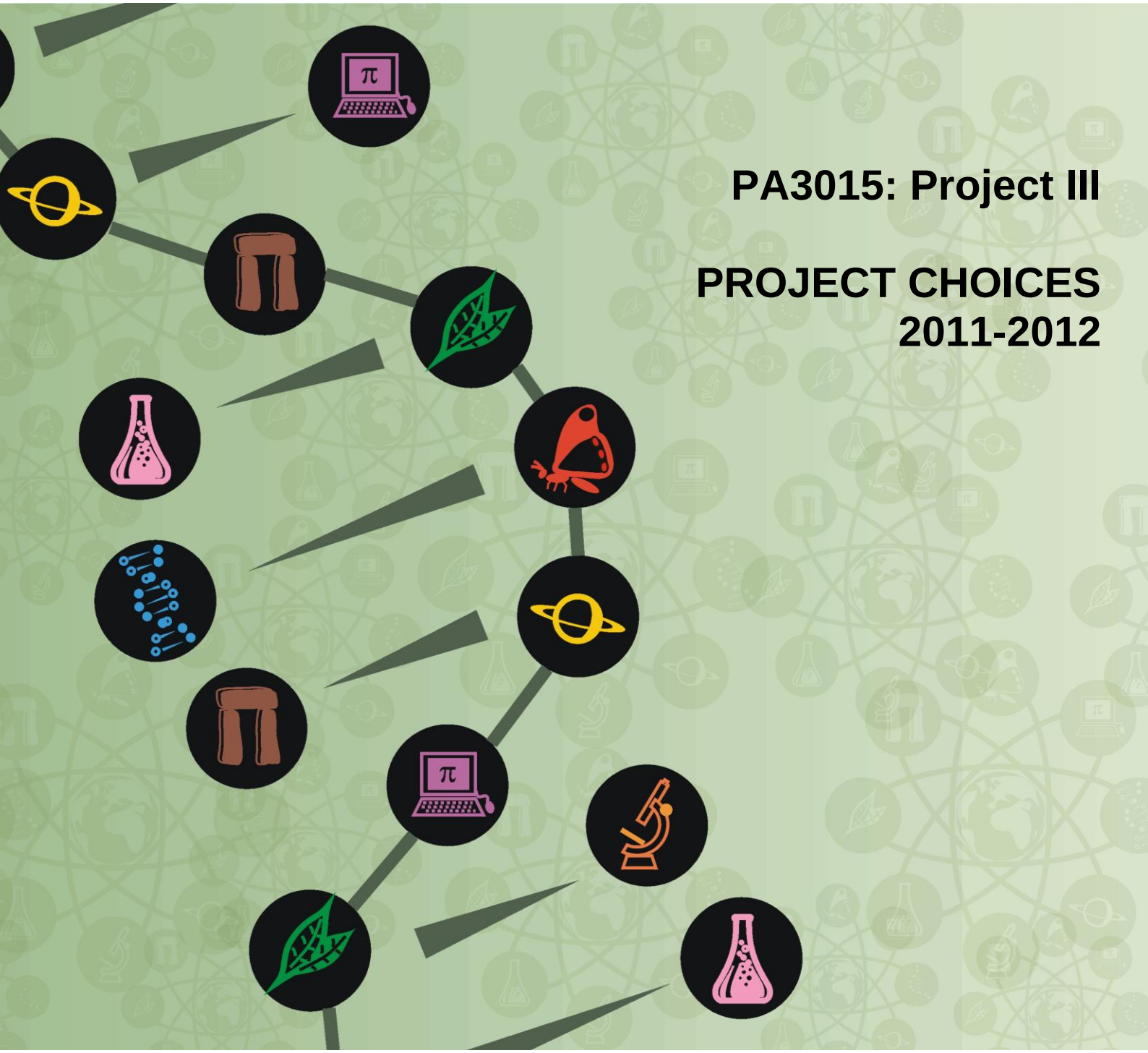
INTERDISCIPLINARY SCIENCE



PA3015: Project III

PROJECT CHOICES 2011-2012

University of Leicester

Contents

Measuring the effect that sebaceous sweat has on overall fingerprint sweat corrosion of brass

Supervisor: Dr John Bond

Project Description
Fingerprint sweat corrosion of brass is now well documented. However, it is also well documented that different people will corrode brass by different amounts. Some of this variation has been shown to be due to the different composition of sweat (i.e. some is more saline than others). It has also been documented that when the water content is removed from the sweat, the corrosion process stops (as the mobility of the ions is effectively stopped and the current produced by the electrochemical reaction can no longer flow).

This project is to assess what effect the sebaceous (oily) component of sweat has on the rate of corrosion and the final corrosion visible. It is hypothesised that the oily components may inhibit the evaporation of water from the sweat which will enable the electrochemical corrosion to carry on for a longer period (in a similar way that a thin film of oil on the surface of a puddle of water slows down the evaporation of the water).

Project Aims
The project will be to compare the rate and final corrosion of different people's a) eccrine, b) sebaceous and c) eccrine and sebaceous sweat on brass. Some statistics may be required to analyse and interpret the data. If time permits (and the equipment is available), it would be useful to examine the Cu/Zn ratio of the corrosion over time for a), b) and c) above using EDX.

Measuring the effect of temperature on the visibility of fingerprint sweat (requires Adobe Photoshop)

Supervisor: Dr John Bond

Project Description
We have shown previously how heating a fingerprint sweat deposit on brass to ~250°C produces sufficient differential oxidation to enable the fingerprint to be visualized. This visualization can be enhanced by digitally colour mapping an image of the fingerprint using Adobe Photoshop. This technique has been used to visualize fingerprints on brass cartridge cases recovered from homicides.

Project Aims
This project is to examine the effect that heating to different temperatures has on the visibility and subsequent colour mapping of fingerprints deposited on other common metals such as steel, aluminium, copper etc. If time permits, the effect that a) eccrine, b) sebaceous and c) a mixture of the two has on the visibility of the fingerprint can be investigated.

Investigating the variation in quality of fingerprint observation

***Supervisor*:** Dr John Bond

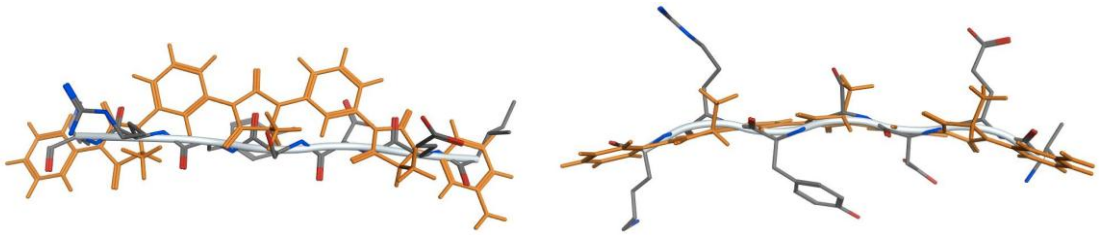
Project Description
We have observed that, even for a trained operator, the quality of inked fingerprints can vary between donors. We have an idea that this may, in part, be due to variability in the height of ridges (or worn ridges), which makes it more difficult to take a good set of fingerprints.

Project Aims

The project would be to sample a wide range on individuals (raging in age, sex, ethnicity) and to take a 3-D impression of a fingerprint from them using dental putty (which we can supply). The student would also take an inked set of fingerprints from that person. The depth of the ridges would then be measured from the cast using optical and (if availability permits) scanning electron microscopy. The student would then look for correlations between ridge depth and age, sex etc. and also the quality of inked prints.

Computational Modelling as a Tool in the Design of Novel Peptidomimetics

Supervisor: Dr Andrew Jamieson



Project Description

The design and synthesis of molecular scaffolds that can mimic the functional features of protein secondary structures has become an active field of research in recent years. Such peptidomimetics have the potential to disrupt biological processes by binding to protein interaction hotspots and so are potentially useful biological probes.

Our group is specifically interested in the use of computational methods with which to aid in the design of novel peptidomimetic scaffolds. Good insight into the conformational bias of this type of molecule can be obtained and used early in the design process.

Project Aims

The aim of this project will be to computationally model (using Spartan software) a novel peptidomimetic scaffold in order to determine the energy minimised conformation that the molecule is likely to adopt.

Effective Science Communication

Supervisor: Dr Cas Kramer

Project Description

In recent years there has been a significant trend to move from Public Understanding of Science to Public Engagement with Science. Government, Research Councils and the science community as a whole recognise the need to engage the general public with science rather than just telling them about it. Science Communication and Public Engagement are high on the agenda of many Research Councils and are therefore becoming increasingly important into today's competitive funding market. Science Communication should not just be fun; it should also be effective to serve a purpose!

Project Aims

GENIE, the Centre for Excellence in Teaching and Learning (CETL) in Genetics at the University of Leicester (www.le.ac.uk/genie), has a well-established and varied outreach programme. This project will look for development and evaluation of outreach activities for school and colleges and the general public. Working closely with GENIE staff the student undertaking this project will explore a range of Science Communication methods and their effectiveness in reaching target audiences.

Preparation of Multimedia learning resources

Supervisor: Dr Dylan Williams

Project Description
In many cases students struggle to do problems, not knowing where to start, yet when they are shown the solution they think that it was relatively easy. In face to face workshops students can ask questions and staff can give hints on how to proceed at a particular stage however this requires a timetabled activity. It would be advantageous if this type of help were available "on student demand" rather than on "staff availability". This project will involve the development of short, structured multimedia resources designed to illustrate the process of solving chemistry problems to be used as online tutorials and revision aids.

Students participating in this project will be asked to research part of the level 1 or 2 curriculum. Students will then develop a series of short, focused video tutorials that will demonstrate how to solve problems of this type. Students will learn about theories of learning styles and will assess the impact of the new resources.

Project Aims
By the end of this project students will be able to:

- Demonstrate their understanding of theories of the learning and teaching process
- Demonstrate an ability to research selected concepts from the level 1 and 2 curriculum.
- Plan and record a series of short video tutorials based on material from the level 1 and 2 curriculum
- Evaluate the impact of resources developed as part of a project through analysis of appropriately selected data.
- Communicate project findings in both written and oral forms

Complex Systems – Agent based modelling with NetLogo

Supervisor: Professor Derek Raine

Project Description
Netlogo is a computer programme (and programming language) that is used to model interacting 'agents', that is objects that can receive and process information and act on it independently. An interesting application in physics is to magnetic systems (the agents are the spins on a lattice), but these methods have been extended to other sciences (including social sciences). The project will investigate the use of NetLogo in the context of various complex systems, depending on the interests of the students.

Examples
'SugarScape' – Investigating artificial societies
Magnetic systems
Evolution of Altruism in artificial societies
Technological innovation and wealth distribution in artificial societies

Project Aims
To investigate agent-based models using NetLogo

Pre-biotic Ecology

***Supervisor*:** Professor Derek Raine

Project Description
Pre-biotic ecology is a new approach to the origin of life. One particular highly simplified but tractable model of pre-biotic ecology envisages 2D-'cells' inhabiting a torus. The cells contain molecules (the 'food set') that can attach themselves to the cell boundaries where they can polymerise according to certain rules. The boundaries between cells can be removed (fusion of cells) or added (fission of cells) according to various rules. The idea is then to develop a computer model of the evolution of the molecules in this picture, to see how spatial and chemical structures can develop which will represent the first steps towards molecular coding. Previous projects have produced a code in the NetLogo programming language which is ideally adapted to agent-based modelling of complex systems. (A guide to programming in NetLogo will be provided.) The code implements a simplified form of the model and shows how a pre-genomic coding can arise which allows inheritance of the information for an autocatalytic network of reactions. (See e.g. Segre and Lancet (2000) Proc Nat Acad Sci., 97, 4112).

Project Aims
This project will investigate the range of behaviour for different rules for polymerisation, for attachment and detachment of molecules, and for fission and fusion of cells in order to extend the model to more complex reaction networks.

Eco-hydrology of Narborough Bog, Leics.

Supervisor: Dr David Harper

Project Description
Narborough Bog Nature Reserve which contains a small reedbed, which is on a layer of peat lying over several metres of gravel. Rain water runs through the peat and into the gravels which once there travels straight to the river. No water is being retained in the peat and therefore it is drying out.

Two ideas that were suggested were to pump water from the River Soar (which runs along the boundary) onto the reedbed. The second option is to put a borehole into the underlying gravels roughly in the centre of the reedbed to pump water from the underlying gravels back onto the reedbed.

This project will continue to develop the work of previous project students in this area.

Project Aims
The project is to find out whether there is a water table under the gravels and investigate its properties.

A database of apotosis gene mutations

Supervisor: Dr R M W Dalgleish (Co-supervisor: Prof M MacFarlane, MRC Toxicology Unit)

Project Description
TNF-related apoptosis-inducing ligand (TRAIL) is a key mediator of apoptotic cell death and therefore plays a role in regulating cell populations both during organ development and in the adult[1,2]. TRAIL belongs to the tumour-necrosis factor (TNF) cytokine superfamily, and induces apoptosis by binding to 'TRAIL-Receptors' on the surface of target cells (e.g. tumour cells). These TRAIL-Receptors belong to the TNF receptor superfamily of proteins, some of which have a

cytoplasmic 'death domain' motif which is required to trigger apoptosis. TRAIL signals for apoptosis through two related pro-apoptotic 'death domain'-containing receptors, TRAIL-R1 (TNFRSF10A) and TRAIL-R2 (TNFRSF10B). However, TRAIL can also bind to 'decoy' receptors that contain either a truncated or no death domain and these are termed, TRAIL-R3 (TNFRSF10C) and TRAIL-R4 (TNFRSF10D). 'Decoy' receptors bind TRAIL but do not signal to apoptosis and thus can interfere with the ability of TRAIL to induce apoptosis. Mutations within TRAIL-receptor genes have been reported and, as these could also potentially interfere with the ability of TRAIL to signal for apoptosis, it is important to identify all known TRAIL-receptor gene mutations and locate this information within a single database.

Project Aims

The project is to carry out a comprehensive literature survey to identify all known TRAIL-receptor gene mutations. The data will then be used to create locus-specific databases (LSDBs) of the mutations using the LOVD LSDB-in-a-box system[3]. A successful outcome will result in the databases being made publicly available.

Reading

1. MacFarlane M. 2003. TRAIL-induced signalling and apoptosis. Toxicol Lett 139:89-97. DOI: 10.1016/S0378-4274(02)00422-8
2. Danial NN, Korsmeyer SJ. 2004. Cell death: critical control points. Cell 116:205-19. DOI: 10.1016/S0092-8674(04)00046-7
3. Fokkema IFAC, den Dunnen JT, Taschner PEM. 2005. LOVD: easy creation of a locus-specific sequence variation database using an "LSDB-in-a-box" approach. Hum Mutat 26:63-68. DOI: 10.1002/humu.20201

Quantifying environmental change at Lake Naivasha, Kenya, using satellite imagery

Supervisor: Dr David Harper

Project Description

Lake Naivasha in Kenya has undergone significant environmental change in the past 30 years. The changes include dramatic water level fluctuations, major alien species impacts, as well as a drastic transformation in land cover around the lake. These changes have decreased the ecological functioning of the lake.

The lake level variation is a result of a combination of climatic changes and an increase in the uptake of water for irrigation. This is due to the presence of the flower industry in Naivasha which has grown dramatically since 1980, a water supply reservoir for the city of Nakuru, a Geothermal Plant using lake water for cooling and smallholder abstractions for plot irrigation. The changes in water level also result in changes in the lake surface area which can clearly be observed in satellite imagery. The impact of these changes on wildlife is significant; for example, the population size of fish eagles is directly related to lake circumference.

There has been a change in the composition of aquatic vegetation as a result of hydrological changes and alien species invasions. In particular, there has been a reduction in the amount of papyrus swamp around the lake. Papyrus performs important ecological function acting as a natural filter for the lake. Without it, the lake can suffer from siltation and eutrophication.

In this project you will use data from the Landsat satellite to investigate changes in lake area and vegetation cover on and around the lake's shore. The Landsat program consists of a series of NASA Earth Observations satellites, which began imaging the Earth in 1972. There is an archive of data available from the past sensors, MSS and TM. The Landsat Enhanced Thematic Mapper is a passive remote sensing instrument which images the Earth's surface at visible and near infrared

wavelengths. It measures reflected visible light and emitted thermal infrared radiation. This information can be used to determine the surface land cover type. It produces images of 30 m resolution and has a revisit time of 16 days.

During the project, GIS software ArcGIS will be used to determine lake area from the images. ENVI image analysis software will be used to recover information about surface vegetation by applying standard vegetation indices, such as NDVI, and image classification techniques. By looking at a series of images, temporal changes in land cover can be identified.

Standard image classification methods use the spectral properties of the surface to separate the main land cover classes (such as bare ground, forest, wetland); however the various aquatic vegetation types may not be spectrally distinct in Landsat imagery due to the wide spectral bands of the instrument. It should be possible to differentiate these vegetation types based on their location relative to the lake and by their different textural appearances. Assistance will be provided from photographs taken at the time and by experience of Dr Harper, who has been studying the lake since 1982.

Project Aims

1. Determine the change in area/circumference/water level of the lake over time using Landsat imagery and GIS software.
2. Map vegetation changes around the lake using standard vegetation indices and image classification techniques.
3. Determine whether it is possible to differentiate between different aquatic vegetation in Landsat ETM+ images and map temporal changes in these vegetation types
4. Consider to what extent the lake level and vegetation changes can be attributed to human activity and what effect the changes have had on the ecosystem as a whole.

Tidal forces: a trigger for seismic activity?

Supervisor: Dr Nigel Bannister

Project Description

In March 2011 the press ran stories relating to the fact that full moon coincided with lunar perigee in that month, claiming that this would cause major earthquakes and other natural disasters. While the event passed uneventfully, the search for a correlation between seismic activity and events that can be predicted is a serious area of research. Given that tidal forces are capable of moving vast quantities of water around the Earth each day, is it unreasonable to suggest that there may be a link between the position of the Sun and Moon, and the occurrence of earthquakes?

Project Aims

To understand the physics of tidal forces and their effects on the Earth and other planetary bodies. To study a statistically significant number of seismic events, searching for correlations between their time and location, and the configuration of planetary bodies. The project will begin with a literature survey to reveal previous studies in this field, and consideration of the physics of tidal interactions. Students will be required to write code to calculate the location of the Sun and Moon with respect to specific locations on the Earth, and use data from online archives to conduct the study.

Reading

Relevant Papers / Books: Introductory astronomy & astrophysics (Zeilik, Gregory & Smith; Library Shelf Mark 520 ZEI).

The magnetic and charged particle environment of Ganymede

Supervisor: Dr Nigel Bannister

Project description
Ganymede, one of Jupiter's Galilean moons and the largest satellite in the solar system, is an unusual world in many respects. One of the properties which makes this body unique is the presence of a magnetosphere. Ganymede is the only moon known to generate an internal magnetic field, and this results in a host of interesting interactions between the moon and the local environment, and between the magnetosphere of the moon and that of Jupiter itself. This project will consider some of these effects using insitu measurements from previous missions which have visited the Jupiter system.

Project goals
To use data from previous missions (particularly Galileo) to investigate the charged particle environment around Ganymede. Of particular interest is the possibility that Ganymede may produce a "shielding effect" that reduces the exposure of spacecraft to radiation at specific locations around the object. The project will involve writing code to extract spacecraft trajectory and planetary position data from archival records, generation of trapped radiation dose estimates, and the comparison of these estimates with measurements from particle detector instruments onboard Galileo to search for signatures in the data that may be related to specific features of the Ganymede magnetic field.

Reading
Introductory astronomy & astrophysics (Zeilik, Gregory & Smith; Library Shelf Mark 520 ZEI), Jupiter (Bagenal, Dowling & McKinnon; Library Shelf Mark 523.45 JUP)

Genetics, ethics and open educational resources (OERs)

Supervisor: Dr Mark Goodwin

Project Description
Open educational resources (OERs) are online learning and teaching materials that are free to use and re-purpose. They have a range of audiences, and are an effective way of making topical teaching materials available to the developing world. The GENIE CETL, based in the Department of Genetics, has an award-winning collection of OERs – the Virtual Genetics Education Centre: http://www2.le.ac.uk/departments/genetics/vgec. The site contains OERs on genetics and related topics for schools and higher education, health professionals and the general public.

Project Aims
This project will involve the development and evaluation of some OERs for teaching about genetics and/or wider ethical, legal and social issues at secondary and/or undergraduate level. The topic and approach will, as far as possible, be adapted to suit the interests of the student, but will probably involve the use of existing online resources (for example, video streamed from the BBC website or YouTube).

This project would especially suit a student interested in teaching, science and society, or aspects of science communication/public engagement with science.

Observing transiting planets

Supervisor: Dr Matt Burleigh

Project Description
You will use the Oadby telescopes, and the remotely operated Pirate telescope on Majorca, to observe extra-solar planets transiting their parent stars. You will determine the radius of the planets by measuring the drop in light from the star as the planet passes in front of it.

Project Aims
To gain experience of practical astronomy, eg planning and carrying out observations, and learning how to reduce and analyse data. To understand, through astronomical observations, how we can measure fundamental physical parameters of planets around other stars.

The project will require travel to the Oadby observatory, the use of departmental computer labs and home computer (when using the remotely operated Pirate telescope on Majorca).

Reading
Introductory Astronomy and Astrophysics by Zeilik and Gregory; An Introduction to Astrobiology by Gilmoir and Sephton; Transiting Exoplanets by Carole A. Haswell.

An ultrasound radar simulator

Supervisor: Professor Tim Yeoman

Project Description
Radar systems have a wide variety of uses in industry and commerce, as well as environmental and geo-science and space exploration. Ultrasound has with a frequency of tens of kHz and a wavelength of order one cm, Such a wavelength is similar to those used in a number of radar systems, although the frequency and wave speed are very different. Ultrasound can thus be used to simulate the operation of radar systems in the laboratory. In this project a simple ultrasound radar simulator will be constructed and tested, using both individual transducers and a phased array of transducers to form the transmitted and received beams. The use of continuous wave, pulsed and chirped transmitted signals will be investigated. The performance of the radar in beamforming and steering, and in the location, identification, and tracking of objects will be investigated and optimised.

Project Aims
The design and construction of the basic elements of a radar system using ultrasound. The driving signals will be produced by a flexible signal generator, while an analogue-to-digital conversion system will log the transmitted and received signals on a computer. This digital output will then be used to test, quantify and optimize the performance of the system under a number of configurations. The performance of the system will be compared to the expected performance of radar systems using basic radar theory.

Genetic epidemiology of chronic disease

Supervisor: Dr Nicola Suter-Giorgini

Project Description
Chronic diseases are on the increase in an aging, increasingly obese population. Individual chronic disease risk is usually determined by a mixture of genetic and environmental factors and advances in the area of “personalised medicine” are starting to enable more appropriate treatments for some of these diseases.

Project Aims
The focus of this project will be determined by the student, but will encompass the current knowledge of one or more chronic diseases (which may include cancer, diabetes and heart disease). Emphasis can also be placed on a particular aspect of the disease such as advances in technologies for treatment, or from a public health, business or ethical perspective. Information gathering will be through literature searching in addition to possibly surveys and communication with appropriate experts in the field, along with any other means of information collection as determined by the student.
http://www.who.int/chp/ncd_global_status_report/en/index.html

Growth patterns in fossil planktonic colonies

Supervisor: Dr Jan Zalasiewicz

Project Description
The graptolites were fossil marine colonies that lived in the early Palaeozoic era, between 400 and 500 million years ago, the most typical forms being planktonic. Their organic living-chambers are commonly preserved in strata of that age, and these have a modular architecture, being added successively to the growing colony. The controls on the construction of these remain largely mysterious, though undoubtedly involved genetic control (to determine overall colony design) and likely also some element of environmental control, from such oceanographic features as water temperature and nutrient content,

Project Aims
This project involves making careful and detailed observations and measurements of morphological characters of a suite of finely preserved specimens of one graptolite species, Monograptus sedgwickii, from the Silurian strata of central Wales, using the i-Science binocular microscope apparatus. These characters will be plotted up and analysed to reveal the growth patterns of these colonies and the possible controls on these. The results should improve our understanding of the biology and ecology of these enigmatic extinct organisms.

Interannual variability of the global atmosphere-biosphere CO_2 exchange

Supervisor: Dr Jörg Kaduk

Project Description
The aim of this project is to determine the variations of the global atmospheric CO_2 concentration and relate the observed variations to the variability of climate variables, e.g. temperature, precipitation and soil moisture as well as to determine those geographical regions which are most relevant for the observed variations.

Project Aims
This project builds on 18 years of NDVI (normalized difference vegetation index, a measure of the greenness of the land surface) and 20 years of global climate data and some existing R code. The task is to analyse these large data sets and to use appropriate simple mathematical operations to determine the relevant characteristics of the global variations in temperature, precipitation, soil moisture, CO_2 and NDVI and relate them to the atmosphere- biosphere CO_2 exchange.

Required for project
- ability to use R code and develop small models in R
- using basic statistics
- working with large data sets

Measuring and modelling soil respiration and its spatial and temporal distribution

Supervisor: Dr Jörg Kaduk

Project Description
This projects aims at identifying the patterns of soil respiration (soil CO_2 efflux) and its dependence on environmental conditions and relationships to soil carbon content and fine root biomass. It is well known that soil respiration responds to temperature in an exponential fashion. However, less is known about its spatial distribution and its response to soil moisture.

Project Aims
The project should comprise measuring soil moisture at a large number of locations as well as soil temperature and moisture. In the lab fine root biomass and soil carbon content should be determined for a representative number of soil cores. Optionally the soil and root nitrogen concentrations can be determined in addition. The analysis should determine relationships between measured soil respiration, soil temperature and moisture, fine root biomass and soil carbon content as well as examine the question whether there are spatial patterns in soil respiration and possible causes for these patterns.

Required for project
- learning to use the IRGA (infrared gas analyser), which is used to measure CO_2 flux
- ability to develop small models in matlab or maple
- using basic statistics
- field work in Wicken Fen (2-3 visits, ~ 2h drive from Leicester, no public transport, no hotel, if no own transport, then significant flexibility to visit the site whenever somebody else goes (about once a month) is required, potentially cattle and ponies on site)

For organisational and safety reasons all projects in Wicken Fen could be conducted together, and students could also share equipment workload. The idea would be to obtain the field measurements for the projects in a team of students. Students could go to Wicken with a PhD student or technician from the Department of Geography.

The carbon and water fluxes of South Africa

Supervisor: Dr Jörg Kaduk

Project Aims
The aim of this model is to use a land surface model to simulate the carbon and water exchange of South Africa and compare the simulations to observations at selected locations as well as regional estimates. The project builds on 25 years of climate data available to drive the model. The task is to analyse the simulation results and compare them to observations. Some observations are available, some however need to be extracted from the literature.

Students choosing this project will
- gain experience with a state of the art HPC computing system.
- develop data analysis capabilities
- learn about the atmosphere-biosphere exchange fluxes in South Africa

Required for project
- ability to or to learn to work efficiently in a software environment, some computing experience (linux, bash, linux file system concept) desirable

- willingness to use the University's HPC – either SPECTRE or ALICE
- willingness to engage with the land surface model JULES (http://www.jchmr.org/jules/). This model mainly operates in batch mode. i.e. the simulation is submitted and results become available at some time but cannot generally be monitored in real time.
- willingness to learn and program in the Data Visualization and Analysis tool ferret (http://ferret.wrc.noaa.gov/Ferret/).
- ability or willingness to learn quickly to work with very large data sets – facilitated by ferret

Measuring and modelling photosynthesis and its spatial distribution and plant community dependence in a regenerating fenland

Supervisor: Dr Jörg Kaduk

Project Description
This project aims at identifying the patterns of photosynthetic capacity and their dependence on environmental conditions and relationships to nutrient status in different plant communities in a regenerating fenland near Cambridge. For example it is well known pioneer species have a higher photosynthetic capacity than climax species. However, it is not clear how exactly the photosynthetic capacity changes within more or less flooding tolerant species.

Project Aims
The project should comprise measuring light saturated photosynthesis and incident light levels in the field in different locations and plant communities. Leaf nitrogen concentrations should be determined in the lab. The analysis should determine relationships between measured light levels, N concentration, light saturated photosynthesis and species. Finally a spatial extrapolation of photosynthesis based on the species map of the fenland should be conducted using a standard photosynthesis model and weather data from the weather station of the fenland.

Required for project
- learning to use the IRGA (infrared gas analyser), which is used to measure CO2 flux
- ability to develop small models in matlab or maple
- using basic statistics
- field work in Wicken Fen (2-3 visits, ~ 2h drive from Leicester, no public transport, no hotel, if no own transport, then significant flexibility to visit the site whenever somebody else goes (about once a month) is required, potentially cattle and ponies on site)

For organisational and safety reasons all projects in Wicken Fen could be conducted together, and students could also share equipment workload. The idea would be to obtain the field measurements for the projects in a team of students. Students could go to Wicken with a PhD student or technician from the Department of Geography.

Measuring and modelling soil heat fluxes and moisture as well as surface temperature and its spatial and temporal distribution in a regenerating fenland

Supervisor: *Dr* Jörg Kaduk

Project Description
Soil heat fluxes are an important part of the energy budget of an ecosystem. They are important in evaluating the quality of the other measurements of the other energy fluxes, as the sum of all energy fluxes at the surface should be zero (with due attention to a proper sign convention). The spatial heterogeneity of the surface (topography, soil, vegetation…) make a determination of the soil heat flux over a larger area very difficult.

Project Aims

This project aims at identifying the patterns of soil heat fluxes and temperature and moisture as well as soil surface temperature and its dependence on environmental conditions

The project should comprise measuring radiation, soil temperature and moisture as well as soil surface temperature at a large number of locations. The analysis should determine relationships between measured radiation, soil temperature and moisture, soil surface temperature and vegetation and soil conditions. as well as examine the question whether there are spatial patterns and possible causes for these patterns.

Required for project

- learning to use a data logger, measurement sensors and their physical principles.
- ability to develop small models in matlab or maple
- using basic statistics
- field work in Wicken Fen (2-3 visits, ~ 2h drive from Leicester, no public transport, no hotel, if no own transport, then significant flexibility to visit the site whenever somebody else goes (about once a month) is required, potentially cattle and ponies on site)

For organisational and safety reasons all projects in Wicken Fen could be conducted together, and students could also share equipment workload. The idea would be to obtain the field measurements for the projects in a team of students. Students could go to Wicken with a PhD student or technician from the Department of Geography.