for the the cause and development of ageing-related diseases such as diabetes mellitus and the metabolic syndrome, in which there is agreed, major unmet clinical need. We actively employ proteomics, metabolomics and transcriptomics to better understand metabolic disease processes with particular focus on the main ageing-related diseases, including diabetes, common forms of heart failure, and neurodegenerative diseases, using both nonclinical models and human clinical trials, with the aim to generate new and improved methods of diagnosis, and also for therapeutic monitoring; and to develop and trial new experimental therapeutic strategies as a route leads to new first-in-class medicines.

Differential proteomics encompasses a rapidly advancing series of integrated technologies that enable systematic exploration of disease phenotypes in cellular and animal models, as well as in humans. Our group has now developed internationally recognised expertise in this field, and has achieved a series of novel advances in the field of metabolic diseases.

Our group is also an integral part of the Maurice Wilkins Centre of Research Excellence for Molecular Biodiscovery, through which the focus of our programme will be the identification of novel proteins of potential therapeutic value, coupled with computational /in silico/ design and array synthesis methods for the development of small-molecule inhibitors of these proteins as therapeutic drugs.

Current areas of investigation include the following:

1. Reversal of the diabetic complications

   Our research programme has identified for the first time, a previously unknown copper-overload state that is central to the pathogenesis of diabetic organ damage. This state generates focused copper-mediated oxidative stress in the vascular beds of susceptible organs that, in turn, leads to or causes the progressive organ damage in the blood vessels, heart, kidneys, retina and nerves, known as the diabetic complications. We now consider this copper-overload state to provide an important new target for therapeutic intervention whose objective is to prevent or reverse the diabetic complications. These insights have enabled us to develop a small molecule that reverses heart disease in models of diabetes, as well as in humans and as a result, we are now completing phase 2 trials.

2. Suppression of islet b-cell degeneration in Type 2 diabetes mellitus

   Our work has led to the development of a novel cell-based model of amyloid-mediated programmed cell death (apoptosis). We are now using this model to study the underlying biochemical and genetic processes that lead to apoptosis in islet beta-cells, with the eventual goal of designing compounds capable of arresting this process in diabetic patients. In related work, group members have defined the unique protofilament that underlies the structure of amylin-amyloid, and are investigating the structural basis of amyloid formation.

3. Mechanisms of insulin resistance

   Insulin resistance is currently thought to be a major mechanism leading to the

development of human diseases such as diabetes, high blood pressure and hardening of the arteries. Moreover, the same failure of insulin signalling seems to occur in all these common diseases. We have recently established that the interplay between certain peptide hormones can cause insulin resistance in skeletal muscle and in living animals. We are currently investigating the biochemical mechanisms that underlie these effects.

4. Discovery of new hormones

Our group has discovered a number of important new bioactive hormones, characterising their modes of action and their applications in experimental therapeutics of metabolic disease. Among these was the discovery and characterisation of the biologically active glycoisoforms of the adipocyte-derived hormone, adiponectin. We have shown that both alcoholic (ASH) and non-alcoholic steatohepatitis (NASH) are adiponectin-deficiency states, and that structure and function of the liver can essentially be normalized by replacement therapy with physiological hormone doses. Through our studies, we have made major contributions to the understanding of adiponectin, including its structure, function, and roles in experimental therapeutics.

Dr Shaoping Zhang

Dr Jackie Aitken

Dr Linda Zhang

Dr Mia Jüllig

Dr Kate Lee

Interests: Development of novel therapies for treatment/suppression of diabetes and its complications including cardiovascular and renal disease, other metabolic disorders and neurodegenerative diseases such as Alzheimer's disease.

Human Molecular Immunology

Professor Rod Dunbar

Room 2009 Thomas Building

Phone: +64 9 373 7599 Ext 85765

Email: r.dunbar@auckland.ac.nz

The immune system depends on a coordinated set of cellular and molecular interactions to protect us against infectious agents, and some of these immune processes can also help control cancer. On the other hand, overactive immune responses can themselves cause disease. Understanding molecular and cellular interactions in the immune system can help us improve therapy for a wide range of diseases.

Our lab currently has 15 staff and students, and we aim to use new technology to better understand cellular immune responses in humans. Current projects mostly sit within two areas:

(1) understanding and manipulating the human immune response to cancer, and (2) understanding the regulation of human cellular immune responses.

Our cancer work is based on the observation that some human immune cells can recognize and kill cancer cells. There is hope that vaccines can be used to stimulate these immune cells in cancer patients to therapeutic effect. The main cancer we study is the skin cancer melanoma, though the techniques are also applicable to other cancers. Currently we are analysing immune responses to melanoma using recently-developed immunological techniques. We are also designing new forms of vaccines in collaboration with Professor Margaret Brimble's group in the Department of Chemistry, and comparing their potency using in vitro models based on human cells (antigen-processing cells and T cells) derived from human blood and skin. We are also hunting for new vaccine targets using our own bioinformatic software, and this work has led to the discovery of a new gene that

may be involved in melanoma. In partnership with Cancer Trials NZ, we have participated in a multi-national phase II trial of a melanoma vaccine developed in Australia, and we intend to take our own vaccines to clinical trial.

Our immune regulation work uses purified populations of human immune cells to model human immune responses in vitro. The crucial molecules controlling immune responses are either expressed on the surfaces of immune cells, or secreted by them, and we can use modern high-throughput techniques to identify these pivotal molecular players. Both surface molecules and secreted products can be exploited therapeutically, so this work has relevance to the large number of diseases where immune modulation is needed.
As well as these core projects, we interact widely with other research groups, both within New Zealand and internationally. We are also fortunate to enjoy excellent support from the medical community in Auckland, and we regularly host clinicians in the lab. Our work necessitates the involvement of experts in other fields, especially in organic chemistry, bioinformatics, and mathematical modelling, and we have active collaborative projects involving staff and graduate students in several other departments. Much of this collaboration involves the Maurice Wilkins Centre, the Centre of Research Excellence to which we are affiliated.

Dr Claudia Mansell

Dr Anna Brooks

Dr Vaughan Feisst

Dr Julie Macintosh

Dr Hussila Keshaw

Interests: Human immunology, especially immune therapy of cancer, and human mesenchymal stem cells, and their potential in tissue engineering

Comparative Animal Physiology and Biochemistry

Dr Tony Hickey

Room 452 Thomas Building

Phone: +64 9 373 7599 Ext 82615

Email: a.hickey@auckland.ac.nz

Animals often interact and survive in some remarkable environments and in unusual physiological states. Some endure remarkable extremes of temperature, oxygen and water availability, the factors that govern life. My interests rest on how animals have adapted to such extremes, and also how we can learn from these animals to gain biomedical insight. But honestly I'm probably most interested in understanding how animals have evolved to extremes of performance and their habitats.

I'm primarily interested in the metabolism of animals, and more specifically this is centred on mitochondrial bioenergetics. My research is however very diverse and it explores hypoxia (low oxygen) tolerance, and how pH, age, exercise, and temperature effects metabolism. I hold research grants exploring acute disease effects on mitochondrial function, the impacts of temperature on fish heart mitochondria, ocean acidification's effects on metabolism and development and energetic efficiency in failing mammalian hearts. More recent work focuses on transplant, and how hypoxia tolerant animals can provide us a better insight to how we should work with organs on ice.

I teach from 1st to 3rd year undergraduate courses (Fundamental Biochemistry, Biosci-101 and Ecophysiology, coordinator Biosci-335) and Zoophysiology (coordinator Biosci-725) at a Post Graduate level. Both Ecophysiology and Zoophysiology are my real favourites, as these papers cover the essentials of life, water, temperature and oxygen. They cover topics such as hibernation, and discuss issues such as 'do

bears really hibernate?', 'how do turtles survive months without oxygen?', are there universal constants for metabolism? These papers are what stimulated me to pursue a career in science and I would recommend them to those interested in biomedicine and ecology.

Environmental Microbiology

Professor Gillian Lewis
Room 101 Lippincott Cottage
Phone: +64 9 373 7599 Ext 87396
Email: gd.lewis@auckland.ac.nz

The central theme of the research in this group is in the study of the applied ecology of natural biofilm microorganisms in fresh water, microbial contaminates in fresh and marine water and the management of microbial components in aquatic systems towards restoration of degraded water bodies. Within this theme my research spans:

- The impact of environmental management practices on water microorganisms, microbial diversity and microbially based food webs.
- Microbial intervention to reduce contamination and ameliorate risk of contaminants in the natural environment.
- Novel microbially based indicators of ecosystem health and human health risk.
- Naturalisation of human faecal bacteria and pathogens in natural freshwater systems

The research uses a full range of molecular, microscopic and culture techniques in both field and lab based situations.

Graduate research can be undertaken in the following areas.

1. Evaluation of the nature and function of microbial assemblages in streams. Field studies are in progress to investigate the use of microbial diversity as a measure of environmental change and responses to perturbation.

2. Ecology of contaminating indicator bacteria natural and constructed in aquatic ecosystems including urban stream and stormwater treatment systems.

3. Specific biotechnology relevant attributes of stream biofilm bacteria.

4. Stormwater treatment using microbial biofilms (an industry linked project).

Associate Professor Kerry Loomes

Interests: Identification of proteins which could be targeted for disease therapy.

1. **Molecular analysis of Antibodies in Acute Rheumatic Fever Using Phage Display**

Supervisors: Dr Nikki Moreland and Professor Rod Dunbar, School of Biological Sciences
Room: Thomas Building North 110N 2002
Phone: +64 9 373 7599 Ext 83887
Email: n.moreland@auckland.ac.nz

Acute rheumatic fever (ARF) is an autoimmune disease that follows an untreated group A streptococcus (GAS) infection. The rates of rheumatic fever in Maori and Pacific Island children in New Zealand are unacceptably high. Disease pathogenesis is not well understood but maybe mediated by anti-streptococcal antibodies

that cross-react with self-tissue in heart and joints. A project is available to generate a phage display antibody library from a patient with acute ARF and, by a process called biopanning, mine this library for antibodies that may play a role in disease.

2. **Mapping the immunogenic epitopes of pili proteins from Group A Streptococcus.**

Supervisors: Dr Nikki Moreland and Dr Paul Young, School of Biological Sciences

Room: Thomas Building North 110N 2002

Phone: +64 9 373 7599 Ext 83887

Email: n.moreland@auckland.ac.nz

Group A Streptococcus (GAS) pili are long, surface exposed structures important for adhesion and colonisation of the bacteria. The component GAS pilin proteins are highly immunogenic and potential vaccine candidates. However, little is known about which regions of the proteins are targeted by the human immune system. In this project a panel of pili-specific antibody fragments isolated from a human antibody library will be characterised to determine specificity and affinity. Antibody fragment/pilin complexes will be co-crystallised to facilitaite visualisation of the most immunogenic epitopes on GAS pili.

Professor Sally Poppitt

Chair in Human Nutrition; Director, Human Nutrition Unit

Room 4022, Institute for Innovation in Biotechnology Thomas Building

Phone: +64 9 373 7599 Ext 83062

and

Human Nutrition Unit, 18 Carrick Place, Mt Eden

Phone +64 9 630 5160

Email: s.poppitt@auckland.ac.nz

The role of nutrition in health and disease, with specific focus on obesity and weight control, diabetes and CVD risk, appetite control. The role of dairy in human health and wellbeing.

Post doctoral research fellows:

Dr Robin McGregor

Dr Marta Silvestre

Molecular Biology of Cellular Differentiation

Dr. Hilary Sheppard

Level 2, Thomas Bldg, Rm 2018

Ext: 81194

Email: h.sheppard@auckland.ac.nz

During the development of multicellular organisms cellular differentiation is the process by which a single pluripotent cell can continuously divide to eventually form a highly complex organism. It is the process by which a less specialised cell becomes a more specialised cell type and acquires a more specific role. However, in a multicellular organism all differentiated cells contain the same DNA. Therefore it is changes in gene expression that determine a cell's fate. Despite the fundamental nature of this process the molecular basis of cellular differentiation is still poorly understood. In part this may be because of the assumption over the last 50 years that most genetic information is transmitted solely via proteins. This was the prevailing view despite the fact that gene number does not increase with increasingly complex organisms. However, levels of intronic and intergenic non-protein-coding DNA does

increase with increasingly complex organisms, reaching 98.8 % in humans. Recently the discovery that much of this intergenic DNA is being dynamically transcribed into functional non-coding RNA has revolutionised the way we think about gene expression.

We aim to understand the role of proteins and non-coding RNA in cellular differentiation. We are particularly interested in understanding the role that small non-coding RNAs, called miRNAs, play in this process. Currently we are examining differentiation in two human cell types – T lymphocytes and mesenchymal stem cells (both in collaboration with Prof. Rod Dunbar and his team). This work will have implications for therapeutic applications that use these cells types.

The Neurogenetics Group

Professor Russell Snell
Room 2016 Thomas Building
Phone: +64 9 373 7599 Ext 85059
Email: r.snell@auckland.ac.nz

Our group aims to unravel the molecular mechanisms of simple and complex genetic disorders and genes underlying valuable bovine traits. Utilising knowledge of causal genes and their pathways we are developing model systems with which to investigate the molecular pathogenesis of disorders to ultimately screen for and test potential therapeutic agents. The genes and markers we are discovering for agricultural traits will be implemented through genetic selection.

In particular we are working on Huntington 's disease (HD), Alzheimer's Disease (AD), Autism Spectrum Disorder (ASD) and spinocerebellar ataxia.

Our group has partnered with LIC (an animal breeding company) for bovine gene discovery. This work in our laboratory is being lead by Dr Mathew Littlejohn.

Our approach is to apply what has been discovered in the genetically simple disorders such as Huntington's disease to inform our research into the more complex diseases such and Alzheimer's. We are using very large bovine data sets via molecular and quantitative genetics to identify mutations.

Major projects:

- Huntington's Disease Sheep Model

  Huntington's disease (HD) is an inherited autosomal dominant neurodegenerative disorder caused by an expansion of a CAG trinucleotide repeat in the huntingtin (HTT) gene [Huntington's Disease Collaborative Research Group (1993).Despite identification of the gene in 1993, the underlying life-long disease process and effective treatments to prevent or delay it remain elusive. In an effort to fast-track treatment strategies for HD into clinical trials, we have developed a new large-animal HD transgenic ovine model. Sheep, Ovis aries L., were selected because the developmental pattern of the ovine basal ganglia and cortex (the regions primarily affected in HD) is similar to the analogous regions of the human brain. Microinjection of a full-length human HTT cDNA containing 73 polyglutamine repeats under the control of the human promotor resulted in six transgenic founders varying in copy number of the transgene (Jacobsen et al 2010). Our current focus is on a single line and we are undertaking a longitudinal study following the progression of the disease. Our aim is, using this model, to identify or confirm the disease molecular mechanisms prior to the onset of symptoms. We also plan to use this model for therapeutic testing.

• *C. elegans* Model System

C.elegans is a simple multicellular organism with a 3 ½ day life cycle. The genome is complete and the lineage of all cells are understood, making it an ideal model for a wide range of biological questions. It is very simple to knock the expression of genes down by feeding e.coli expressing targeted RNA molecules. It is also relatively straight forward to make transgenics. We are using *C.elegans* to model Huntingtons disease and Alzheimers disease.

• Mechanisms of Alzheimer's disease

Simple inherited mutations resulting in early onset Alzheimer's disease (AD) have implicated directly the amyloid precursor protein (APP) and small cleavage fragments of this protein (the A βeta peptide) in AD. The peptides are found in late onset AD forming plaques, one of the characteristic features of the disease. We are developing a model of the production of the A βeta peptides in *C. elegans* expressing the full length APP protein and the enzyme required for cleavage. We will use this to follow the progression of cell damage and hope to use this to follow the progression of cell damage and hope to use it to test modifying agents.

• Autism

With ASD affecting ~1:88 children over eight, and with an estimated cost of approximately 3.2million USD in care over a person's lifetime, ASD represents a significant health burden in the population. ASD has a strong (heritability estimates as high as 90%) but complex genetic basis. Up until now there has been no program in New Zealand to investigate autistic traits and heritability using next generation sequencing.

We have recently launched a research programme in Autism Spectrum Disorders (ASD) which will be carried out within the Centre of Brain Research (CBR) - University of Auckland. This will involved setting up a Research Volunteer Register (in conjunction with the CBR) offering individuals with ASD or their families to participate. Our initial research will be on genetics and finding causative genes, primarily involving individuals in families with more than one person with ASD. Dr Jessie Jacobsen will be taking a lead role in the development of this project.

New Zealand collaborators

- Professor Richard Faull and Dr Henry Waldvogel, University of Auckland - Sheep Model for Huntington's disease
- Professor Mike Dragunow, University of Auckland - Neurodegeneration
- Dr Richard Roxburgh - Neurogenetic disease
- Dr Rosamund Hill – Autism
- Dr Phil Wood, ADHB - Alzheimer's disease

International collaborations

- Dr Warwick Grant, La Trobe University - C. elegans models
- Professors Mike Owen and Julie Williams Department of Psychological Medicine Cardiff University - The Genetics of Alzheimer's Disease
- Professors James Gusella and Marcy MacDonald, Department of Genetics Harvard Medical School - Huntington's disease genetics and a Huntington's disease sheep model
- Professor Mark Rees Swansea University - Sheep Model for Huntington's Disease
- Dr Simon Bawden and Skye Rudiger, South Australia - HD Transgenic Sheep Model
- Professor Jenny Marton, University of Cambridge - HD Transgenic Sheep Model

Dr Jessie Jacobsen
Dr Suzanne Reid
Dr Kristen Henty
Dr Matt Littlejohn
Interests: Uncovering mechanisms of disease via gene11

Cell Biology of Virus Infection

Dr John Taylor
Room 2022 Thomas Building
Phone: +64 9 373 7599 Ext 82854
Email: ja.taylor@auckland.ac.nz

The main interest of our lab is the pathogenesis of viral infections. Our research uses rotavirus, a major cause of gastroenteritis in infants, as an experimental tool to reveal ways in which infection can influence cellular, immunological and physiological function in the host. Our goal is to understand the mechanisms that underpin viral disease at a molecular level and thereby identify new opportunities for therapeutic control of disease. A second area of research is the engineering of viruses as gene vectors for antigen delivery to immune cells as a strategy for the development of novel vaccines and immunotherapeutics.

Microbial ecology

Dr Mike Taylor
Room 334D Thomas Building
Phone: +64 9 373 7599 Ext 82280
Email: mw.taylor@auckland.ac.nz

My research interests span the broad field of microbial ecology, focussing in particular on the associations formed between animals (host organisms) and the microbes living in and around them. Such interactions range from being pathogenic in nature, to microbes acting as a food source, to tightly linked symbioses in which both partners benefit. Understanding which microorganisms are associated with which hosts – and why – is central to my research. While research in my lab has focussed on marine sponge and insect symbionts in the past, more recently we have started to investigate the microbial ecology of endemic NZ vertebrates such as the critically endangered kakapo. Exploring the human microbiome has also become a major research focus for the group. Most of the work in our laboratory involves the application of modern molecular methods (e.g. next-generation sequencing), and I would particularly welcome enquiries from students with a strong microbiology and/or bioinformatics background.

Cellular Molecular and Organismal Biology Section

Molecular Plant Physiology

Associate Professor Andrew Allan
(Plant and Food Research)
Room 313 Thomas Building
Phone: +64 9 373 7599 Ext 86631
Email: Andrew.allan@plantandfood.co.nz

My research focuses on the plant genes that control levels of compounds that are pigmented or have health effects on the consumer. We work on fruit crops and have the genomes (apple, peach, strawberry, grape), or expressed genes (kiwifruit, berries), greenhouses full of plants, and experts in the area of physiology, molecular biology, and biochemistry.

We are funded in Government (MBIE) programs with the objective of producing "Elite plants with new colour & health attributes". In my lab we have the target of understanding the production of fruit health and colour compounds, such as the red anthocyanin, yellow and orange carotenoids and the green chlorophylls, as well as the colourless flavonoids. With this understanding it will be possible to develop (via breeding - usually) fruit with novel appearance, colour changes that indicate harvest and eating ripeness and healthy fruit with enhanced levels of antioxidants.

Through this research we will enhance our understanding of the biosynthesis, regulation and development of plant pigments and health compounds. We exploit whole genome sequences that are available for an increasing number of plants. Also allelic diversity found in the germplasm and breeding resources, at both the genetic and epigenetic level.
Our lab uses transformation of model plants (Arabidopsis, tobacco, strawberry) for gene function testing as well as transformation of kiwifruit, apple, and other species.

Current research projects include:

- The red fleshed Apple.
- New Kiwifruit colours - the transcriptional regulation of carotenoid biosynthesis in plants.
- Comparative genomics of Apple, strawberry and peach.
- Environmental over-rides on anthocyanin synthesis.
- Transcription factors controlling phenylpropanoid branch points.
- Transcriptional control of de-greening (chlorophyll levels).

Structural Biology Laboratory

Professor Ted (E N) Baker
Room 470 Thomas Building
Phone: +64 9 373 7599 Ext 84415
Email: ted.baker@auckland.ac.nz

Research in Structural Biology focuses on the central importance of three-dimensional structure in biology. The specificity of all biological processes depends on recognition between the molecules involved (proteins, nucleic acids and many small-molecule substrates, cofactors and effectors). We aim to determine the three-dimensional structures of key proteins and biological assemblies, including both soluble proteins and membrane proteins, in order to understand how they act. Possible applications from this structural information include the design of new tools for biotechnology and the development of new therapeutic agents. The research involves a variety of approaches, including bioinformatics, gene cloning, protein expression, purification and crystallization, structure determination by X-ray crystallography, cryo-electron microscopy and NMR, structural

analysis by computer graphics, binding studies and mutagenesis. Research in the Structural Biology Laboratory receives funding from the Centres of Research Excellence fund, the Health Research Council, the Marsden Fund, the New Economy Research Fund and the Auckland Medical Research Foundation.

Current projects include:

1. Structural genomics of TB (Ted Baker, Shaun Lott)

   The explosive growth in genome sequencing worldwide has fundamentally changed many aspects of biological research. Finding out the functions of the newly-discovered gene products is a critical next step - at least 40% are currently of unknown function and 90% are of unknown structure. We are partners in a major international structural genomics project, focused on proteins from Mycobacterium tuberculosis, the bacterium that causes TB. Our goals are to understand the key aspects of TB biology, and establish the structures and functions of proteins that will enable the development of new anti-TB drugs. We are focusing on TB proteins from several categories:

(i) Enzymes from key biosynthetic pathways, for example, those involved in the synthesis of vitamins, amino acids and cofactors. These enzymes are good targets for the design of new anti-TB drugs.

(ii) Proteins that play a role in virulence or in the ability of the organism to survive in macrophages and other hostile environments. These include proteins involved in iron uptake, proteins that enable the bacterium to change its metabolism to utilise host cholesterol and proteins that enable it to change its energy requirements.

Overall, the project will involve a mix of bioinformatics, gene cloning and expression, protein purification and crystallization, 3D structural analysis by X-ray crystallography or NMR, binding experiments and functional assays. It may also involve the design of new inhibitors and drug candidates.

2. Structural biology of superantigens and other bacterial virulence factors (Ted Baker)

   Many serious diseases are caused by proteins that are produced by pathogenic bacteria to disable their human host. In collaboration with Professor John Fraser (Molecular Medicine) we focus on proteins implicated in the virulence of the two most common human pathogens, Staphylococcus aureus and Streptococcus pyogenes. By solving their 3D structures, and carrying out parallel functional studies, we aim to find out how these proteins work, as a first stage towards new therapies for bacterial disease. One group of proteins, called superantigens, act by disrupting the human immune system by binding to MHC class II molecules and T-cell receptors. Another group resembles superantigens but instead binds to the glycan chains on human cell surface receptors. We are also targeting other potential virulence proteins that we identify from the genomes of S. aureus and S. pyogenes, in particular proteins that are attached to the cell surface and enable the bacteria to attach to human cells.

3. Structural analysis of proteins involved in insect communication (Ted Baker, Richard Newcomb – Plant & Food Research)

   This project combines research on the biology of insect communication, carried out at Plant & Food Research (Mt Albert), with the structural biology programme in the School of Biological Sciences. Insects use chemical species, in the form of odorants, for host-finding, mate recognition and other aspects of their biology. Odorant binding proteins in the insect antennae receive these

chemical signals and pass them to receptors and other proteins for processing. Genomics and proteomics approaches at Plant & Food Research have been used to discover the proteins that bind odorants in the antennae of the moth, Epiphyas postvittana. The genes fall into distinct families and a collection of them have now been cloned and inserted into expression vectors for production of their recombinant protein products. The project will involve expression, purification and crystallisation of one or more of the proteins, structure solution by crystallography or NMR, and determination of how they bind their chemical ligands. The long-term goal is to be able to design novel, selective agents for insect control.

4. Structural studies of bacterial pili (Ted Baker)

Many pathogenic bacteria express pili on their cell surface. These are long, thin thread-like structures which enable the bacteria to attach themselves to cells of a host organism. These pili have to be very strong and stable to enable them to withstand mechanical stress and proteolysis. We recently made a very exciting discovery, that the pili from the human pathogen Streptococcus pyogenes are stabilised by an unusual kind of covalent bond, formed spontaneously between lysine side chains and asparagine side chains. This work was published in Science in 2007. We have also discovered that bonds of this kind are probably present in the pili of other Gram-positive bacteria, and in other cell surface proteins involved in adhesion.

We aim to clone and express the pilus subunits from selected species, crystallise them for structural analysis and use mass spectrometry, mutagenesis, proteolysis and circular dichroism to test their structure and stability. We also think that this novel kind of cross-link can be introduced to other proteins to convert them to"super-stable"forms that would resist chemical, thermal and mechanical stress, and be of great value in biotechnology.

Dr Ghader Bashiri
Room 472 Thomas Building
Phone: +64 9 373 7599 Ext 87237
Email: g.bashiri@auckland.ac.nz

My current research interest is microbial pathogenesis, focusing on *Mycobacterium tuberculosis*, the bacteria that cause TB. The overall aim of our research is to explore new approaches/targets to combating persistence, which is the major roadblock to improved TB therapy.

The majority of my research on TB is in association with Professor Ted Baker and focuses on the followings topics;

- Role of coenzyme F_{420} in the biology and pathogenesis of *Mycobacterium tuberculosis*. We investigate the F_{420} biosynthesis pathway, as well as F_{420}-dependent enzymes from mycobacteria.
- Metabolism of amino acids in *M. tuberculosis*. We are interested in the amino acids that are either not synthesised by humans (e.g. branched chain amino acids) or whose presence provides an advantage for bacterial pathogenesis (e.g. proline).
- Biosynthesis of menaquinone, the electron carrier in the electron transfer chain of mycobacteria. This project is conducted with Dr. Jodie Johnston.

Research projects include cloning and expression of target proteins from different mycobacterial species, crystallisation for structural analyses and functional characterization using different biochemical and biophysical techniques.

Dr Karine David
Room 310 Thomas Building
Phone: +64 9 373 7599 Ext 83793
Email: k.david@auckland.ac.nz

My research is aimed at investigating the early events of auxin signalling. Auxin is one of the major plant hormones implicated in virtually every aspect of plant growth and development. Despite its established biological and agronomic importance, the molecular mechanisms underlying the auxin early response remain unclear. I'm particularly interested in the auxin extracellular receptor ABP1 (Auxin-binding protein 1), an essential membrane-bound protein that controls early events in auxin signalling and the components of the ABP1 signalling pathway. I am mostly using *Arabidopsis* as a model plants and we aim to identify and characterise proteins/genes acting downstream of ABP1. Because a mutation in ABP1 gene is embryo lethal, conditional knock-out lines of ABP1 are used via a collaboration with the group of C. Rechenmann in France (CNRS). We are also interested in applied research and, in collaboration with Dr Robert Schaffer (Plant and Food Research), we are looking at the role of auxin during apple and kiwifruit development. The approaches used are multidisciplinary and combine genetics, molecular biology, biochemistry and proteomics.

Projects are suitable for graduate students majoring in either Biological Sciences or in Wine Science.

Structural studies of HIV-host interactions and mechanisms of retroviral restriction.

Dr David Goldstone
Rm 402A Thomas Building
Phone +64 9 373 7599 Ext 84607
E-mail: d.goldstone@auckland.ac.nz

HIV currently infects over 2 million people every year with approximately 1.6 million people dying with AIDS related illness. Whilst HIV is the most recent retroviral pathogen to infect humans, the human genome displays prolonged evidence of exposure to retroviral pathogens. Consequently, cells have developed protein-based mechanisms to prevent and contain retroviral infection disrupting multiple stages of the retroviral lifecycle.

Our research uses Structural biology (primarily X-ray crystallography) and biophysical approaches (Small-angle X-ray scattering, dynamic and static light scattering, protein biochemistry) to understand the how these proteins recognise retroviral components within the host cell, and then act to disrupt the retroviral lifecycle.

Current projects are available investigating the structure and function of members of the TRIM protein family. Members of this protein family have been shown to disrupt infection of diverse retroviruses including HIV-1. We are interested in how members of this protein family recognise the structural components of HIV and are able to function at different stages of the retroviral lifecycle, disrupting reverse transcription, transcription from the integrated provirus and viral egress with the long-term goal of developing new anti-retroviral therapies.

Associate Professor David Greenwood
Room 313 Thomas Building
Phone: +64 373 5599 ext 86631/87540
Email: dave.greenwood@plantandfood.co.nz or david.greenwood@auckland.ac.nz
Web site: https://unidirectory.auckland.ac.nz/profile/david-greenwood

1. Mass spectrometry of proteins, peptides and

metabolites
2. Development of high resolution accurate mass applications in mass spectrometry
3. Practicalities of the integration of -omics technologies into Systems Biology
4. The molecular mechanisms of plant pathogen interactions
5. Chemical ecology of endangered species

Molecular Pharmacology

Associate Professor Debbie L Hay
Room 462 Thomas Building
Phone: +64 9 373 7599 Ext 88229
Email: dl.hay@auckland.ac.nz

GPCRs are a major class of cell surface protein to which many therapeutic agents are directed. Some of these receptors only function in the presence of additional proteins called RAMPs (receptor activity modifying proteins). The discovery of RAMPs radically altered our understanding of how GPCR pharmacology could be modulated and therefore targeted with selective drugs.

We have a programme of research dedicated to understanding more about these important proteins, supported by strong local and international collaborations.

The peptide hormones amylin, adrenomedullin, calcitonin gene-related peptide and calcitonin need RAMPs in order to activate their GPCRs. These peptides have relevance to many physiological and pathophysiological processes including migraine, cancer and cardiovascular disease and therefore detailed knowledge about their receptors is a crucial step toward designing selective drugs that may mimic or block their actions.

We are studying the molecular pharmacology and signalling of this system using an assortment of techniques and several complementary disciplines. This work ranges from signalling in primary neurons to structural biology and chemistry. The development of novel agonists and antagonists for these receptors, aided by determining the ligand binding pockets of the receptors and the structure-activity relationships of the peptides, could yield improved drugs as well as vital tools for understanding the function of these peptides in health and disease. Furthermore, the work contributes towards the broader understanding of mechanisms of GPCR ligand interactions. As GPCRs are such important drug targets, this information is crucial for future success. This research has particular relevance to diabetes, obesity, cancer and cardiovascular disease.

Plant Cell Walls

Professor Philip Harris
Room 315A Thomas Building
Phone: +64 9 373 7599 Ext 88366
Email: p.harris@auckland.ac.nz

Internationally, there is an enormous amount of interest in plant cell walls, ranging from very basic studies concerning cell-wall synthesis and evolution to more applied studies. We have extensive experience in research on plant cell-wall polysaccharides and phenolic components using a wide range of techniques. These involve chemical and biochemical techniques, such as various types of mass spectrometry (MALDI-TOF; GC-MS etc), high performance anion-exchange chromatography (HPAEC-PAD), and capillary gas chromatography (GC). We also use fluorescence and electron microscopy in conjunction with specific probes, such as monoclonal antibodies, to locate particular components in cell walls.

The topics listed below cover a vast number of potential research projects. I encourage you to come and talk to me and learn how exciting plant cell walls are!

1. Cell walls of monocotyledons

   Over the last few years, we have learnt a great deal about the structures of the polysaccharides and phenolic components in monocotyledon cell walls and their possible evolution. However, much remains unknown. A variety of exciting projects are available.

2. Cell walls of ferns, gymnosperms and basal angiosperms

   Currently, there is enormous interest in the diversity and evolution of plant cell walls. New Zealand's flora is rich in many taxa that would be exciting to investigate from this perspective. A range of projects are available, including ones involving mostly microscopy and ones involving a more chemical approach.

3. Hydroxycinnamic acids in plant cell walls

   Ferulic acid and its dimers, trimers and tetramers, are ester-linked to polysaccharides in the primary cell walls of many angiosperms, where they are believed to play important structural roles. p-Coumaric acid also occurs ester-linked to lignin in the lignified secondary walls of these plants, but its functional role is uncertain. Several projects are available.

4. Wood cell walls

   A range of exciting projects are available concerning the relationship between wood quality and cell-wall structure and composition. Most of our work is on the wood cell walls of radiata pine.

Structural Studies on Drug Design Targets from *Mycobacterium tuberculosis* using *Mycobacterium smegmatis* as an Expression System

Supervisors: Dr Jodie Johnston & Prof Ted Baker, Structural Biology Laboratory

Room 472 Thomas Building

Phone: +64 9 373 7599 Ext 87237
Email: jm.johnston@auckland.ac.nz

The bacterium *Mycobacterium tuberculosis* (*Mtb*) is the primary causative agent of tuberculosis (TB), a disease with a long history in humans, which still has a significant impact on human mortality today. Although there are a number of effective drug treatments for TB available they are not ideal and this, along with emerging drug resistant strains makes it necessary for new drugs against TB to be developed. This project has a broad scope with potential for a student to gain skills in a wide range of techniques. It involves working with several key biosynthetic proteins from *Mtb* that have been identified as good potential drug design candidates. Some proteins will need to undergo expression and solubility testing in *E. coli* or *M. smegmatis* as well as crystallisation trials to see if they are suitable for structural studies, while other candidates are already more progressed. One or two of the most suitable proteins, chosen to in conjunction with the student, will then be used for structural studies using X-ray crystallography, functional characterisation and potential inhibitor binding experiments.

Structural Biology of Enveloped RNA Viruses

Dr Richard Kingston

Room 472A Thomas Building

Phone: +64 9 373 7599 Ext 84414

Email: rl.kingston@auckland.ac.nz

Website: http://persephone.sbs.auckland.ac.nz/richard/lab

Our research focuses on two families of viruses that cause infectious disease in humans, the paramyxoviruses and the retroviruses. While these viral families replicate in very different ways within the cell, they both have RNA genomes, and they are both enveloped (i.e. wrapped in a membrane that is derived from the host). We study both viral and host proteins, with a particular emphasis on understanding the interactions (protein-protein, protein-RNA, and protein-lipid) that underlie viral replication, viral particle formation, and the cellular response to viral infection. This involves using a variety of structural and biophysical techniques as required by the problem. These techniques include spectroscopy, calorimetry, X-ray crystallography and electron microscopy.

Replication machinery of measles and mumps viruses.

Measles and mumps viruses are important human pathogens, especially in developing nations. Both are members of the paramyxovirus family, and they have a similar organisation and mode of replication. These viruses protect their RNA genome by packaging it into a helical protein-nucleic acid complex termed the nucleocapsid. The viral copying machinery - the polymerase - "walks" along the nucleocapsid during replication. We study the architecture and function of the polymerase, and we are particularly interested in the way the polymerase engages and moves along the nucleocapsid during RNA synthesis.

The innate immune response to viral infection, and evasion mechanisms adopted by measles and mumps viruses.

The interferon (IFN) family of cytokines plays a critical role in host defense against viral infection. Secreted from infected cells, IFNs activate protective functions in neighboring cells through a signal transduction pathway. Paramyxoviruses counteract the IFN response by encoding proteins that bind to, and inactivate, members of the signaling cascade, a process we seek to understand in molecular detail. We are also investigating members of the Mx protein family, which have antiviral properties and are regulated by interferon.

The assembly and organization of Rous sarcoma virus.

Rous sarcoma virus (RSV) is an avian retrovirus, closely related to human immunodeficiency virus (HIV). Retroviruses cause cancer and immune disorders in many species. For all retroviruses, the formation of spherical viral particles is directed by the Gag polyprotein. However the particles initially released from an infected cell are immature and non-infectious. Subsequently, proteolytic cleavage of the Gag polyprotein results in a substantial rearrangement of the virion interior. The defining step of this maturation process is the formation of the convex protein shell or capsid that surrounds the viral replication machinery, and helps facilitate infection. We are investigating the role of the Gag polyprotein, and its constituent domains, in retroviral assembly. We want to understand the architecture of the immature retroviral capsid, the physical forces which help form and stabilize the mature capsid, and the role of host factors in retroviral assembly and exit.

AgResearch Structural Biology Laboratory

Associate Professor Shaun Lott
Room 424A Thomas Building

Phone: +64 9 373 7599 Ext 87074
Email: s.lott@auckland.ac.nz

The research in the AgResearch Structural Biology Laboratory is a mixture of projects, some of which

are carried out in collaboration with AgResearch, and others in collaboration with researchers at the Universities of Auckland and Otago in New Zealand and also Universities overseas. We aim to address biologically interesting problems using a range of structural and biophysical techniques including X-ray crystallography, electron microscopy (EM), nuclear magnetic resonance (NMR) and circular dichroism (CD) spectroscopy, isothermal titration calorimetry (ITC) and surface plasmon resonance (SPR), as appropriate.

1. Structure, function and interactions of the COMMD protein family

   (In collaboration with Dr. Fiona McDonald, University of Otago and Dr. Ezra Burstein, University of Texas South Western Medical Center)

   The family of proteins known as the COMMD proteins are thought to be involved in carcinogenesis and tumour progression. As well as a general role in cancers associated with chronic inflammation through their interaction with the transcription factor NF κB, they may be specifically involved in prostate cancer progression and in some lymphomas. The aim of this project is to determine the atomic structures of these proteins in order to understand the way in which they function, and to structurally and functionally characterise macromolecular complexes of COMMD proteins interacting with both NF κB and other associated proteins. Our long-term aim is to understand the molecular details of COMMD protein inhibition of NF κB, with the aim of designing modulators of these interactions as therapeutic agents.

2. Structural Biology of *Mycobacterium tuberculosis*

   Mycobacterium tuberculosis is arguably the world's biggest infectious disease problem, causing close to 1.5 million deaths per year. We have several projects aimed at understanding the biology of M. tuberculosis and developing new therapeutic interventions.

a) Drug targets from *M. tuberculosis*

   (In collaboration with Prof. Ted Baker, Prof Greg Cook at the University of Otago and Prof. Dean Crick at Colorado State University)

   We have determined the structures of several enzymes known to be essential for the bacterium to cause disease, including anthranilate phosphoribosyl transferase (AnPRT; TrpD), the enzyme that catalyses the second committed step in tryptophan biosynthesis, and salicylate synthase (MbtI) that catalyses the production of salicylate, essential for the production of the iron-scavenging *siderophore mycobactin*, GlmU, an enzyme essential for cell wall biosynthesis, and Ndh-2, an enzyme essential for oxidative phosphorylation. Through a combination of *in silico* modelling and *in vitro* assays, we have identified inhibitors of these enzymes, and using structure-guided synthesis of more potent inhibitors that may be useful anti-mycobacterial agents of the future.

c) Transcriptional regulation in *M. tuberculosis*

   (In collaboration with Dr Sharon Kendall, Royal Veterinary College, London)

   We have shown that the essential transcriptional regulator KstR, which has previously been implicated in pathogenesis, directly controls the expression of many lipid metabolism genes in *M. tuberculosis.* Additionally, a similar transcriptional regulator, KstR2, has also been identified to control a smaller regulon thought to be specific for cholesterol metabolism. KstR and KstR2 both belong to the TetR family of transcriptional regulators, and our hypothesis is that the activation of KstR and/or KstR2 is triggered by lipid ligands derived from the human host, triggering bacterial

adaptation to the intracellular environment. We have determined the structures of both of these transcription factors and we are currently working to identify the ligands that trigger them to release from their DNA-bound form. Ultimately, we aim to design compounds that will disrupt lipid metabolism in *M. tuberculosis*, which would be a novel therapeutic route.

3. Engineering the structure of insecticidal toxins from *Yersinia entomophaga*.

   (In collaboration with Dr Mark Hurst, Biocontrol and Biosecurity, AgResearch, and Dr Michael Landsberg, University of Queensland)

   The insecticidal 'ABC' toxin produced by *Yersinia entomophaga* is a large (~2.5MDa) complex that causes severe disease and rapid death in susceptible insects. Using a combination of electron microscopy (EM) and X-ray crystallography, we have determined the structure of these complexes, and have published the results in recent papers in *PNAS* and *Nature*. The A protein in the complex forms a pentamer responsible for membrane binding, and the B and N-terminal parts of the C proteins form a large, hollow structure that encapsulates and protects the cytotoxic C-terminal portion of the C protein. The B/C complex is the first example of a structure that contains RHS (rearrangement hot spot) repeats, and illustrates a striking structural architecture that is likely to be conserved across both this widely distributed bacterial protein family and the related eukaryotic YD-repeat-containing protein family. The structure suggests a generic mechanism for how these protein families may encapsulate and deliver proteins into target cells. Our current work is aimed at understanding their mechanism of action and engineering them to carry non-native cargo proteins.

Structural Biology and Protein Engineering

Associate Professor Peter Metcalf

Room 465 Thomas Building

Phone: +64 9 373 7599 Ext 84810

Email: peter.metcalf@auckland.ac.nz

Website: www.bioscienceresearch.co.nz/staff/peter-metcalf

1. Insect virus polyhedra

   The infective form of certain insect viruses are remarkable micron sized protein crystals called polyhedra that each contain numerous virus particles embedded in a crystalline lattice. The crystals survive for years in soil or on leaves and feeding insect larvae become infected by ingesting them.

   We recently published the atomic structure of polyhedra from cypovirus infected silk-worms determined using novel micro-crystallographic techniques (Coulibaly et al., 2007, Nature 446, 97-101). This work explained why the crystals are so stable, but left unanswered the key question of how the virus particles are incorporated into the crystals as they grow within infected cells. The project involves research in this area using a variety of approaches including micro-crystallography applied to a range of different types of insect virus polyhedra.

2. Micro-crystal protein engineering

   Insect virus polyhedra are remarkably stable compared to most protein molecules and can be modified to incorporate foreign protein molecules instead of the virus particles they normally contain. These unique properties suggest applications in biotechnology. The atomic structure of cypovirus and baculovirus polyhedra that we determined now means that these crystals can be modified, using structure based

protein engineering methods. The project involves the development and characterisation of modified polyhedra produced using insect cell expression systems.

3. Granulovirus Nano-crystals

   The infectious particles of the insect virus granulovirus are tiny stable protein crystals about 400 nanometers long that surround a single membrane bound virus particle. We have determined the atomic structure of the crystalline part of these particles and the project involves using mass-spectrometry, electron microscopy and other analytical techiques to learn how the the other proteins in the particles interact with the crystal matrix.

Molecular Ecology, Evolution and Genetics

Dr Craig Millar
Room 228N Thomas Building
Phone: +64 9 373 7599 Ext 85186
Email: cd.millar@auckland.ac.nz

I have interests in the areas of molecular ecology, evolution and molecular genetics. My research has involved the development of genetic methods for sex assignment in a range of organisms, and the recovery and analysis of ancient DNA. I have also used molecular genetics techniques to study contemporary issues in evolutionary and conservation biology. I am a member of the Allan Wilson Centre for Molecular Ecology and Evolution, one of New Zealand's Centre's of Research Excellence.

My current research is focused in the following three research projects:

1. The moa genome: a targeted approach.

   This research project involves the extension of previous work that we have conducted on moa. The extinct moa of New Zealand possessed many unique phenotypes. Some moa species were the largest birds to have lived, while others were relatively small. Using new DNA technologies for sequencing ancient DNA, we are targeting the genetic networks that underlie growth in two moa species that differed dramatically in size. This research will involve sequencing these genetic networks using new DNA capture methods in combination with next-generation sequencing.

2. Investigating the action of anaesthetic agents on the circadian clock.

   I am currently involved in an inter-faculty research programme that is investigating the effects of general anaesthesia on circadian rhythms. This project is led by Dr Warman and Dr Cheeseman from the Department of Anaesthesiology. We are investigating the effects of general anaesthesia on time perception and the circadian clock using the honey bee as a model. In order to understand whether general anaesthesia 'steals time' by shifting the circadian clock, we are examining the influence of anaesthesia on bee orientation behaviour, on their time sense, and on the pattern of gene expression in the bee brain.

3. Does climate change drive evolution?

   In this project we aim to identify the molecular changes that have occurred in Adélie penguins in response to a ~10°C increase in temperature. This temperature change has occurred in the Antarctic since the last glacial maximum ~18,000 years ago. We will sequence the genomes of a large number of ancient Adélie penguins from bones (>18,000 years) and compare these to the genome of modern individuals living in warmer times. As a result of this comparison we will be able to identify among the ~20,000 avian genes those genes that have allowed penguins to cope with climate change.

Structural Biology of Membrane Proteins and Molecular Machines

Associate Professor Alok K. Mitra
Room 420A Thomas Building
Phone: +64 9 373 7599 Ext 88162
Email: a.mitra@auckland.ac.nz

Our research focus is to understand structure/function correlates of protein complexes and membrane proteins. The importance of these systems in biology is underscored by the fact that many cellular processes require multi-protein complexes or protein machines and that more than 20% of genes of both prokaryotic and eukaryotic organisms code for integral membrane or membrane–associated proteins, of which over 70% are drug targets. These systems can often be refractory to structural studies by traditional methods. Cryo-electron microscopy (cryo-EM) on the other hand has proven to be a powerful technique to reveal detailed mechanistic insight of such systems at the molecular level. Our multi-faceted research directions utilize advanced cryo-EM imaging method together with other complementary structural methods to reveal structure/function insights at the highest resolution. These are described below.

MACROMOLECULAR COMPLEXES

1. Adiponectin, synthesised by adipocyte tissues, is a multifunctional hormone that displays a strong insulin sensitisation. Endogenous adiponectin elicits varying oligomeric states, which are directly responsible for its pharmacological activity. Using image analysis of purified recombinant murine adiponectin, we are visualizing these so-called high molecular weight (HMW) complexes with a view to understanding their structures and structural dynamics that may be related to multifaceted function. We have discovered that the short N-terminal non-collagenous domain (AHD) is largely responsible for the so-called high-molecular weight adiponectin. This project aims to shed molecular insight into the role of the AHD using a combination of techniques including electron microscopy, and complementary biophysical methods, generate bacterially-derived adiponectin mimic and dissect the role of endoplasmic reticulum chaperones in regulating adiponectin assembly and release. In collaboration with Dr Yu Wang at the University of Hong Kong School of Medicine.

2. We are revealing the 3-dimensional architecture of anti-feeding prophage (Afp), a naturally occurring protein nano-machine. Afp is a novel microinjection device produced by the bacteria Serratia entomophila. This macromolecular assembly, is composed of 18 different proteins and acts by injecting a protein toxin that causes cessation of feeding of the larvae of agricultural pest Costelytra zealandica and is therefore of considerable agricultural impact. We are implementing modern cryo-electron microscopy imaging methods, in particular electron cryo-tomography to generate detailed 3-D structures of the extended (resting) and contracted (putative functionally active) forms of Afp. This work is in collaboration with Dr. Mark Hurst (Ag Research).

3. Capsid proteins are critical to viral morphogenesis and infectivity and are therefore important therapeutic targets. Current studies are directed at membrane-remodelling properties of D13 of vaccinia virus. Poxviruses such as vaccinia virus undergo complex and multi-stage morphogenesis in the process of developing into infectious particles. Scaffolding proteins dictate this morphogenesis by playing a critical role in viral assembly through poorly understood mechanism. We are studying the biological roles of D13 from vaccinia virus based on in vitro assembly systems. We

observe curvature-inducing properties instigated by D13, which appear to facilitate membrane remodelling in the assembly of particles resembling immature virion, a critical early poxvirus maturation intermediate. Details of these in vitro structures and the influence of binding partners are subject of investigation through electron microscopy and tomography with the ultimate goal of gaining insight into the role of D13 in the assembly process at the molecular level. In collaboration with Fasseli Coulibaly at Monash University. We are also interested in the mode of assembly of retrovirus Rous sarcoma virus capsid protein CA to understand the viral core formation. Different in vitro assembly products including icosahedral particles and 2D crystalline sheets are subject to cryo-EM based structural analysis. This study is in collaboration with Dr. R. Kingston, University of Auckland.

4. The peroxiredoxin (Prx) family are ubiquitously distributed antioxidant enzymes, which catalyse the reduction of potentially harmful reactive oxygen and nitrogen species. In humans, loss of Prx function is linked to various diseases including Alzheimer's, Parkinson's, numerous cancers and age related disease. The building block of Prx is a homodimer, which subsequently can oligomerize to generate a vast variety of high-molecular weight (HMW) assemblies including icosahedra, interlocking toroids and stacked toroids. We have found that under low pH, human Prx3 spontaneously organises into long nanotubes formed by regular stacking of the toroidal assemblies. Such nanotubes are believed to exist in vivo and are implicated in chaperone activity. The propensity to form these ordered nanotubes can be exploited for use as a vehicle tailored as a cargo-delivery system provided one can regulate various features such as the dimension of the tubes, electrostatic properties of the lumen of the tube and spacing of the toroidal motifs. We are determining at sub nanometre resolution the 3-dimensional structure of the nanotubes, for potential applications in designing of wide-variety of nanotubes. This work is in collaboration with Dr. Juliet Gerrard of Univ. Cantab.

MEMBRANE PROTEINS

I. Channels and transporters

1. We aim to gain insight into the molecular mechanism of multi-drug resistance in cell membranes and as a model system is revealing the structure of the E. coli. AcrA/AcrB/TolC drug-efflux complex in the lipid bilayer membranes. The clinical and medical relevance of the project is extended also to mammalian AcrB homologues e.g. the Niemann-Pick transporter type C1, genetic defect of which leads to aberrant regulation of cellular cholesterol homeostasis and the hedgehog receptor Patched involved in hedgehog signalling pathway whose dysfunction is implicated in tumour initiation and growth.

2. The near-atomic resolution structure of human AQP1 membrane channel generated using cryo-EM by us, and others has provided insight into how the remarkable water-specific transport through this channel is achieved. AQP1 has been implicated in human diseases related to disorder in fluid transport and therefore is an important drug target. We are engaged in collaborative research to develop rationally designed specific inhibitors for water passage starting with small, potential lead compounds. This work is in collaboration with Dr R Patil, ALCON Laboratories, Fort Worth, TX USA.

3. We are interested in the widely distributed class of oligomeric transporters that mediate the passage of divalent cations. We wish to reveal the poorly understood mechanism of Hg^{2+} transport across bacterial membranes,

implicated in mercuric ion resistance in gram-negative bacteria.

II. Pore-forming toxins

1. Colicins are members of a group of soluble plasmid-encoded bacteriocins that form non-specific voltage-gated ion channels in the cytoplasmic membrane of sensitive cells and are excellent models to understand membrane protein folding. Our goal is to visualize at the highest resolution, the 3-dimensional structures of colicin Ia and colicin S channels in the lipid bilayer to reveal the structure of the channel. For this purpose we are investigating lipid-reconstituted colicin using a host of imaging and biophysical techniques. This work is in collaboration with Dr K. Jakes at the Albert Einstein College of Medicine, Bronx, NY, USA and Dr. D. Linke (Max-Planck Institute, University of Tuebingen, Germany).

2. Anthrax toxin is the causative agent of anthrax and is a cocktail of 3 monomeric proteins, lethal factor (LF, 90 kD), oedema factor (EF, 89 kD) and the protective antigen (PA, 83 kD). Anthrax can be countered either by vaccination or antibiotics; however, an antitoxin is not yet available. We recently discovered that 1G3 instigates sever perturbation of the heptameric protective antigen prepore (PA63h) structure and creates a super complex. This phenotype highlights the feasibility for optimisation of vaccines based on analogous structural modification of PA63h as additional strategies for future remedies against anthrax. For this purpose, we are carrying out studies using electron microscopy and complementary biophysical studies to probe into the details of the mode of action of 1G3 with PA63h both in the soluble and membrane-inserted state. Current investigations are also directed at determining the structure of the ternary complex with the soluble domain of the receptor attached to the ligand bound PA63h, and ternary complex reconstituted into the membrane bilayer. This work is in collaboration with Dr S Leppla at the NIAID, National Institute of Health, USA.

Plant Pathology / Virology

Professor Mike Pearson
Room 338B Thomas Building,
Phone: +64 9 373 7599 Ext 88371
Email: m.pearson@auckland.ac.nz

My research focuses primarily on the characterisation, epidemiology and control of viruses infecting plants and fungi. Current and potential research areas include:

1. Characterisation and epidemiology of viral pathogens of crop plants and native plant species: This research is aimed at understanding the nature of virus diseases of New Zealand and Pacific Island commercial crops and NZ native plant species. It involves virus characterisation using electron microscopy, serology and molecular techniques and studies of their epidemiology and impact.

2. Mycoviruses: Detection, characterisation and ecological effects: Viruses have been detected in a wide range of fungal species. In most cases, the effects of these viruses on the fungus are unknown, but some have been shown to adversely affect the fungus and are being investigated for their potential as biocontrol agents. In collaboration with scientists at Plant and Food Research and AgResearch we are studying fungal viruses and investigating their effects on plant pathogenic fungi (eg Botrytis and Sclerotinia) and fungal endophytes (Epichloe spp.) at both the molecular and population level.

3. New technologies for plant virus diagnostics: In conjunction with the MAF, the Bio-Protection Research Centre, and Plant and Food Research we are developing improved molecular techniques for the detection and identification of plant viruses, with a particular emphasis on biosecurity.

Arthur, K., Pearson, M. Geographic distribution and sequence diversity of the mycovirus *Botrytis virus F.* Mycological Progress, DOI 10.1007/s11557-014-1000-4

Khalifa, M.E., Pearson, M.N. Molecular characterisation of an endornavirus infecting the phytopathogen *Sclerotinium sclerotiorum*. Virus Research, 189: 303-309, 2014

Khalifa, M.E., Pearson, M.N. Molecular characterization of novel mitoviruses associated with *Sclerotinia sclerotiorum. Archives of Virology* DOI 10.1007/s00705-014-2171-7, 2014

Woo, E.N.Y., Pearson, M.N.. First Report of *Strawberry latent ringspot virus in Vaccinium darrowii*. Journal of Phytopathology.Published online : 26 FEB 2014, DOI: 10.1111/jph.12235, 2014

Woo, E.N.Y., Ward, L.I., Pearson, M.N. Biological and Molecular Variation of *Cherry leaf roll virus* isolates from *Malus domestica*, *Ribes rubrum, Rubus idaeus, Rumex obtusifolius* and *Vaccinium darrowii*. Plant Pathology 63: 838–845. DOI: 10.1111/ppa.12166, 2014

Yie, S.W., Khalifa, M.E., Hahn, T., Pearson, M.N. Molecular characterization of a novel *Victorivirus* from the entomopathogenic fungus *Beauvaria bassiana. Archives of Virology* 159: 1321-1327, 2014

The Flowering Lab

Associate Professor Jo Putterill
Room 318A Thomas Building
Phone: +64 9 373 7599 Ext 87233
Email: j.putterill@auckland.ac.nz

We study the regulation of the time to flowering in plants using molecular biology, biochemistry and gene transfer techniques. The timing of flowering to favourable seasons of the year is crucial for reproductive success in plants and there is commercial interest in breeding varieties with customised flowering for increased productivity. Recently, there has been great progress in flowering research with the identification of FT protein as the long sought after florigen, a universal floral promoting substance.

We are particularly interested in how external environmental cues such as day length and winter cold regulate flowering. We use a model plant, the legume Medicago truncatula, in order to discover new mechanisms for flowering control and test how well the flowering network is conserved between species. We are also using this knowledge to develop tools for customising flowering in industrial crops.

You are very welcome to make contact by email to discuss graduate opportunities in the Flowering Lab or more generally in Plant Molecular Science in Auckland (at the University and at the CRI Plant and Food Research, Mt Albert).

Texture Genomics Group

Dr. Robert Schaffer
(Plant and Food Research, Mount Albert)
Email: robert.schaffer@plantandfood.co.nz

We seek to understand the physiological and physical mechanisms that contribute to different fruit textures. There is a huge diversity of textures across different fruits, ranging from soft, melting, juicy fruits, to hard crunchy fruit. Fruit texture is a complex interaction of many factors such as cell wall chemistry, cell size and shape, cell packing and cell turgor. Texture is also a temporal trait; fruit change their textures as they mature. Understanding these complexities offer a wide range of research opportunities covering molecular biology, cell biology, biochemistry, microscopy and sensory science.

Current projects include:

- The role of ethylene in fruit softening
- Transcriptional control of texture in apples
- Transcriptomics of fruit maturation and ripening
- Molecular diagnostics.

Structural Biology of signalling complexes, protein kinases involved in inflammation and cancer, and bacterial surface proteins.

Dr Christopher Squire

Room 403 Thomas Building

Phone: +64 9 373 7599 Ext 88806

Email: c.squire@auckland.ac.nz

A number of potential projects are available with themes of structural biology, drug discovery and protein engineering. We use a number of complementary techniques to study our biological systems including X-ray crystallography, small-angle X-ray scattering, fragment screening, and computational modeling.

1. Probing cell-signalling complexes involved in inflammation and cancer

   PI3kinase signalling and malfunction are intimately involved in diseases like cancer and in the body's inflammatory response. Our current interest is in the inflammatory signalling pathway, also recently implicated in melanoma, mediated by the PI3Kγ complex. In particular, we know that binding of a regulatory subunit and a G protein Gβγ complex to the catalytic subunit of PI3Kγ are critical to signalling. But what does this complex look like? Can we understand the structural basis of signalling? A joint project with Researchers at the University of Auckland School of Medicine (Dr. Jack Flanagan & Prof. Peter Shepherd).

   For additional reading: Vadas O, Dbouk HA, Shymanets A, Perisic O, Burke JE, Abi Saab WF, Khalil BD, Harteneck C, Bresnick AR, Nürnberg B, Backer JM, Williams RL. Molecular determinants of PI3Kγ-mediated activation downstream of G-protein-coupled receptors (GPCRs). Proc Natl Acad Sci U S A. 2013 Nov 19;110(47):18862-7. doi: 10.1073/pnas.1304801110.

2. Drugs to treat cancer

   We collaborate with the Auckland Cancer Society Research Centre (Dr. Jack Flanagan, Dr. Jeff Smaill, A. Prof. Adam Patterson, A. Prof. Mark McKeage), and have focussed on drug discovery efforts for protein kinases involved in cancer (Fibroblast growth factor receptor 1, Epidermal growth factor receptor). We will use X-ray crystallography to develop new leads and drug molecules to treat cancer. The ACSRC has a long and successful history in cancer drug development and our work with them has the potential to impact in a very real way on the lives of cancer patients.

   For additional reading: Sci Transl Med 18 December 2013: Vol. 5, Issue 216, p. 216ra177 Sci. Transl. Med. DOI: 10.1126/scitranslmed.3007205

3. Stabilising elongated proteins – extreme measures for an extreme lifestyle

   We recently discovered an unprecedented type of intramolecular bond inside a bacterial surface protein. This ester bond provides structural and proteolytic stability to an elongated and flexible surface protein that would in its absence completely fall apart and kill the bacterium. What can we learn about surface protein function in bacteria? At a more fundamental level, can we find other such unusual bonds in any of the other domains of life particularly extremophiles where an extreme lifestyle may translate to extreme stability mechanisms! Joint project with SBS rsearchers (Dr. Paul Young, Prof. Ted Baker).

   For additional reading: Kwon H, Squire CJ, Young PG, Baker EN. Autocatalytically generated Thr-Glnester bond cross-links stabilize the repetitive Ig-domain shaft of a bacterial cell surface adhesin. Proc Natl Acad Sci U S A. 2014 Jan 28;111(4):1367-72. doi: 10.1073/pnas.1316855111.

Industrial and Medical Microbiology

Associate Professor Silas Villas-Boas
Room 3010 Thomas Building
Phone: +64 9 373 7599 Ext 83762
Email: s.villas-boas@auckland.ac.nz

My group carries out research on microbial physiology with focus on metabolic mechanisms in living cells. Through a multi-disciplinary approach involving aspects of microbiology, biochemistry, chemistry and engineering, we aim to develop new, cutting edge technologies used to gain insight into the mechanisms governing complex metabolic pathways relevant in industrial fermentation processes, human disease development and in food processes.

Our current research projects are:
- Production of natural food colorants via microbial fermentation.
- Bioprospecting of biological active compounds of microbial origin.
- Bioconversion of agroindustry byproducts
- Fungal metabolism

Our research uses a full range of microbiological, biochemical and post-genomics techniques, particularly metabolomics and fluxomics, as well as metabolic engineering and fermentation technology.

Graduate research can be undertaken in the following areas:

1. Screening and selection of pigment-producing microbes isolated from the New Zealand environment, optimization of microbial pigment production via fermentation, and purification and characterization of microbial pigments.

2. Biodiscovery of metabolic active metabolites produced by microorganisms (natural antimicrobials, anti-tumours, insecticides and herbicides).

3. Designing fermentation processes to bioconvert agroindustry by-products such as fruit vegetable residues into high added-value food ingredients.

4. Development of mathematical models and tools to explore the properties and capabilities of cellular systems aiming to elucidate hidden cellular mechanisms and to design new enhanced strategies for metabolic engineering.

Ecology, Evolution and Behavioural Biology Section

Academic Staff:

Associate Professor Jacqueline Beggs
Dr Souyad Boudjelas
Dr Bruce Burns
Professor Kendall Clements
Professor Mick Clout
Dr Rochelle Constantine
Dr Todd Dennis
Dr Brendon Dunphy
Dr Anne Gaskett
Dr Mat Goddard
Dr Greg Holwell
Dr Shane Lavery
Professor Bill Lee
Associate Professor George Perry
Dr Matt Rayner
Dr Howard Ross
Dr James Russell
Dr Anna Santure
Associate Professor Mary Sewell
Dr Judy Sutherland
Dr Margaret Stanley
Professor Michael Walker
Dr Shane Wright

Affiliate:

Professor C. Scott Baker
(Oregon State University)
Associate Professor Thomas Buckley
(Landcare Research)
Associate Professor Mark Costello
(Leigh Marine Lab)
Ms Mandy Harper
Professor Andrew Jeffs
(Leigh Marine Lab)
Dr Steffen Klaere (Statistics)
Dr Agnes LePort (Leigh Marine Lab)
Dr Louise Malone (Plant & Food Research)
Professor John Montgomery
Professor Richard Newcomb
(Plant & Food Research)
Dave Seldon (Teaching & Learning)
Dr Nick Shears
(Statistics - Leigh Marine Lab)

Ecological Entomology

Associate Professor Jacqueline Beggs
Tāmaki Innovation Campus
Phone: +64 9 373 7599 Ext 86823
email: j.beggs@auckland.ac.nz

Most insects in New Zealand are endemic, and they play a pivotal role in the function of our native ecosystems. Yet many species are undescribed and their ecology is poorly understood. Add to this the continual arrival of new invasive invertebrates, and there is a never-ending supply of critical research questions to be addressed if we are to understand and manage the biosecurity and biodiversity of New Zealand.

My research area is the biodiversity and biosecurity of natural New Zealand ecosystems. My main research focuses on the ecology and control of invasive invertebrates, particularly in communities influenced by sugar-rich resources; honeydew and nectar. This is complemented by research on the biodiversity and conservation of native species, such as pollination ecology and restoration ecology.

Associate Professor Thomas Buckley

Rm 252 Thomas Building
Phone: +64 9 373 7599 Ext 82632
Email: BuckleyT@landcareresearch.co.nz

My research focuses on the application of genomic methods to understanding the evolution of New Zealand terrestrial invertebrates. I have on-going projects on stick insects, cicadas, beetles, moths, earthworms and weta. I am currently using whole genome data, transcriptomics (gene expression) and SNP data to reveal the genetic basis of adaptation in stick insects and weta. These genomic analyses are often coupled with functional studies of adaptation and organismal performance. I am particularly interested in questions on the biogeographic origins of New Zealand invertebrates and evolutionary processes within New Zealand. These questions are addressed using phylogenetic and genomic approaches. A large area of focus is understanding the methods of analysis and these include phylogenetics, model selection, tests of topology, coalescent models and the assembly and analysis of whole genomes, transcriptomes and gene expression data. I am also involved in a range of conservation genetics projects on highly threatened invertebrates including tusked and giant weta. I have large data sets from transcriptomic and whole genome studies that are awaiting study by graduate students.

Plant Ecology and Restoration Ecology

Dr Bruce Burns

Tāmaki Innovation Campus

Phone: +64 9 373 7599 Extn 83135

Email: b.burns@auckland.ac.nz

My research interests seek to understand what determines plant community composition and structure in different environments and how these change over time. I am particularly interested in species-level positive feedback mechanisms as potential keys to managing plant communities. I have four main research themes:

1. Forest ecology.
   How does variation in environment, disturbance regime, and biotic interactions lead to spatial and temporal differences in forest composition, structure and biomass? I'm particularly interested in the unusual forests dominated by the ancient conifer Agathis australis (kauri) and other long-lived pioneer trees, the effects of tree ferns in New Zealand forests, and the ecology of hemiephiphytes such as Metrosideros robusta (northern rata), once a common component of North Island forests in New Zealand.

2. Old field restoration.
   Reversing biodiversity decline now requires restoration of degraded ecosystems. How do we manage natural processes to achieve restoration goals cost-effectively in these systems? In particular, how do we restore forest to abandoned pasture in New Zealand?

3. Biodiversity management in urban and rural ecosystems.
   There is increasing interest in maintaining and increasing native plants and animals in human-dominated landscapes while reducing the impact of invasive species. What determines the persistence of indigenous biota within these landscapes and how can management be adapted that is sympathetic to biodiversity?

4. Conservation ecology.
   The development of areas where mammalian pests are reduced to near-zero densities has increased dramatically as a conservation strategy in New Zealand, sometimes using pest-proof fencing. What changes and responses in natural communities occur as a result of this intervention, and what contribution to national conservation goals will these techniques achieve?

Fish Biology and Evolution

Professor Kendall Clements
Rm 136 Thomas Building
Phone: +64 9 373 7599 Ext 87223
Email: k.clements@auckland.ac.nz

I have two main topics of research interest: (a) the biology of marine herbivorous fishes, and (b) evolution and speciation in fishes. Both involve collaboration with scientists nationally and internationally. The first of these topics involves many aspects of the biology of marine herbivorous fishes, including ecological work on distribution, feeding rates and diet choice, phylogenetic studies on the evolution of herbivory, age and growth studies, and biochemical and physiological studies on metabolism and the function of the digestive system. A particular interest has been the activities and identity of the diverse endosymbiotic microorganisms that inhabit the gut of these fishes, and I have several PhD students working in the area.

The second of my research topics has a focus on evolution (including speciation) and phylogeography of reef fishes in both temperate and tropical waters. Current research involves evolutionary studies on drummers (Kyphosidae), nibblers (Girellidae), parrotfishes (Labridae), and triplefins (Tripterygiidae), including ecological work relevant to our understanding of speciation processes.

A large range of potential student projects is available on these two research topics, many involving collaborative supervision with other staff members and scientists at other institutions. Diving experience is useful for many projects, which mainly involve a mixture of laboratory and field-based research.

Conservation Ecology

Professor Mick Clout
Tāmaki Innovation Campus
Phone: +64 9 373 7599 Ext 85281
Email: m.clout@auckland.ac.nz

1. Conservation ecology.
   Ecology, behaviour and conservation of native vertebrates, especially birds.
2. Biosecurity and invasion biology.
   Ecology, behaviour and management of invasive alien species, especially mammals.

Dr Rochelle Constantine
Room 138 Thomas Building
Phone: +64 9 373 7599 Ext 85093
Email: r.constantine@auckland.ac.nz

My research interests focus on the behaviour, ecology and conservation of cetaceans; I lead the Marine Mammal Ecology Group and I am the Director of the Joint Graduate School in Coastal and Marine Science. We use a variety of techniques including spatial ecology, population modeling, behavioural data collection and molecular methods to understand the population recovery, anthropogenic effects, ranging behaviour and habitat use of Bryde's whales, bottlenose dolphins, humpback whales and Maui's dolphins. I collaborate with a number of researchers overseas, in DoC and CRIs in New Zealand and supervise students with graduate research projects..

Spatial and Movement Ecology

Dr Todd E. Dennis
Room 128 Thomas Building
Phone: +64 9 373 7599 Ext 87288
Email: t.dennis@auckland.ac.nz

My research covers a broad range of fundamental and applied topics within the fields of movement & spatial ecology, with strong linkages to behavioural ecology, geography, and wildlife management. I am particularly interested in:

1. dynamic modelling of animal movement and the factors that drive it;
2. patterns of animal space-use;
3. data-capture methodologies for quantifying space-use and movement, especially satellite telemetry;
4. statistical and simulation models of inferring behaviour and ecological processes within geospatial lifelines;
5. application of the 'movement ecology' paradigm for conservation and management of endangered wildlife and invasive pests, especially threatened/endangered species of parrots;
6. dispersal, translocation, homing, and migration;
7. geovisualisation of behavioural patterns, and;
8. human-wildlife conflict;
9. species distribution models and conservation biogeography.

Students working with me can expect to learn and use geographic information science, animal-tracking techniques (GPS, ARGOS satellite telemetry, radio-telemetry), models of animal movement, and various univariate, multivariate, geospatial, and randomisation statistical procedures.

New and on-going projects focus on a wide range of animal species both within New Zealand and overseas (especially Australia and the US).

Dr Brendon Dunphy
Room 142 Thomas Building
Phone: +64 9 373 7599 Ext 87583
Email: b.dunphy@auckland.ac.nz

The physiological resilience of marine animals to biotic and abiotic perturbations underpins most of the research I am involved in. I am particularly interested in what metabolic strategies intertidal invertebrates employ to maintain homeostasis within a fluctuating environment and how we might use this information to predict the effects of future climate change. Another strand of research I am involved in is unpicking patterns of larval connectivity of marine invertebrates within the coastal environment. Moreover, by integrating this information within an aquaculture context I am also interested in improving the production and sustainability of current aquaculture practices. Thus far, the model organisms I have used are mussels and oysters with a number of ecological and molecular techniques employed. Finally, I have recently branched out into endothermic species and I am looking at the physiological capacity of New Zealand's seabirds.

Sensory ecology, chemical ecology, plant and animal colour, pollination and other plant-animal interactions

Dr Anne Gaskett
Room 1020 Thomas Building
Phone: +64 9 373 7599 Ext 89509
Email: a.gaskett@auckland.ac.nz

I study sensory ecology – the evolution of animal signals and communication. I research how animals perceive colours and smells and how plants can use mimicry and false signals to manipulate animal behaviour. My students and I have a wide range of study subjects: seabirds, insects (flies, bees, wasps, dungbeetles), orchids,

mosses, magnoliids and carnivorous plants. We address theoretical, applied and conservation outcomes and use a range of field and lab techniques including GC-MS and spectral analyses and modelling.

Deceptive pollination in orchids
Diverse and enigmatic, orchids are fascinating. I investigate how orchids lure insects into acting as pollinators with scents and colours, mimicry and sensory deception. New Zealand and Australian orchids have a range of unusual pollination systems involving sexual, food and brood-site deception.

Moss ecology and animal behaviour
Amazingly, some mosses mimic the rotting odours of carcasses and dung to attract flies to disperse their spores. Do they use native and introduced flies and hosts? In New Zealand, these mosses now grow on the skeletons of introduced mammals like deer – who were their original native hosts? Moa and other herbivorous birds? Studying these ancient moss lineages provides insight into the early origins of complex plant-animal interactions, and crucially, how ecological networks can survive in a changing world.

Sensory based conservation of seabirds
Seabirds are some of the world's most at-risk taxa. Foraging far out at sea, nesting in burrows and living in colonies all select for unique sensory adaptations. We investigate how we can use olfactory, visual and auditory signals to assist in seabird conservation and translocations

Experimental Ecology and Evolution

Dr Mat Goddard
Room 3006 Thomas Building
Phone: +64 9 373 7599 Ext 89537
Email: m.goddard@auckland.ac.nz

My lab's interests revolve around the causes and consequences of Natural Selection from both a fundamental and applied perspective. An experimental approach is usually taken to understand the genetics, ecology and evolution of natural and experimental populations and communities of yeasts. The lab's efforts have extended to include various applied aspects of fungi in any area of fermentation biology and yeast ecology, but we typically concentrate in the area of viticulture winemaking. However, I am keen to develop projects that are concerned with any aspect of ecology and evolution and encourage any prospective student to discuss these further with me.

Some current projects include:

- The ecology of natural vineyard fungi including their variation between niches and in space
- The evolution and origin of sex
- Saccharomyces cerevisiae's ecological niche
- Microbial biogeography
- The genetics of adaptation
- The dynamics of selfish genetic elements
- Yeasts' influence on wine characteristics
- Yeast species interactions.

Evolutionary and Behavioural Ecology of Sexual Reproduction

Dr Greg Holwell
Room 139 Thomas Building
Phone: +64 9 373 7599 Ext 83652
Email: g.holwell@auckland.ac.nz

My research focuses on terrestrial invertebrates and their fascinating reproductive biology and behaviour. New Zealand has a large number of relatively unstudied invertebrate fauna awaiting investigation and I am open to discussing projects with students on a number of topics. I enjoy an integrative approach that utilises advanced

imaging techniques for investigating morphology, behavioural observation and experiments, and field work to understand animal reproduction in an ecological context. My research also places animal reproduction into an evolutionary framework through comparative approaches, molecular phylogenetics, and exploration of the costs and benefits of reproductive strategies. I am particularly interested in the following research areas:

1. Sexual selection and sexual conflict. This is one of the most fascinating and topical areas of behavioural ecology research. Mate choice and competition for mates have driven spectacular behavioural and morphological adaptations in animals. I am particularly interested in how conflicts of interest between male and females influence their reproductive strategies, and how sexual selection drives the evolution of exaggerated morphologies such as weapons and ornaments. I am open to working with students on sexual selection in any terrestrial invertebrates utilising a combination of behavioural, ecological, molecular or imaging techniques.
2. Biology of praying mantises. These are among the most charismatic of insects and yet they are relatively unstudied. While many species exhibit sexual cannibalism, others do not. All however display fascinating reproductive behaviours. Research will focus on the two praying mantis species found in New Zealand, but also Australian and South East Asian species with fieldwork in a number of locations.

Ecology, Aquaculture and Marine Biotechnology

Professor Andrew Jeffs

Email: a.jeffs@auckland.ac.nz

My research interests in aquaculture and marine biotechnology are broad with an active involvement in a range of research projects, including very applied projects working closely with the seafood industry, to more esoteric marine ecological issues related to aquaculture. Some examples of current projects are investigating the biology of mussel larvae, aquaculture of rock lobsters, and the biochemistry of oceanic plankton. I have a particular interest in the mysterious nature of cross-continental shelf transport of lobster larvae and this research is using a mix of field and laboratory techniques.

Postgraduate research opportunities:

1. Investigating the role of underwater sounds in influencing the behaviour of pelagic crabs, shrimps, lobsters and fishes.
2. Investigating the early biology and ecology of mussel larvae and juveniles as it relates to aquaculture applications.
3. Exploring the biochemical energetics of lobster, fish and crab larvae.
4. Investigating transparent tissues of offshore marine organisms.
5. Investigating the potential for the aquaculture of sea cucumbers to yield valuable bioactive compounds.
6. Determining the aquaculture potential of New Zealand inshore octopus and urchin species.

Some of these projects will involve commercial research partners and there is the potential to attract research funding.

Marine Molecular Ecology and Evolution

Dr Shane Lavery

Room 126 Thomas Building

Phone: +64 9 373 7599 Ext 83764

Email: s.lavery@auckland.ac.nz

My research focuses on the application of molecular techniques to the understanding of theoretical and applied issues in ecology,

evolution and biodiversity of marine fauna.

Current and potential research areas include:

- NZ coastal community connectivity and marine reserves

  We do not yet have any clear understanding of how connected are different marine communities around New Zealand's coast. How far do the larvae of different organisms travel before settling? Where do new recruits come from? Which communities act as sources of larvae and which as sinks? If we wish to protect communities in reserves, how large do they need to be in order to be self-sustaining, or how far apart can they be before losing their natural connectivity? These are the sorts of questions that can be answered using molecular approaches, by examining the differences among populations within a variety of coastal organisms, both native and invasive.

- Molecular taxonomy and phylogenetics of Antarctic and New Zealand marine invertebrates

  We are only now beginning to understand the extraordinary diversity of marine organisms in the waters around New Zealand and Antarctica. Many are yet to be properly described, there are likely to be many cryptic species yet to be discovered, and the past evolutionary relationships of many of them are yet to be examined. Through analysis of DNA sequences from adults and from planktonic larvae collected in coastal waters, we can dramatically increase our knowledge of benthic invertebrate biodiversity. Through analysis and comparison of our sequences to those found on public databases, along with phylogenetic tree reconstruction, we can quantify larval diversity and determine the species identity of many previously unknown larval forms.

- Adaptation and speciation in the marine environment

  What happens at the molecular level when marine species diverge? If a new species arises through isolation (allopatry), we might expect selectively neutral genes to diverge most rapidly, followed by other genes under selection, as the new species adapts to its environment. Alternatively, species may diverge within the same location (sympatry), through processes such as sexual selection and microhabitat differentiation. Here, we may expect to see strong selection driving functional genes to diverge rapidly, with neutral genes following over time. We can examine these processes of adaptation and speciation at the molecular level, by comparing rates of evolution between functional and neutral genes, and looking at the signatures of selection in the DNA.

Neuroethology and Fish Biology

Professor John Montgomery
Room 140 Thomas Building
Phone: +64 9 373 7599 Ext 87208
Leigh Marine Lab
Phone: +64 9 373 7599 Ext 83611
Email: j.montgomery@auckland.ac.nz

1. Studies of behaviour of fish (sharks and rays, scorpion fish, nocturnal predators, native fishes, trout), involving the use of lateral line and electrosense for prey localisation and orientation. Study of motor control systems and swimming behaviour.

2. Marine acoustics and passive acoustic orientation.

3. Larval fish active recruitment mechanisms.

Marine Phycology – Biodiversity, systematics and evolution of marine macroalgae

Professor Wendy Nelson

Phone: 64 4 3860600

NIWA,Private Bag 14-901, Wellington 6241

Email: wendy.nelson@auckland.ac.nz; wendy.nelson@niwa.co.nz

My research in marine phycology includes work on systematics, biogeography, ecology and life histories, with a primary focus on discovery and documentation of the NZ flora. I have a close research partnership with Judy Sutherland (University of Auckland) who brings molecular phylogenetic skills to our joint programmes. Refer to Biodiversity, evolution and systematics of New Zealand marine algae (page 80).

Potential student projects:

Projects on marine macroalgae can include a range of approaches – with a focus on deepening understanding and contributing to knowledge of the flora - including systematics, ecology, life histories, and with work on native and introduced species.

Gracilariales

- Systematics and ecology of Melanthalia in NZ
- Identity of introduced Gracilaria in Manukau Harbour
- Systematics & ecology of NZ Curdiea species

Ulvales

- Description and characterisation of NZ species Ulva , Umbraulva and Gemina

Coralline algae

- Rhodolith ecology and responses to human induced changes
- Systematics and ecology of selected NZ coralline algae (both geniculate and non-geniculate species)

Bangiales

- Life histories, ecology and systematics of NZ species (many undescribed species requiring characterisation)

Ceramiales

- Systematics of NZ taxa – many genera to work on including Polysiphonia, Ceramium

Codium

- Revision of the genus in NZ – both branched and prostrate species

Forest and landscape ecology

Associate Professor George Perry

City Campus & Tamaki Innovation Campus

Phone: +64 9 373 7599 Ext 84599

email: george.perry@auckland.ac.nz

All ecological processes take place within a spatial context - my research interests are broad but are all concerned with understanding interactions between spatial pattern and ecological process.

1. Landscape-level vegetation dynamics and disturbance. I am particularly interested in the dynamics of fire-prone landscapes and ecosystems, past and present. Recent research in this area has emphasised the use of modelling approaches to complement paleoecological information, focussing on NZ's early prehistoric period.

2 The reciprocal effects of spatial pattern on ecological process, particularly in terms of competition, coexistence and dispersal in plant communities. Research in this area blends field- and model-based approaches, with field work ongoing in Nothofagus forests in the South Island and species-rich shrublands in southwest Australia.

3. Spatial ecological modelling. I am interested in the development and evaluation of statistical and simulation models for investigating the long-term dynamics of forest landscapes.

Dr. Matt Rayner

Email: mrayner@aucklandmuseum.com

Website: www.bioscienceresearch.co.nz/staff/matt_rayner and www.mattrayner.co.nz

My research is focussed on the biology and My research is focussed on the biology and conservation of mobile avian vertebrates and I am particularly interested in cross-disciplinary research combining advanced tracking technologies, GIS based modelling and behavioural, cellular and molecular toolsets to test hypotheses regarding the ecological and evolutionary context of animal behaviour in space and time.

My main research interests focus on the role of movement in animal behaviour, community ecology and ecological speciation.

Seabird behaviour, ecology and conservation
New Zealand is a world centre of seabird diversity yet surprisingly little is known about the biology of these fascinating animals. How do seabirds forage and partition foraging resources? How does habitat and oceanic productivity mediate inter and intra species differences in breeding biology, behaviour, physiology and population genetic structure? Where and when do seabird migrate? New Zealand presents the ideal background for the study and conservation of these internationally significant species.

Movement ecology of native birds in fragmented landscape.
Fragmentation of natural habitats and the impacts of invasive species are key threats to New Zealand avifauna. Accordingly understanding the extent to which mobile species travel between relict populations is becoming vital, particularly when these species offer ecosystem services at a landscape scale. I am using advanced tracking technology to understand landscape-scale connectivity in threatened endemic birds such as kaka and kereru.

Phylogenetics and Evolutionary Bioinformatics

Dr Howard Ross

Room 284 Thomas Building

Phone: +64 9 373 7599 Ext 86160

Email: h.ross@auckland.ac.nz

I am interested in the application of computational phylogenetic methods to a diverse range of problems, involving organisms from RNA viruses to mammals, using molecular genetic data from individual genes or whole genomes. I collaborate with "data generators", scientists whose research programmes involve increasingly large amounts of data.

Current research includes:

- Molecular methods for species identification. The identity of every organism can potentially be found in the molecular archive but work is needed to assess the best method for finding that identity.
- Adaptive evolution. Molecular sequences contain the fingerprint of adaptive evolution. The interesting question now is where and when did that adaptive evolution occur. Recent research projects have considered RNA viruses but the growing genetic databases should enable wider analyses.

Quantitative Ecology and Island Conservation

Dr James Russell

Tāmaki Innovation Campus

Phone: +64 9 373 7599 Ext 86833

Science Centre, Rm Rm 303.217,

Phone: +64 9 373 7599 Ext 88745

email: j.russell@auckland.ac.nz

I am interested in a variety of ecological questions which often have underlying application to conservation. I have a particular enthusiasm for islands, where complex ecological relationships can become reduceable and tractable. Of particular interest are population and behavioural biology questions relating to what makes species threatened or invasive, and how these trends can be reversed. I also work with macroecology questions related to biogeography such as species diversity and community composition, and in the application of genetic methods within an ecological context. My work often has a strong statistical modelling or analytical component. I also have a strong interest in animal ethics and environmental attitudes.

A selection of possible research topics are provided below, but students are also encouraged to discuss other projects they are interested in where they think the project will ma tch well with my research interests. Many of these research projects will require developing and applying good quantitative skills, which are vital in ecological research and management.

- Island Conservation

Islands are biodiversity hotspots, but many islands now have multiple threatened and introduced species, and the way they interact among one another, and the order in which they arrive, can have important consequences for biosecurity and conservation. Research in this topic could involve studying the distribution of multiple species from a particular taxa (e.g. small mammals, birds or insects), modelling their interactions, or experimental work investigating interactions. Collaboration with external agencies such as the Department of Conservation and Landcare Research are encouraged.

- Quantitative Ecology

Numerical methods are increasingly important in conservation. Research projects might involve developing or refining statistical estimation methods (maximum likelihood or Bayesian), mathematical population biology models, or computer intensive methods such as track image analysis. Students from other departments such as Statistics, Mathematics or Computer Science are encouraged to discuss possible co-supervision of projects in this area.

- Environmental Attitudes

The implementation of many current conservation methods now interacts strongly with the values the local community and interest groups have. Projects in this area would investigate which environmental attiudes and ethical values are important in different groups, and how they affect conservation strategies. Students from other departments such as Sociology or Psychology are encouraged to discuss possible co-supervision of projects in this area.

Evolutionary and quantitative genetics and genomics

Dr Anna Santure

Room 290, Thomas Building

Phone +64 9 373 7599 ext 83801

Email: a.santure@auckland.ac.nz

The majority of traits linked to survival and

reproduction, and hence the overall fitness of individuals in a population, are complex and quantitative – they are influenced by many factors, both genetic and environmental, and tend to have continuous distributions across a range of phenotypes. For example, body size in animals is a quantitative trait often strongly linked to survival and reproductive success. I am really interested in understanding the genetic basis of these quantitative traits, to help us predict how populations will adapt to future selection pressures. My current research focuses on two aspects – (i) understanding the adaptive potential of threatened populations and (ii) determining the influence of genomic imprinting on traits of agricultural importance

(i) Threatened populations: We are currently working on understanding the genetic basis of reproductive and morphological characters in populations of two endangered New Zealand species, the hihi (stitchbird, Notiomystis cincta) on Tiritiri Matangi Island, and Stewart Island robin (toutouwai, Petroica australis rakiura) on Ulva Island. We are developing genomics resources to further understand the evolutionary potential of these species in a rapidly changing world. This research is ideally suited to a candidate with a strong background in statistics, mathematics, bioinformatics, computer programming or similar, as well as a passion for ecology and conservation biology.

(ii) Genomic imprinting: Genes are imprinted when their expression depends on the sex of the parent passing them on. For example, the copy of a gene we inherit from mum might be expressed, while the copy that we inherit from dad is turned off. We are currently working on models and statistical techniques to dissect the influence of genomic imprinting on production traits in sheep and dairy cattle, with the aim to improve selective breeding programs. This research is ideally suited to a candidate with a strong background in statistics, mathematics, bioinformatics, computer programming or similar, as well as a passion for applied science.

In addition, I have research interests in a broad range of other population and quantitative genetics and genomics, including population genetic and quantitative genetic theory, especially with regard to genomic imprinting and population differentiation, and the use of marker data to reconstruct pedigrees and describe population differentiation, and in conservation genetics. Please get in touch if you'd like to chat about these or other research possibilities!

Marine Invertebrate Ecology

Associate Professor Mary Sewell
Room 130 Thomas Building
Phone: +64 9 373 7599 Ext 83758
Email: m.sewell@auckland.ac.nz

Research in my laboratory focuses on reproduction and development of marine invertebrates, particularly in echinoderms. Current research falls into five general areas:

(a) Reproduction and larval development in local fauna. Studies involve the reproductive cycle of the chosen species using gonad indices and histology, with the rearing of larvae in the laboratory. In addition we are applying DNA sequencing to match larval and adult forms from wild-collected plankton samples. Research in this area is important for understanding the ecology of local marine species and for marine biosecurity.

(b) Maternal investment and the energetics of larval development. This involves taking a physiological (metabolic rate) and biochemical (protein and lipid utilization) approach to studies of marine invertebrate development. Larvae are reared in the

laboratory, or obtained from aquaculture facilities, and measurements made of biochemical measures throughout development. Recent research projects include sea urchin, sea cucumber and starfish larvae.

(c) Antarctic meroplankton. As part of the Latitudinal Gradient Project (www.lgp.aq) we have studied in detail the distribution and abundance of the Antarctic meroplankton along the Victoria Land Coast, and as part of the International Polar Year-Census of Antarctic Marine Life (IPY-CAML) Ross Sea voyage are examining the relationship between meroplankton abundance, depth and habitat (shelf/abyss/seamount). Morphological identification and DNA sequencing of larvae are being used to understand more of the ecology of Antarctic marine invertebrates and fish.

(d) Hauraki Gulf zooplankton studies. We have recently begun using the morphological and molecular techniques developed for Antarctic larvae in studying the Hauraki Gulf zooplankton in terms of relationship to water quality (urban/rural catchments) and as potential diet items for Bryde's whale; in the latter we are taking a metagenomics approach.

(e) Impacts of climate change on marine invertebrates, with a focus on ocean acidification in both Antarctica and New Zealand. We have developed a state-of-the art facility at the University of Auckland for the creation of seawaters of differing seawater chemistries (using CO2 bubbling by mass flow controllers) and to measure to a high degree of accuracy the seawater chemistry (pH, pCO2, carbonate parameters etc). This is a growing area of research in my laboratory with study of the impact of rising sea water temperatures and ocean acidification on the development of echinoderms.

Urban ecology/ Invasion Biology/ Plant-animal interactions

Dr Margaret Stanley

Tāmaki Innovation Campus

Phone: +64 9 373 7599 Ext 86819

Email: mc.stanley@auckland.ac.nz

My interests in terrestrial ecology are diverse, but can be loosely grouped into three main areas of interest: urban ecology; invasion ecology; plant-animal interactions. Often these three research areas can overlap. Although much of my research is applied ecology, I do undertake research on the co-evolutionary aspects of plant-animal interactions.

I am interested in research on a variety of taxa (birds, invertebrates, plants, reptiles, mammals, etc.). Available for BSc(Hons), MSc or PhD supervision.

Possible research areas:

Urban Ecology
- Road ecology: how animals (native and invasive) interact with roads
- Interaction between native and introduced organisms in urban areas (eg birds)
- Connectivity of urban areas with natural areas (particularly pest movement)
- Enhancing biodiversity/restoration (including tree protection)

Invasion Ecology
- The influence of connectivity on large scale pest movements & impacts
- Impacts of invasive animals/invertebrates on native communities (particularly on ecological functions such as pollination/seed dispersal)
- Ecology and impact of newly established invasive plants
- Invasive species and climate change
- Competition+/or facilitation among multiple invasive species
- Predicting establishment of pre-border pests

and predicting the potential distribution of newly established pests
- Dispersal of weed seeds by birds
- Impacts of invasive species in rare ecosystems (eg hakea in northern gumlands)

Plant-animal interactions (native and/or exotic systems)
- Seed dispersal and pollination within communities
- Plant defences – interactions with herbivores

Biodiversity, evolution and systematics of New Zealand marine algae

Dr Judy Sutherland
Room 149 Thomas Building
Phone: +64 9 373 7599 Ext 83682
email: j.sutherland@auckland.ac.nz

My research focuses on understanding New Zealand's marine algal (seaweed) flora using molecular tools. I work mainly with macroalgae (seaweeds) with occasional forays into microalgae.

Molecular tools have revolutionised understanding of the relationships and evolution of the algae. Marker assisted identification (MIA) allows is to investigate relationships, trace histories of range expansions and invasions, and carry on the work of describing and cataloging New Zealand's wonderfully diverse seaweed flora.

Students with an interest in systematics, phylogeography, and other applications of molecular tools are welcome to get in touch to discuss ideas.

Animal Behaviour in Space and Time

Professor Michael Walker
Room 1016 Thomas Building
Phone: +64 9 373 7599 Ext 87054
Email: m.walker@auckland.ac.nz

The uncanny ability of some animals to make long, precisely directed and timed journeys has defied scientific explanation for centuries and is fascinating to study in detail today.

Postgraduate students in our research group are engaged in exciting developments in the study of:
- the structure, function and use of the magnetic sense and
- the theory and experimental analysis of navigation by animals.

These developments promise rapid advances in our understanding of how animals find their way over long distances.

We are also actively engaged in the study of the general behaviour of animals in space and time using animal tracking devices based on the global positioning system satellites. Recent students have engaged in research on habitat use by birds and small mammals including studies in the conservation and management of other important species, both natives and exotics.

We also study the mechanisms underpinning the circatidal and circalunar clocks. This research may have biomedical applications as well as applications in food production.

Biogeography and Genetic Taxonomy

Dr Shane Wright

Horton Senior Lecturer in Plant Biogeography

Tāmaki Innovation Campus

Phone: +64 9 373 7599 Ext 81775

Email: sd.wright@auckland.ac.nz

My research is currently focused on the effect on rates of molecular evolution of: (1) population size/area and (2) productivity/available energy. The question of population size is being addressed by comparing mutation rates (substitution rates) for congeners or conspecifics where one population or species occurs in an insular situation and another occurs on an adjacent land mass with much greater area. In practice this involves a comparison of congeners/conspecifics between: (a) Chatham Islands-New Zealand mainland for plants and birds, (b) D'Entrecasteaux Archipelago-New Guinea mainland, again for plants and birds, and (c) Fiji-New Guinea for plants. The question of productivity is being addressed by similar rate comparisons between congeners amongst plants, birds and marine fish. The plant and fish studies involve latitudinal sampling between: (a) lowland New Guinea and lowland New Zealand/Southern Australia for plants, and (b) tropical and temperate Australian waters for fish. The bird study involves altitudinal rather than latitudinal displacement and is conducted entirely within New Guinea. In that instance comparisons are made between congeners, one of which is lowland and the other montane

Joint Graduate School in Plant & Food Research

(Director, Associate Professor. Andrew Allan)

The Crown Research Institute Plant & Food Research, at Mt Albert, is one of the world's leading food science organisations and is in close proximity to the University of Auckland.

A wide range of research projects are available at the Plant & Food Research Mt Albert Research Centre site, with the aim of producing novel healthier foods faster and with less environmental impact. Many of the programmes integrate a number of research disciplines including plant physiology, plant biochemistry, and metabolomics, plant pathology, plant molecular biology, sensory and consumer science, postharvest research and integrated pest management. Students based at Mt Albert gain experience in a commercial research environment, as well as having access to the academic resources of the University.

FUNCTIONAL GENOMICS: COLOUR AND HEALTH

SBS staff:

Associate Professor Jo Putterill

Joint appointees:

Associate Professor Andrew Allan

(andrew.allan@plantandfood.co.nz)

Our team is interested in highly pigmented fruit. Anthocyanins are the main pigments in red fruit such as apple and cherries, but not fruit like tomato. We have isolated transcription factors that control plant colour, and are currently looking at ways that the environment and plant developmental processes can switch these transcription factors on and off. We are also investigating fruit compounds that are associated with health such as vitamin C.

FUNCTIONAL GENOMICS: TEXTURE

SBS staff:

Professor Philip Harris

Associate Professor Jo Putterill

Dr Karine David

Joint appointees:

Dr Robert Schaffer

robert.schaffer@plantandfood.co.nz)

Plant & Food Research contacts:

Dr Rosie Schroeder

(rosie.schroeder@plantandfood.co.nz)

We seek to understand the physiological and physical mechanisms that contribute to different fruit textures. There is a huge diversity of textures across different fruits, ranging from soft, melting, juicy fruits, to hard crunchy fruit. Fruit texture is a complex interaction of many factors such as cell wall chemistry, cell size and shape, cell packing and cell turgor. Texture is also a temporal trait; fruit change their textures as they mature. Understanding these complexities offer a wide range of research opportunities covering molecular biology, cell biology, biochemistry, and sensory science.

FUNCTIONAL GENOMICS: FLAVOUR

Joint appointees:

Associate Professor Andy Allan
(andrew.allan@plantandfood.co.nz)
Professor Richard Newcomb
(Richard.Newcomb@plantandfood.co.nz)

Plant & Food Research contacts:

Dr Ross Atkinson
(Ross.Atkinson@plantandfood.co.nz)
Dr Ken Marsh
(Ken.Marsh@plantandfood.co.nz)

Flavour and aroma research is focussed on the identification and analysis of volatile components, sugars and acids in fruit, food and beverages. The genes/enzymes involved in the production of these flavour components are characterised in bacteria, yeast and plants. This work is combined with sensory analysis looking at the interaction between people and the flavours and fragrances of kiwifruit, apples and wines.

Selected papers:

- Nieuwenhuizen NJ, Green SA, Chen X, Bailleul EJD, Matich AJ, Wang MY, Atkinson RG (2012) Functional genomics reveals that a compact terpene synthase gene family can account for terpene volatile production in apple. Plant Physiology 161: 787-804
- Garcia CV, Quek S-Y, Stevenson RJ, Atkinson RG, Winz RA (2012) Changes in the bound aroma profiles of 'Hayward' and 'Hort16A' kiwifruit (Actinidia spp.) during ripening and GC-olfactometry analysis. Food Chemistry 137: 45-54
- Atkinson RG, Gunaseelan K, Wang MY, Luo L, Wang T, Norling CL, Johnston SL, Maddumage R, Schröder R, Schaffer RJ (2011) Dissecting the role of climacteric ethylene in kiwifruit (Actinidia chinensis) ripening using an ACC-oxidase knockdown line. Journal of Experimental Botany 62: 3821-3835

FUNCTIONAL GENOMICS: PLANT DEVELOPMENT

SBS staff:

Associate Professor Jo Putterill

Dr Karine David

Plant & Food Research contacts:

Dr Kim Snowden
(kim.snowden@plantandfood.co.nz)
Dr Erica Varkonyi-Gasic
(erika.varkonyi-gasic@plantandfood.co.nz)

We are interested in discovering the underlying molecular switches that control key plant developmental processes. Our work allows us to determine how well these processes have been evolutionarily conserved and therefore work out robust methods to alter agronomic traits. In particular we aim to be able to understand and control the switch from vegetative to floral development and also to control the outgrowth of meristems into branches. These characteristics allow us to modify plant architecture and control flowering time. These traits are important for our perennial crops as they impact on the timing of crop production as well as crop yield and ease of harvest. Our research uses both important horticultural crops as well as model plant species, and we use a combination of methodologies in our research such as molecular biology, genetics, physiology and microscopy..

KIWIFRUIT BREEDING BIOLOGY

SBS staff:

Associate Professor Andy Allan
(Director Joint Graduate School)

Plant & Food Research contacts:

Dr Paul Datson
(Paul.Datson@plantandfood.co.nz)
Dr Lena Fraser
(lena.fraser@plantandfood.co.nz)
Dr Elena Hilario
(elena.hilario@plantandfood.co.nz)
Dr Jinhu Wu
(jinhu.wu@plantandfood.co.nz)

We apply modern techniques to unravel the biology of Actinidia, and aid in the production of new cultivars of New Zealand's most important horticultural crop. Kiwifruit are dioecious, with X and Y sex chromosomes, a useful model for studying the early stages of evolution of sex chromosomes. Having identified the sex chromosomes through genetic mapping, and located the sex-determining locus, we aim to be the first in the world to identify sex-determining genes in a dioecious plant species. Several projects within this area include: constructing a physical map of the sex-determining region using bacterial artificial chromosomes (BACs), exploring rates of sequence divergence between the X and Y chromosomes, and the process of retrotransposon accumulation and Y chromosome degradation.

Another aspect of our research is aimed at understanding biosystematic relationships between Actinidia species and populations. Our large germplasm collection of Actinidia, combined with our EST database of kiwifruit genes, supports a wide range of projects investigating phylogenetics of Actinidia.

Our comprehensive genetic map offers the opportunity of quantitative trait loci (QTL) analyses of important fruit and vine characters. Identification of QTLs locates the regions of the genome which contain the genes responsible for expression and modification of these traits, and allows development of genetic markers for marker assisted selection (MAS). We are also interested in the mapping of specific genes for important traits.

POSTHARVEST BIOLOGY

SBS staff:

Dr Karine David

Plant & Food Research Contacts:

Dr Ian Ferguson
(iferguson@plantandfood.co.nz)
Dr Jason Johnston
(jjohnston@plantandfood.co.nz)

We are interested in the regulation of fruit ripening and storage disorders. After harvest, fruit need to be maintained so consumers can reliably buy high quality products. High quality requires a combination of successful practices to be followed starting with harvest timing, followed by the optimum storage conditions. By understanding the processes involved in ripening we aim to improve the quality of fruit bought by the consumers. Current research areas include regulation of the ripening hormone ethylene and its mode of action and the prediction of storage disorders using molecular markers..

PLANT PATHOGENS: MOLECULAR VIROLOGY

SBS staff:

Professor Mike Pearson

Joint appointees:

Dr Robin MacDiarmid

Associate Professor Matt Templeton

Viruses (plant, animal or computer) are pieces of encoded software that infect their host, hijack the

host machinery to replicate and then infect a new host. We are interested in viruses that infect NZ crops such as kiwifruit, citrus, grapes and ornamentals, as well as our native plants. We are also interested in sequencing the bee viruses that are involved in colony collapse along with Varroa mite. In these projects you may be involved in discovering new viruses that have never previously been identified or discovering new strains of a known virus.

In addition, we are interested in how viruses affect plants including altering hormone regulation, RNA silencing, and plant development. This leads us into discovering how plants resist infection and how plant viruses overcome these defences. It's biochemical warfare out there!

Molecular virology uses mass spectrometry, massively parallel sequencing technologies, and bioinformatics and can offer many exciting possibilities in both plant and animal research, as well as basic and applied employment opportunities in New Zealand and abroad**.**

Recent publications

Khalifa, M.E., Pearson, M.N. Molecular characterization of novel mitoviruses associated with *Sclerotinia sclerotiorum*. *Archives of Virology* DOI 10.1007/s00705-014-2171-7, 2014

Tauati, S.J., Pearson, M.N., Choquer, M., Foster, G.D., Bailey, A.M. Investigating the role of dicer 2 (dcr2) in gene silencing and the regulation of mycoviruses in *Botrytis cinerea*. Microbiology 83, July 2014

Waller, T., Greenwood, D., MacDiarmid, R. (2012) A critical review of translation initiation factor eIF2a kinases in plants – regulating protein synthesis during stress. Functional Plant Biology 39(9) 717-735.

MacDiarmid, R.M. (Accepted) Chimeric, Infectious, and Stable Virus Transcripts to Study RNA Silencing in Dark Green Islands. Invited review for Methods in Molecular Biology, Antiviral resistance in plants. Edited by: M-B Wang and J. M. Watson, Humana Press Inc., Totowa, NJ. (Invited publication)

Lilly, S.T., Drummond, R.S., Pearson, M.N. and MacDiarmid, R. M. (2011) Identification and validation of reference genes for transcript normalization studies in virus-infected *Arabidopsis thaliana* Molecular Plant-Microbe Interactions 24(3):294-304. Impact Factor 4.41

Varkonyi-Gasic, E., Gould, N., Sandanayaka, M., Sutherland, P. and R.M. MacDiarmid. (2010) Characterisation of microRNAs from apple (*Malus domestica* 'Royal Gala') vascular tissue and phloem sap. BMC Plant Biology 10:159. Impact Factor 3.77 (Highly accessed)

Blouin, A.G., Greenwood, D.R., Chavan, R.R., Pearson, M.N., Clover, G.R.G., MacDiarmid, R.M., and Cohen, D. (2010) A generic method for identifying plant viruses by high resolution tandem mass spectrometry of the coat proteins. Journal of Virological Methods 163 49–56. Impact Factor 2.133.

MOLECULAR PLANT-PATHOGEN INTERACTIONS

SBS staff:

Professor Mike Pearson

Joint appointees:

Dr Matt Templeton (matt.templeton@plantandfood.co.nz)

Plant & Food Research contacts:

Dr Jo Bowen (Joanna.Bowen@plantandfood.co.nz)

Our long term aim is to assist in the development of strategies for sustainable and durable plant resistance. *Venturia inaequalis* is the cause of apple scab disease. We aim to identify and

analyse the structure and function of effector proteins (genes that are essential for invasion of the host) and avirulence genes (that are recognised by apple resistance proteins).

We have recently assembled a high quality draft of the *V. inaequalis* genome and complemented this with two deep-sequenced transcriptomes, one of these from infected apple leaves. From this data we have identified the secretome and several genes upregulated during infection.

To complement this work we aim to identify resistance genes against fungal pathogens such as *V. inaequalis* and *Podosphaera leucotricha* and some sucking insects. We are investigating the structure of a domain shared by the largest class of resistance genes - the nucleotide binding site (NBS) domain. These domains share sequence homology with genes in the mammalian programmed cell death (apoptosis) pathway and plant resistance reactions often involve a programmed cell death component (the so called hypersensitive response). The protein structure will be compared to those of related NBS domains in order to develop an understanding of its role in the disease resistance process and its potential link with the programmed cell death pathway in plants and animals.

Recent publications

Bowen, J.K., Mesarich, C.H., Bus, V.G., Beresford, R.M., Plummer, K. M. Templeton MD (2009) *Venturia inaequalis*: the causal agent of apple scab. Molec. Plant Pathol. (accepted for publication).

Bowen, J.K., Mesarich, C.H., Rees-George, J. Cui, W. Win J. Fitzgerald, A. Plummer, K. M. Templeton MD (2009) Candidate effector gene identification in the ascomycete fungal phytopathogen *Venturia inaequalis* by expressed sequence tag analysis. Molec. Plant Pathol. 10(3) 431-448.

W.T. Jones, D. Harvey, X. Sun, D.R. Greenwood, T.H. Al-Samarrai, C.H. Mesarich, J. Lowry, M.D. Templeton, Heterologous expression, isotopic-labeling and immuno-characterization of Cin1, a novel protein secreted by the phytopathogenic fungus *Venturia inaequalis*, Protein Expression and Purification (2009), 65(2): 140-147.

Kucheryava N, Bowen JK, Sutherland PW, Conolly JJ, Mesarich CH, Rikkerink EH, Kemen E, Plummer KM, Hahn M, Templeton MD. Two novel *Venturia inaequalis* genes induced upon morphogenetic differentiation during infection and in vitro growth on cellophane. Fungal Genet Biol. 45(10), 1329-1339.

Bus VG, Laurens FN, van de Weg WE, Rusholme RL, Rikkerink EH, Gardiner SE, Bassett HC, Kodde LP, Plummer KM. The Vh8 locus of a new gene-for-gene interaction between *Venturia inaequalis* and the wild apple *Malus sieversii* is closely linked to the Vh2 locus in *Malus pumila* R12740-7A. New Phytol. 2005;166:1035-49.

MOLECULAR VIROLOGY

SBS staff:
Professor Mike Pearson
Dr Robin MacDiarmid
Dr John Taylor
Associate Professor Dave Greenwood

Plant & Food Research contacts:
Dr Dan Cohen

Viruses (plant, animal or computer) are pieces of encoded software that infect their host, hijack the host machinery to replicate and then infect a new host. We are interested in identifying, understanding, managing and using viruses that infect hosts both in the horticultural and medical settings.

We are interested in viruses that infect NZ crops such as kiwifruit, grapes and citrus, and also our native plants. We are also interested

in bee viruses that are involved in colony collapse along with Varroa mite. In these projects you may be involved in discovering new viruses that have never previously been identified or discovering new strains of a known virus.

We are also interested in how viruses affect plants including altering hormone regulation, RNA silencing, and plant development. This leads us into discovering how plants resist infection, how plant viruses overcome these defences, and forms the basis of potential management strategies.

Viruses can be used as vectors to deliver or silence genes to cells of the host. We are developing a range of virus vectors for gene function discovery in plants and fungi as well as targeting cancer cells in humans.

Molecular virology uses leading mass spectrometry and massively parallel sequencing technologies and can offer many exciting possibilities in both plant and animal research, as well as basic and applied employment opportunities in New Zealand and abroad.

Recent publications

1. Waller, T., Greenwood, D., MacDiarmid, R. (2012) A critical review of translation initiation factor eIF2α kinases in plants – regulating protein synthesis during stress. Functional Plant Biology 39(9) 717-735.
2. MacDiarmid, R.M. (2012) Chimeric, infectious, and stable virus transcripts to study RNA silencing in 'dark green islands'. Methods in Molecular Biology 894, 299-308.
3. Blouin AG, Chavan RR, Pearson MN, MacDiarmid RM, Cohen D (2012). Detection and characterisation of two novel vitiviruses infecting Actinidia. Archives of Virology. 157 (4): 713-722.
4. Lilly ST, Drummond RS, Pearson MN, MacDiarmid RM 2011. Identification and validation of reference genes for transcript normalization studies in virus-infected Arabidopsis thaliana. Molecular Plant-Microbe Interactions 24(3): 294–304.
5. Varkonyi-Gasic E, Gould N, Sandanayaka M, Sutherland P, MacDiarmid RM 2010. Characterisation of microRNAs from apple (Malus domestica 'Royal Gala') vascular tissue and phloem sap. BMC Plant Biology 10: 159. Impact Factor 3.77
6. Blouin AG, Greenwood DR, Chavan RR, Pearson MN, Clover GRG, MacDiarmid RM, Cohen D 2010. A generic method for identifying plant viruses by high resolution tandem mass spectrometry of the coat proteins. Journal of Virological Methods 163: 49–56.

ENTOMOLOGY

SBS staff:

Associate Professor Jacqueline Beggs

Dr Anne Gaskett

Dr Margaret Stanley

Joint appointees:

Professor Richard Newcomb

Plant & Food Research contacts:

Dr Robin Gardner-Gee

Dr Jacqui Todd

Plant & Food Research's Applied Entomology teams at Mt Albert comprise about 20 researchers working on a range of projects aimed at promoting the profitability and environmental sustainability of New Zealand's horticulture industries. Major research themes at Auckland are:

- Environmental impacts of agricultural biotechnologies. Developing a better understanding of, and tools to assess, the potential impacts of new technologies, such as new cultivars (including genetically modified plants), biological control agents, agri-chemicals and nanomaterials, on non-target, beneficial organisms, e.g. honey bees, predators, parasitoids and insect pathogens.
- Understanding, measuring and preserving invertebrate biodiversity and the provision of ecosystem services in agricultural ecosystems.
- Development of Integrated Pest Management (IPM) programmes and underpinning research. The emphasis is on techniques to minimise or prevent the use of broad-spectrum insecticides for control of horticultural, vegetable, arable and ornamental pests. Both field and laboratory based research is carried out to investigate the biology, ecology and behaviour of key pests and natural enemies. Projects include: the development of pest monitoring systems and spray thresholds (to ensure that insecticides are applied only when necessary); the use of new highly specific sprays (such as insect growth regulators), and non-chemical control techniques (such as mating disruption using pheromones); biological control strategies, investigating the introduction of new natural enemies, understanding the impact of parasitoids already present in New Zealand, understanding the feeding behaviour of sucking insects and transmission of plant diseases by insect vectors.
- New tools and techniques to support export market access for New Zealand's horticultural products, including development of new, safer methods for post-harvest disinfestation.
- Insect genomics. Understanding gene function in Lepidoptera, particularly in relation to olfaction and digestion. Using gene-based interactions between insects and plants as a basis for developing novel insect control technologies.

There are also opportunities to participate in entomological research being carried out at Plant & Food Research's other sites: Te Puke (kiwifruit research), Hawke's Bay (apples and winegrapes), Palmerston North (insect genomics and disinfestation research), and Lincoln (arable and vegetable crops).

Joint Graduate School in Biodiversity and Biosecurity

Director: Associate Professor Jacqueline Beggs

The University of Auckland and Landcare Research are New Zealand's two leading research organisations in environmental science and ecology research. We have combined our resources and expertise to create the Joint Graduate School in Biodiversity and Biosecurity as part of the Centre for Biodiversity and Biosecurity.

The Joint Graduate School offers postgraduate students the opportunity to undertake Masters or PhD research to help maintain New Zealand's terrestrial ecosystems and to enable our natural flora, fauna and fungi to flourish. This includes the systematics and conservation of native vertebrates, invertebrates, plants, fungi, and bacteria; and research on the ecology, impacts and control of invasive plants and animals. The Joint Graduate School also offers students access to Landcare Research's scientific expertise and research infrastructure across the country. Primary resources maintained by Landcare Research include NZ's largest land invertebrate collection (NZAC), the national fungal herbarium (PDD), and the national fungal and bacterial culture collection (ICMP).

INVERTEBRATE SYSTEMATICS

SBS staff:

Dr Anne Gaskett

Dr Greg Holwell

Joint appointees:

Associate Professor Thomas Buckley

Landcare Research staff:

Dr Trevor Crosby

Dr Marie-Claude Larivière

Dr Shaun Forgie

Dr Rich Leschen

Dr Robert Hoare

Dr Darren Ward

Dr Zhi-Qiang Zhang

Dr Zeng Zhao

Current research emphasises the systematics of insects and other land invertebrates using morphological and molecular approaches. Specific groups covered include:

Diptera (flies), Hemiptera (bugs), Hymenoptera (parasitoids), Acari (mites) and Onychophora (velvet worms). Phasmatodea (stick insects), Coleoptera (beetles), Diptera (flies), Lepidoptera (moths), Hemiptera (bugs), Hymenoptera (parasitoids), Acari (mites) and Onychophora (velvet worms). Nematodes, Biogeography, phylogeography and speciation in land invertebrates is also being investigated.

FUNGAL SYSTEMATICS AND ECOLOGY

SBS Staff:

Professor Mike Pearson

Dr Bruce Burns

Dr Rebekah Fuller

Landcare Research Staff:

Dr Peter Johnston

Dr Stan Bellgard

Dr Peter Buchanan

Dr Eric McKenzie

Dr Maj Padamsee

Dr Bevan Weir

Research utilises both morphological and molecular data in an integrated approach to understanding the diversity of New Zealand's fungi and plant pathogenic bacteria, and includes high-throughput environmental sequencing. Work is undertaken at both regional and global scales, increasing the understanding of New Zealand's fungal and bacterial diversity and placing this diversity in a global phylogenetic context. Systematic data is applied to understanding the origin and ecology of New Zealand's fungi and bacteria, and the impacts that the diversity of these organisms have on ecosystem functioning. Current research expertise covers both basidiomycete and ascomycete groups with wood rotting, leaf endophytic, mycorrhizal, and plant pathogenic lifestyles. With less than half New Zealand's expected fungal diversity currently recorded, we are keen to discover endemic species new to science, while also seeking protection for those assessed as threatened.

Current research targeting organisms causing plant diseases, includes Colletotrichum on a range of horticultural crops, Botrytis on grapes, Phytophthora on a broad range of host plants including Phytophthora taxon Agathis on kauri, and the bacteria Pseudomonas and Xanthomonas. We also research biocontrol of weeds using pathogenic fungi and bacteria, the biogeography of fungi of New Zealand and the South Pacific, and the genetic basis of pathogenicity. Landcare Research is custodian of the national collections of fungal specimens (NZ Fungal and Plant Disease Collection – PDD Fungarium) and of living strains of plant-associated fungi and bacteria (Culture Collection ICMP).

Fuller, R., Johnston, P.R., Pearson, M.N. The diversity of *Schizophyllum commune* in New Zealand. New Zealand Journal of Botany, 51:286-296. 2013

Dhami, M.K., Weir, B.S., Taylor, M.W., Beggs, J.R. 2013. Diverse honeydew-consuming fungal communities associated with scale insects. PLoS ONE 8(7): e70316.

Johnston, P.R., Hoksbergen, K., Park, D., Beever, R.E. 2014. Genetic diversity of Botrytis in New Zealand vineyards and the significance of its seasonal and regional variation. Plant Pathology 63(4): 888–898.

Pouliot, A., May T., McMullan-Fisher, S., Buchanan, P., Allison, L., Packer, J. 2014. It's time for a Global Strategy for Plant and Fungus Conservation. Australasian Plant Conservation 22(4): 22–23.

Padamsee, M., McKenzie, E.H.C. 2014. A new species of rust fungus on the New Zealand endemic plant, Myosotidium, in isolated Chatham Islands. Phytotaxa 174(3): 223-230.

TERRESTRIAL ECOLOGY

SBS staff:

Associate Professor Jacqueline Beggs
Dr Bruce Burns
Professor Mick Clout
Dr Todd Dennis
Dr Anne Gaskett
Dr Greg Howell
Associate Professor George Perry
Dr James Russell
Dr Margaret Stanley

Co-appointed staff:

Professor Bill Lee

Landcare Research staff:

Dr Robyn Symcock
Dr Dan Tompkins
Dr Darren Ward
Dr Janet Wilmshurst
Dr Susan Wiser
Dr Zhi-Qiang Zhang

There is a diverse range of research on the relationships between organisms and their environment. Some research is focussed on understanding how biodiversity affects ecological function, while other research is targeted at conserving native biodiversity, restoring ecosystems or understanding behavioural interactions. We work in a wide range of terrestrial ecosystems, from forests and urban sites to rare ecosystems such as gumlands. We also work on a diverse range of taxa, from fungi and yeasts to plants, insects, birds and mammals.

INVASIVE SPECIES

SBS staff:

Associate Professor Jacqueline Beggs
Dr Bruce Burns
Professor Mick Clout
Dr Anne Gaskett
Dr Greg Holwell
Dr James Russell
Dr Margaret Stanley

Co-appointed staff:

Professor Bill Lee

Landcare Research staff:

Dr Phil Cowan
Dr Al Glen
John Innes
Eric McKenzie
Dr Quentin Paynter

Dr Dan Tompkins
Dr Darren Ward
Dr Bevan Weir

There are a range of projects directed at understanding invasion processes, the ecology of invasive species and subsequent management strategies. Project areas include the pathways for insect and weed invasion, developing tools for assessing the potential for establishment, measuring ecological impact of exotic species, and population modelling of invasive species and biocontrol agents. Research is also aimed at developing control tools; classical biocontrol of weeds with insects and pathogens, host specificity and risk analysis of biocontrol agents on non-target species, bioherbicide products for inundative biocontrol of weeds and insecticides for invasive wasps and ants, so that managers can either eradicate or control species that do establish.

Other research is designed to help managers decide where and when to control invasive mammals, based on knowledge of their ecology and impacts. Research is conducted in collaboration with the Department of Conservation on public conservation land, and with other agencies and private groups to provide information for extending biodiversity outcomes by linking protected sites across the New Zealand landscape. Also a major component of the research aims to improve cost-effective control of agricultural pests. The research spans forest, dryland, alpine, and (lowland) braided river ecosystems. Modelling is used to predict the likely consequences of global change drivers, including climate change and land use change, for management of invasive mammals across major conservation and production ecosystems in New Zealand.

BIOSYSTEMATICS

SBS staff:
Dr Greg Holwell

Co-appointed staff:
Assoc Prof Thomas Buckley

Landcare Research staff:
Dr Peter Buchanan
Dr Robert Hoare
Dr Peter Johnston
Dr Rich Leschen
Dr Maj Padamsee
Dr Bevan Weir
Dr Zeng Zhao
Dr Zhi-Qiang Zhang

Research utilises both morphological and molecular data in an integrated approach to understanding the diversity of New Zealand's biota. Work is undertaken at both regional and global scales, increasing the understanding of New Zealand's biological diversity and placing this diversity in a global phylogenetic context. Systematic data is applied to understanding the origin and ecology of New Zealand's biota, and the impacts that the diversity of these organisms have on ecosystem functioning.

ECOLOGICAL GENETICS

SBS staff:
Dr James Russell

Co-appointed staff:
Associate Professor Thomas Buckley
Landcare Research has a research group who

work on a number of projects that are concerned with the conservation of genetic diversity. These projects include freshwater fish conservation genetics and skink population genetics. Projects are also available in the field of plant conservation/population genetics with a focus on threatened plant species. Also many projects focus on the conservation of invertebrates which link strongly with the Department of Conservation efforts. These presently include molluscs, ground beetles, and onychophora. Projects also exist that use genetic markers to track pest species such as possums and stoats.

For further information: www.ecogene.co.nz

Joint Graduate School in Coastal & Marine Science

Director: Dr Rochelle Constantine
School of Biological Sciences

The JGS in Coastal and Marine Science is a multidisciplinary joint initiative between the University of Auckland and the National Institute of Water and Atmosphere (NIWA), which combines leading expertise in coastal science, marine ecology, fisheries science, aquaculture, oceanography and marine systems modelling.

The JGS provides exciting opportunities for postgraduate student research across a broad range of topics in Coastal and Marine Science, jointly supervised between NIWA and the University. Students in the JGS have the opportunity to gain experience in an applied research environment, as well as having access to the academic resources of the University.

To find out more about the opportunities for research presented by the JGS in the School of Biological Sciences please contact
Dr Rochelle Constantine
(r.constantine@auckland.ac.nz)

Opportunities for projects jointly supervised by staff of SBS and other external institutions

The School has close relationships with a number of other external research agencies such as Auckland Council, Ministry of Agriculture and Forestry, Department of Conservation, SCION, and CSIRO (Australia). Consequently there is opportunity for research students to undertake projects that are supervised jointly by SBS staff and selected staff of appropriate CRIs and other external institutions. Students interested in these areas should initially contact the SBS staff member associated with each project area, in order to discuss research opportunities.

Auckland Museum

A wide range of projects are available based on the Museum's large and historic natural history research collections totalling some 1.5 million specimens. Training in collection curation and management is available alongside research projects. Students with interests in these areas should discuss potential projects with the Museum staff involved and with potential SBS co-supervisors.

INSECT BIOSYSTEMATICS

SBS staff:
Dr Greg Holwell
Dr Anne Gaskett

Museum staff:
John Early

The opportunity exists for biosystematics studies

based on the Museum's large insect collections, with a primary focus on the biosystematics of the Hymenoptera. A secondary area of research interest is the insect fauna of northern New Zealand's offshore islands.

MORPHOLOGY AND TAXONOMY OF TERRESTRIAL VERTEBRATES

SBS staff:

Professor Mick Clout

Museum staff:

Dr Brian Gill

There are opportunities to use the large collection of birds, reptiles, amphibians and land mammals (study-skins, bones and some whole fluid-preserved specimens) to study aspects of taxonomy, biogeography, morphology and anatomy. There is a comprehensive collection of New Zealand fauna, including extinct and endangered species, and important holdings from the southwest Pacific islands. Potential projects include adaptations and diet of New Zealand vertebrates, using specimens held by the museum.

TAXONOMY AND SYSTEMATICS OF FISHES

SBS staff

Professor Kendall Clements

Museum staff

Dr Tom Trnski

New Zealand boasts one of the largest and most isolated marine regions in the world, and as a result has a highly diverse and distinctive fish fauna. Much of this biodiversity remains undescribed, presenting opportunities for postgraduate projects on the biogeography, phylogeography, systematics and phylogeny of fishes. Projects using molecular, ontogenetic (larval) and morphological characters are available using the museum's fish collection and supplemented with field collections. Students with interest in these areas should discuss potential projects with museum and/or SBS staff.

VASCULAR PLANT AND MACROALGAL SYSTEMATICS

SBS staff:

Professor Wendy Nelson

Museum staff:

Ewen Cameron

The Herbarium of the Auckland Museum has extensive collections of the New Zealand flora with particular strength in the flora of northern New Zealand. The New Zealand terrestrial and marine floras are rich in endemic species and much of the diversity remains to be fully documented. Many species of marine algae are undescribed. There are opportunities for research projects on systematics, biogeography and phylogeny of vascular plants and macroalgae using the herbarium as a key resource.

Opportunities for projects jointly supervised by staff of SBS and other University of Auckland departments/ schools

SBS is keen to foster interdisciplinary study and encourages joint supervision where this appears to be appropriate. In choosing a graduate degree, the key criteria to consider are (i) the availability of supervision and (ii) the most appropriate programme of study. Professor Philip Harris, the SBS Postgraduate Coordinator, and other staff are available to discuss projects where joint supervision would be helpful and appropriate.

The Faculty of Medical and Health Sciences

The BSc(Hons) programme in Biomedical Science is coordinated by a joint Board of Studies drawn from SBS, Science Faculty and FMHS staff. Fourth year projects may be undertaken at the City or Grafton campuses. A number of relevant graduate level courses, each of 15 point value, are offered by SBS and FMHS.

BSc(Hons), MSc or PhD students interested in jointly supervised research projects should contact the SBS staff who work in the biomedical research area (Professors EN Baker, Brittain, Cooper, Dunbar, Poppitt, Associate Professors Birch, Christie, Lott, Love, Metcalf, Mitra, Drs Goddard, Hay, Kingston, Loomes, Taylor, Villas-Boas) or individual FMHS staff.

School of Environment

A number of staff in this School have research expertise in related areas such as ecology, environmental management, and water quality. Such staff offer graduate courses, some jointly taught with staff from Biological Sciences and the Leigh Marine Laboratory, and provide attractive opportunities for joint research and thesis supervision for many students in biological sciences.

Leigh Marine Laboratory

A number of marine biology staff are based at the Leigh Marine Laboratory near Warkworth north of Auckland. The possibility exists to base part of the research project at Leigh, or for joint supervision of relevant research projects.

Further information about Leigh staff's research interests may be found at

www.marine.auckland.ac.nz/staff-research

Department of Statistics

The Department of Statistics welcomes the opportunity to supervise or co-supervise graduate student projects with emphasis on biology, ecology, fisheries or bioinformatics. The Department has one of the largest groups of biological/ecological statisticians in the Southern Hemisphere.

www.stat.auckland.ac.nz/research

Staff directory

For email addresses, refer to the Research section in this handbook, pages 36-93.

Name	Telephone No Dial: 373 7599	Location	Room
Associate Professor Andy Allan	Ext 86631	Level 2, Thomas Bldg	313
Dr Kate Angel	Ext 81235	Level 2, Thomas Bldg	2018
Professor Ted Baker	Ext 84415	Level 4, Thomas Bldg	470
Dr Augusto Barbosa	Ext 85087	Level 3, Thomas Bldg	348B
Associate Professor Jacqueline Beggs	Ext 86823	Tāmaki Innovation Campus	
Associate Professor Nigel Birch	Ext 88239	Level 2, Thomas Bldg	228M
Professor Margaret Brimble	Ext 81239	Level 4, Thomas Bldg	4008
Professor Tom Brittain	Ext 88246	Level 4, Thomas Bldg	402B
Dr Bruce Burns	Ext 83135	Tāmaki Innovation Campus	
Associate Professor David Christie	Ext 88009	Level 4, Thomas Bldg	402C
Professor Kendall Clements	Ext 87223	Level 1, Thomas Bldg	136
Professor Mick Clout	Ext 85281	Tāmaki Innovation Campus	
Dr Rochelle Constantine	Ext 85093	Level 1, Thomas Bldg	138
Professor Garth Cooper	Ext 87239	Level 4, Thomas Bldg	4004
Dr Karine David	Ext 83793	Level 3, Thomas Bldg	310
Dr Todd Dennis	Ext 87288	Level 1, Thomas Bldg	128
Professor Rod Dunbar	Ext 85765	Level 4, Thomas Bldg	2009
Dr Brendon Dunphy	Ext 87583	Level 1, Thomas Bldg	142
Dr Anne Gaskett	Ext 89509	Level 1, Thomas Bldg	1020
Dr Mat Goddard	Ext 89537	Level 3, Thomas Bldg	3006
Dr David Goldstone	Ext 84607	Level 3, Thomas Bldg	401A
Associate Professor Dave Greenwood	Ext 86631	Level 2, Thomas Bldg	313
Professor Philip Harris	Ext 88366	Level 3, Thomas Bldg	315A
Associate Professor Debbie Hay	Ext 88229	Level 3, Thomas Bldg	462
Dr Tony Hickey	Ext 82615	Level 4, Thomas Bldg	452
Dr Greg Holwell	Ext 83652	Level 1, Thomas Bldg	139
Professor Andrew Jeffs	+64 9 360-1126	Leigh Marine Laboratory	
Dr Jodie Johnston	Ext 87237	Level 4, Thomas Bldg	472
Dr Richard Kingston	Ext 84414	Level 4, Thomas Bldg	472A
Professor Joerg Kistler	Ext 88250	Level 4, Thomas Bldg	402
Dr Shane Lavery	Ext 83764	Level 1, Thomas Bldg	126
Professor Gillian Lewis	Ext 87396	Lippincott Cottage	101

Name	Telephone No Dial: 373 7599	Location	Room
Associate Professor Kerry Loomes	Ext 88372	Level 4, Thomas Bldg	4020
Associate Professor Shaun Lott	Ext 87074	Level 4, Thomas Bldg	424A
Dr Robin MacDiarmid	Ext 86631	Level 2, Thomas Bldg	254
Associate Professor Peter Metcalf	Ext 84810	Level 4, Thomas Bldg	465
Dr Craig Millar	Ext 85186	Level 2 Thomas Bldg	228N
Associate Professor Alok Mitra	Ext 88162	Level 4, Thomas Bldg	420A
Professor John Montgomery	Ext 87208	Level 1, Thomas Bldg	140
Dr Judith O'Brien	Ext 88764	Lippincott Cottage	G02
Professor Michael Pearson	Ext 88371	Level 3, Thomas Bldg	338A
Associate Professor George Perry	Ext 84599	Tamaki Innovation Campus	733.
Professor Sally Poppitt	+64 9 630 5160	Nutrition Unit, 18 Carrick Pl, Mt Eden	
Associate Professor Joanna Putterill	Ext 87233	Level 3, Thomas Bldg	318A
Dr Matt Rayner	mrayner@aucklandmuseum.com	Auckland Museum	
Dr Howard Ross	Ext 86160	Level 2, Thomas Bldg	284
Dr James Russell	Ext 86833 Ext 88745	Tāmaki Innovation Campus City Campus	733.334 303.217
Dr Anna Santure	Ext. 83801	Level 2, Thomas Bldg	290
Dr Robert Schaffer	Ext 86631	Level 2, Thomas Bldg	254
Associate Professor Mary Sewell	Ext 83758	Level 1, Thomas Bldg	130
Professor Russell Snell	Ext 85059	Level 2, Thomas Bldg	2016
Dr Hilary Sheppard	Ext 81194	Level 2, Thomas Bldg	2002
Dr Chris Squire	Ext 88806	Level 4, Thomas Bldg	403
Dr Margaret Stanley	Ext 86819	Tāmaki Campus	
Dr Judy Sutherland	Ext 83682	Level 1, Thomas Bldg	149
Dr John Taylor	Ext 82854	Level 4, Thomas Bldg	2022
Dr Michael Taylor	Ext 82280	Level 3, Thomas Bldg	334C
Associate Professor Silas Villas-Boas	Ext 83762	Level 3, Thomas Bldg	3010
Professor Michael Walker	Ext 87054	Level 2, Thomas Bldg	1016
Dr Shane Wright	Ext 81775	Tāmaki Innovation Campus	

Joint Graduate School in Biodiversity and Biosecurity

Landcare Research, 231 Morrin Road, St Johns, Auckland
Telephone: +64 9 574 4100
www.biodiversity-biosecurity.auckland.ac.nz

Name	Email
Assoc. Prof. Thomas Buckley	BuckleyT@landcareresearch.co.nz
Professor William Lee	Leew@landcareresearch.co.nz

Joint Graduate School in Plant and Food Science

Private Bag 92169, Auckland Mail Centre Auckland 1142
120 Mt Albert Road, Sandringham, Auckland 1025
Telephone: +64 9 925 7000
www.plantandfood.auckland.ac.nz

Name	Email
Assoc. Prof. Andrew Allan	andrew.allan@plantandfood.co.nz
Dr Robin MacDiarmid	robin.macdiarmid@plantandfood.co.nz
Assoc. Prof. Louise Malone	louise.malone@plantandfood.co.nz
Professor Richard Newcomb	richard.newcomb@plantandfood.co.nz
Dr Robert Schaffer	robert.schaffer@plantandfood.co.nz
Assoc. Prof. Matthew Templeton	Matt.Templeton@plantandfood.co.nz

Joint Graduate School in Coastal and Marine Science

Name	Email
Rochelle Constantine	r.constantine@auckland.ac.nz

Notes