RESEARCH: INSPIRING PEOPLE

College of Health & Science

CAPABILITIES working with business and government
The University of Western Sydney seeks to foster strong partnerships with industry and government agencies. It offers a vibrant environment with motivated and enthusiastic staff. Substantial investments in recent years mean that the University’s extensive facilities represent the latest generation of technologies.

Many of the organisations with which it works are drawn by the University’s links to the dynamic, growing community of Western Sydney. These are enhanced by international relationships and a global outlook.
The University’s College of Health and Science forms the largest science-based group in an Australian university. The discipline areas it covers include medicine, mathematics, computing, engineering, biology, chemistry, construction, industrial design, horticulture, agriculture, animal science, biomolecular science, nanotechnology, environmental science, environmental health, food science, forensic science, health sciences, sports science, nursing and complementary medicine.

Research in the College is strongly integrated with the application of new knowledge and ideas. Staff in the College embody a wealth of discipline-based expertise that is underpinned by an extensive range of innovative facilities to help businesses and government to improve their products and services. These capabilities and associated outcomes are proving instrumental in economic, social, community and environmental change.

Engagements with industry and government range from providing advice and services that can resolve immediate problems, to long-term collaborations in research projects of mutual interest and benefit.

**Schools**
The College encompasses six schools:
- The School of Biomedical and Health Sciences
- The School of Computing and Mathematics
- The School of Engineering
- The School of Medicine
- The School of Natural Sciences
- The School of Nursing

**Centres in primary strengths**
The College’s three research centres represent primary areas of research strength and excellence.

The Centre for Complementary Medicine Research (CompleMED) assists in the safe and effective use of complementary medicines through evidence-based assessment and integration with conventional health care practices.

The Centre for Plant and Food Science is asking fundamental questions and formulating solutions to problems relevant to natural and commercial plant systems.

The Urban Research Centre leads research and teaching in urban management and development.

**Emerging research**
The College is increasing its focus in such areas as: vulnerable families and chronic and complex care (the N-FORCE Research Group); water; men’s health; public health and health promotion; rehabilitation; management information systems; nanoscience; sustainable, innovative engineering and construction; precision robotics; power conversion; and intelligent motion control.
The University of Western Sydney is increasingly recognised for its characterisation, imaging and microanalysis capabilities. It is home to highly regarded experts and state-of-the-art equipment that offer new insights into: plants and animals; the development of new materials and pharmaceuticals; and in chemical and forensic analysis – to name just some of the potential areas of application.

Innovative uses of NMR
The University has made a multi-million dollar investment in ensuring that its nuclear magnetic resonance (NMR) facility is a national leader. In many aspects it has no rivals in Australia.

NMR contains a number of sub-disciplines including magnetic resonance imaging (MRI), which is traditionally used in hospitals and medical facilities. But the highly innovative UWS team is encouraging the use of NMR and very high resolution MRI (also known as NMR microscopy) by industry, government agencies and research organisations in such diverse fields as entomology, neuroscience, rheology, molecular association, materials, nanotechnology, plant science, well-logging, electrochemistry and surfactants.

The University’s major NMR facility can be used to study: ligand binding and transmembrane transport; drug binding; association and association kinetics of proteins, surfactants and small molecules; diffusion in porous systems ranging from sandstone to polymers to brain tissue; plants, water flow and freezing in plants; supercooled liquids and biological tissues.

The NMR facility comprises three co-located spectrometers:

1. A wide-bore 500 MHz, 11.7 tesla spectrometer – for high resolution imaging, very high gradient diffusion measurements and high resolution magic angle spinning
2. A 400 MHz, 9.4 tesla spectrometer – for general high resolution studies and low gradient diffusion measurements
3. A 300 MHz, 7 tesla spectrometer – for general high resolution studies
Imaging and diffusion are complementary techniques: used together they offer novel perspectives. The group at UWS is renowned for its work on NMR diffusion studies.

Three other NMR systems in the School of Natural Sciences are used to analyse solids and liquids such as geological samples, soils, organic matter in soil, biomaterials, polymers and composites, sol-gel systems and other materials underpinning our work in nanotechnology.

NMR in the School of Biomedical Sciences is used to determine the structure of molecules and diffusion of biomolecules within cells.

**Stunning, live images**

In 2007 UWS established its Confocal Bio-Imaging Facility (CBIF), drawing together a dozen instruments which collectively produce live, three-dimensional images of almost any material.

This state-of-the-art facility is unique in Australia and the best in the South East Asian region. It uses a suite of lasers to depict inorganic materials, plants and animal cells in incredible detail. The images appear on a computer screen in vibrant colours.

Confocal laser imaging is increasingly popular in science and industry, especially for biological, environmental and forensic science. For example, it can image:

- A virus crossing a cell membrane in real-time
- Living cells dividing and changing over days or weeks
- Live cells, with little or no sample preparation

» Real-time, solution-based molecular interactions, in femtolitre volumes
» The effects of drugs or other chemicals at the cellular level

Other uses include:
» Elemental analysis
» Microanalysis of explosives or unknown powders
» Activity of experimental drugs

The Confocal Bio-Imaging Facility comprises several analysis techniques.

**Multi-photon confocal microscopy** offers multiple chemical analyses with lasers in real time. For example, users can:

- Selectively image components of dividing cells
- Determine events occurring in bioactive agents
- Investigate a family of biochemical compounds to pinpoint requirements, saving the need to start with micro-arrays.
**Fluorescence lifetime imaging** determines the length of time a molecule can fluoresce. Because it can probe greater tissue depths than conventional fluorescence microscopy, it is especially useful in biomedical tissue imaging. For example, a water supply analyst could identify a disease organism such as Giardia, its effects on the host and quantify the amount present.

**Fluorescence resonance energy transfer** is used to quantify molecular dynamics in biophysics and biochemistry, such as protein–protein interactions, protein–DNA interactions and protein conformational changes. It measures energy transfer of molecules. For example, a pharmaceutical firm could use this capability to “see” drugs moving across the cell membrane and to determine the effects on the cell.

**Fluorescence correlation spectroscopy** is used to characterise proteins, biomolecules and pharmaceuticals, for example, and their dynamics. It enables tracking of an individual molecule through cells and tissues. For example, using viral DNA, a drug can be tracked to see how it moves through the cells of a plant or animal cell.

**Confocal Raman spectroscopy** is used for microscopic examination of minerals and materials such as polymers and ceramics, cells and proteins. For example, in forensics applications it can monitor chemicals and chemical reactions in real time to:

- Identify drugs such as steroids and narcotics
- Provide a molecular ‘fingerprint’ that complements the information available via infrared spectroscopy, mapping the distribution and quantity of a substance of interest, such as material on a knife.

**Latest generation scanning electron microscope**

UWS’s new, high-end field emission scanning electron microscope (FESEM) offers ultra high resolution for use in nanotechnology, engineering, chemistry, physics and biomedicine, among other fields.

FESEMs can analyse structures as small as 1 nanometre on the surface of materials and biological tissue, in order to characterise polymers, coatings on materials, nanotechnological systems and sub-cellular proteins, for example. New applications are emerging in nanotechnology, where fabrication techniques are so advanced that SEM technologies have been developed to enable researchers to image the structures that they make.

Increasingly SEM is replacing traditional optical microscopes in pathology, forensics, and metallurgical and environmental analysis.
In a FESEM, electrons are generated in a source (the emission) and focused using a strong electrical voltage gradient (the field). An electron beam is formed to scan an object and secondary electrons are produced by interaction with atoms at the object’s surface. Information from these electrons is employed to reconstruct a very detailed image of the topography of the surface of the specimen.

The new FESEM, located in the School of Natural Sciences, offers both high-vacuum and low-vacuum capabilities (10 to 100 – 200 Pa).
diverse analysis capabilities

The College has an extensive, diverse array of analytical capabilities that can address a wide range of industry needs. Staff provide expert advice on the right techniques to use, conduct the experiments, and then work with clients and research partners on the interpretation of results.

As well as using the University’s own facilities, staff utilise equipment located elsewhere, drawing on their wide networks and established access arrangements.

This is supported by supercomputing for conducting molecular dynamic calculations and general computational chemistry.

Simultaneous thermal, mass and evolving-gas analyses

Thermal analysis offers a perfect tool for the characterisation of all kinds of organic and inorganic solids and liquids. Thermodynamic transitions, thermal stability, decomposition and chemical reactions are detected and quantified with high accuracy across a broad temperature range. The thermal analysis facility in the School of Natural Sciences is unique in Australia. This capability is of interest to organisations ranging from polymer manufacturers and mining companies to insurance companies and fire brigades.

Combining thermal analysis with powerful infrared spectroscopy for gas analysis provides additional information about the composition and quantity of evolved gases: details about the chemistry behind processes that most experiments lack.

UWS’s thermal analysis facilities include a simultaneous differential scanning calorimeter thermogravimetric analyser (DSC-TGA) coupled to an infrared spectrometer.

» The DSC-TGA component operates from ambient temperature to 1650°C and incorporates a thermo-balance that has exceptional resolution (10⁻⁷ g). The vacuum-tight construction enables measurements in defined atmospheres.

» The evolved gas analysis component is connected via a transfer line which is constantly at 200°C and a fast, highly sensitive, liquid nitrogen cooled mercury-cadmium-tellurium detector (7000–600 cm⁻¹ range).
These facilities can be applied to solve a broad range of R&D problems in such areas as the development of nanostructured materials (e.g. carbon nanotubes and layered silicate nanocomposites), mineralogy, biological systems, forensic science and exploration of energy sources.

UWS’s expertise includes analysing the composition and structure of materials, solid-state reactions, combustion products, evaporation and out-gassing, decomposition processes, catalysis, polymerisation, specific heats of chemical processes, defining phase diagrams and glass-transitions.

Separation and mass analysis
Liquid chromatography-mass spectrometry (LC-MS/MS) combines the physical separation capabilities of liquid chromatography with the analysis of molecule and ion mass. It enables selective and sensitive analyses of liquids used in pharmaceutical, clinical, polymer, toxicological and environmental operations.

The applications of this capability include: design, synthesis and characterisation of new stationary phases for enhanced separations; elucidation of retention mechanisms; studies of viscous fingering of solutions (particularly those of non-retained analytes and macromolecules); and development of new methodologies for analysis of complex samples including pharmaceuticals, biological materials and plastics.

The School of Natural Sciences has a well-equipped laboratory with column-packing facilities, 1D and 2D high performance liquid chromatography instruments, gas chromatography-mass spectrometry and gel permeation chromatography.

Elemental analysis
High-performance liquid chromatography (HPLC) or laser ablation can be used to quantify atomic elements, for example to map the elements in rocks or cells.

Atomic-scale images
An atomic force microscope enables surface topology to be imaged and can also be used to manipulate matter at the nanoscale. Scanning surfaces provides a true 3D surface profile. Samples are not damaged and biological macromolecules and even living organisms can be studied.

A scanning tunnelling microscope forms high-resolution images by scanning surfaces to detect a weak electric current flowing between the scanner tip – which is the size of an individual atom – and the surface.

Minerals analysis
Geochemistry and structural analysis undertaken in the College includes x-raying samples and developing methods for locating significant mineral deposits by examining the geochemistry of the surrounding landforms and other geology.

Highly sensitive characterisation
The University’s inductively coupled plasma mass spectroscopy facility has very high sensitivity and is suitable for characterisation of both inorganic and organometallic compounds.
The College’s capabilities across the health sector demonstrate its innovative approach, focus on applied sciences and links to industry and public policy development.
Complementary medicine testing
The College of Health and Science has pursued a strong position in complementary medicine, establishing an extensive new range of facilities used by industry. The combination of analytical and pharmacological capabilities and the research excellence of the Centre for Complementary Medicine Research (CompleMED) creates a stand-out facility for research and services.

The capabilities cover the full range of product testing including:
» Acquisition of evidence for efficacy, and validation of products and practices
» Chemical definition of herbal medicines
» Herbal pharmacology testing of mechanisms of action
» Establishing clinical trial standard operating procedures and expertise
» Herbal analysis and pharmacology

CompleMED researchers can then undertake quality assurance and stability testing in World Health Organisation (WHO) climatic zones III and IV, which correspond to hot/dry and hot/humid climates, respectively.

The analysis laboratory features:
» High performance liquid chromatography
» Mass spectrometry
» High performance thin layer chromatography
» Gas liquid chromatography

The new Herbal Pharmacological Laboratory is designed for biomolecular studies including high-throughput bioassays and quantitative real-time polymerase chain reaction, which can, for example, identify viral load in patients or cells.

Tissue culture experiments
The Herbal Pharmacological Laboratory’s tissue culture facility allows researchers to culture a variety of human and animal cell lines as well as primary cells, such as nerve cells from the brains of mice or rats. Examining cells in culture enables researchers to perform biochemical, molecular biological or biophysical experiments under controlled conditions, such as:
» Using the patch-clamp technique, recording the tiny electrical currents flowing through ion channels inserted in the plasma membrane of cells in culture. This technique is so sensitive that researchers can directly follow the opening and closing of single channel molecules.
» Digital fluorescence imaging, in which researchers use dyes to monitor changes in cultured cells in the intracellular concentration of a variety of ions, pH or even transmembrane voltage.

The facility is notable for being able to undertake patch-clamp electrophysiology and digital fluorescence imaging at the same time.
Clinical trials of Chinese herbal medicines
CompleMED has extensive international networks, especially with China. The team works with several Sydney hospitals and Chinese institutional collaborators. CompleMED offers experience with standard operating procedures for clinical trials. Its staff can also assist in generating evidence for regulatory applications for products.

Public health and policy
Government agencies can take advantage of CompleMED's research capabilities for the development of regulations and practices regarding safety, usage, integration, practitioner standards and health policy development. For example, it has been collaborating with the WHO on the development of guidelines for the harmonisation of traditional and modern medicine, and with the TGA on regulatory approaches to complementary medicine products.

Pharmaceuticals and biomedicine
The College maintains facilities in its School of Biomedical and Health Sciences that underpin capabilities in:
» Pharmacology, particularly in synthetic organic chemistry
» Synthesis of drugs for the treatment of cancer, for example with agents used to locate disease within the body
» Materials chemistry development of nanomaterials used in medicine.

Developments in the School of Medicine and School of Biomedical and Health Sciences are focusing on molecular biology, molecular pharmacology, microbiology and biochemistry. The University is investing in new medical laboratory facilities with:
» State-of-the-art animal facilities
» Physical Containment 2 areas
» First-rate proteomics equipment
» Advanced neuroscience technologies.

These capabilities are suited to the basic drug design needs of the pharmaceutical industry. The School of Biomedical and Health Sciences has extensive experience in the use of functional genomics to reveal the molecular workings of promising anti-cancer drugs, and understand the molecular effects of reactive oxygen species that cause ageing, neurodegenerative disease and cancer. This rapidly growing branch of biomedical research applies high-throughput robotic technologies to take advantage of information gained from the sequencing of the human genome.

The School of Medicine collaborates with Campbelltown Hospital for clinical trials while the School of Biomedical and Health Sciences continues its collaborations with several Australian and international institutions.

Health and medical services
With capabilities in sports and medical science, health services management, health promotion, public health, occupational therapy and complementary medicine, the College is a potential research and services partner for government agencies, institutes of sport, private health insurers, and private health rehabilitation companies.
» The University maintains its own clinic for practical experience as well as research in podiatry, traditional Chinese medicine, osteopathy, naturopathy, and remedial and relaxation massage.
» The School of Medicine offers expertise in population health, the mental trauma that follows disaster, eating disorders, renal and obstetric medicine, immunology, and vascular surgery – and other areas are being rapidly added.
» The School of Biomedical and Health Sciences offers expertise in health-related physical activity, primary care health interventions, psychological aspects of health and rehabilitation, and clinical trials in rehabilitation.
» The Men’s Health Information and Resource Centre in the School of Biomedical and Health Sciences has established a strong reputation for its capabilities in communicating with men about their health, Indigenous health, and wider policy and advocacy issues.
» Organisations in the health sector also work with health informatics specialists in the College’s School of Computing and Mathematics.
plants, animals and the environment

Research in agriculture, horticulture, animal science and the environment in the College of Health and Science is oriented towards: application; integration of research, business and community engagement; and cooperation across fields. The facilities underpinning this research are diverse, ranging from orchards and animal houses, to a food processing plant and experimental eucalypt forest site.

Agriculture and horticulture
UWS has a century-long tradition of agricultural research and services.

Among the experimental field sites in the College of Health and Science are:
» Cleared agricultural lands
» Many farm dams within close proximity for replicated studies
» Climate-controlled plant-growth cabinets
» A post-harvest controlled environment system and physiology laboratories
» Stone fruit and citrus orchards
» A vineyard
» An olive grove and cleared plots

Animals kept on campus include horses, deer, sheep, reptiles and marsupials, and the School of Natural Sciences even offers agistment facilities for horses. Its experience can be extended to assisting other organisations involved in animal welfare.

Expertise in global positioning and geographic information systems is brought to bear on agricultural studies.

The Centre for Plant and Food Science offers capabilities in:
» Interactions of plants with their environments
» Innovative plant products for horticultural industries
» Sustainable plant production and management systems, emphasising integrated pest and disease management

In addition, the capabilities in chromatography analysis of chemicals in plants available in the School of Natural Science can be applied to examining the concentration of ions in flavour additives and diseased plants.
Food technology and processing
UWS features a pilot plant equipped to process a variety of foods and even a small abattoir as part of its capabilities in this area. It also uses its molecular laboratory and chromatography facilities for food analysis. Other facilities are designed for encapsulation of bacteria and other bioactive molecules for targeted release within living organisms. For example, UWS researchers are investigating novel delivery systems for probiotics and probiotic-based functional foods and nutraceuticals that are being developed.

The Centre for Plant and Food Science has particular expertise in designing, developing and producing value-added, health-based, safe and nutritious food products; and developing innovative technologies to maintain food quality and nutrition.

The School of Biomedical and Health Sciences’ experience in the use of functional genomics is also providing insight into the secrets of making better flavours in beer, wine and bread.

Environmental field sites
Agricultural studies are complemented by field sites that take advantage of UWS’s local environment, including:
- Wetlands developed specifically for water reuse
- Remnant woodlands of the Cumberland Plain and River Flat Forest

Forestry
The Centre for Plant and Food Science is undertaking a major study – the Hawkesbury Forest Experiment – that aims to generate predictive understanding of the growth, carbon storage potential and water use of both managed and unmanaged eucalypt forests that are growing in typical Australian, water-limited conditions, and their responses to rising carbon dioxide levels.

An exemplar of UWS’s approach to collaboration, this experiment brings together experts from the University of Western Sydney, the University of New South Wales, the University of Technology, Sydney, the NSW Department of Primary Industries, and the Swedish University of Agricultural Sciences. It has attracted substantial funding from the Australian Greenhouse Office.

The experiment includes contrasting watering treatments, to test for the first time the effect of elevated carbon dioxide on productivity of large woody plants with limited water. The results will not only be of interest to the forestry sector, but also to environmental researchers and policy-makers and businesses involved in carbon trading.

In addition, the Centre for Plant and Food Science is well resourced to assist businesses with challenges related to microbiology, soil ecosystems, forest management practices and rehabilitation of native forests.

Wildlife and conservation
Research focusing on reptile health and endangered species is undertaken with parks agencies, world heritage areas and zoos. The University has particular expertise in tracking animals and identifying the needs of species about which little is known.
The School of Engineering offers engineering consulting and research capabilities aimed at identifying practical and efficient solutions to clients’ needs.

**Construction technology**
UWS is home to one of Australia’s best laboratories for independent testing and monitoring for the construction and manufacturing industries. Its expertise is especially relevant to civil, structural, and signal processing engineering businesses and regulatory bodies.

The University’s Construction Technology Research Laboratory offers:
- NATA accreditation for testing of both assemblies and components
- Compliance with Australian and ISO standards
- Static and dynamic testing
- Testing in the laboratory or on site, such as testing of road surfaces on the site of Sydney’s M7 Motorway
- Structural monitoring services to monitor movements, strains and vibrations of structures such as bridges, multistorey buildings and other isolated structures
- Measurement of cracks
- Assessment and determination of modal frequencies of structures
- Assessment of products, procedures and design criteria
- Structural assessment and development of performance criteria for new products
- Forensic testing

These services are suited to concrete, steel and plastics, and composites of these, as well as polystyrene, alloys and timber. They utilise:
- Five multi-purpose loading frames, offering flexibility and a capacity of up to 5000kN (500 tonnes)
- A 16m by 8m multiconfigurable loading floor
- Numerous actuators, ranging from 150kN to 2000kN
- Expertise in materials, electronics, mechatronics and industrial design
Design and manufacturing
The School of Engineering has a range of capabilities for mechatronics, industrial design and small-scale production, with an emphasis on sustainable design.

Facilities include:
- 3D computing modelling and simulation laboratories
- A materials analysis and testing laboratory
- An engineering and computer numerical controlled machining workshop
- Product ergonomic studies and usability laboratory
- Computer engineering laboratory
- Electrical and electronic engineering laboratory
- Mechatronic engineering laboratory
- Robotic assembly laboratory

Rapid prototyping
Using 3D computer-aided design model data to produce an accurate physical prototype – a 3D ‘print’ – is a fast and cost-effective way to produce physical models and functional or semi-functional prototypes. The School of Engineering uses rapid prototyping 3D printing to enable clients to:
- Communicate design concepts
- Conceive and present an architectural project
- Produce models with any geometric complexity or intricacy without elaborate machine set-up or final assembly
- Produce low-volume tooling, which can be an intermediate step between design and high-volume manufacturing
- Test products and if necessary, modify and retest
- Produce small runs of objects

Mechanical engineers can use 3D printers to create prototypes directly from digital data. Architects can obtain quick, inexpensive models. In industrial design models can be printed, sanded and painted to replicate production models. Biomedical researchers can use 3D printers to create full-colour parts to accurately represent molecular models. A medical supplier could test a jaw, tooth or bone. A plastics manufacturer can reduce the expense of prototyping in plastic by checking designs first.

Other sectors finding this an invaluable tool range from window manufacturers and electrical engineering businesses to mining and R&D organisations. The technique is applicable to both industrial and commercial products.

The turn-around speed is phenomenal: for example, from request to print in barely a week for design of a product that was in stores within three months.

The School has three fused-deposition modelling machines, a Thermojet 3D printer and laser scanning facilities. They are used to make objects from various materials, including composites. If necessary a foam model can be scanned to generate the required 3D image.
The combination of computer science scholars, information technology experts, statisticians and mathematicians in the School of Computing and Mathematics increases the reliability and quality of results that they produce. They amalgamate strong fundamental theoretical knowledge and in-depth understanding with practical information technology capabilities and human-centered computing – an amalgamation invaluable in many applied areas, from biomedical and social sciences to business. The School’s capabilities are combined with extensive interaction with businesses and government bodies.

**Emerging business environments**

Online virtual worlds are distributed electronic environments where people can work and interact over the Internet in a semi-realistic manner. This is a strong UWS capability that is being applied to potential opportunities for businesses. The analysis of social, behavioural and economic aspects of the virtual communities enabled by these worlds is relevant to organisations, software engineering projects, electronic markets and a myriad of other areas. A feature of the University’s facilities is a large virtual reality screen that enables a shared view of developments.

**Electronic markets and electronic business transactions** are also areas of strong capabilities. Consultancy services provide businesses with advice on future trading environments, especially the support and automation of multi-attribute negotiation in those environments and their anticipated effect on business networks.

**Intelligent information systems expertise** is also available in multi-agent systems, case-based reasoning, artificial intelligence technologies and applications of knowledge management and collaborative business processes.

**Regional eBusiness focus**

Two major surveys in recent years have given the School a deep understanding of the information and communication technology (ICT) needs of businesses in Western Sydney. A team is developing applications to meet these needs, focusing on emerging technologies.

The Advanced Enterprise Information Management Systems (AeIMS) research group is helping small and medium sized enterprises (SMEs) in Western Sydney to progressively plan and implement new business processes based on ICT – the process of ‘eTransformation’.

AeIMS is active in both awareness-raising and working directly with clients. AeIMS engages with industry associations and local councils, and is working with the Western Sydney IT Cluster of the NSW Department of State and Regional Development, involving about 240 SMEs, and the Penrith Valley Economic Development Board.
Business intelligence and analytics, statistical and mathematical methods

Knowledge capture and management is a critical competency for the survival of businesses as they grapple with accessing, using and managing vast amounts of often incomplete and inconsistent data and information.

Expert advice is available on:
» Selecting appropriate analytical mathematical and statistical methods
» The full range of statistical and data mining approaches
» The application of mathematical techniques
» A diverse range of computer programs
» Interpretation and presentation of results
» Qualitative and quantitative data analysis
» Various analytics

Health informatics

Health informatics – or ‘e-health’ – provides information and communication technology support in health and medicine. It involves the fusion of ICT with medical and biological sciences and organisational aspects of health care.

Expert advice is available on various aspects of e-health, including:
» Administrative systems for admission and finances
» Patient journey transformation
» Business process modelling
» Clinical data collection
» Physiological data collection
» Data and information integration, warehousing, mining and visualisation
» Clinical analysis and research
» Training
» Telemedicine and telehealth, based on using broadband networks
» Virtual reality anatomy models
The Spatial Indicators Laboratory in the UWS Urban Research Centre captures, analyses and produces spatially referenced data via geographical information system (GIS) and mapping technologies. The Centre aims to be Sydney’s leading urban and spatial indicators laboratory and the most comprehensive supplier of data, indicators and information about the changing conditions of our cities.

The Spatial Indicators Laboratory utilises MapInfo Professional GIS software and extension Arrows software, which allows the visual representation of flow data. The Centre applies cutting-edge research techniques, multiple disciplines and creative approaches to generate new knowledge and practical policy outcomes.

The Centre has a focus on the Sydney Greater Metropolitan Region, seeing it as an excellent base for internationally relevant urban studies.

Partnerships for research in areas of mutual interest are formed with government and semi-government organisations, development corporations, and industry and community associations such as property groups and council associations.

The Centre’s research themes provide the framework for these partnerships:

» Housing, especially affordability, sustainability and brownfield developments

» Infrastructure, including public-private partnerships, governance and regulation, ports and materials flows

» Design and architecture of the city, such as urban office spaces, celebrity architects, business parks and new business spaces, hotels, airports and Nanjing and Shanghai urban development

» Urban indicators, at city-wide and neighbourhood scales, and including labour markets, economic self containment, community, cultural activity, sustainability, physical activity and health and well-being

» Urban dynamics, notably demographic change, migration and shrinking cities
With the only dedicated crime scene house in Australia and a range of facilities dedicated to forensics applications, UWS is distinguishing itself in delivering forensics training services.

UWS provides practical experience for police and emergency services organisations. In the crime scene house, UWS staff can lead training sessions using materials, such as blood, that are typically found in crime scenes. Participants reconstruct a scene and extract evidence such as DNA and fingerprints for court evidence.

Forensics facilities include:

- An imaging laboratory for investigations and reconstruction
- An instrumentation laboratory, which features a glass analysis system that can identify glass types
- Polarisation microscopy systems to examine, for example, hairs
- High resolution cameras
- Machines for examination of fingerprints
- A source of monochromatic light that can be tuned to examine evidence, which can quickly reveal aspects and make visible evidence that is invisible in normal light
- Cutting-edge forensic photography technology

Archaeology
Forensics imaging and chemistry are also applied in analysis of archaeology sites.
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