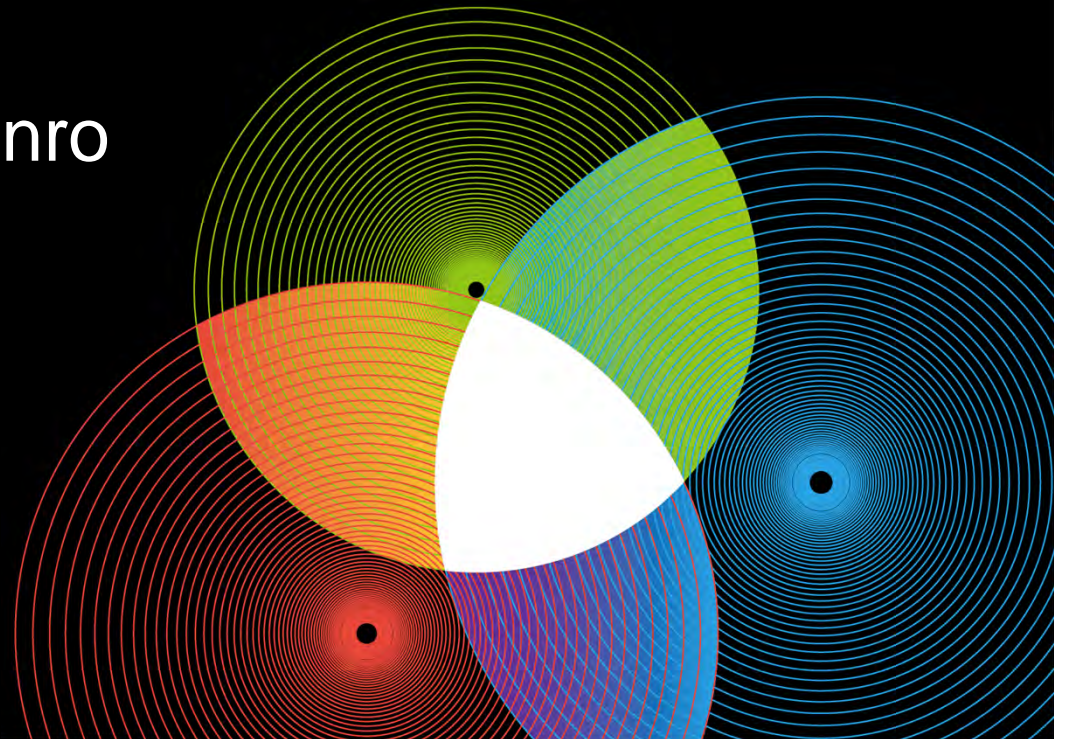


A balanced approach - from blue sky science to solving industry needs ...with flashes of light

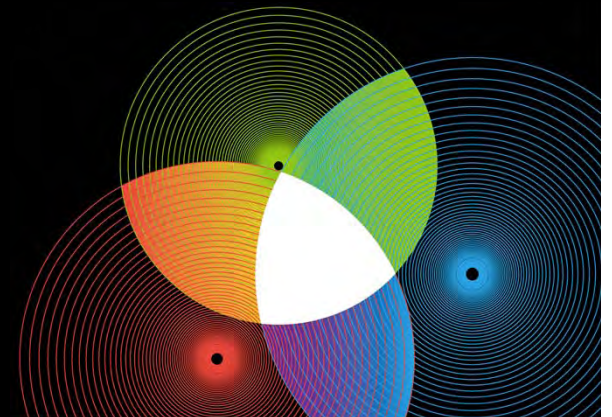
Tanya Monro

Tanya Monro, CRCA, 18 May 2011



Themes

- ▣ Building a research career
- ▣ A transdisciplinary approach
- ▣ Blue-sky to applied & translational research & back again



Institute for Photonics & Advanced Sensing (IPAS)

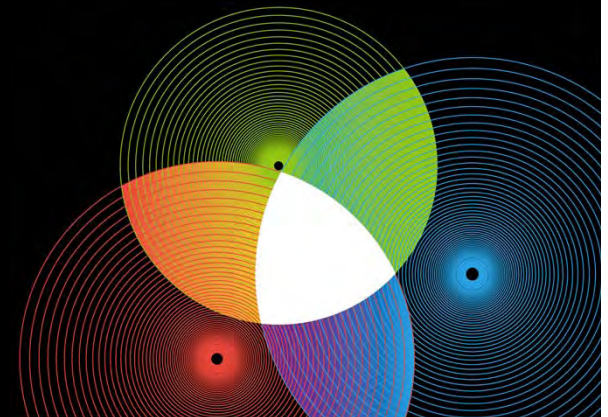
- Launched Nov 2009
- Transdisciplinary approach
- 140 members across physics, chemistry & biology
- Focused on developing disruptive new sensing technologies
- Solving real problems AND creating new tools for research
- Rich seam of opportunities between the traditional disciplines



tanya.monro@adelaide.edu.au

www.ipas.edu.au

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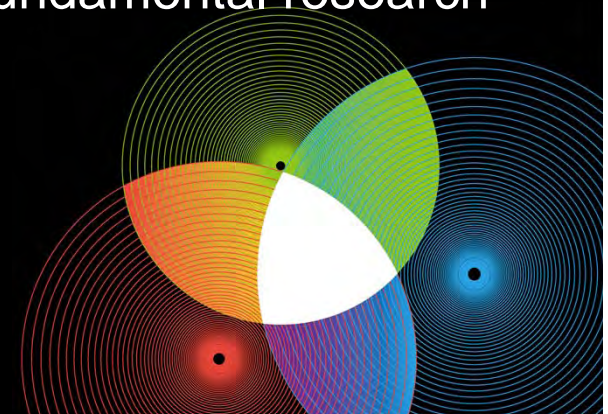
Building a research career

▣ PhD:

- jointly between Physics @ Uni. Sydney & Photonics CRC
- Started with purely theoretical / numerical project
- Branched into experimental work in later stages

▣ Postdoc -> Group Leader @ Uni. Southampton UK

- Sought to work in new/dynamic area
- Developed approaches for analysing microstructured materials
- Funding imperative – sought links with industry & defence
- Opportunities to bring together diverse fields
- Understanding industry needs drove forward fundamental research

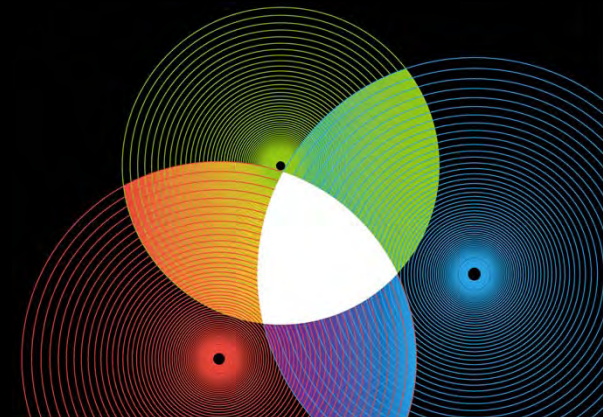


At the University of Adelaide

- 2005 Inaugural DSTO chair of Photonics
- 2006 Centre of Expertise in Photonics (CoEP) established
Soft glass optical fibre facilities come online
- 2009 Institute for Photonics & Advanced Sensing (IPAS) formed
- 2011 Silica optical fibre facility online
Kick off of STARR laboratories
- 2013 ***Illumin8*** building due to come online

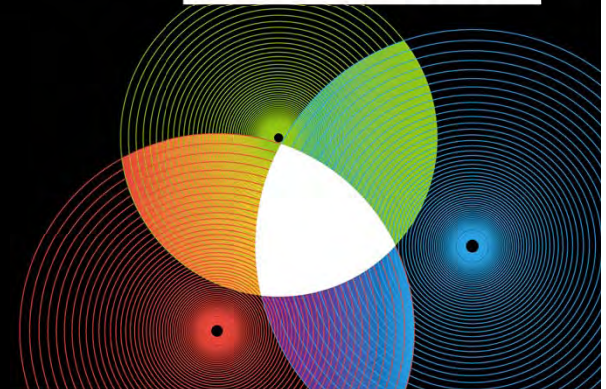
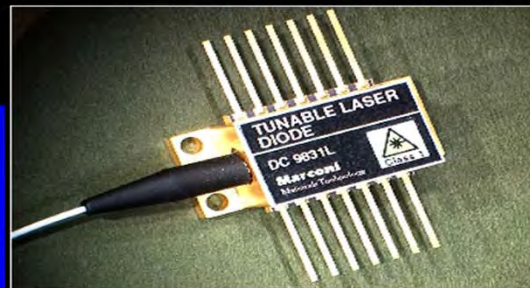
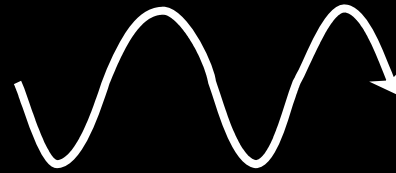


\$97M building project



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Photonics is the science of the photon, the fundamental particle of light



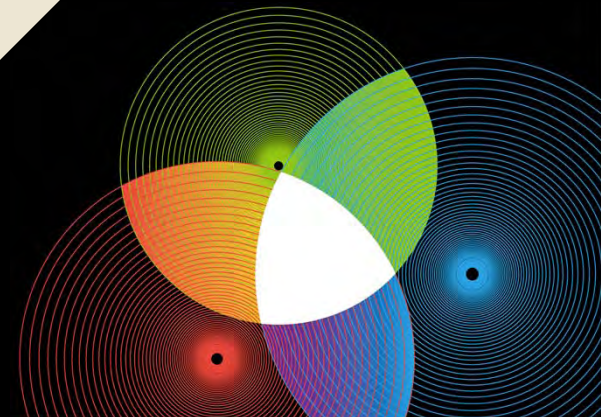
Tanya Monro, CRCA, 18 May 2011

3 photonics revolutions

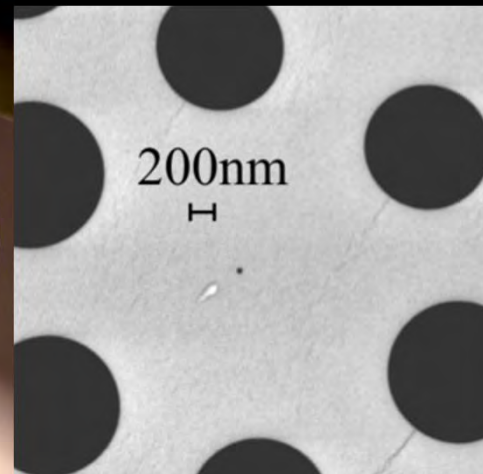
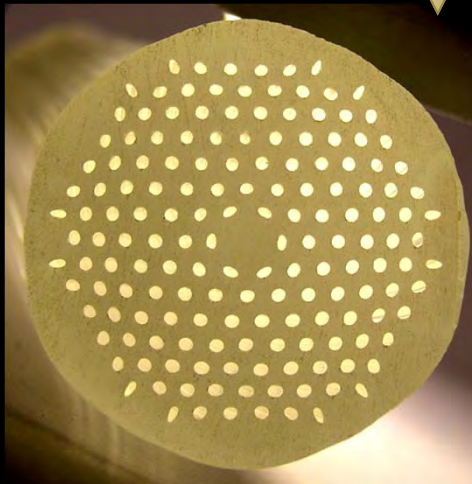
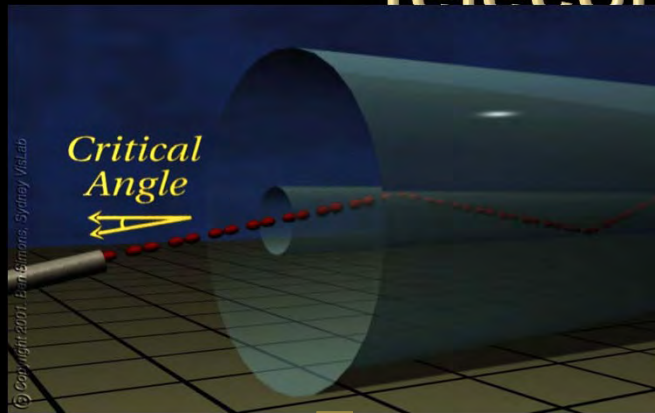
1960
The laser

1980s
Optical fibres for
telecommunications

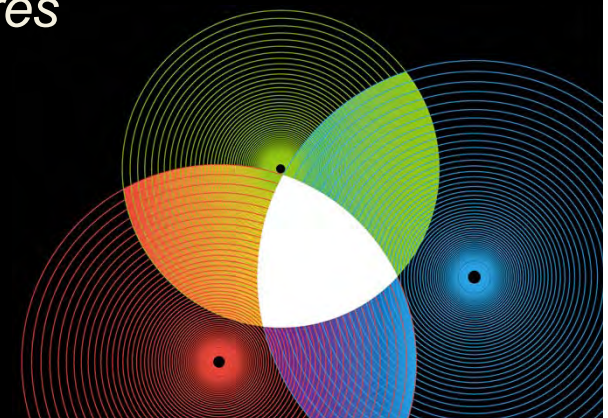
Now:
Photonic tools for
probing our world



Optical fibres – beyond telecommunications

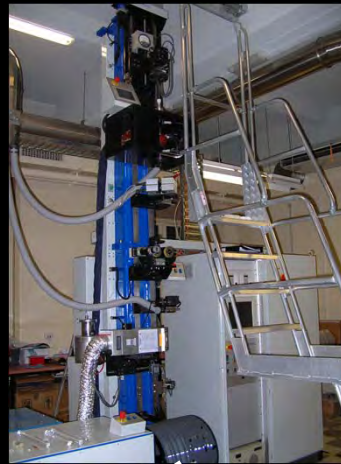


*Microstructured &
Nanostructured
optical fibres*

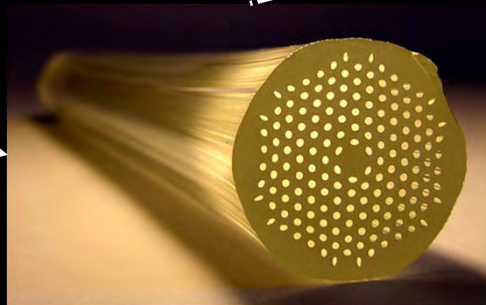


Tanya Monro, CRCA, 18 May 2011

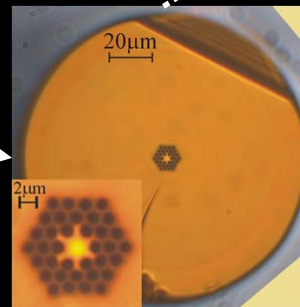
Soft glass optical fibre research capabilities @ UoA



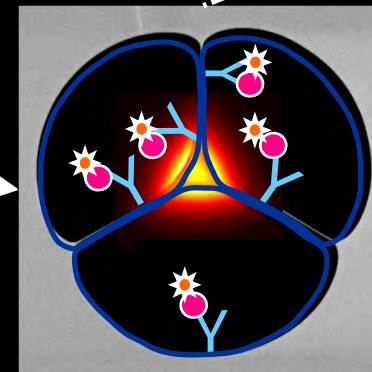
Bulk



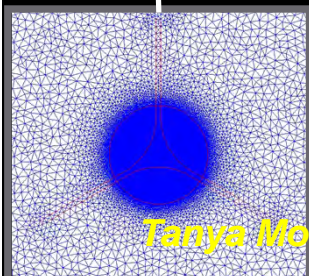
Macroscopic Structure



Microscopic Structure



Functionalisation



Tanya Monro Design, 18 May 2011

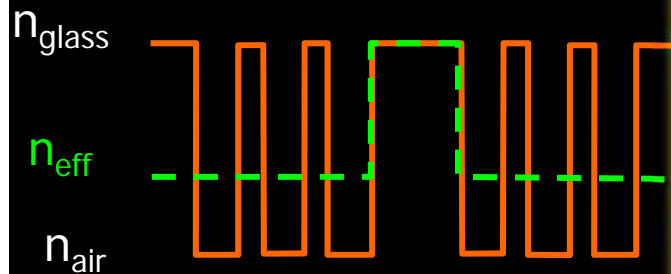
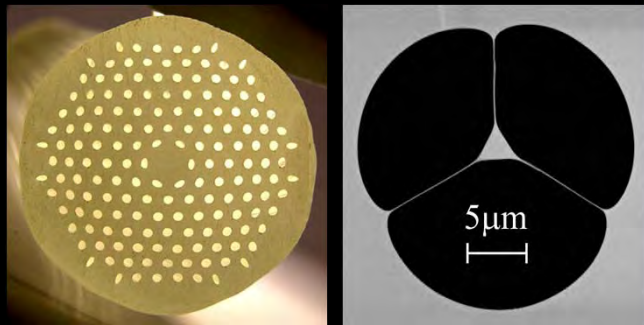
Devices



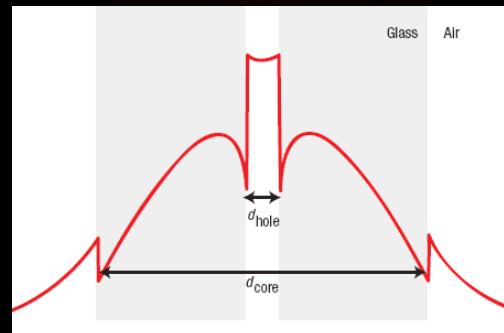
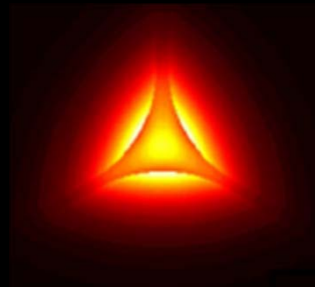
New ways of guiding light

Microstructured fibres can be made from a single materials
- enables fibres to be made out of virtually any optical material

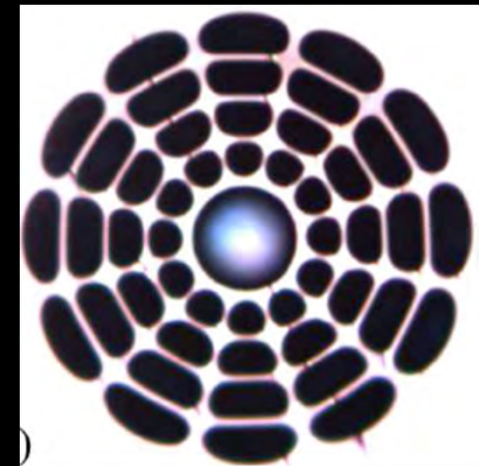
index-guiding MOFs



“edge”-guiding

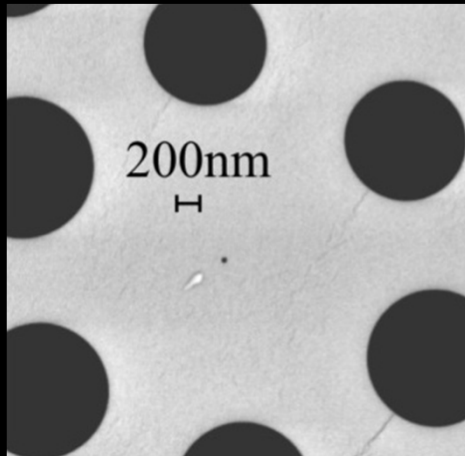


bandgap fibres

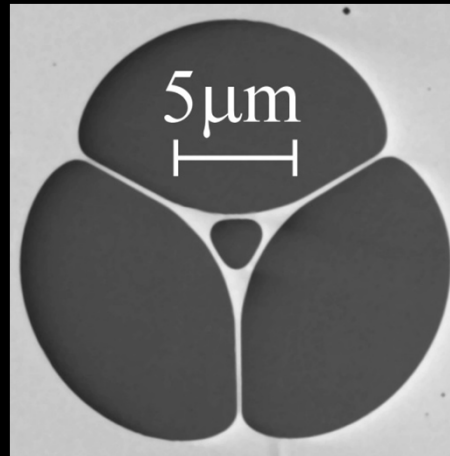


Recent fibre highlights

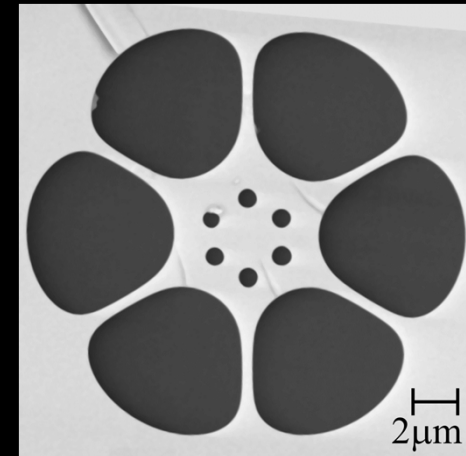
smallest hole of 20nm



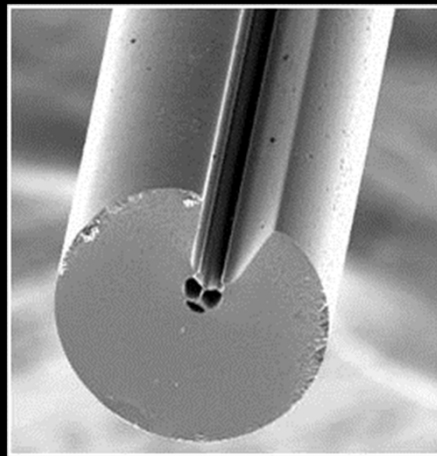
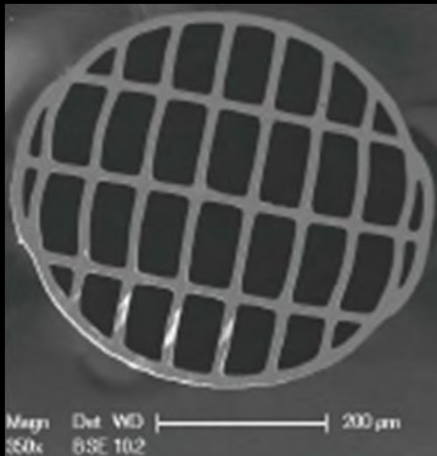
multiple cores



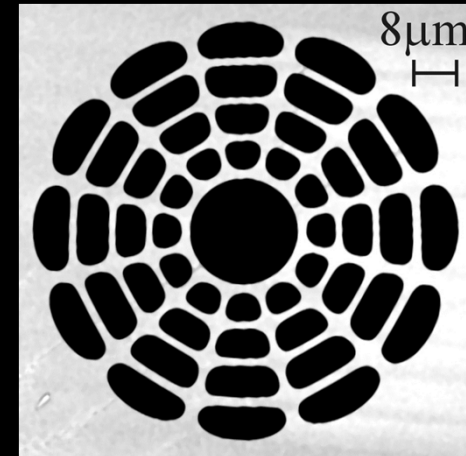
very different hole sizes



asymmetric structures



air core



A fine line



"A fine line"

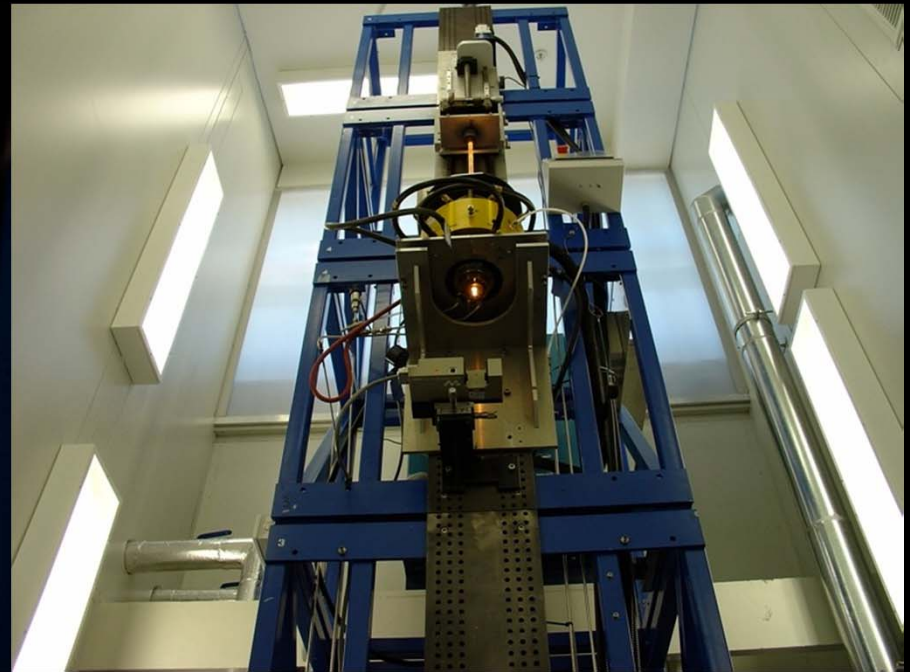
Glass art meets glass science

Exhibition at Adelaide's Jam Factory

26 March – 7 May 2011

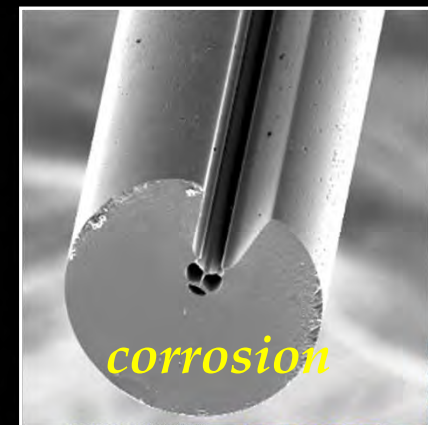
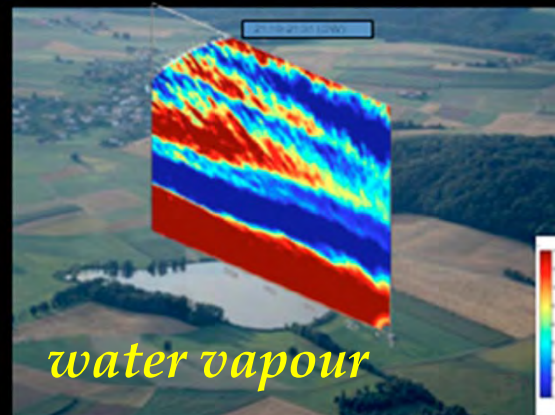
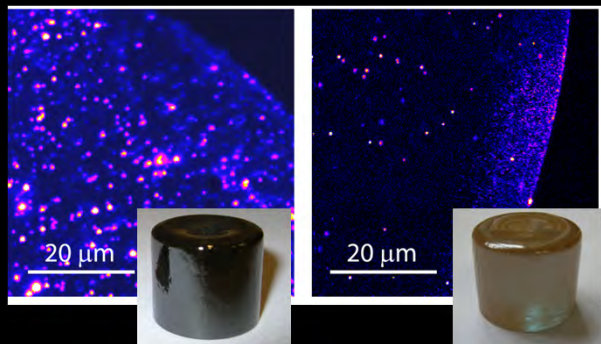
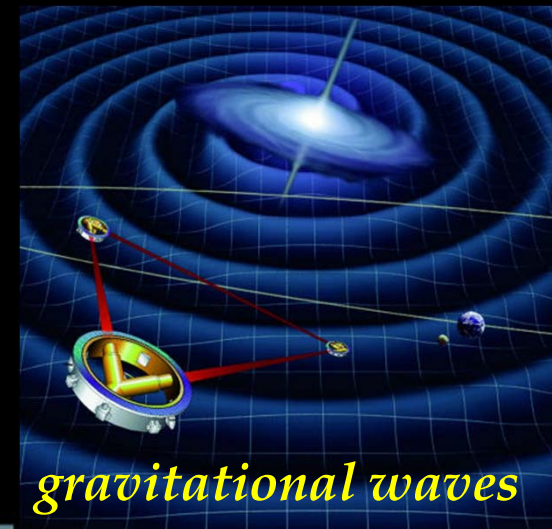
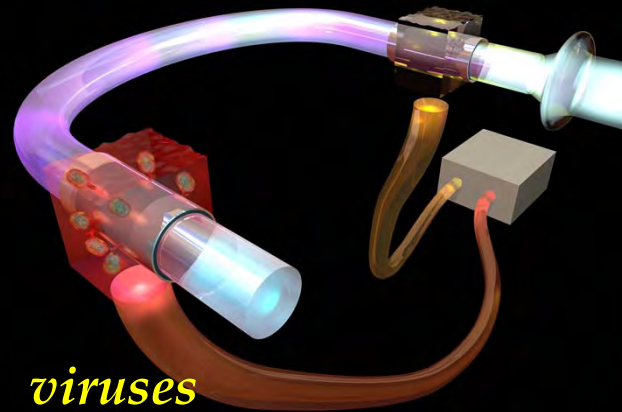
Tanya Monro, CRCA, 18 May 2011

Silica glass optical fibre research capabilities @ UoA

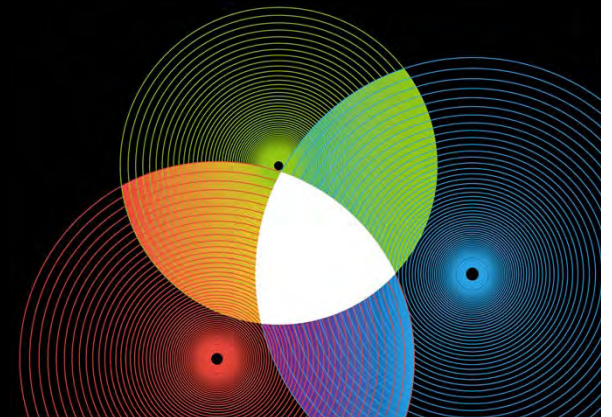
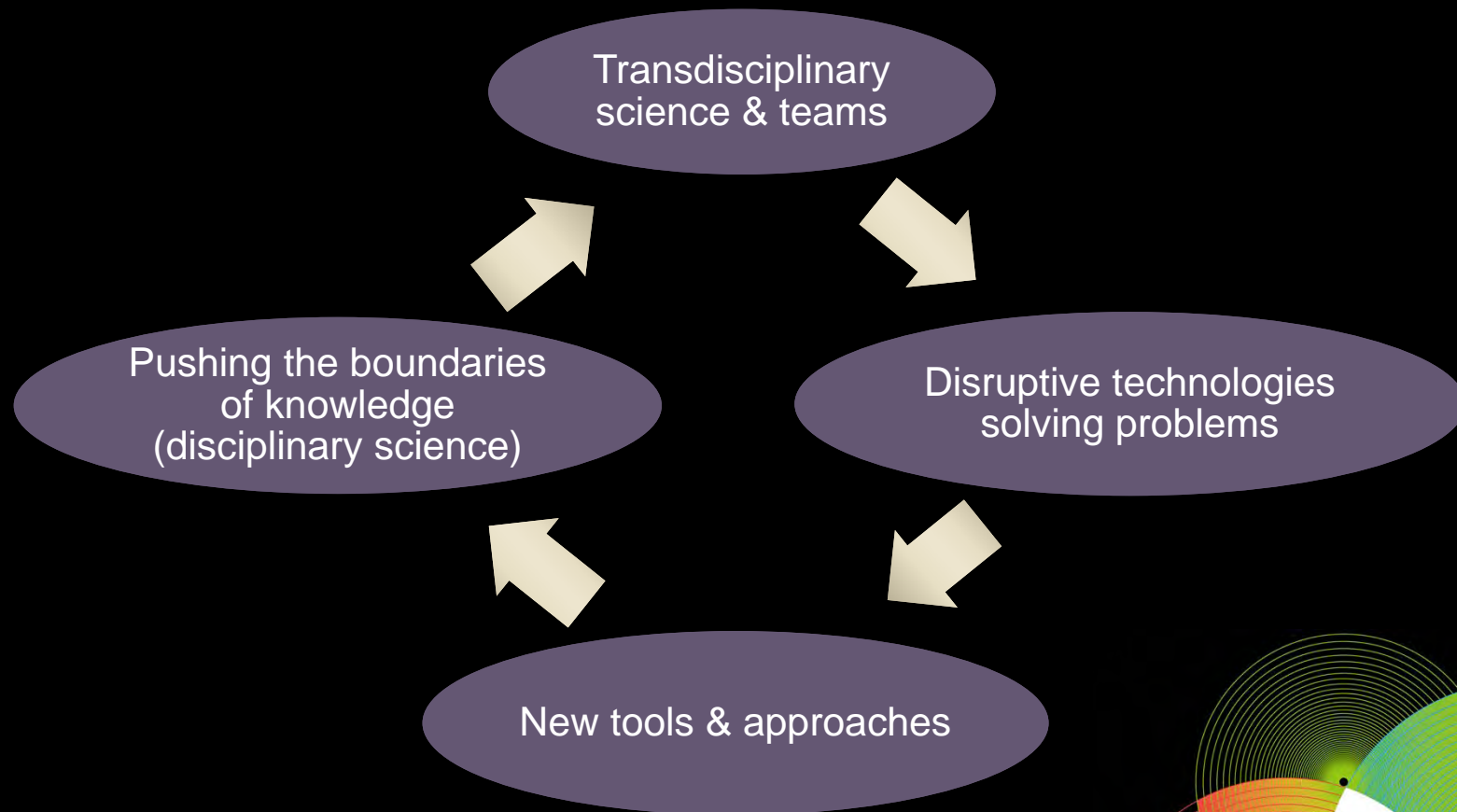


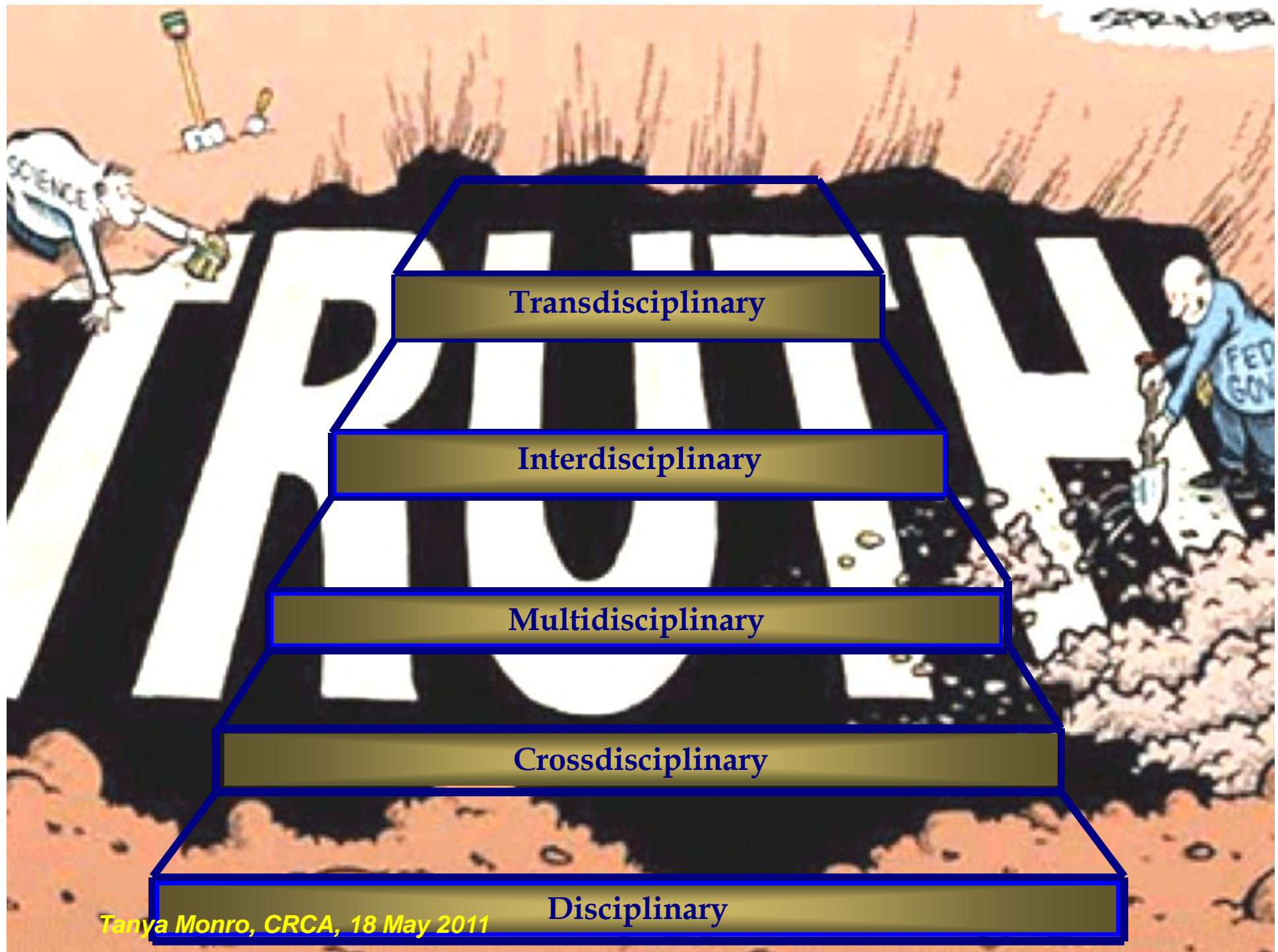
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New tools for measurement....



Transdisciplinary philosophy





Transdisciplinary

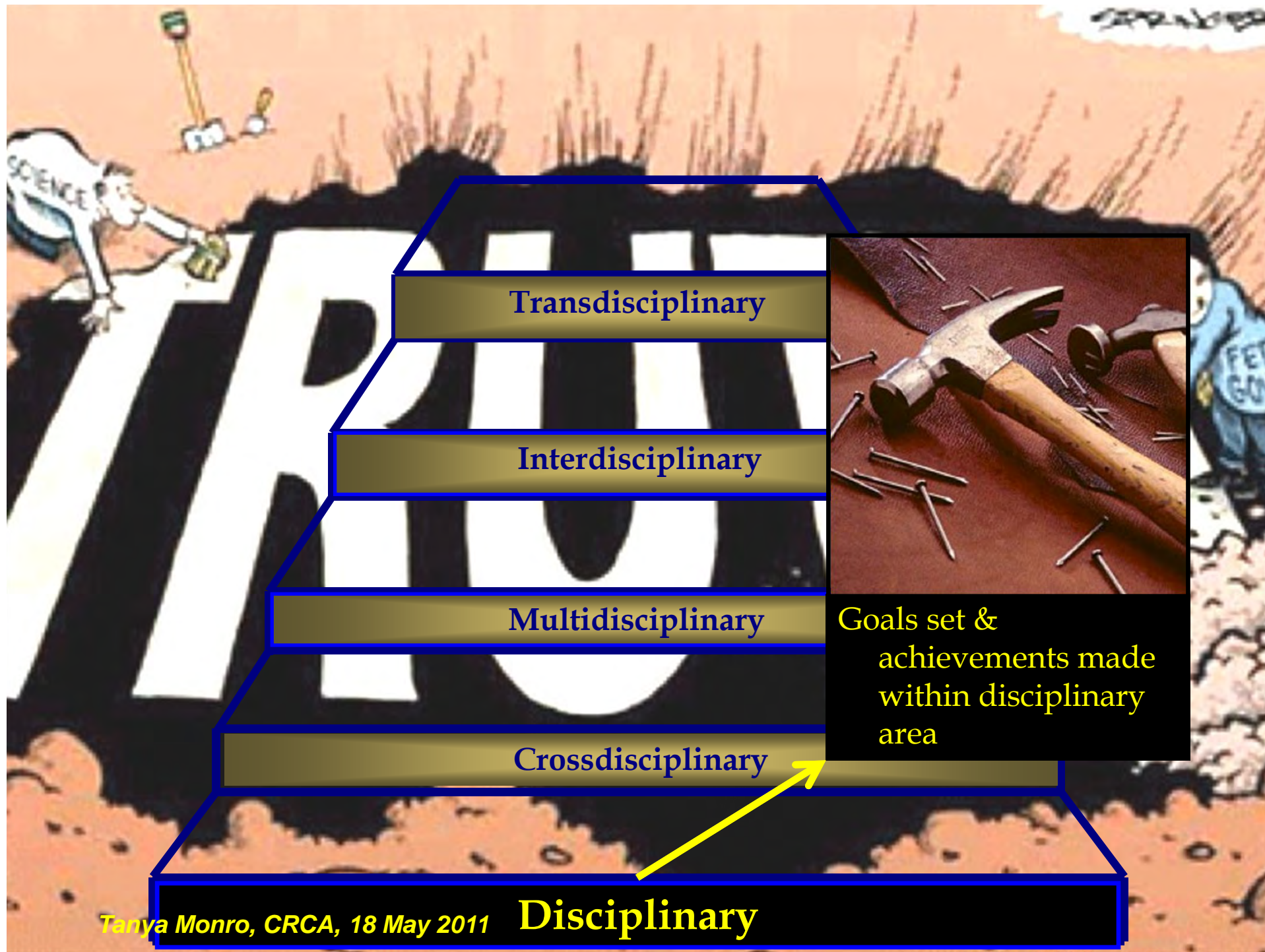
Interdisciplinary

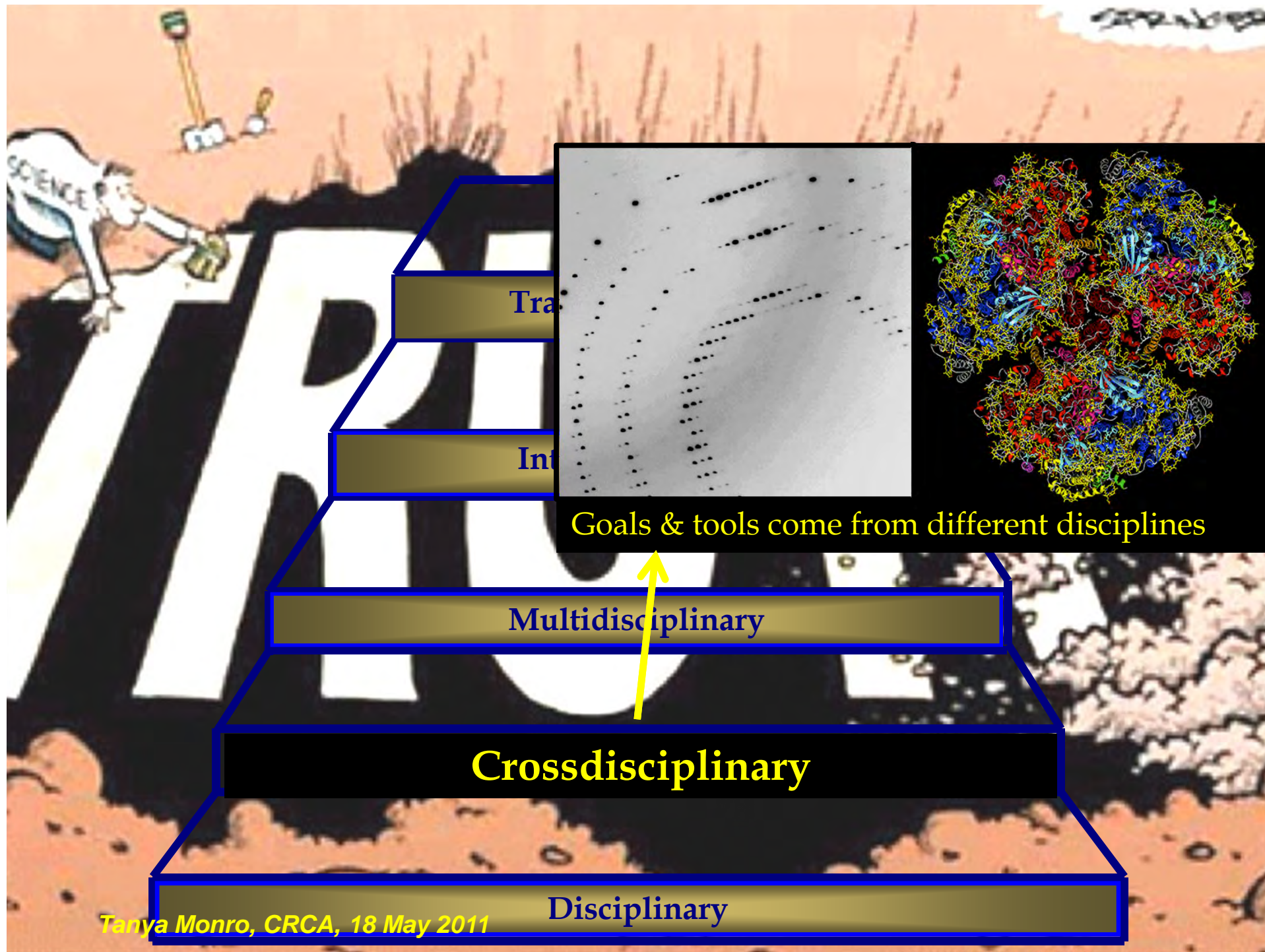
Multidisciplinary

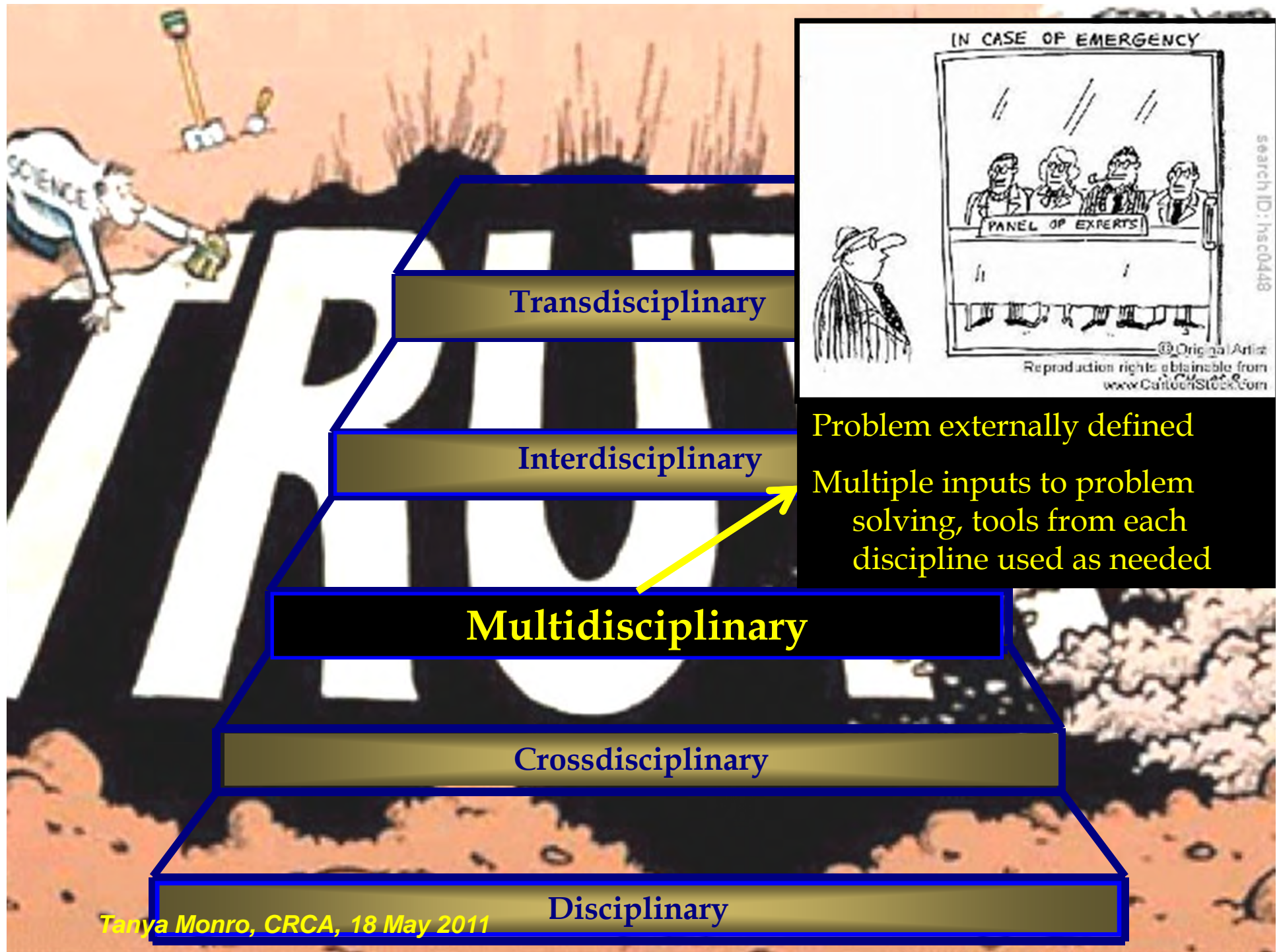
Crossdisciplinary

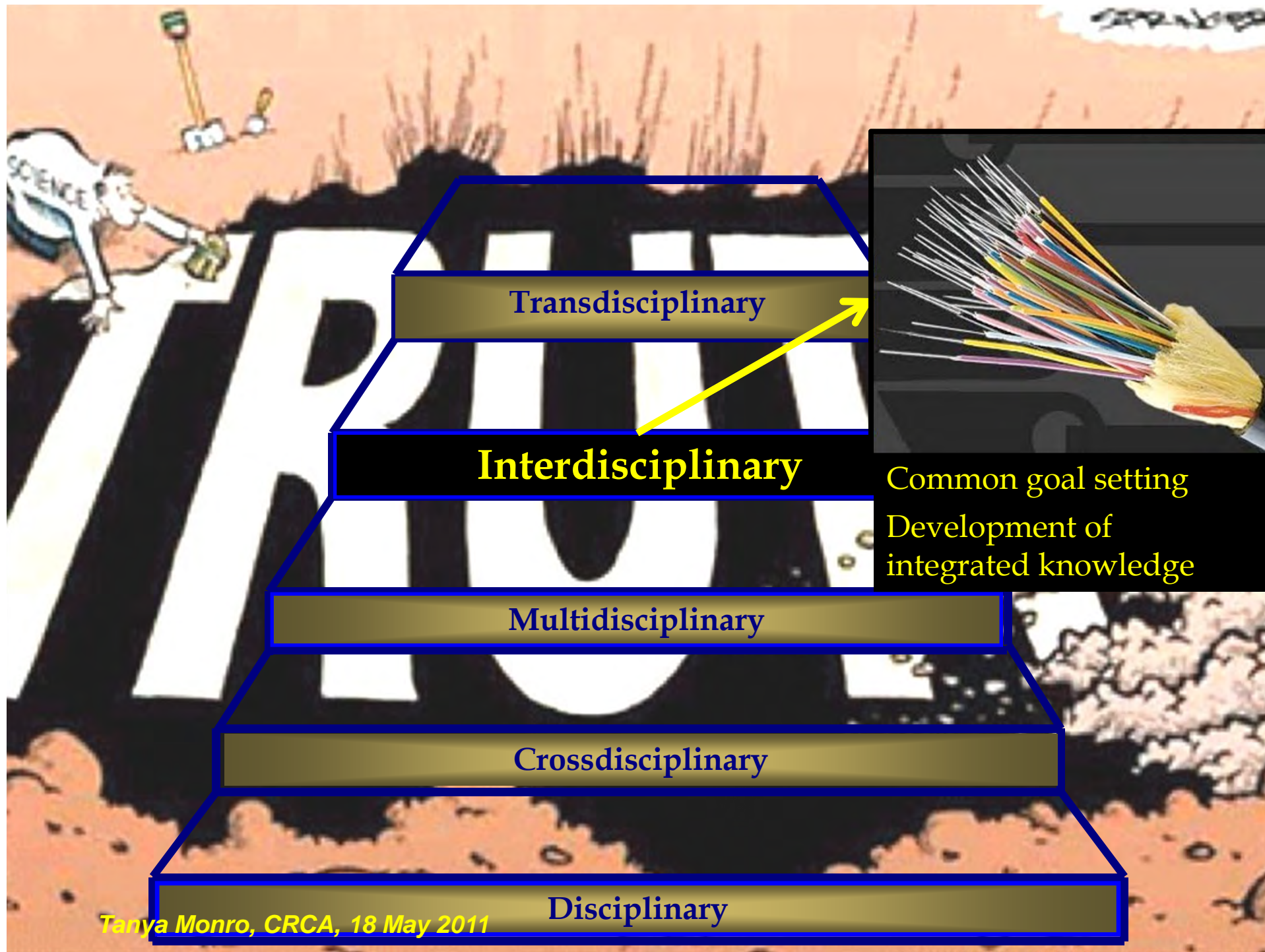
Disciplinary

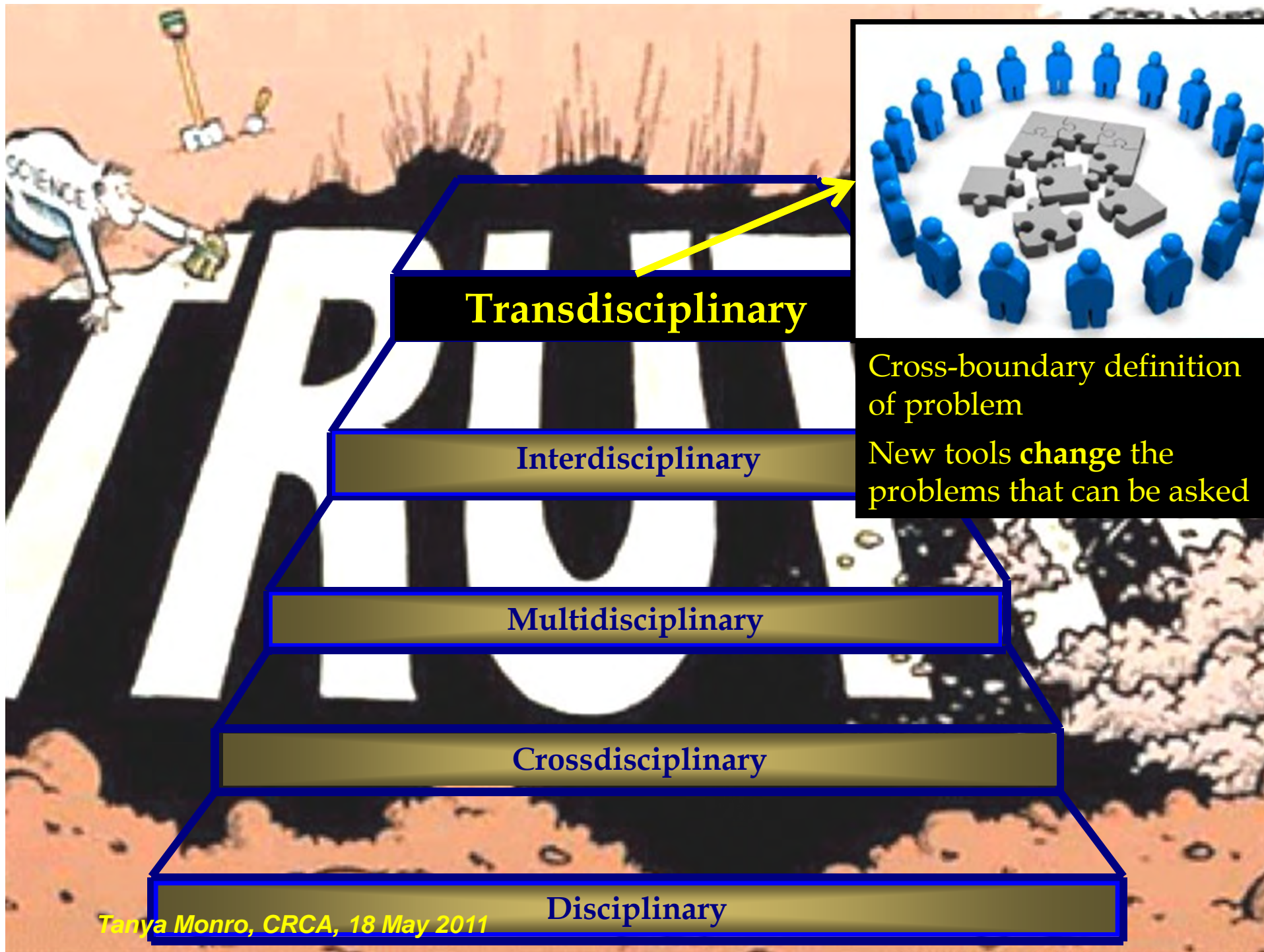
Tanya Monro, CRCA, 18 May 2011







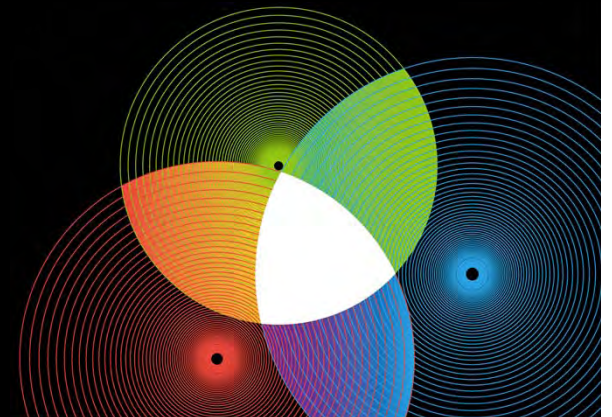




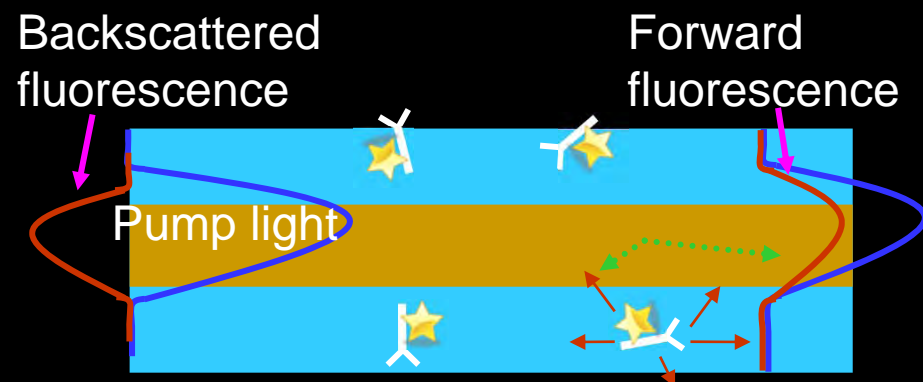
Blue sky to translational research OR translational to blue sky research?

Applications:

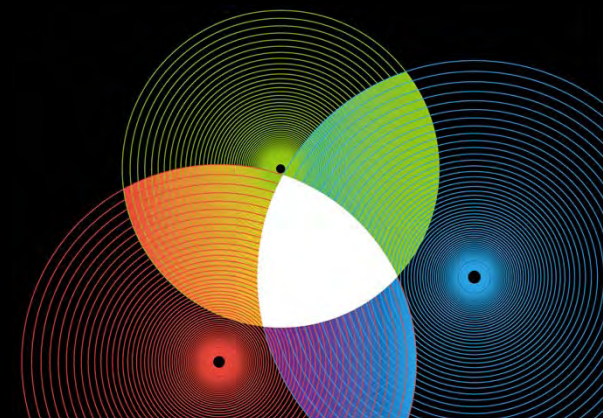
- ▣ Fuel degradation monitoring
- ▣ Corrosion monitoring
- ▣ Soil nutrient monitoring
- ▣ Radiation detection
- ▣ Virus detection
- ▣ New lasers for defence



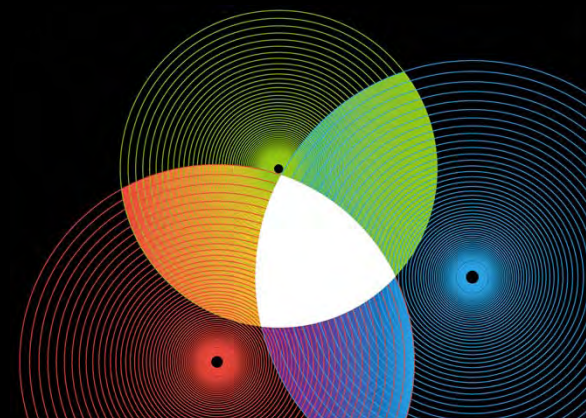
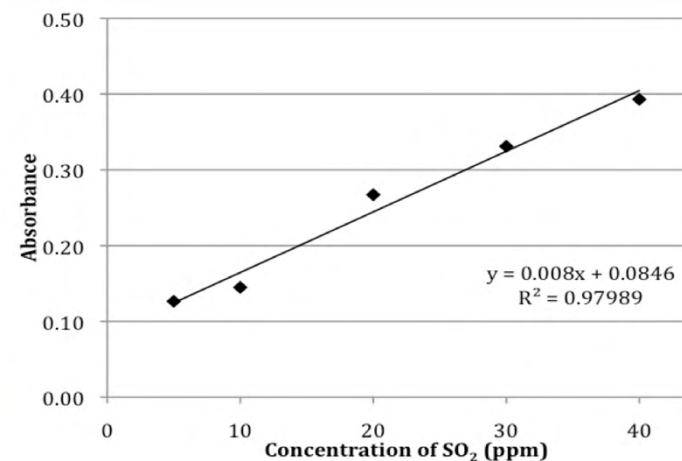
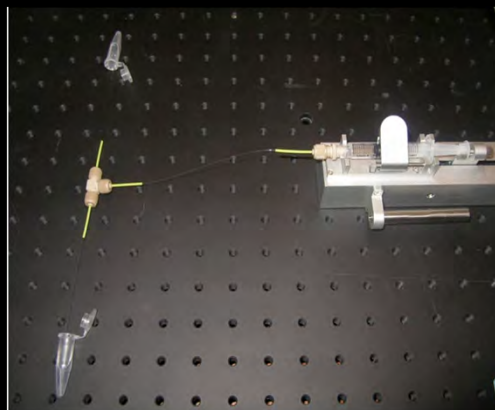
Dip sensing



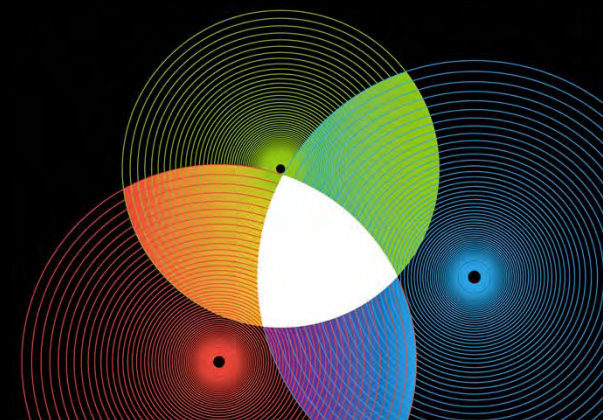
Tanya Monro, CRCA, 18 May 2011



Smart Bungs for Wine Sensing



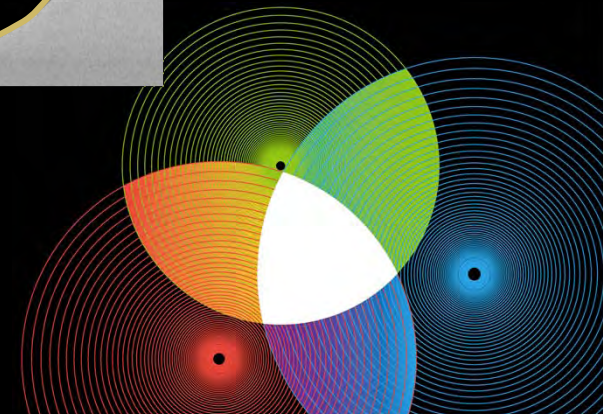
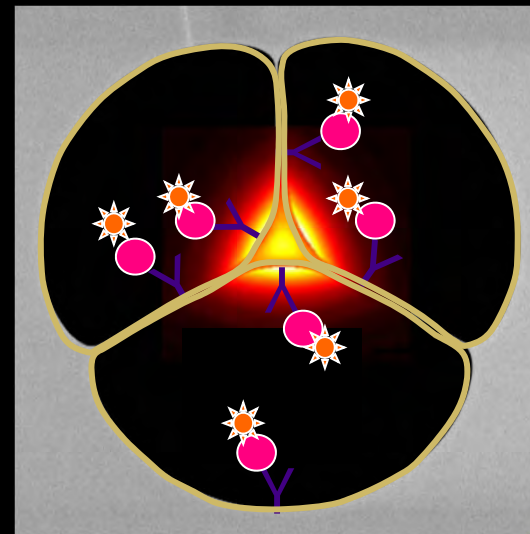
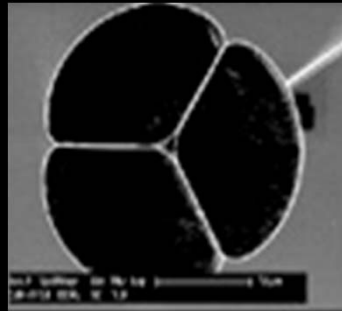
Fuel, wine and babies...



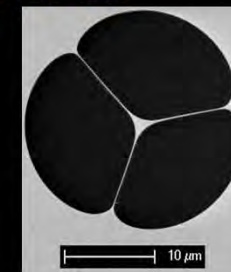
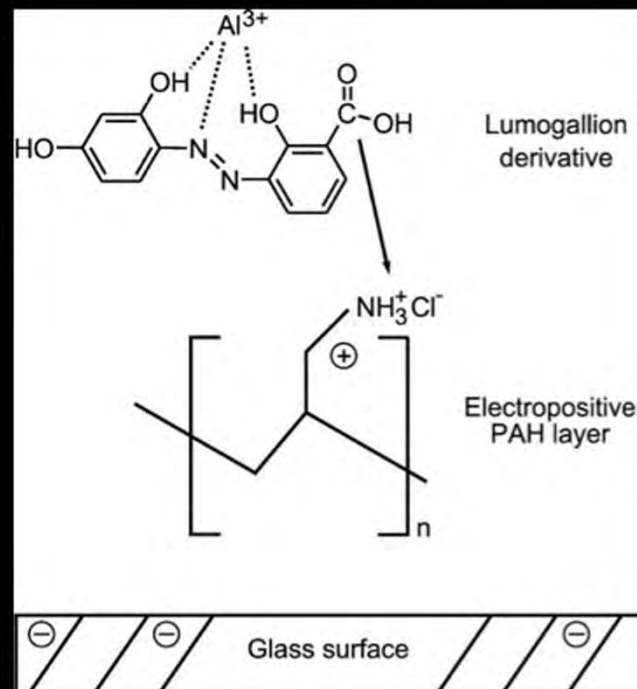
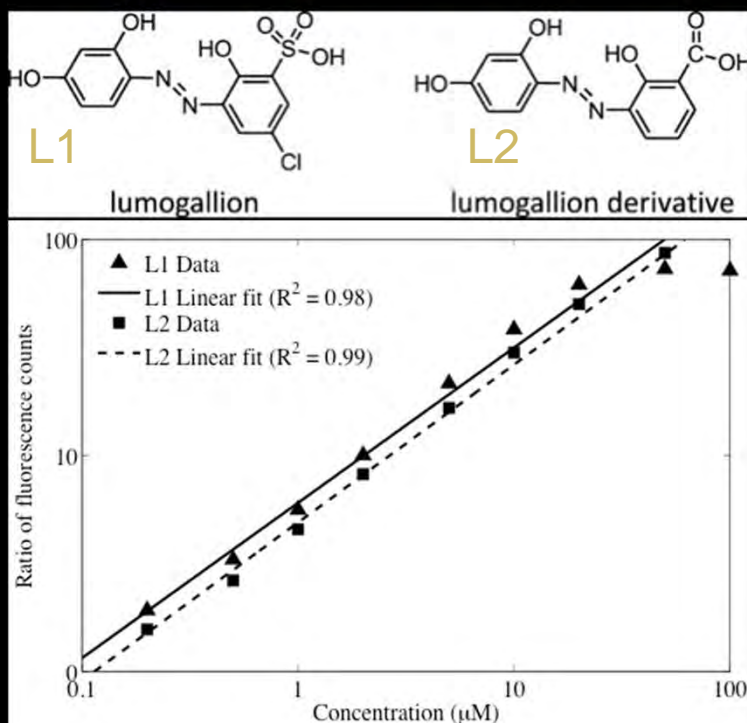
Tanya Monro, CRCA, 18 May 2011

Surface functionalisation

Use the internal surfaces of the fibres as a scaffold for adding functionality



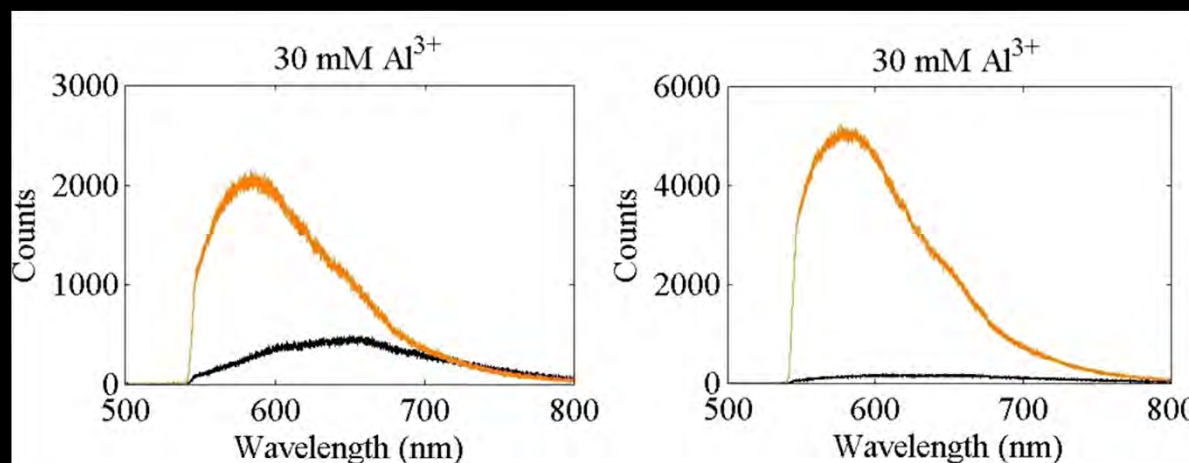
Surface functionalised dip sensors for Al



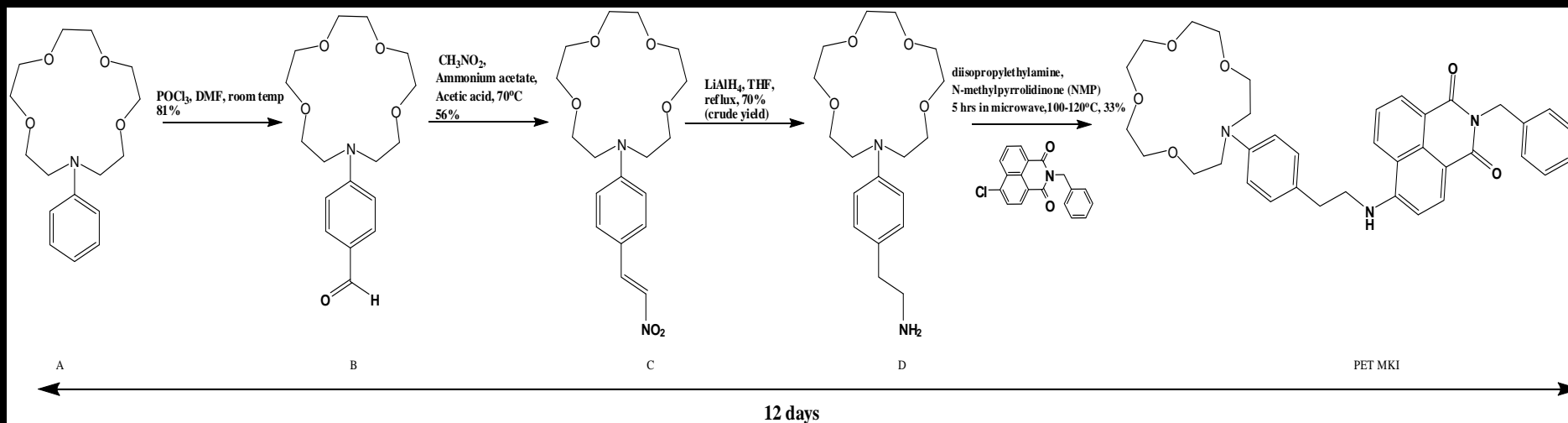
Warren-Smith
Langmuir 2011



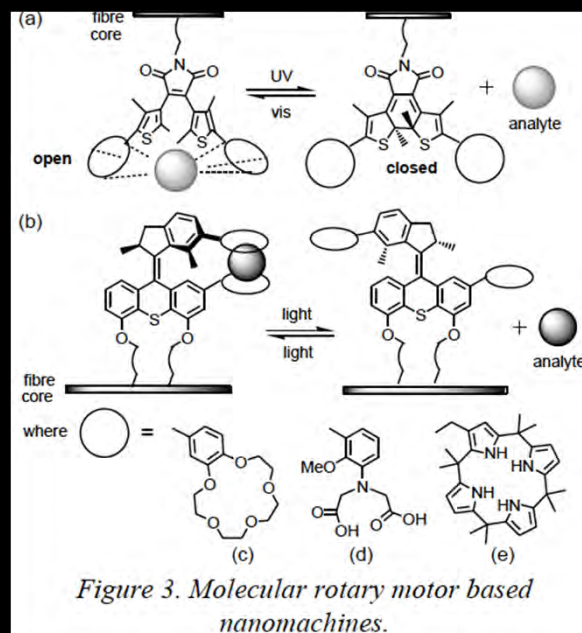
Tanya Monro, CRCA, 18 May
2011



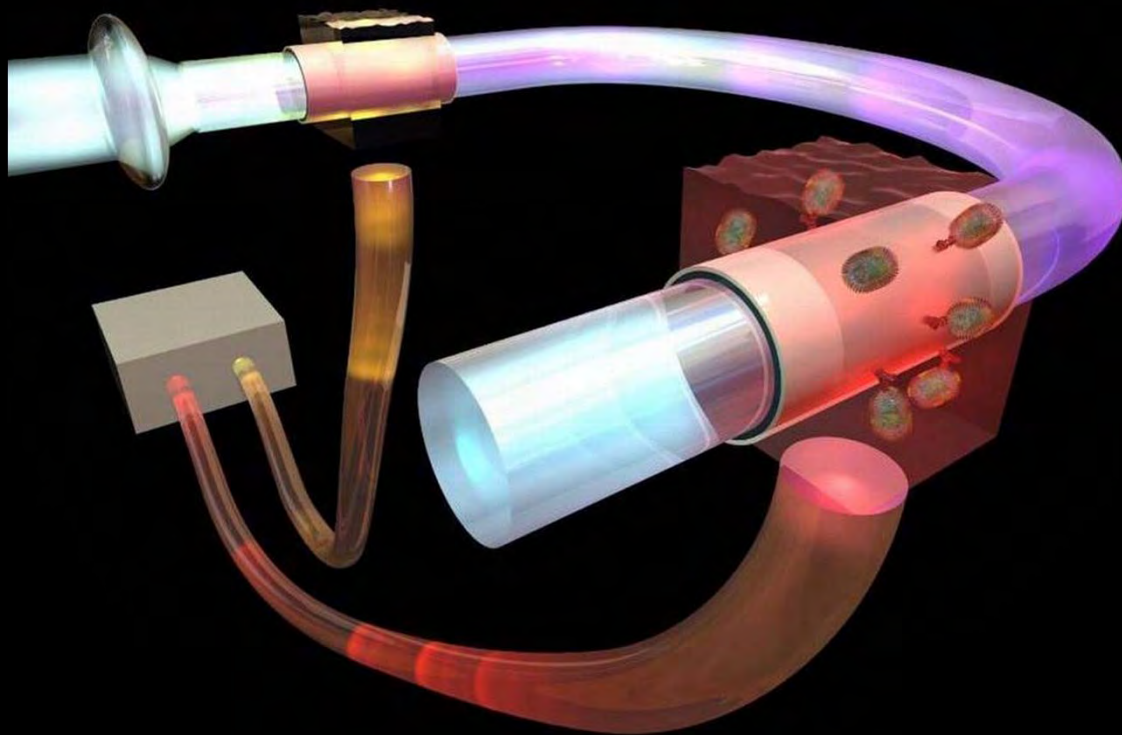
Ion selective dip sensors using the Photo-induced Electron Transfer effect



Light controlled surface functionality

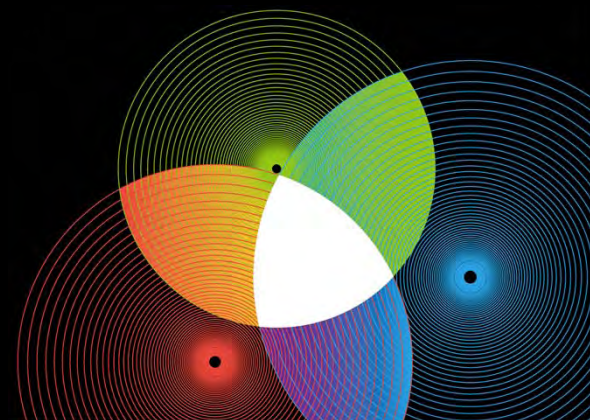


Novel optical fibre SPR system



Francois Biosensors & Bioelectronics 2010

Tanya Monro, CRCA, 18 May 2011



Influenza Detection

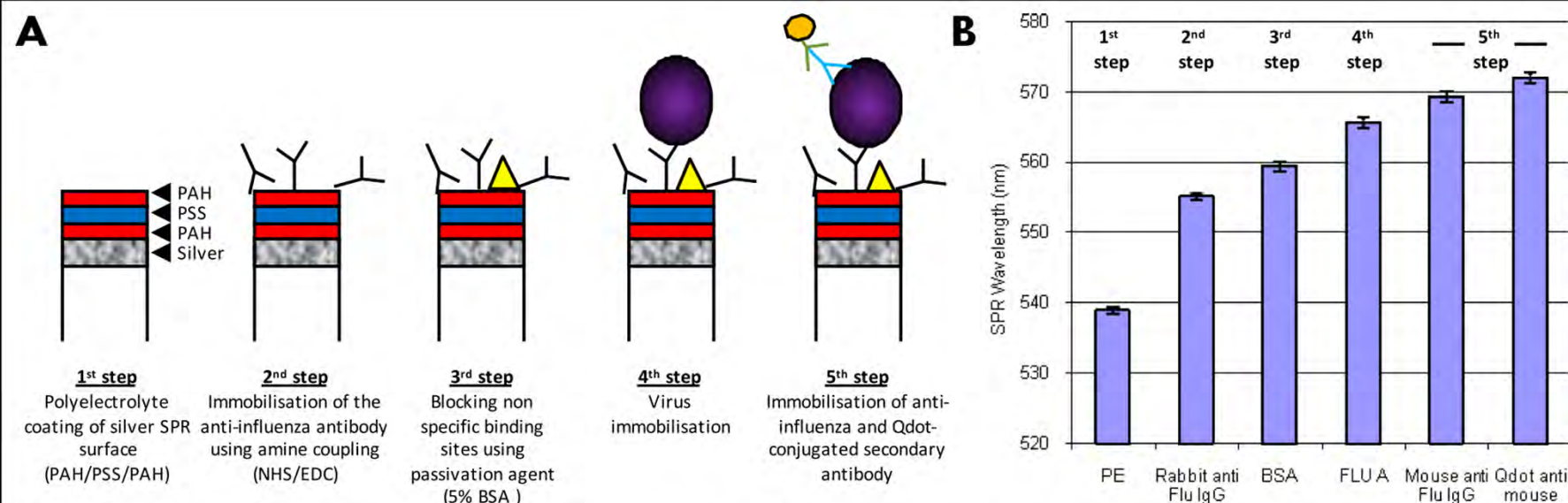
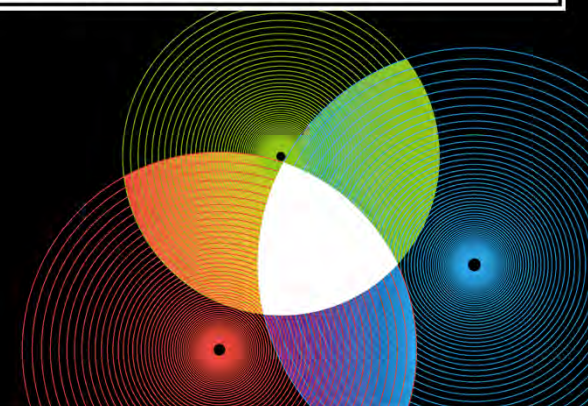


Fig. 4 (A) Schematic representation of the surface functionalisation process for the specific detection of the swine flu influenza virus. **(B)** SPR wavelength measured using the VeSPR sensor at each of the surface functionalisation steps indicating specific swine flu detection.

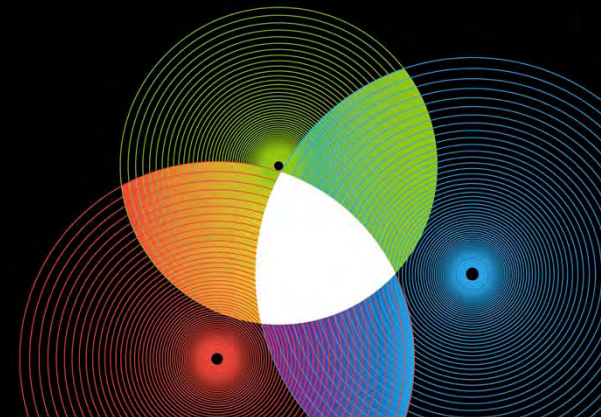
Collaboration with T. Kok, SA Pathology

Tanya Monro, CRCA, 18 May 2011



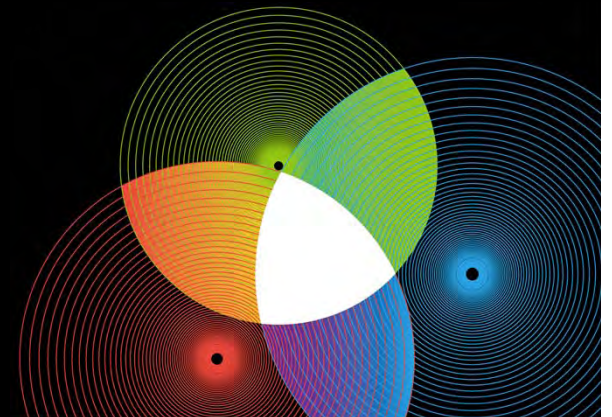
In summary...

- ▣ Optical fibres can do much more than transmit information
- ▣ Can harness light-matter interactions within emerging forms of optical fibers and devices to create new forms of chemical, biological & radiation sensors
- ▣ This requires developments in photonics, materials science, surface science, biological sciences and in the gaps
- ▣ Applications requirement feeds underpinning research capacity, creates new fundamental questions, leads in unexpected directions



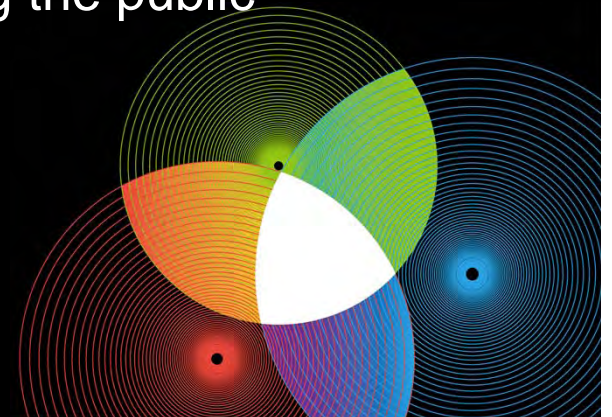
Current challenges we face

- ▣ Perception that applied research is 2nd rate
- ▣ Limited cross-over between “fundamental” and “applied” research communities
- ▣ Disciplinary silos, reinforced by: ERA, funding panels
- ▣ Need for more mobility between academic, public sector & industrial research careers

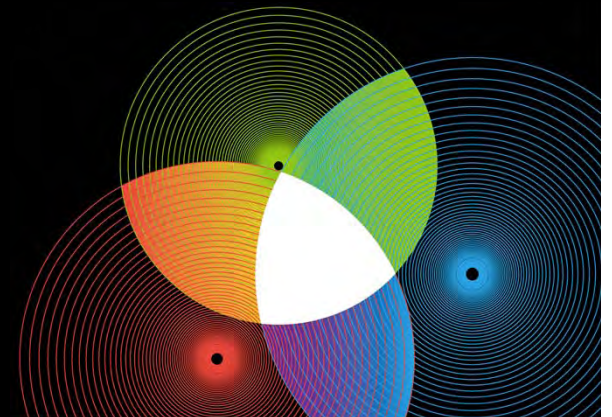
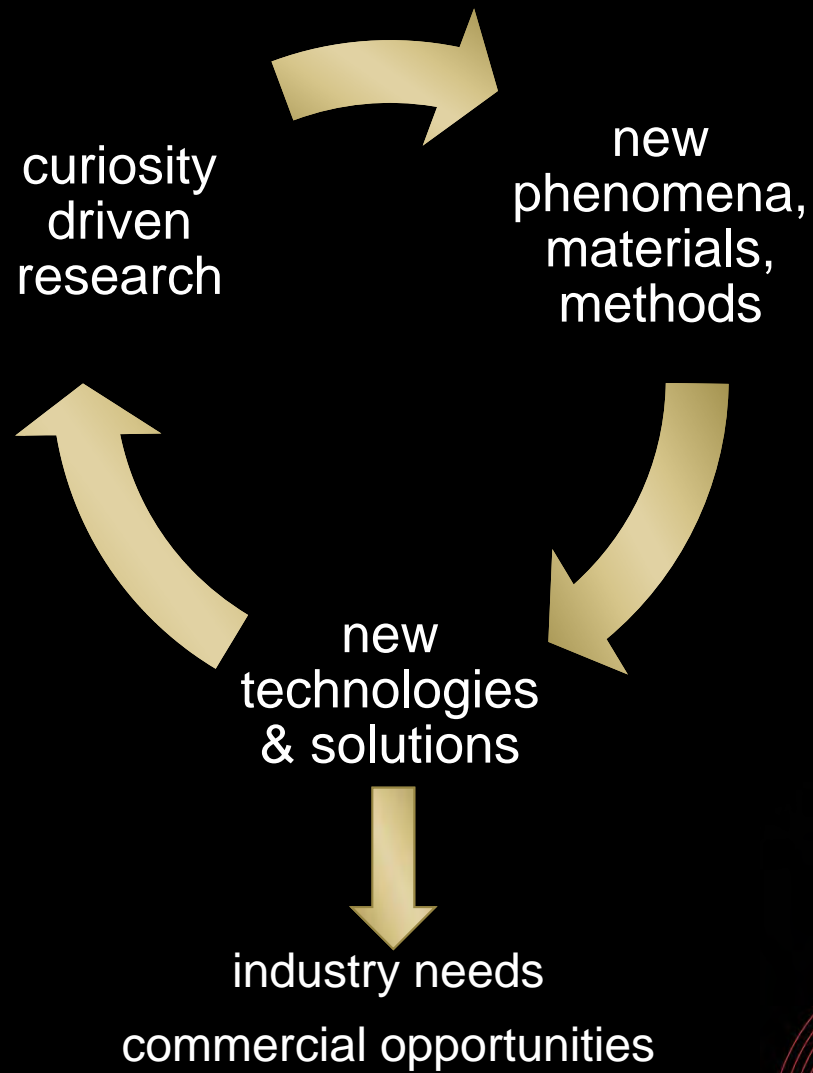


What can we do?

- ▣ Recognise excellence in all forms of research
- ▣ Seek to engage broader range of researchers and research capabilities in more applied projects
- ▣ Development & sustain underpinning capability in our areas of strength
- ▣ Seek to build new areas of strength with the capacity to deliver new science outcomes AND a diverse range of possible applications outcomes
- ▣ Encourage more movement between pure and applied activities
- ▣ Make more use of social media and online communications as a way of forging new opportunities and engaging the public
- ▣ Speak to different audiences

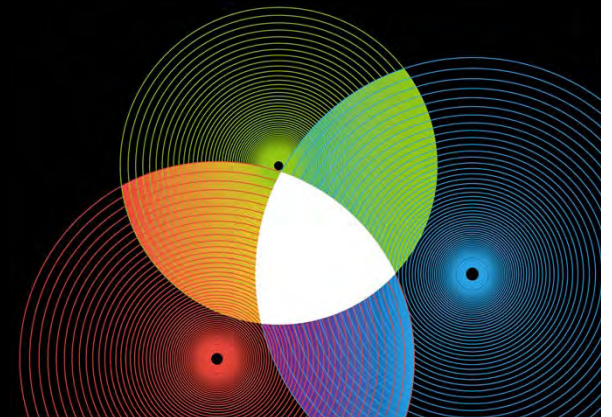


Reinforce the virtuous cycle



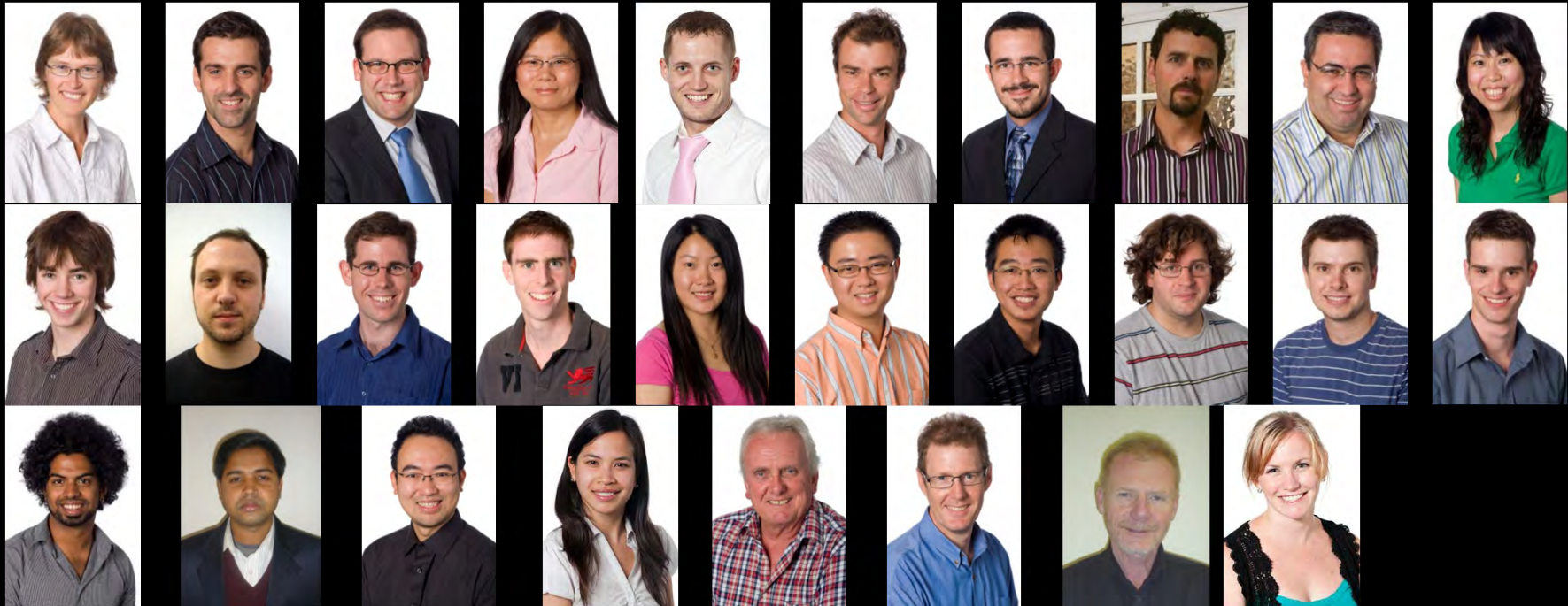
Research strategy tips

- ▣ Don't respect silos
- ▣ Understand yourself and build effective teams
- ▣ Unique research infrastructure
- ▣ Long term collaborations and partnerships
- ▣ Diversify funding sources
- ▣ Blend curiosity driven & applied research streams



Acknowledgements

Thanks to: the ARC, DSTO, SA State Govt, Federal Govt,
The University of Adelaide



Tanya Monro, CRCA, 18 May 2011