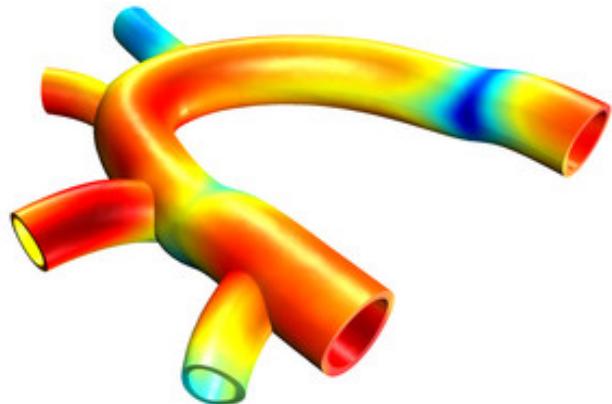


Graduate School of Biomedical Engineering

BIOM1010 Engineering in Medicine and Biology

Introduction to Biomedical Engineering

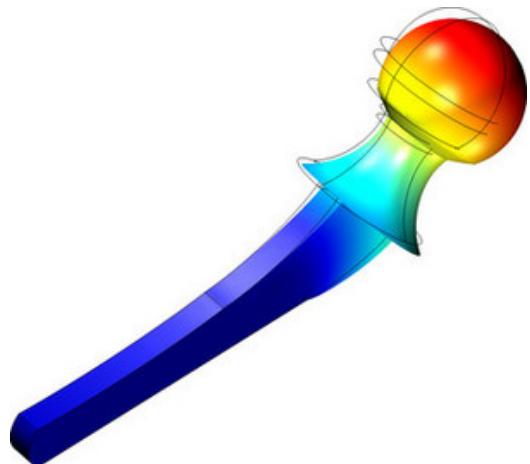


A/Prof Socrates Dokos

s.dokos@unsw.edu.au

Ext 59406

Room 506 Samuels

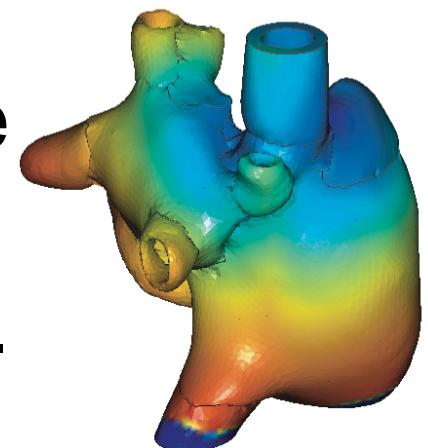
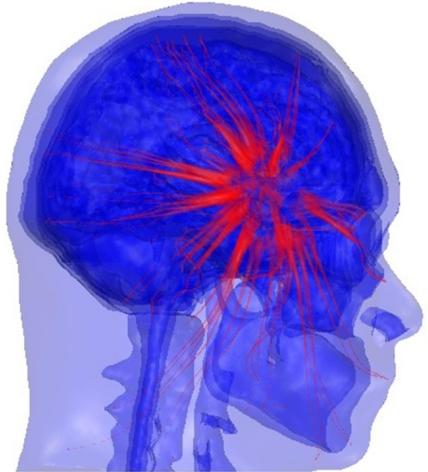


Technology in Medicine and Biology



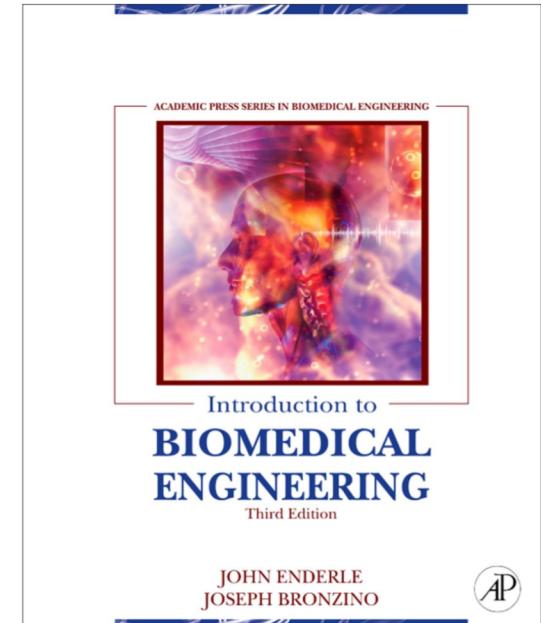
What is Biomedical Engineering

- The application of engineering techniques and analysis to problem-solving in medicine and the biomedical sciences
- Requires considerable expertise in engineering as well as the biological and medical sciences.



What is Biomedical Engineering

- ***Biomedical Engineers apply electrical, chemical, optical, mechanical, and other engineering principles to understand, modify, or control biological (i.e., human and animal) systems.***

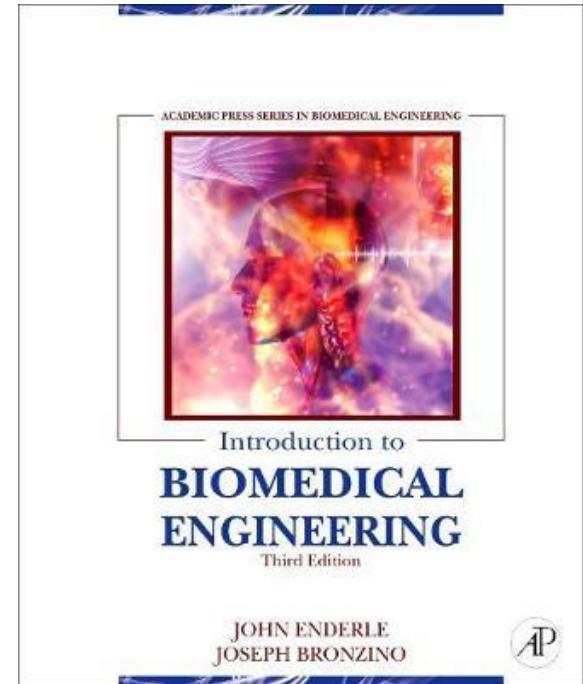


Joseph D Bronzino

Clinical Engineers are biomedical engineers who work within a hospital or clinic.

Clinical Engineers

- *Biomedical engineers who work in a hospital or clinic*



Biomedical Engineering

Interfacing engineering with medical sciences

- Cell & Molecular biology
- Anatomy
- Physiology
- Pathology
- Biochemistry
- Microbiology
- Pharmacology
- Genetics
- Embryology
- Immunology

- Medical Devices
- Biocompatibility
- Instrumentation
- Clinical Systems
- Tissue Engineering
 - Biomaterials
- Biosignal analysis
- Biomechanics
- Biosensors

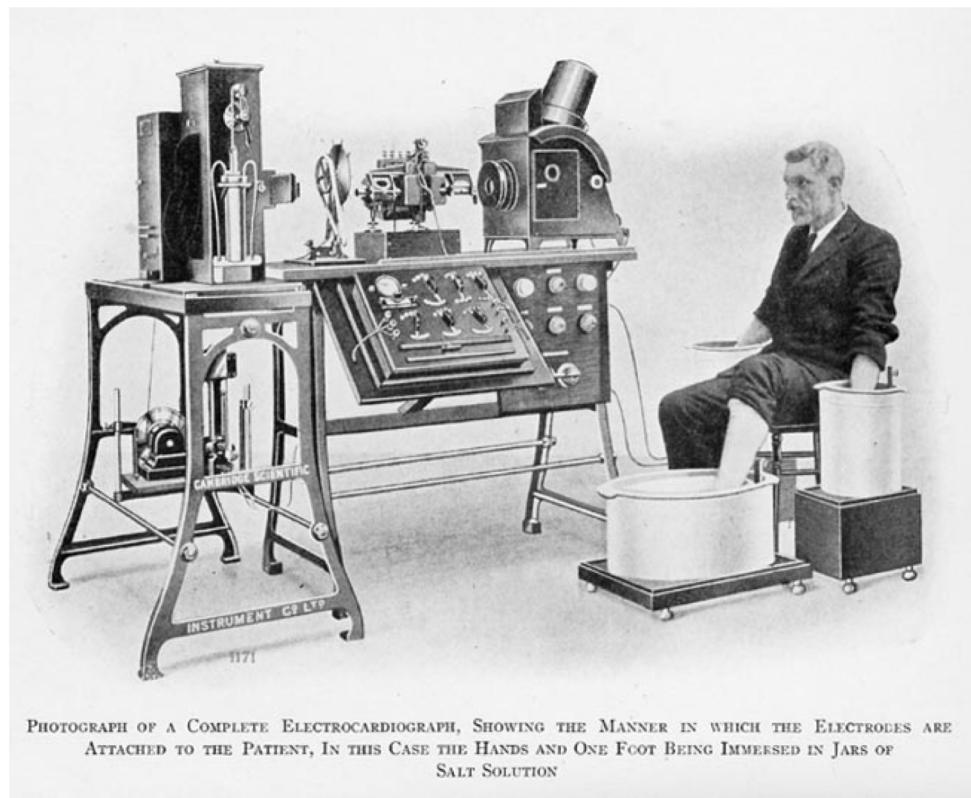
- Signal processing
- Robotics
- Instrumentation
- Bioinformatics
- Materials science
- Computational Modelling
- Process control
- Mechanics
- Software
- Polymers

What do Biomedical Engineers Do?

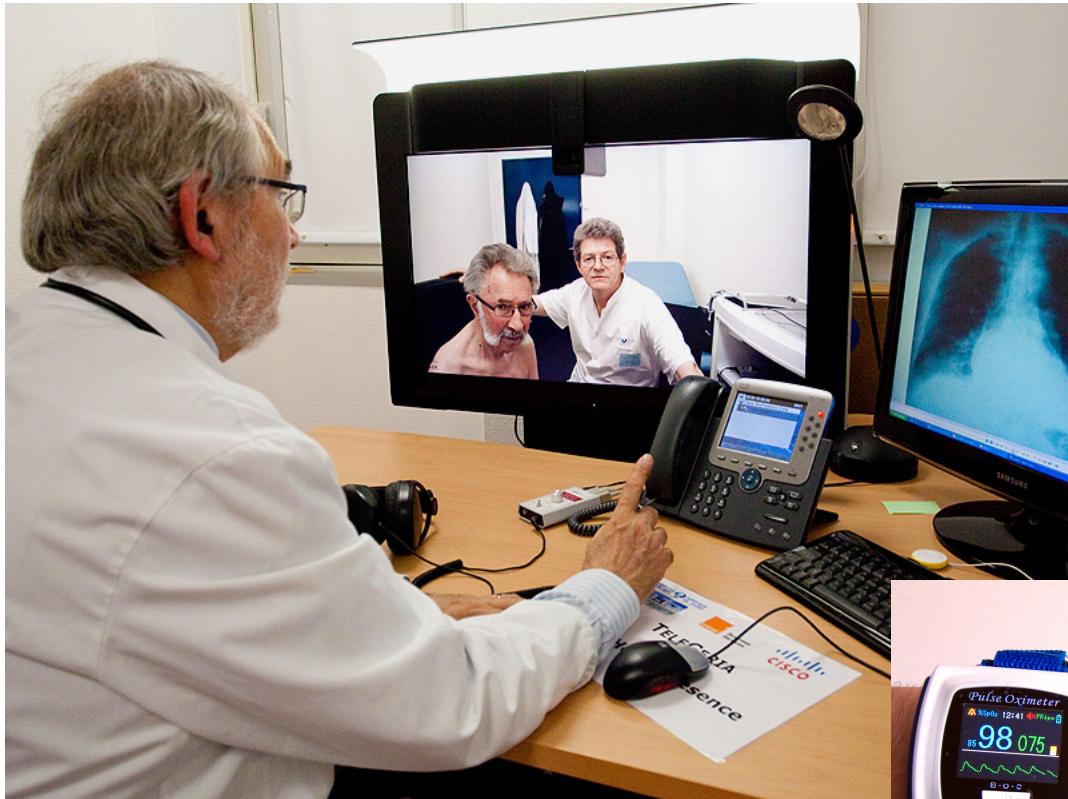
- Apply new technologies to the design, development and manufacture of medical devices & medical instrumentation
- Replacement body parts



Technology Innovation



Technology Innovation



Biomedical Engineering Disciplines

Medical & Biological
Signal Analysis

Biosensors

Clinical Engineering

Medical and
Bioinformatics

Rehabilitation
Engineering

Physiological
Modelling

Biomechanics

Prosthetic Devices &
Artificial Organs

Medical Imaging



Biomaterials

Biotechnology

Tissue Engineering

Neural Engineering

Biomedical
Instrumentation

Bionanotechnology

Biomedical Engineering Societies



IEEE



BMES
BIOMEDICAL ENGINEERING SOCIETY™

Biomedical Engineering in Australia

The screenshot shows the top navigation bar of the Engineers Australia website. It includes links for 'about us', 'join EA', 'help', 'contact', a search bar, a dropdown menu for 'Everything', and a 'LOG IN' button. Below this is a secondary navigation bar with links for 'Resource Centre', 'Training + development', 'News', 'Conferences + Events', 'Membership', and 'Engineering registers'. A third navigation bar at the bottom features icons and links for 'For Individuals', 'For Business', 'For Migrants', 'For Students + Educators', 'Communities + Groups', and 'Government + Policy'.

Biomedical College

The Biomedical College aims to be the peak representative body for Biomedical Engineering Professionals in Australia.

The College does this by offering a range of services, such as:

- Setting of standards of practice within biomedical engineering, and providing mechanisms to help attain these standards
- Hosting a broad range of continuing professional development (CPD) opportunities
- Fostering new biomedical engineering practitioners through mentoring, workshops and awards
- Facilitating partnerships with our peers including the diverse range of health and other professionals with whom the biomedical engineering team work to achieve common goals
- Providing a forum for the exchange of information on developments and issues pertaining to the biomedical engineering area of practice.
- Facilitating aid to developing and disaster-torn countries
- Supporting the accreditation of tertiary education facilities offering biomedical engineering courses in accordance with EA Stage 1 competencies and the Washington, Sydney and Dublin Accords
- Recommendations and advice regarding biomedical engineering professional practice, who can provide it, where it is necessary and how to engage these services in Australia.

If you work closely with medical practitioners, health-industry professionals, or medical and vehicle safety equipment manufacturers, then the Biomedical College is an ideal home for you.



About Us



Awards



**National Committees
& Related Groups**



**Publications &
Resources**

Local Biomedical Engineering Industries



RESMED



See also www.ausbiotech.org

Australian Medical Device Industry

- There are more than 500 medical device companies in Australia.
- Of these, 40 are ASX-listed medical device companies.
- Total market capitalisation of listed medical devices companies was \$9.546 billion in February 2012. The medical diagnostics sector is a similar size.
- Australia is the 4th largest market by revenue for medical devices and the third largest for diagnostics in the Asia Pacific, joining Japan, China, South Korea and India in the top five.
- The majority of medical technology companies in Australia (60%) employ less than 20 people, with just 10% employing more than 100 people.
- Around 80% of enterprises are concentrated on the east coast and excel in niche markets.
- Cochlear and ResMed are the biggest biomedical engineering companies in Australia
- About 30% of Australian medtech companies manufacture locally.

Medical Bionics

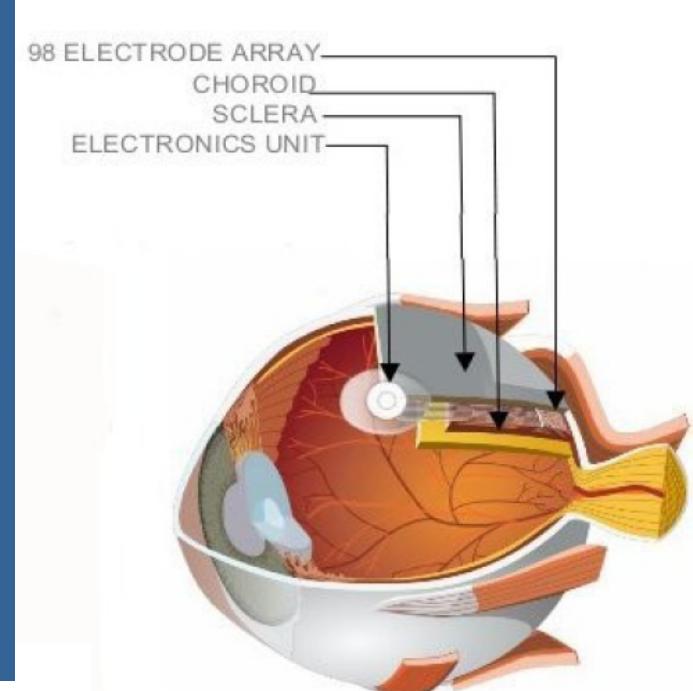
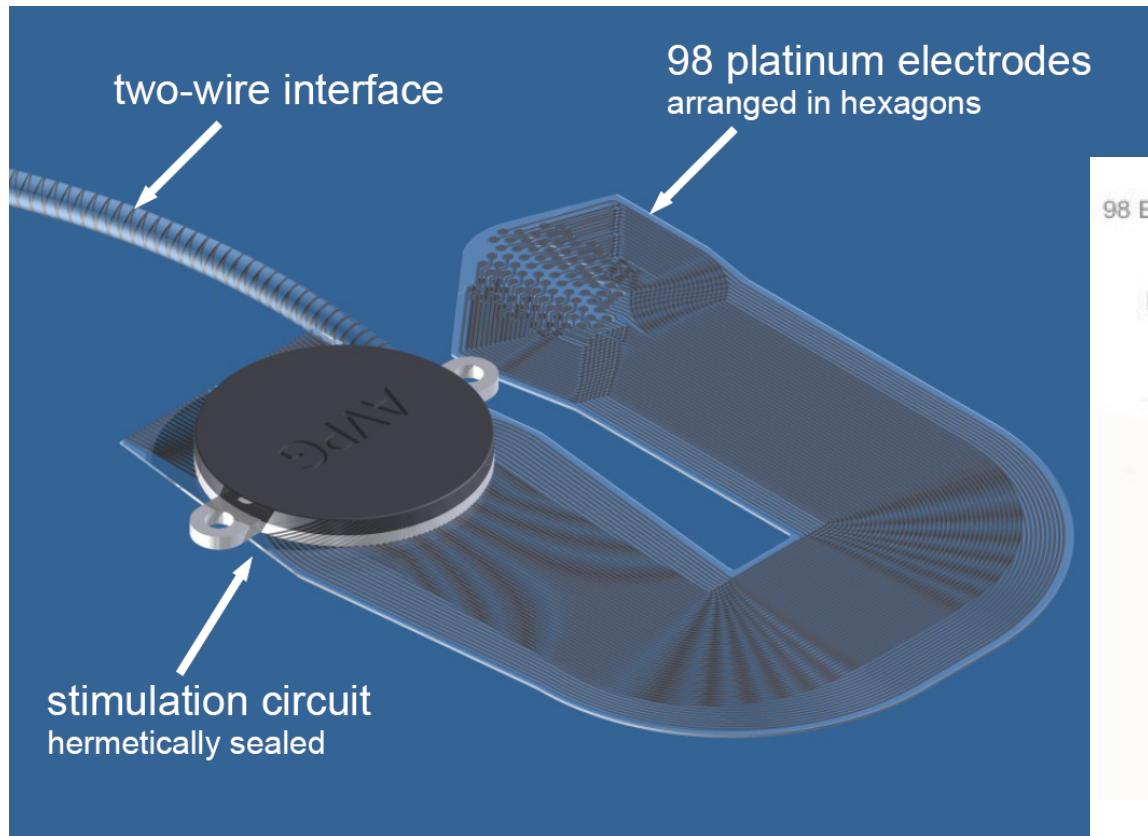
2020 summit: Rudd seizes on bionic eye idea



Prime Minister Kevin Rudd says he supports the health group's proposal for '2020 vision by 2020: a bionic eye'. Mr Rudd also flagged an increase in health funding, particularly for preventative health, which he says has been neglected. But he said it may not happen in the coming Federal Budget.

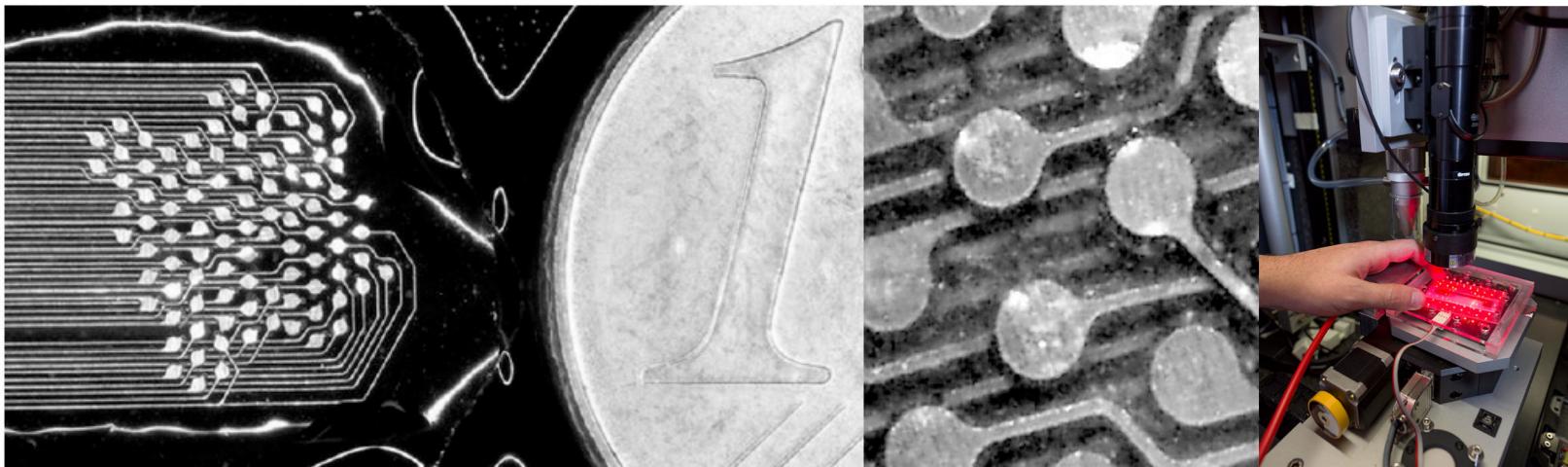
ABC News 20 April 2008

Bionic Eye: Wide-View Device



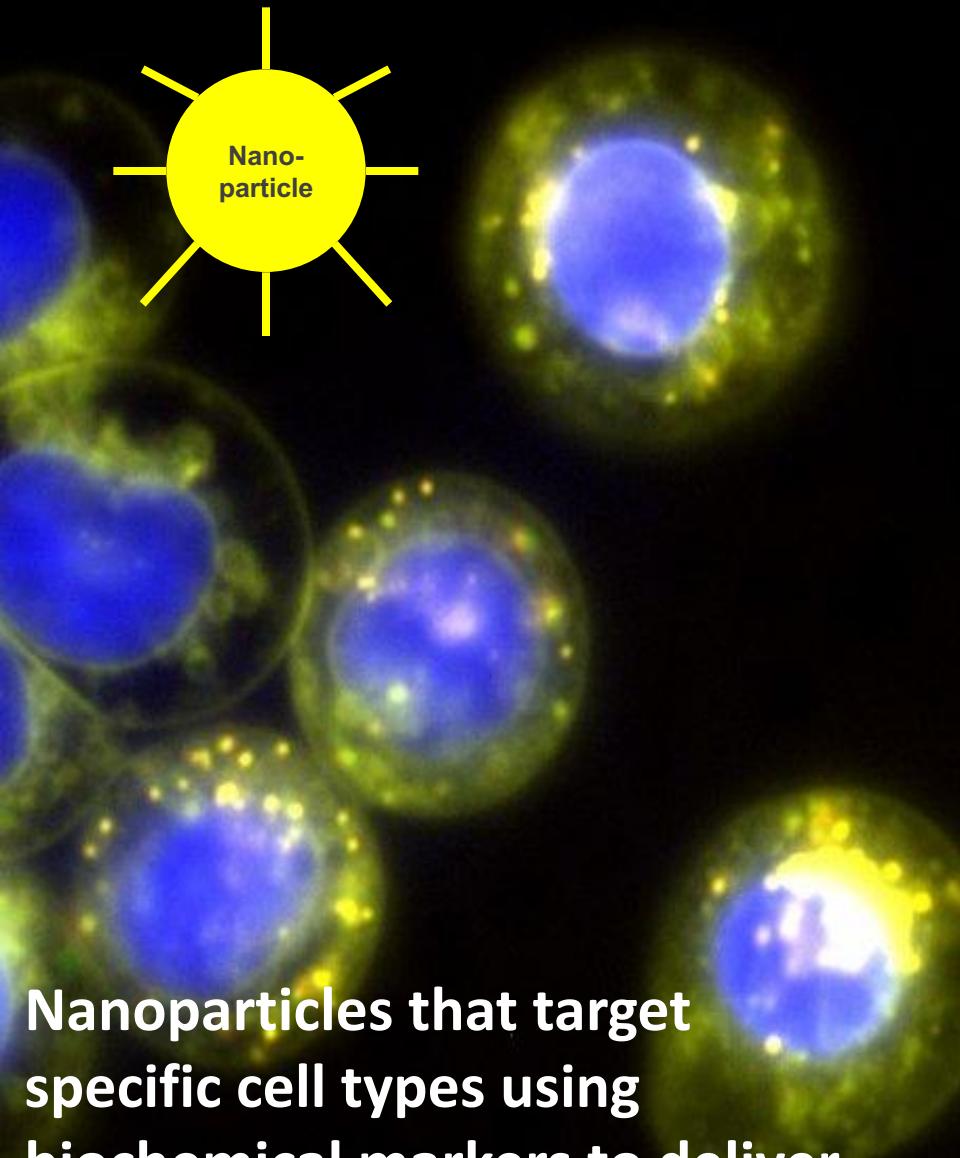
Microtechnology

- Research into multi-electrode arrays with precisely defined spatial geometries:

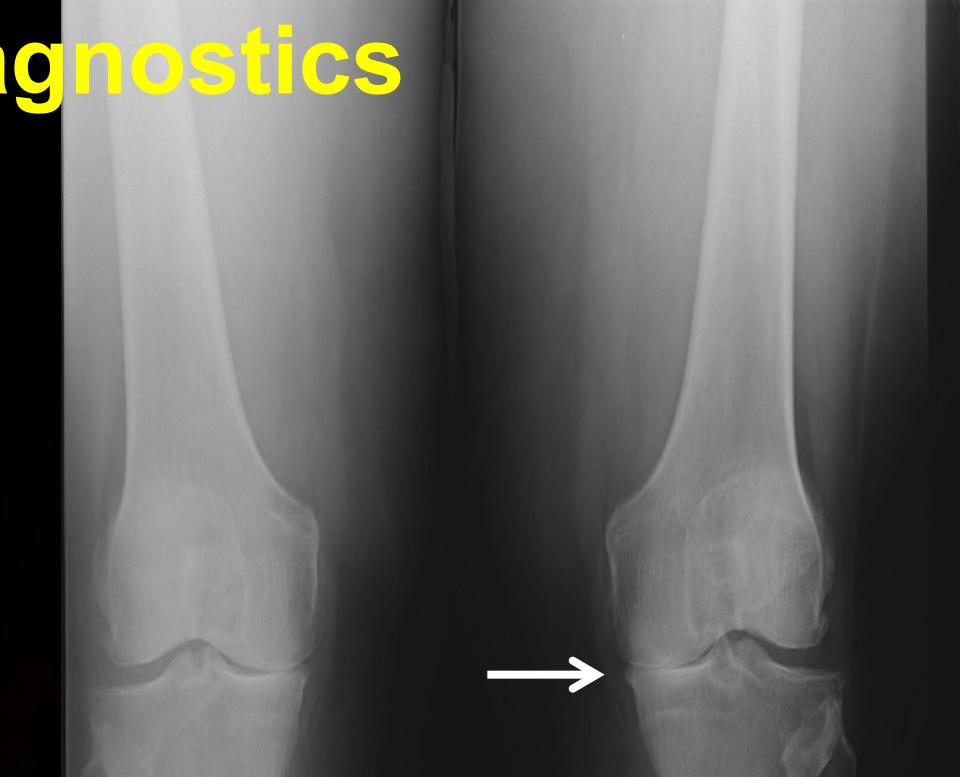


- The image shows a multi-layered, biologically inert, high-density electrode array

Therapeutics and Diagnostics



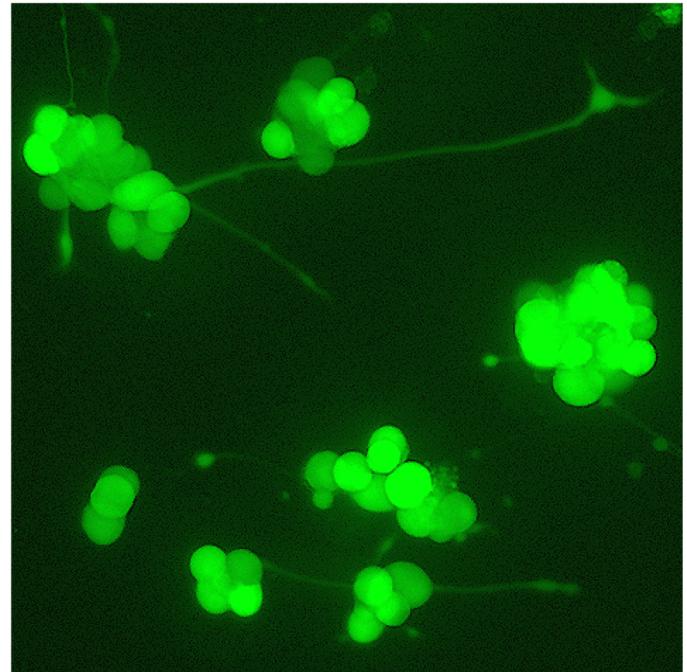
Nanoparticles that target specific cell types using biochemical markers to deliver therapeutic agents.



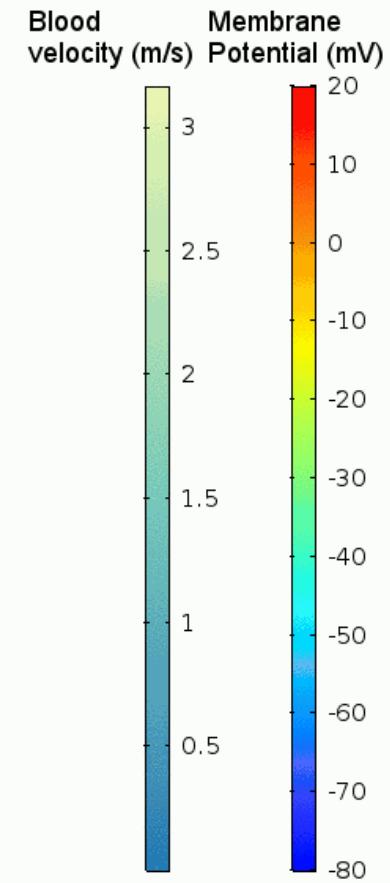
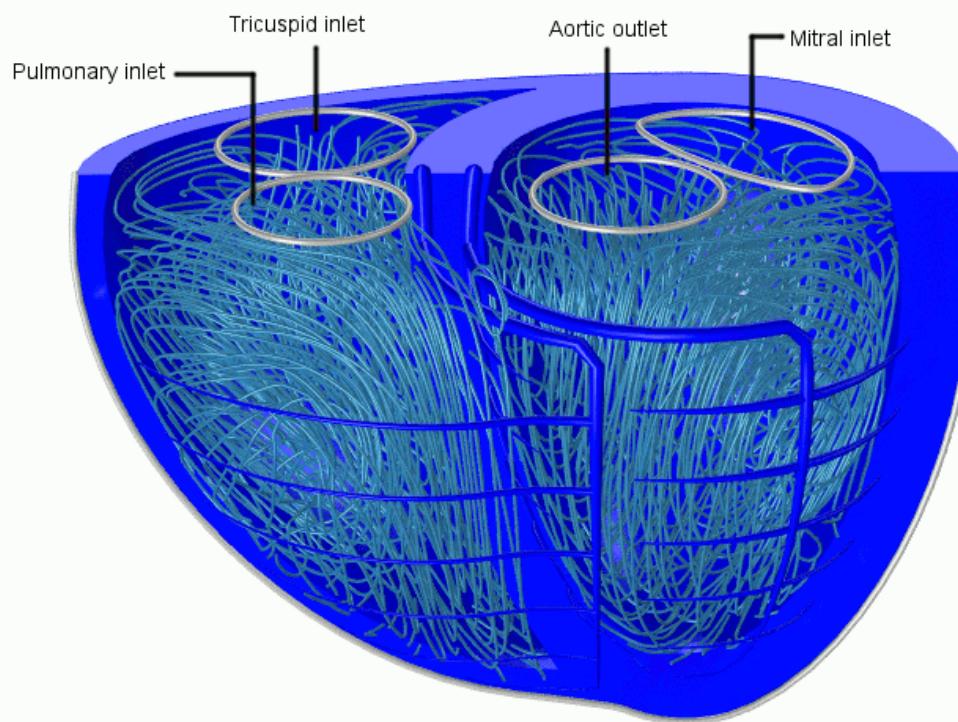
Interfacial Technology

Interface living cells with electronic systems

The image shows neurite outgrowth of living cells on electroactive-bioactive polymer coatings



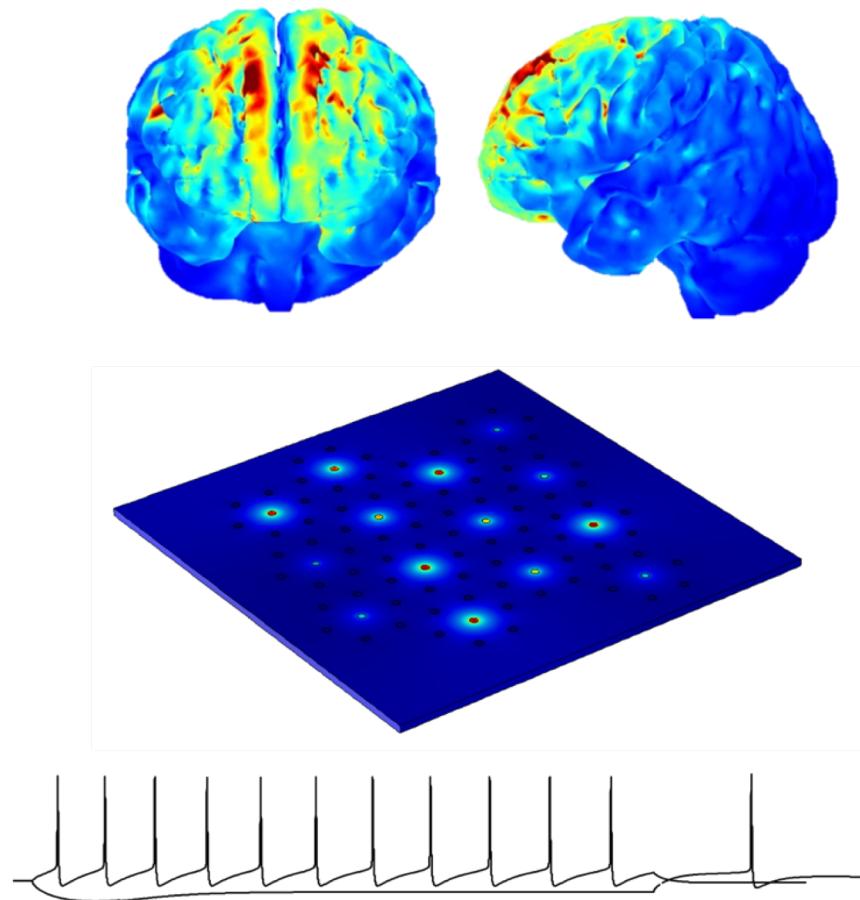
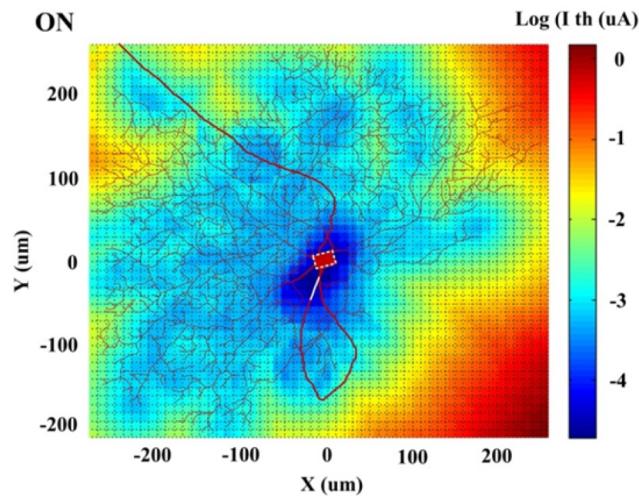
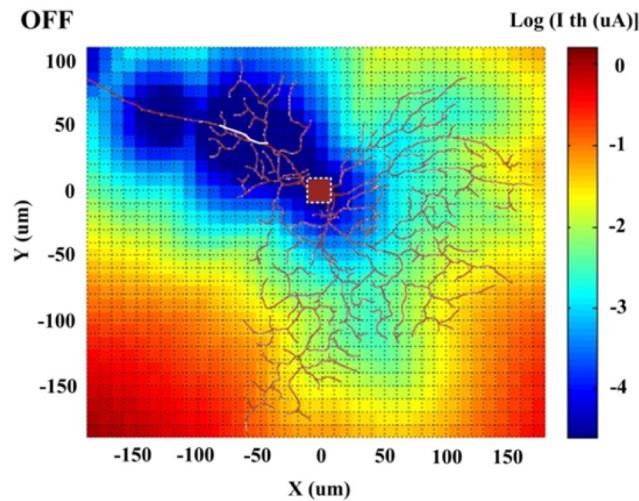
Computational Modelling



Cardiac Electromechanics

Modelling Applications

Modelling Electrical Stimulation of Neural Tissues



BIOM1010

Engineering in Medicine and Biology

What is this course about?

BIOM1010 - Engineering in Medicine and Biology

- Introduction to the field of Biomedical Engineering, where the principles of engineering are used to solve problems in medicine and biology
- Learn about the various aspects of Biomedical engineering – from experts in the field

Course Objectives

- Understand various applications of engineering and technology to medicine
- Learn to apply basic mathematics, physics and engineering methods to solve biomedical problems
- Develop analytical and information finding skills such that, given a problem involving an application of technology in medicine / biology, you can:
 - Research the relevant anatomy, physiology and pathology
 - Research the given technology
 - Analyse the problem and arrive at a solution
 - Write a concise and professional report detailing the analysis and solution, using effectively the languages of engineering and medicine/biology

Course Outline

Week	Date	Lecture (Tuesday 4-6 pm, CLB 8)	Tutorial (Various Days, Samuels 518)
1	24-7-2018	Introduction to Biomedical Engineering	No Tutorial
2	31-7-2018	Musculoskeletal modelling in physical rehabilitation	Simulation-based design of injury prevention devices
3	7-8-2018	Wound healing and infections	Graphing
4	14-8-2018	Image Processing for Physiological Measurement	Image Processing
5	21-8-2018	Ethics in Biomedical Engineering	Ethics
6	28-8-2018	Bionic Hearts	Bionic Hearts Citing & Referencing
7	4-9-2018	Implantable and Wearable Bionics	Implantable and Wearable Bionics
8	11-9-2018	Monitoring human movement using wearable sensors	Monitoring human movement
9	18-9-2018	Biomaterials & Tissue Engineering	Biomaterials
Break			
10	2-10-2018	Computational Modelling in Bioengineering	Introduction to Matlab
11	9-10-2018	Sensory neural prostheses and transcutaneous energy	Sensory neural prostheses
12	16-10-2018	Presentations	No tutorial

Assessment

- Weekly Quizzes 15%
 - 10 quizzes (1.5% each) in weeks 3-12
- Participation in tutorial / online activities 10%
- Major Report & Presentation 35%
- Final Exam 40%

Major Report

- A report on a specific medical device/ engineering application to medicine
- Includes:
 - Background
 - Current Market
 - Device Design
 - Benefits
 - Future Developments

Major Report

- **Interim Reports 5%**
 - Draft 1: Problem Definition, Potential Device Market, Relevant Anatomy and Physiology
 - Due Week 6 (2.5%)
 - Draft 2: Outline of Whole Report, Device Design, Annotated Bibliography
 - Due Week 9 (2.5%)
- **Oral Presentation (10%)**
 - Video Submission (10 minutes)
 - Peer Evaluation
 - Present to Entire Class (Week 12)
- **Written Report (20%)**
 - Due Week 12

Major Report

- Groups of 5
- Pick your own groups and topics
 - Group members must be from your tutorial class
 - Submit via Moodle by Friday, Aug 10 (Week 3)
- Those not in a group will be assigned
 - Full group and topic list released in Week 4

What is Expected of YOU

- Workload
 - 4 contact hours/week
 - Approximately 6 hours/week **non-contact**
- The expectation is that you
 - Attend every class and tutorial
 - Complete weekly online activities in Moodle
 - Revise material before weekly quizzes
 - Prepare pre-work where requested
 - Spend significant time doing your own research on your assignment topic

Who am I?

- A/Prof Socrates Dokos
 - Deputy Head of School GSBmE
 - Education Focussed Role
 - Research in computational modelling of excitable tissues (electrical and mechanical properties)
 - Undergraduate degree in Electrical Engineering (UNSW)
 - PhD in Biomedical Engineering (UNSW)
 - E-mail: s.dokos@unsw.edu.au
 - Phone: x59406
 - Office: Room 506, Samuels Building (F25)

Using Moodle

- <http://teaching.unsw.edu.au/moodle-students> for guide to accessing online courses
- BIOM1010 has now undergone a major Moodle uplift, with substantial new online learning activities, 3D virtual reality infographics and a host of other resources.
Please take advantage of these to enhance your learning and engage with the material!
- All course marks will be posted
- Use Moodle as a tool for group and work discussions
- I will regularly post announcements and other news
- E-mail me directly for urgent matters

Using Moodle

The screenshot shows the Moodle course page for BIOM1010 Engineering in Medicine (S2 2018). The left sidebar contains navigation links for the myUNSW Portal, Faculty of Engineering, and the course itself. The main content area features a decorative banner with a DNA helix and the text "BIOM1010 Engineering in Medicine and Biology". Below the banner is a summary of recent activity, including announcements, forum posts, and a feedback section. A large "Click me to start!" button is prominently displayed. To the right is a "Course Outline" table and two interactive infographics: one about biomedical technologies and another about global health issues.

Navigation

- Dashboard
- Site home
- Site pages
- My courses
 - UNSW - University of New South Wales
 - BIOM1010-5187_00850**
 - Participants
 - Badges
 - Competencies
 - BIOM1010 Home
 - Hidden area for staff use only.
 - Getting started
 - Major Assignment
 - Week X - Musculoskeletal modelling in physical reh...
 - Week X: Wound healing and infections
 - Week X: Image processing for physiological measure...
 - Week X - "Mending broken hearts": An introduction ...
 - Week X - Bionic eye and neural interfacing
 - Week X - Up, down, turn around: Monitoring human m...
 - Week X - Biomaterials and Polymers
 - Week X - Cell engineering (Robert Nordon)
 - Week X - Computational simulations in bioengineering
 - Week X: Biomaterials and tissue engineering
 - More...
- Sandpit Request Form

Settings

- Course administration
 - Edit settings
 - Turn editing on
 - Course completion
- Users
- Filters
- Reports
- Gradebook setup

BIOM1010 Home

BIOM1010 Engineering in Medicine and Biology

Announcements

Ask questions here

Recent forum posts

Lecture Recordings

Feedback matters

Click me to start!

Course Outline

Week	Lecture (CLB 8)	Lecturer	Tutorial (Samuels 518)	Assessment
Week 1	Introduction to Biomedical Engineering	Socrates Dokos	No tutorial	
Week 2	Musculoskeletal modeling in physical rehabilitation	Lauren Kark	Simulation-based design of injury prevention devices	
Week 3	Wound healing and infections	Brooke Farrugia	Graphing Data	Quiz 1 Group & Topics
Week 4	Image processing for physiological measurement	Heba Khamis	Image processing	Quiz 2
Week 5	Ethics in biomedical engineering	John Whitelock	Ethics	Quiz 3
Week 6	Bionic hearts	Michael Stevens	Bionic hearts	Quiz 4 Citing and referencing Draft report
Week 7	Implantable and Wearable Bionics	Nigel Lovell	Implantable and Wearable Bionics	Quiz 5
Week 8	Monitoring human movement using wearable sensors	Michael Stevens	Monitoring human movement	Quiz 6 Quiz 7

Interactive infographic: Where biomedical technologies apply

Interactive infographic: Health issues around the world

Plagiarism

Plagiarism is taking the ideas or words of others and passing them off as your own. Plagiarism is a type of intellectual theft.

The screenshot shows the UNSW Engineering website. At the top, there's a yellow header bar with the UNSW logo and the word "Engineering". Below it, the main navigation menu includes "News", "Events", "About us", "Study with us", "Research", and "Alumni & industry". A sidebar on the left features a yellow box with the heading "SOUND PRINCIPLES" and the subtext "A drive for gender diversity in engineering", followed by a "Read more" button. To the right of the sidebar is a photograph of two students working on a project. A vertical sidebar on the right contains links such as "Campus information", "Important information for program outlines", "Enrolment information", "Course outlines", "Timetables and key dates", "How to..", "Plagiarism" (which is highlighted in red), "Forms", "Workplace Health and Safety", "Entrepreneurship in Biomedical Engineering", and "ALUMNI & IN". At the bottom, there are buttons for "FUTURE STUDENTS" and "CURRENT STUDENTS", along with an "Outbound student exchange" link.

The screenshot shows a Google Doc titled "Non-Plagiarism Declaration". The document is a form with several input fields. It starts with the University of New South Wales logo and the title "Non-Plagiarism Declaration". There are three rows of input fields: the first row has three columns labeled "Student Number", "Family Name", and "Other Names"; the second row has two columns labeled "Course ID" and "Course Name"; the third row has two columns labeled "Submission Date" and "Course Coordinator/Lecturer". Below these fields is a large empty input field labeled "Assignment Title". At the bottom, there is a statement: "In preparing this assessment task I have followed the [Student Code of Conduct](#). I certify



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Thank You!