

Medical Devices Team 医疗仪器开发团队



Scientia Prof Nigel H Lovell
Team leader



Dr Michael Stevens

Fall detection & prevention

便携式摔倒检测 / 预防 器件



Prof Gary Housley

Gene electrotherapy
基因电疗法

Dr Rylie Green



Dr Aaron Gilmour



A/Prof Stephen Redmond

Biological electrode
可植入生物电极



Dr David Chang

Facial paralysis diagnosis
面肌麻痹辅助检测仪器

Prof Laura Poole-Warren

Dr Josef Goding

Prof John Morley



Dr David Tsai



Dr Alejandro Barriga-Rivera



Dr Marc Patrick Zapf



Implantable bionics
可植入仿生器件

Prof Gregg Suaning

A/Prof Socrates Dokos

Dr Amr AlAbed

Dr Tianruo Guo

Dr Lilach Bareket

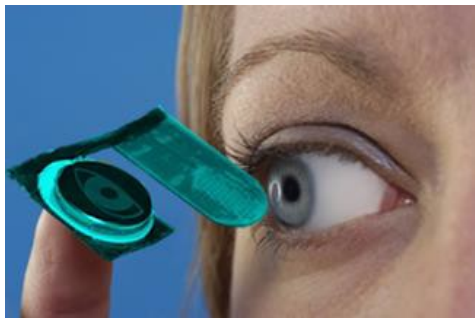
- Research and intellectual property focussed on implantable bionic devices and biomaterials 我们着重研究与开发可植入医用器件及材料
- Multidisciplinary group with both industry and university collaborations across Australian and internationally 我们汇集了澳洲国内外多家合作企业与研究单位

Biomonitoring and Bionics 生物监测与仿生器件技术

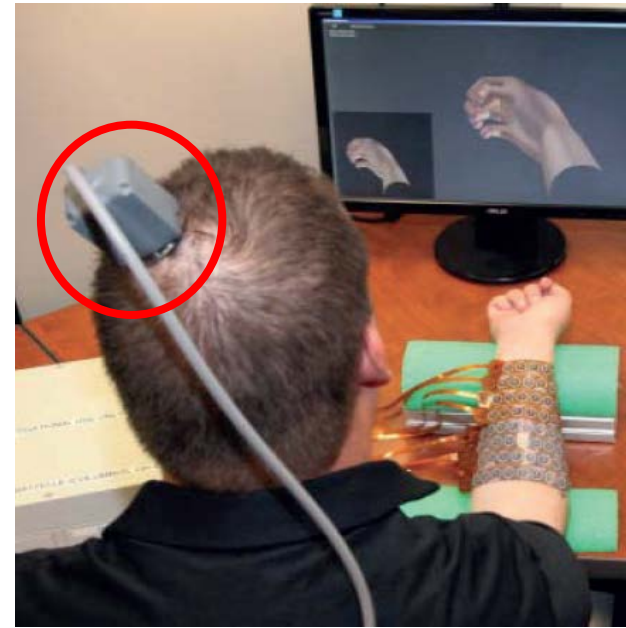
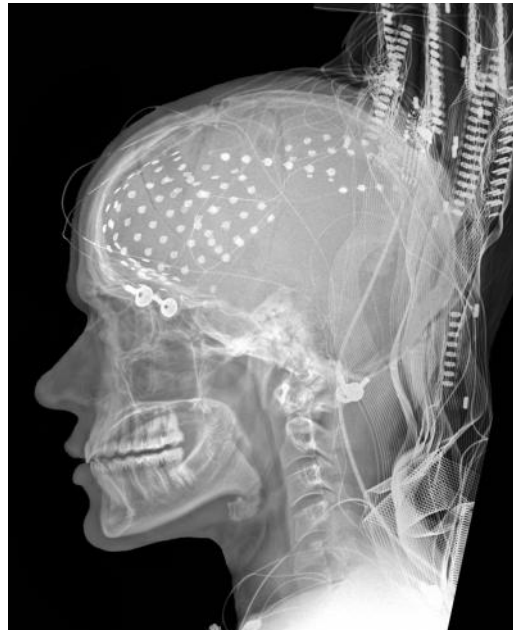
Implantable sensors and devices 可植入传感器及医疗器件
(bionic eye, heart assist devices)

Wearable sensors and Smartphone Apps 便携传感器，智能手机软件
(falls detection/prevention/activity classification)

Clinical measurements for management of chronic disease 慢性病远程监测
(telehealth monitoring, decision support systems)

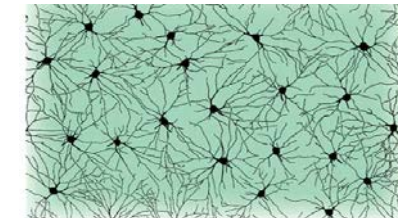
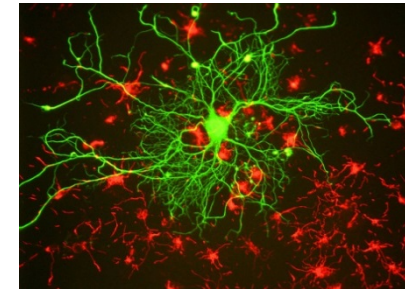
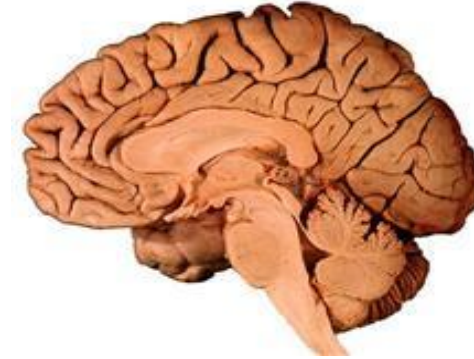


The Neural Interfacing Challenge 神经接口面临的挑战



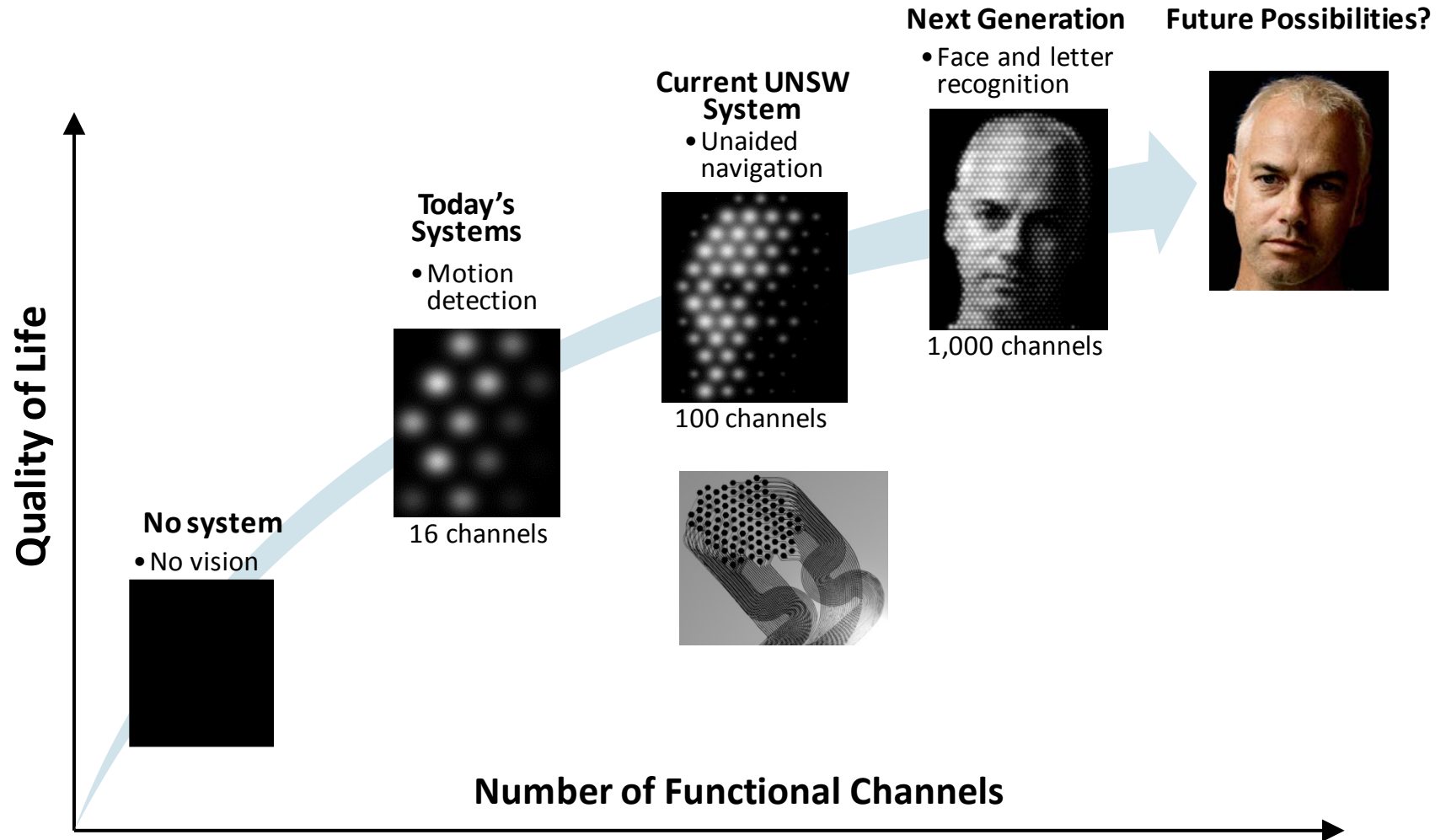
Restoring cortical control of functional movement in a human with quadriplegia, *Nature* (2016) 533(7602).

The Neural Interfacing Challenge 神经接口面临的挑战



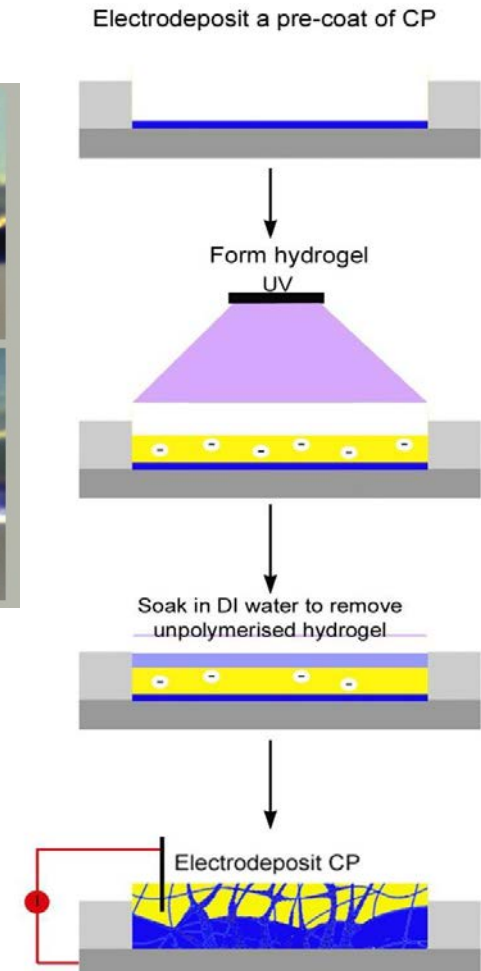
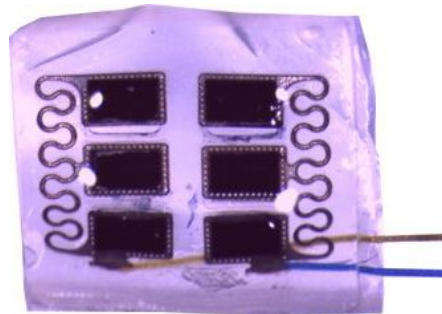
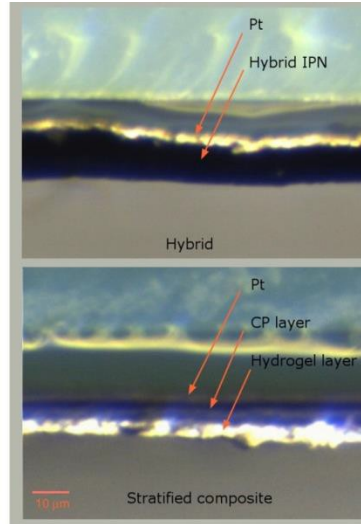
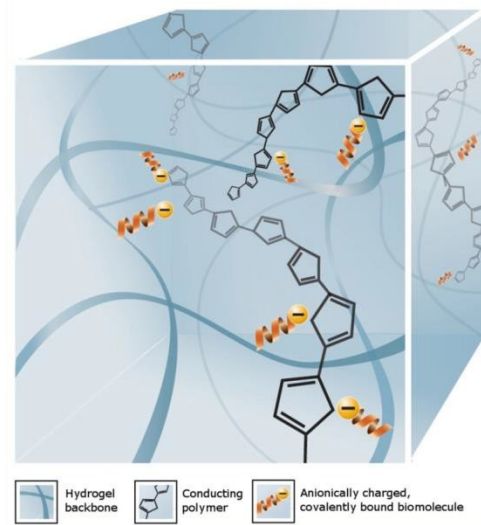
Why is the Interface so Critical? 神经接口的重要性

As number of **functional** channels increase, **【有效】** 电极越多
so does patient quality of life 患者的生活质量才越高



Conductive Hydrogels 用于生物电极的导电水凝胶技术

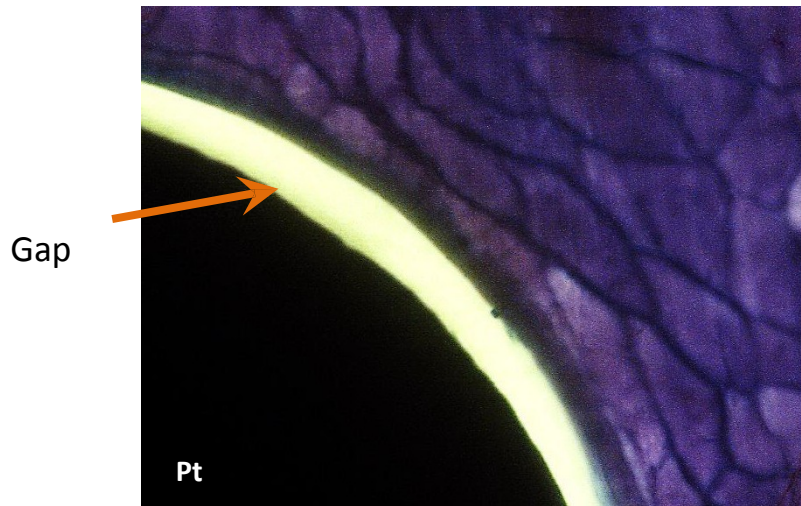
- Components are a PEDOT conducting polymer (CP) and a PVA hydrogel 导电聚合物 + 聚乙烯醇水凝胶
- Hydrogel component dopes the CP component, producing a hybrid 水凝胶涂在导电聚合物层上，形成复合材料



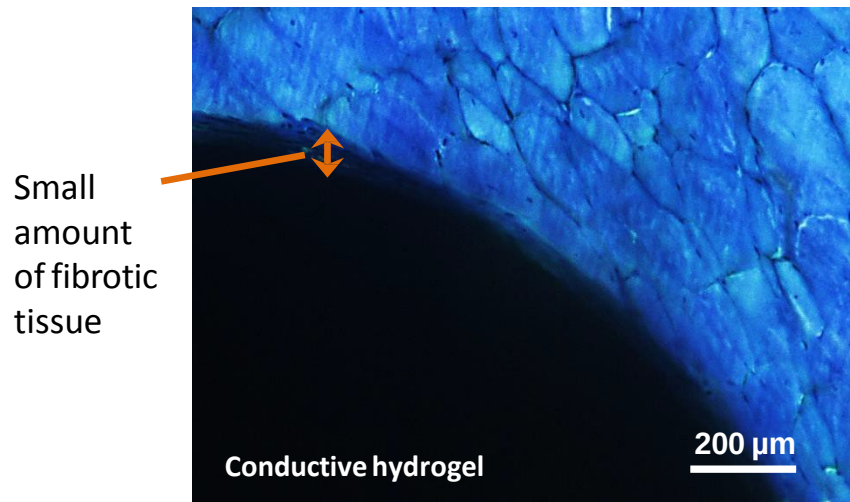
Green et al, Macromol Biosci, 2012

In Vivo Performance – 12 weeks

生物电极动物活体测试（植入12周后）



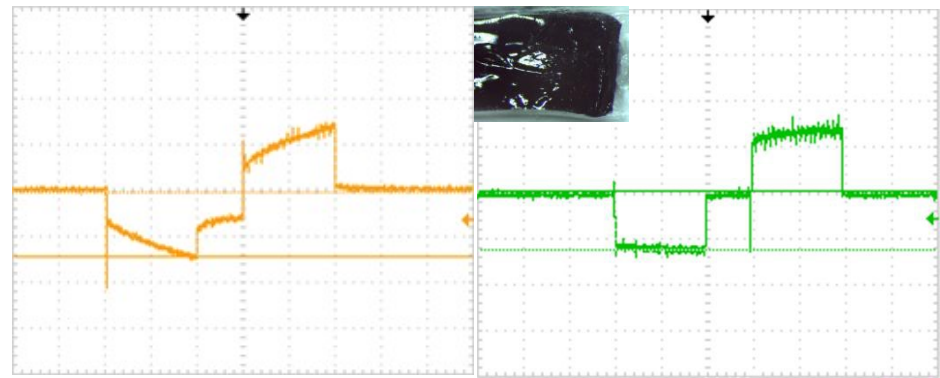
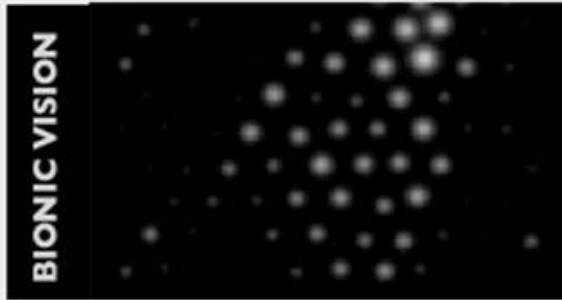
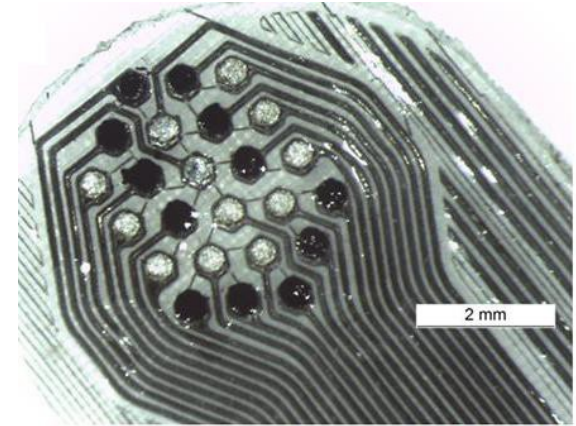
- Bare platinum clearly has no biointegration and there is a gap between the platinum and the tissue
传统白金材料无法与生物组织“融合”，接口处缝隙明显



- Conductive hydrogel is well integrated and shows a very minimal inflammatory response
导电水凝胶材料可与组织无缝连接，几乎无炎症发生

Polymer Electronics 复合材料电子器件

- Implantable materials
可植入性材料
- Coatings or standalone materials
无金属聚合体电极
- Can be 3D printed
支持3D打印技术
- Soft, flexible and improved electrical performance
柔软性，韧性，电气性能大幅提到

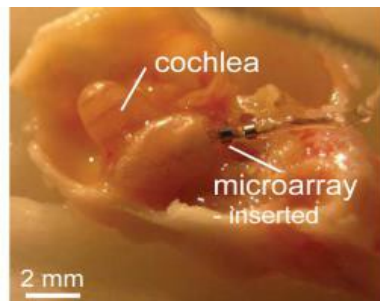
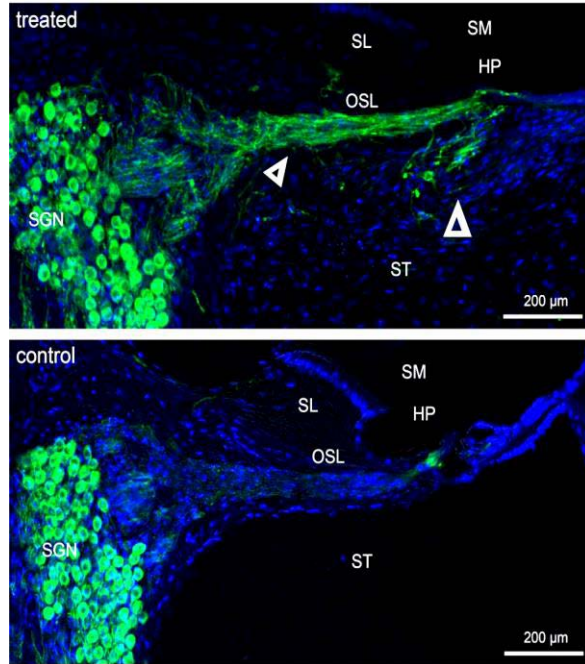


Platinum
铂电极

Conductive gel
复合材料电极

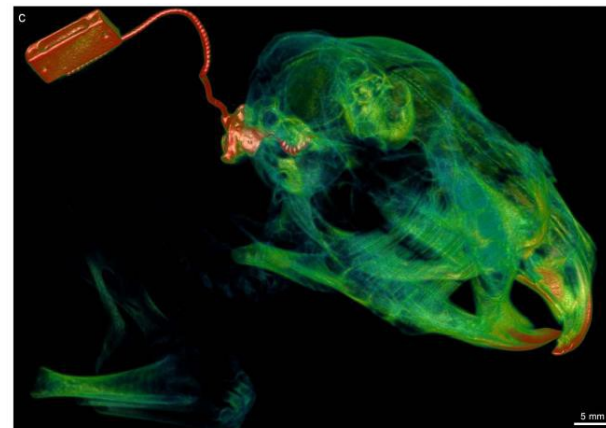
BADGE: Bionic Array–Driven Gene Electrotransfer

针对可植入电子器件的“基因电转移”技术



New technology founded on the principle that shaping of the electric fields around an array of closely spaced electrodes, modelled around a cochlear implant, provides efficient localized electroporation of target tissues and transduction of the cells with naked DNA gene constructs via gene electrotransfer.

利用仿生电极（如人工耳蜗电极）临时增大神经细胞膜通透性，从而向细胞内植入DNA，促使电极周围神经组织积极生长，可极大改变神经接口的性能

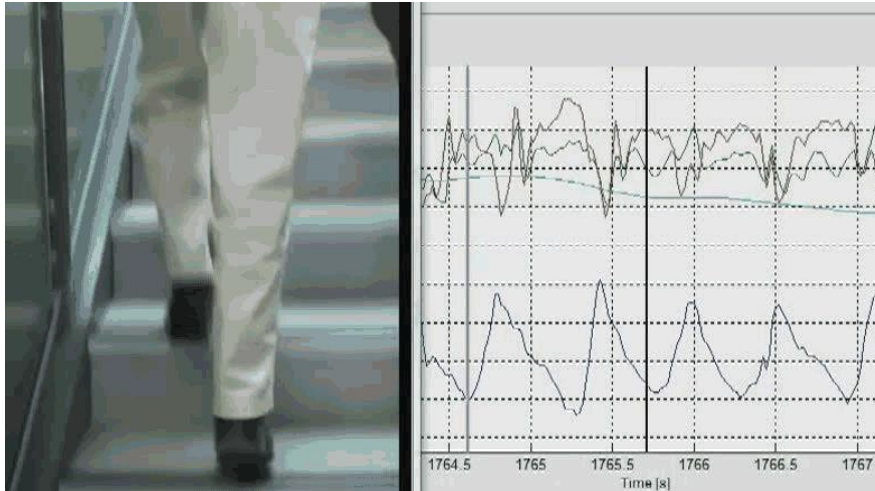
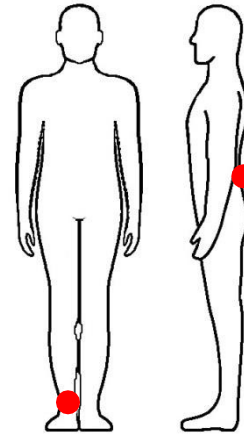


Fall Prevention 跌倒预防

The unit on body 便携设备:

Monitoring 远程监测

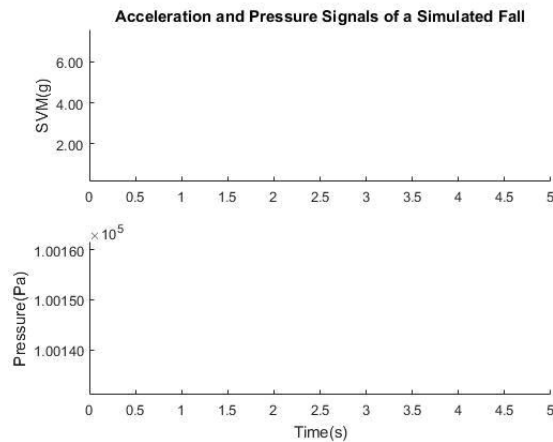
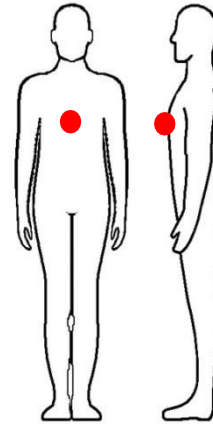
Analysis for prevention 摔倒预防分析



Tested in hospital 已通过临床测试

Fall Detection 跌倒检测

- Worn around the neck 颈部佩戴
- Detects fall, then contacts family member by telephone 手机绑定
- Lightweight, comfortable, waterproof 轻便, 舒适, 防水
- **Lowest false alarm rate reported in literature** 史上最低误报率
- Commercialisation opportunity 市场巨大 商机无限



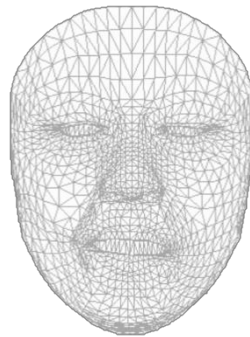
KinectBased Facial Assessment Tool

面肌麻痹辅助检测

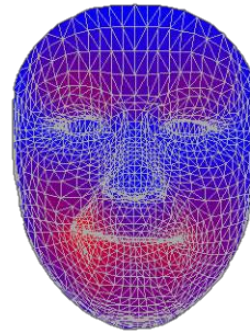
- Automatic facial paralysis diagnosis 自动面肌麻痹检测
- Minimal expert intervention 几乎无需专业人员介入
- Affordable and convenient 物美价廉, 使用方便



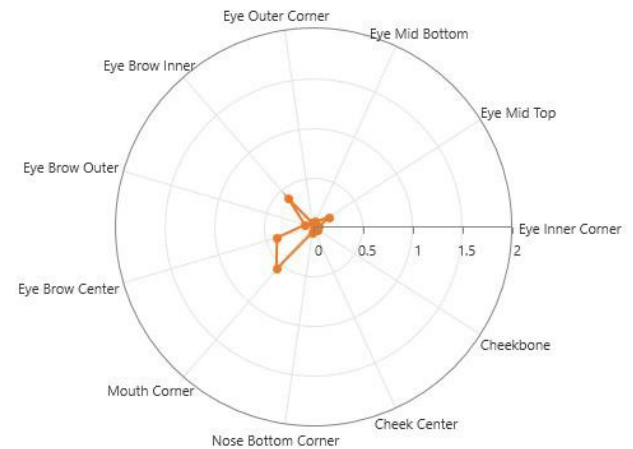
Face detection and 3d model fitting performed on image



3D face model is extracted and normalized



Displacement algorithm visualized on data



Symmetrical difference plotted in a radar chart

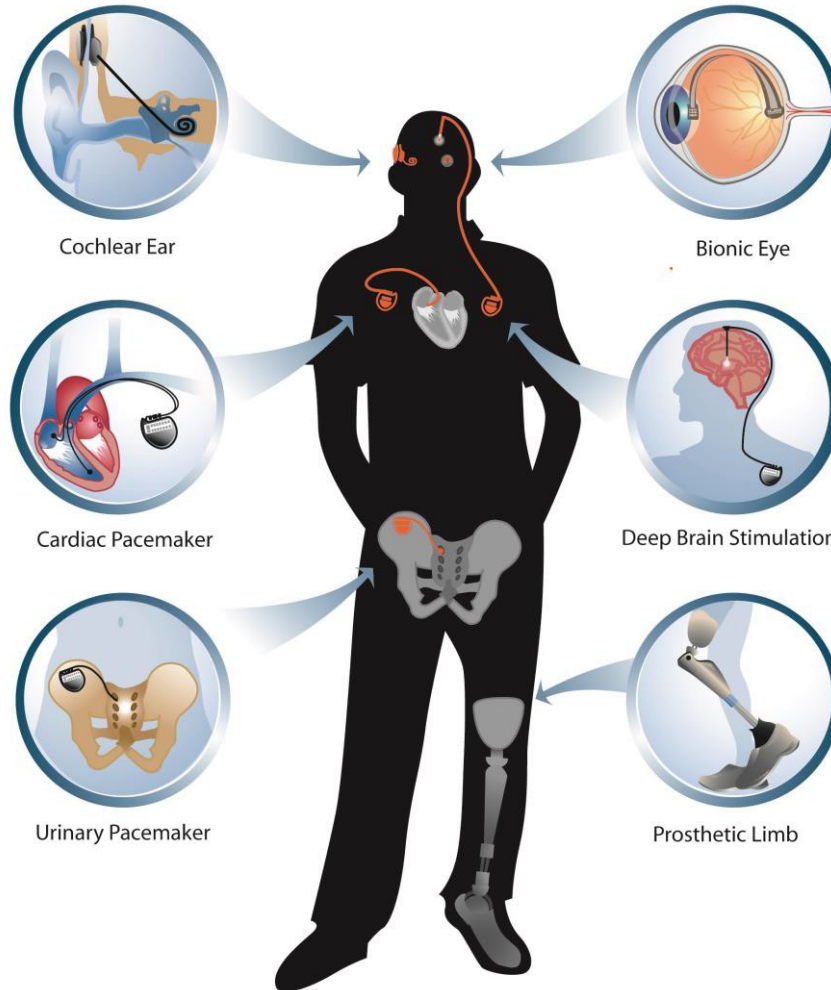
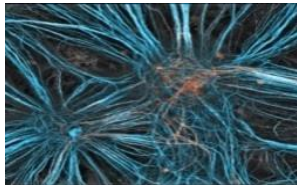
Capabilities 我们的实力

Devices

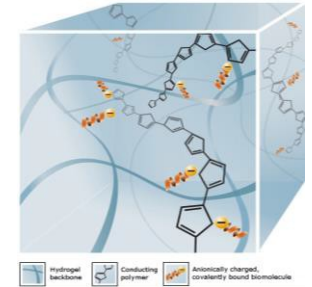


- Device fabrication
制造工艺
- Animal trials
动物测试
- Clinical trials
临床测试
- Big data analysis /
biosignal processing
生理信号大数据分析 /
处理

Neurophysiology



New materials



- Material design
新医用材料开发
- Analysis
多重可靠性分析
 - chemical
 - biological
 - mechanical
- ISO standards
通过国际标准