
IPAS exists to deliver breakthrough science, drive innovation and thus enable illuminated decision making for a safer, healthier & wealthier world



Director's Welcome



Our vision is to make IPAS a global hub of photonics and advanced sensing research creating transformational new approaches to sensing, and a new profession of transdisciplinary problem solvers.

Many of the best opportunities for scientific breakthroughs over the next few decades sit between the conventional scientific disciplines. Similarly, pressing problems in health, the environment and national security require the fusion of technologies and approaches from many areas of science. IPAS has been created to bring together physicists, chemists and biologists to pursue a transdisciplinary approach to science. We are developing novel photonic, sensing and measurement technologies that will create new tools for scientific research, stimulate the creation of new industries, and inspire a new generation to engage in science and technology. The Institute is supported by modern infrastructure and an innovation culture, and we work in partnership with government and industry on projects aimed at delivering real-world outcomes.

IPAS is working on a range of scientific challenges and future technologies via our 6 science themes:

- Optical Materials & Structures
- Lasers & Nonlinear Optics
- Remote Sensing
- Chemical & Radiation Sensing
- Surface & Synthetic Chemistry
- Medical Diagnostics & Biological Sensing



IPAS is one of 5 world-leading research institutes at The University of Adelaide. The institutes are central to the University's strategy of supporting its recognised areas of research excellence and growing research capacity within these fields.

IPAS builds on the research capabilities within the University's Schools and Faculties, bringing them together under a common identity. This benefits our members and stakeholders through increased research opportunities, capabilities and scale. The Australian Federal Government, South Australian State Government, DSTO, Defence SA and The University of Adelaide have invested over \$40M to construct a headquarters for IPAS, which will house a unique suite of transdisciplinary laboratories. These facilities will include glass development and processing, optical fibre

fabrication, laser and device development, luminescence dating, environmental genomics, photonic sensor development, and synthetic, surface and bio-chemistry laboratories in addition to offices to co-locate IPAS researchers and students from a broad range of scientific disciplines. This will all be located in the University's new illumin8 building, which is due for completion by early 2013.

IPAS acknowledges a strong ongoing partnership with DSTO and their support for the Centre of Expertise in Photonics (CoEP) and numerous research projects.

The CoEP now covers all optics and photonics activities at the University of interest to Defence, including: fibre development, fibre lasers, transmission fibres, nonlinear fibres & devices, electro optic devices, free space laser development and atmospheric sensing.

IPAS Research Themes

IPAS research is organised into 6 major themes. These span fundamental science to application-driven research.

Optical Materials & Structures

Heike Ebendorff-Heidepriem & Tanya Monro

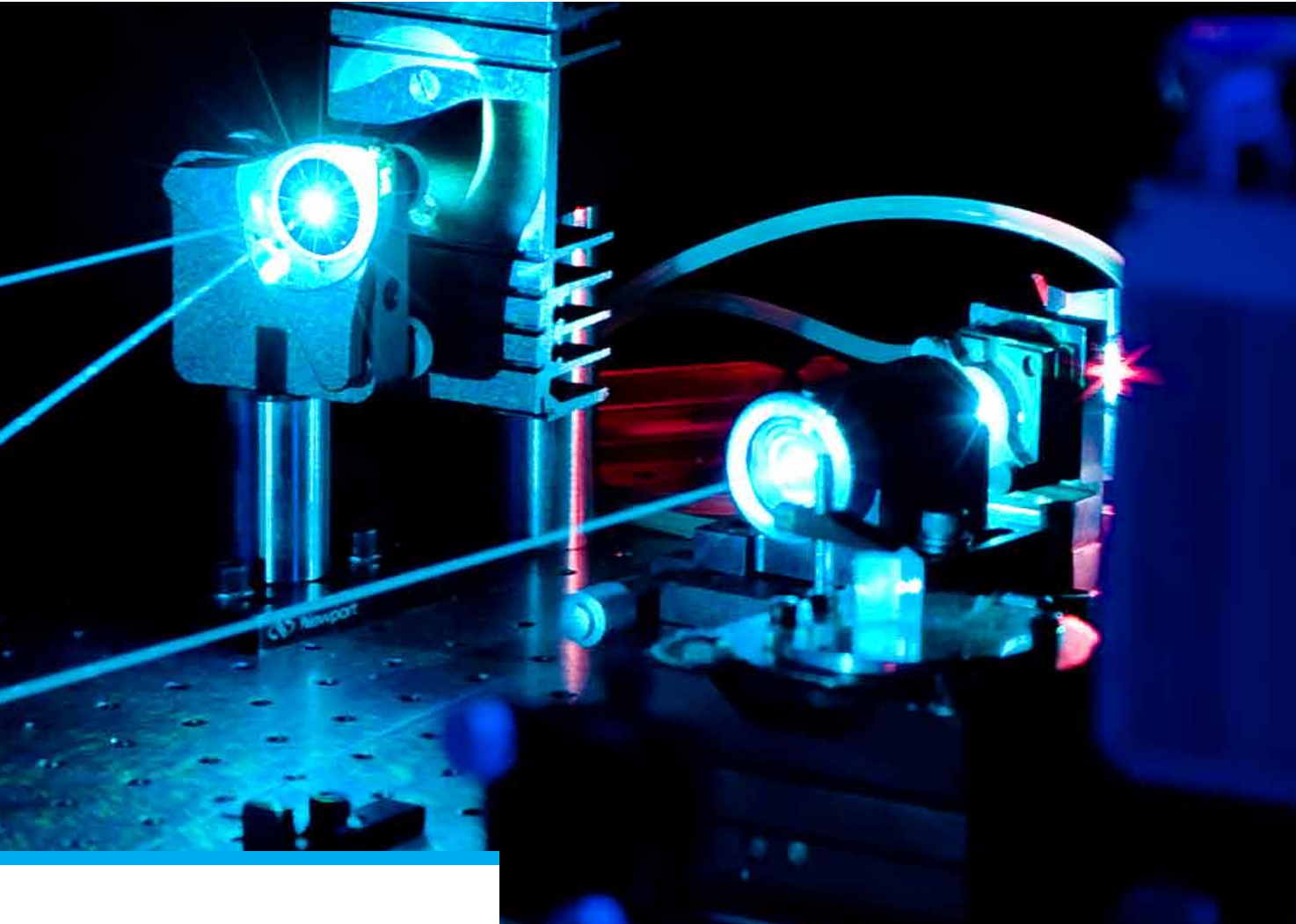
Our research focuses on developing new glasses with novel optical properties, fabricating micro and nanostructured soft glass optical fibres, and developing novel silica and polymer fibres, including the capacity for rare-earth and nanoparticulate doping. We have a strong focus on developing glasses and fibres capable of transmitting light in the mid-infrared and THz spectral regions. Our modelling capability also allows us to develop new theoretical frameworks for understanding waveguides and fibres with extreme properties and nanoscale features.

Lasers & Nonlinear Optics

David Lancaster & David Ottaway

We research and develop novel free space, fibre and chip laser architectures operating at new wavelengths, regimes and high powers. The need for these is driven by applications in astronomy (guidestar), gravitational wave detection (LIGO), supercontinuum generation, defence and laser radar (LIDAR).





Surface Science & Synthetic Chemistry

Andrew Abell & Chris Sumby

Our chemistry teams develop novel biological and chemical surface coatings, (with a focus on glass surfaces) and surface functionality strategies to enable the realisation of sensors for specific chemicals and biomolecules.

There are research programs synthesising novel molecules for ion trapping and fluorescence-based sensing architectures. Other programs includes the development of new materials for catalysis and efficient gas storage.

Chemical & Radiation Sensing

Nigel Spooner & Tanya Monro

Using in-house and specialty optical fibres with unique surface coatings developed by our chemistry teams, we have research programs developing novel optical fibre-based chemical sensors for water quality, corrosion sensing and environmental monitoring. We are also researching new fibre-based radiation dosimetry sensors for medicine, industry and defence. Our Environmental Luminescence facility, which houses the most comprehensive collection of these systems in the world, develops new forensic luminescence techniques and provides a range of training and dating services to industry.

Medical Diagnostics & Biological Sensing

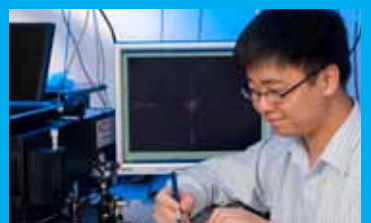
Tanya Monro & Peter Hoffmann

We are harnessing photonics, proteomics and DNA technologies and are working in conjunction with clinicians to create rapid photonics-based approaches for medical diagnostics, pushing the boundaries of speed, sensitivity and sample volumes. We have produced optical fibre-based dip sensors capable of measuring chemicals and biomolecules in concentrations as low as $<0.2\text{nM}$ and/or picolitre (μL) volume samples. Our novel surface plasmon resonance (SPR) systems are capable of label free diagnostics of pathogens and biomarkers.

Remote Sensing

David Ottaway & Gavin Rowell

From the search for gravitational waves using ultra-precise lasers (LIGO), the development of LIDAR systems for measuring wind fields for wind farms, to pollutants at industrial sites and the detection of cosmic and gamma rays, our research teams develop, deploy and refine a range of photonic technologies for sensing at a distance.



Management Committee (SMC)

Nigel Spooner

Luminescence, Radiation sensing, Optical Dating Technique Development



Andrew Abell

Surface Chemistry, Protein and Peptide Synthesis



Heike Ebendorff-Heidepriem

Glass science, Fibre Fabrication and Characterisation



Gavin Rowell

High Energy Astrophysics, Cosmic Ray Detection



Chris Sumby

Synthetic Chemistry, Functional Organic Materials, Analytical Chemistry



David Ottaway

Solid State Lasers, LIDAR Sensors, Gravitational Wave Detection



Tanya Monro

Optical fibres, Theoretical and Experimental Photonics, Optical Sensors



Peter Hoffmann

Proteomics, Biomarker Discovery, Biological Sensors



David Lancaster

Fibre Lasers, Silica Glass and Fibre Fabrication



Tilanka Munasinghe

IPAS Student Committee Chair



The SMC are the leaders of the IPAS Research Themes

IPAS Board

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*Executive Dean,
Faculty of Sciences,
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Dr Jurgen Michaelis

CEO, BioInnovation SA



Professor Tanya Monro

IPAS Institute Director



Mr Piers Lincoln

*IPAS Institute Manager
(Observer)*



Dr Neil Bryans

*Executive Director, Counter
Terrorism and Security
Technology Centre, DSTO*



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*Deputy Chief Defence
Scientist (Information and
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The University of Adelaide*



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*IPAS Chairman
CEO, Water Industry Alliance*



Professor Andrew Holmes

*University Laureate Professor
and CSIRO Fellow,
The University of Melbourne*



IPAS SAG

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*Protein Structure,
Function and Interactions*



Professor Roger Clay
*Astronomy, Astrophysics,
Cosmic Rays*



Professor Alan Cooper
*Ancient DNA, Palaeology,
Biogeography*



Professor TuckWeng Kok
*Virology, Biotechnology,
Diagnostics*



Professor Roger Clay
*Proteomics, Immunology,
Chemokine Biology*



Professor Jesper Munch
*Solid State Lasers, LIDAR
Sensors, Gravitational
Wave Detection*



Professor John Prescott
*Luminescence,
Radiation Sensing*



Professor Iain Reid
*Atmospheric Physics,
Atmospheric Radar*



Professor Bob Vincent
*Atmospheric Physics,
Atmospheric Radar*



Director's Welcome

IPAS Research Themes and IPAS
Scientific Management Committee

IPAS Board and
Senior Advisory Group (SAG)

Products, Services and
Links with industry

Products, Services and Links with Industry



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- Supply of novel soft glass and microstructured optical fibres
 - Production of silica preforms and fibres
 - Development of novel photonic sensor platforms
 - Development of laser systems
 - Luminescence dating of samples



Many research projects at IPAS have application-focused goals and we have established bespoke and unique facilities for the production of optical materials, optical fibres, glass surface functionalisation, luminescence dating and materials characterisation.

We offer access to these products and services via consultancy, contract research, collaborative research and ARC Linkage grants. IPAS is also part of the Optofab node of the Australian National Fabrication Facility (ANFF) and many academic groups and companies work with us via this scheme. For a full listing of the equipment and services we offer please visit our website (www.adelaide.edu.au/ipas/facilities).

IPAS has a portfolio of patents ranging from microstructured optical fibres to advanced sensing platforms and new laser architectures. We actively seek industry partners who can work with us to take these innovations to market.

All commercial contracts with IPAS are handled by Adelaide Research and Innovation (ARI) who manage The University of Adelaide's commercial research and consultancy partnerships, form new business ventures based on University expertise and develop the University's innovative ideas and technologies with commercial potential.

For access to commercial services please contact:

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Tanya Monro
IPAS Institute Director



Professor Tanya Monro is an ARC Federation Fellow and as well as Director of IPAS, she is also the Director of the Centre of Expertise in Photonics (CoEP) within the School of Chemistry & Physics at The University of Adelaide.

Tanya obtained her PhD in physics in 1998 from The University of Sydney, for which she was awarded the Bragg Gold Medal. In 2000, she received a Royal Society University Research Fellowship at the Optoelectronics Research Centre at The University of Southampton, UK.

She returned to Australia in 2005 as the inaugural DSTO Chair of Photonics at The University of Adelaide.

Tanya was named South Australia's Australian of the Year (2011), South Australian Scientist of the Year and Telstra Business Woman of the Year (Community & Government Category) (2010), Prime Minister's Malcolm McIntosh Prize 'Physical Scientist of the Year' (2008), the Australian Institute of Physics' 'Women in Physics Lecturer' (2007), Cosmos Magazine's 'Bright Spark' Award (2006)

A Fellow of the Australian Academy of Technological Sciences and Engineering (ATSE), Tanya has published over 370 papers in journals and refereed conference proceedings, and has raised over \$70M in research funding.

Peter Hoffmann
IPAS Deputy Director



Dr Hoffmann is a Senior Researcher, a founding member of IPAS and is also Director of the Adelaide Proteomics Centre (APC) at The University of Adelaide. Since his PhD award in 1999 Peter has established and led proteomics groups in Australia (Melbourne) and Germany (Leipzig). His research is focused on biomarker discovery in cancer, detection of protein phosphorylation and tissue imaging mass spectrometry.

In 2005, Peter returned from Germany to Australia to establish the APC at The University of Adelaide. The APC provides the research community with services and access to the latest in proteomics technologies, serving SA, interstate and overseas universities and industry.

In addition to establishing the APC, Peter's proteomics research group has attracted funding of over \$4M via NHMRC, ARC and Ovarian Cancer Research Foundation grants. His work is on the forefront of proteomics technology and he is regularly invited to present at national and international proteomics conferences.