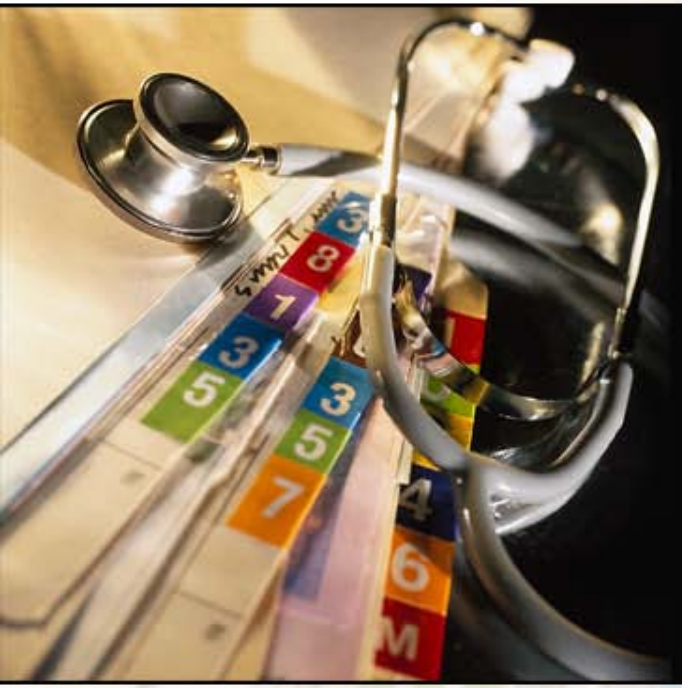
課程名稱： 醫學工程概論

（Introduction to biomedical engineering）



生醫感測

Biosensors

授課教師： 潘力誠副教授

開課單位 ： 通識教育中心

開課學期 ： 102學年度上學期

上課地點 ： 2202 上課時間 ： 星期一3, 4

學 習 目 標：

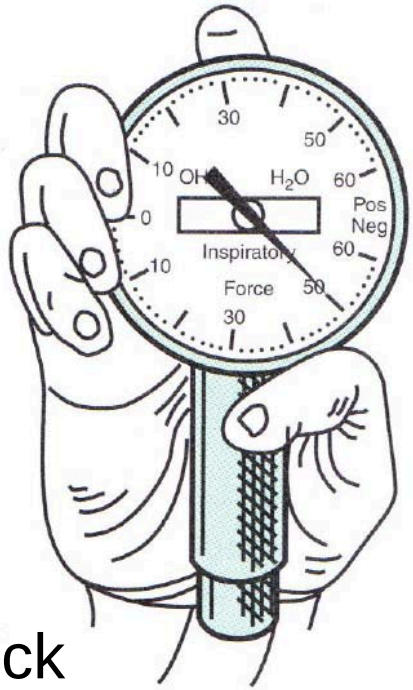
- 物理性感測器設計原理
- 壓力感知器
- 電感式感知器
- 電容式感知器
- 生化感知器

物理性感測器設計原理

- Pressure Measurements
- Aneroid manometer
- Electrical Mechanical transducers

  -Displacement of diaphragm changes

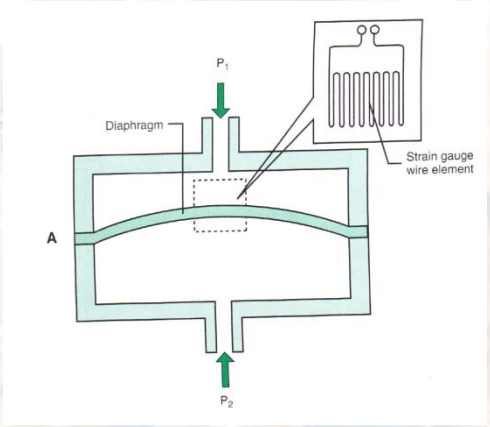
  -Change resistance, capacitance, inductance
- Increase resistance decreases voltage
- Inductive transducer has good frequency response and insensitive to vibration and shock



壓力感知器

Impedance Plethysmography

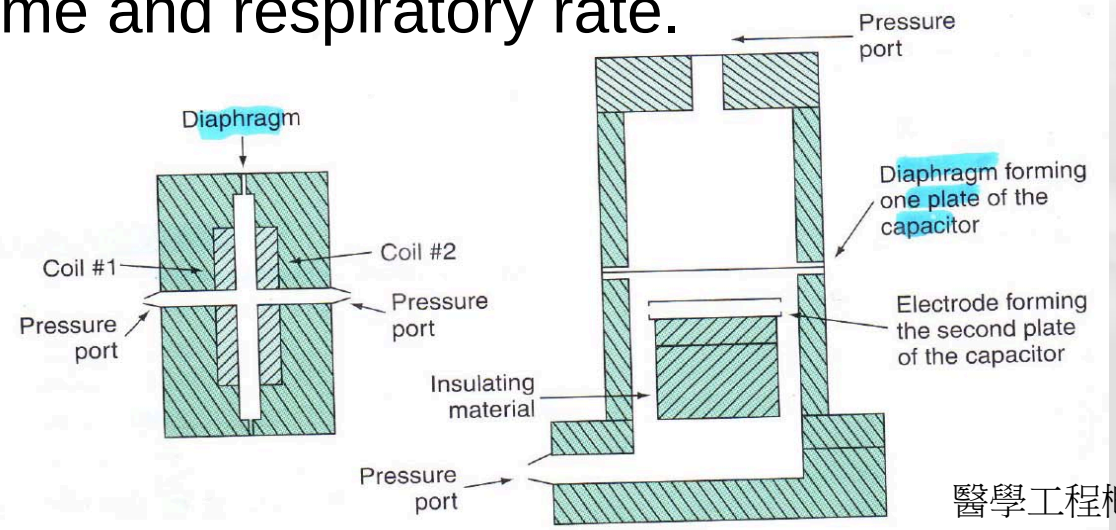
- Changes in electrical impedance between two electrodes.
- Impedance: resistance and capacitance
- Changes: blood, bone, tissue
- Driving force: 100 kHz, low amplitude, electrical current.
- Demodulated and displace as waveform
- Impedance Pneumography is often used in home apnea monitoring



電感式壓力感知器

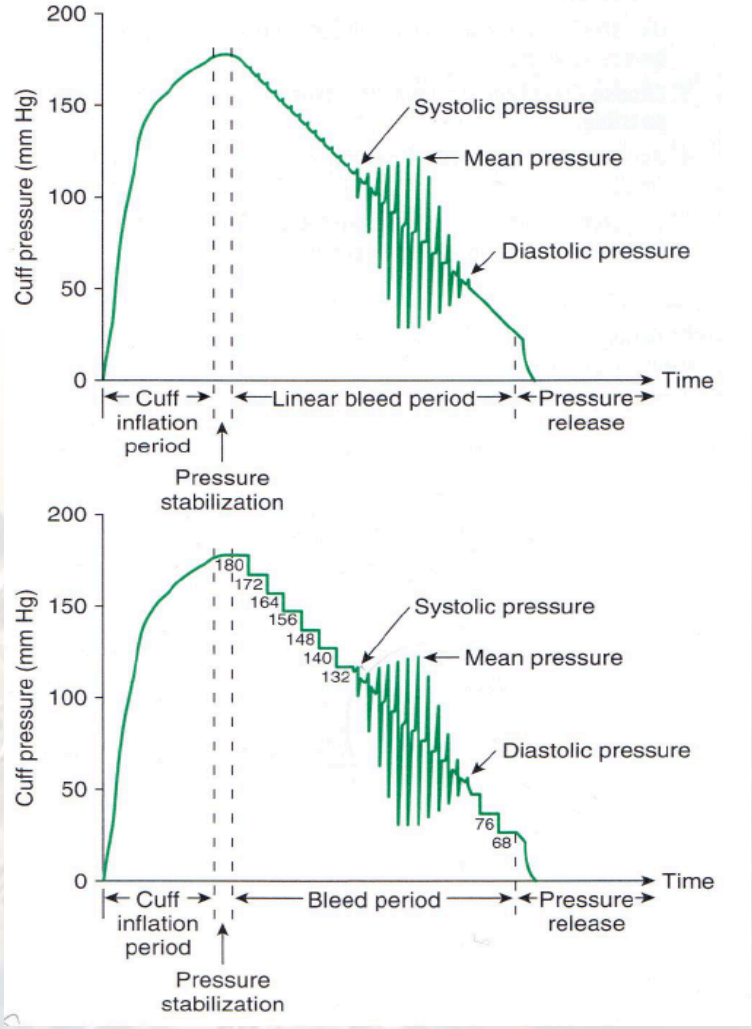
Respiratory Inductive Plethysmography

- Sum in movement of rib cage, and abdomen.
- Driven by 20 mV, alternating current voltage at 300kHz
- Change in coil diameter causes change in oscillating frequencies
- Frequency alternation is converted to waveform.
- Display tidal volume and respiratory rate.



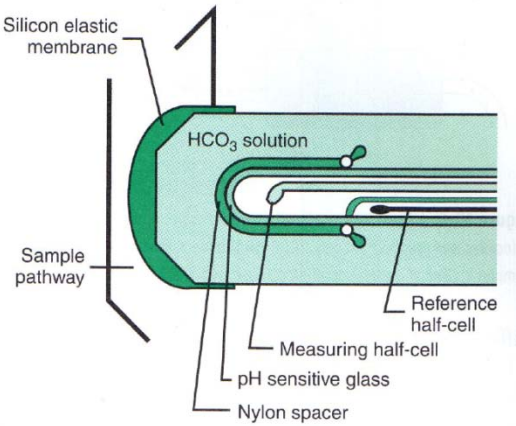
Korotkoff sound

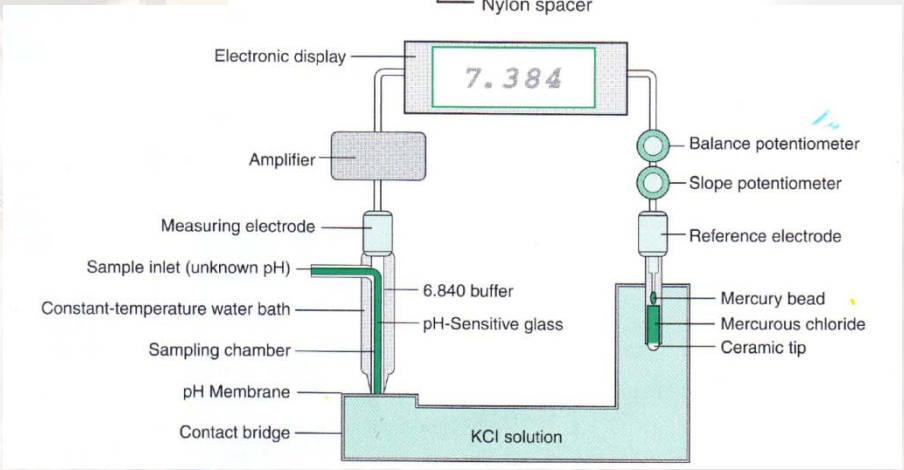
- Cut pressure increase 30 mmHg above the pressure radial pulse disappear
- Deflate 5 mm Hg per second
- Systolic pressure- first tapping sound
- Diastolic pressure- last audible pressure
- Oscillatory pressure measurement



Blood Gas Analyzers

- PH electrode:
- Half Cell potential：Ag/AgCl in phosphate buffer vs. Hg/HgO2 in saturate KCl
- Measuring electrode: permeable to H+
- Vm=-61.5 log [H+] + C (in mv)
- pH=-log [H+]
- PCO2 electrode fig10-5
- PCO2: H2O + CO2→H2CO3 → H+ + HCO3-
- pH=pk+log(HCO3-/PCO2)
- PO2 electrode fig10-6, fig10-7
- PO2: O2 + 2H2O + 4e- →4OH-
- 4Ag → 4Ag++4e-, 4Ag++4 Cl-→ AgCl





RFID原理簡介

- Tags 標籤
  - active
  - passive



- Reader 讀取器

發出無線電波(electromagnetic (radio) waves) 讀取標籤 (tag) 的資料

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Passive RFID tag之「可植入晶片」簡述

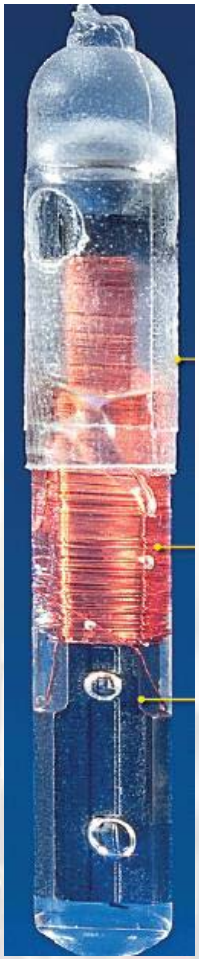
- 可植入式 (Implantable)

Passive RFID tag之「可植入晶片」簡述

- 小而精密 (一個Microchip)

Passive RFID tag之「可植入晶片」簡述

- 不需內建電池
- A “passive transponder”



RFID + 植入晶片 + 「sensor」 = 更舒適有效率的測血糖方法

血糖測量系統 (sensor)

電子訊號傳輸裝置

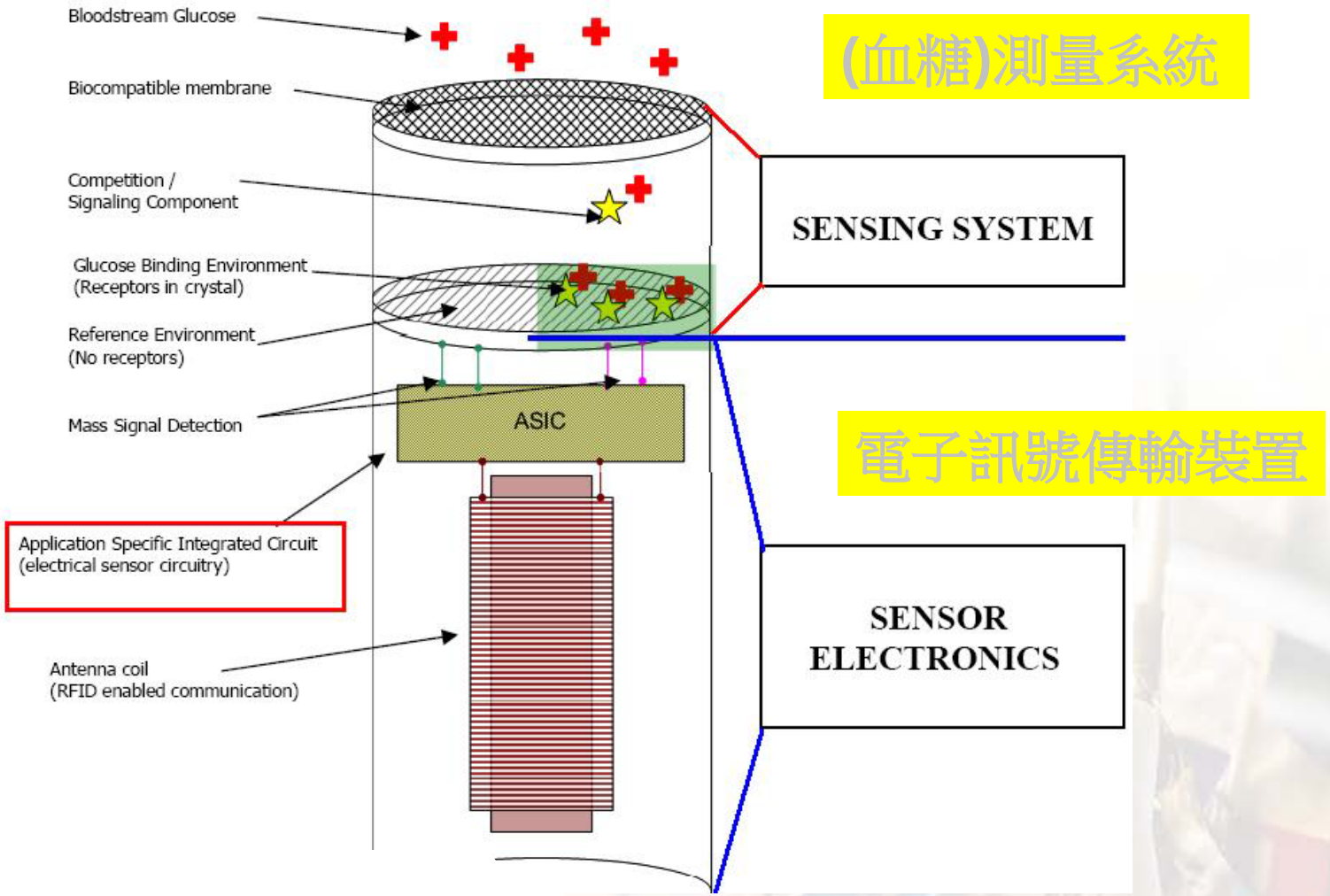
in 植入式晶片

RFID reader

若血糖值高

給予降血糖藥物

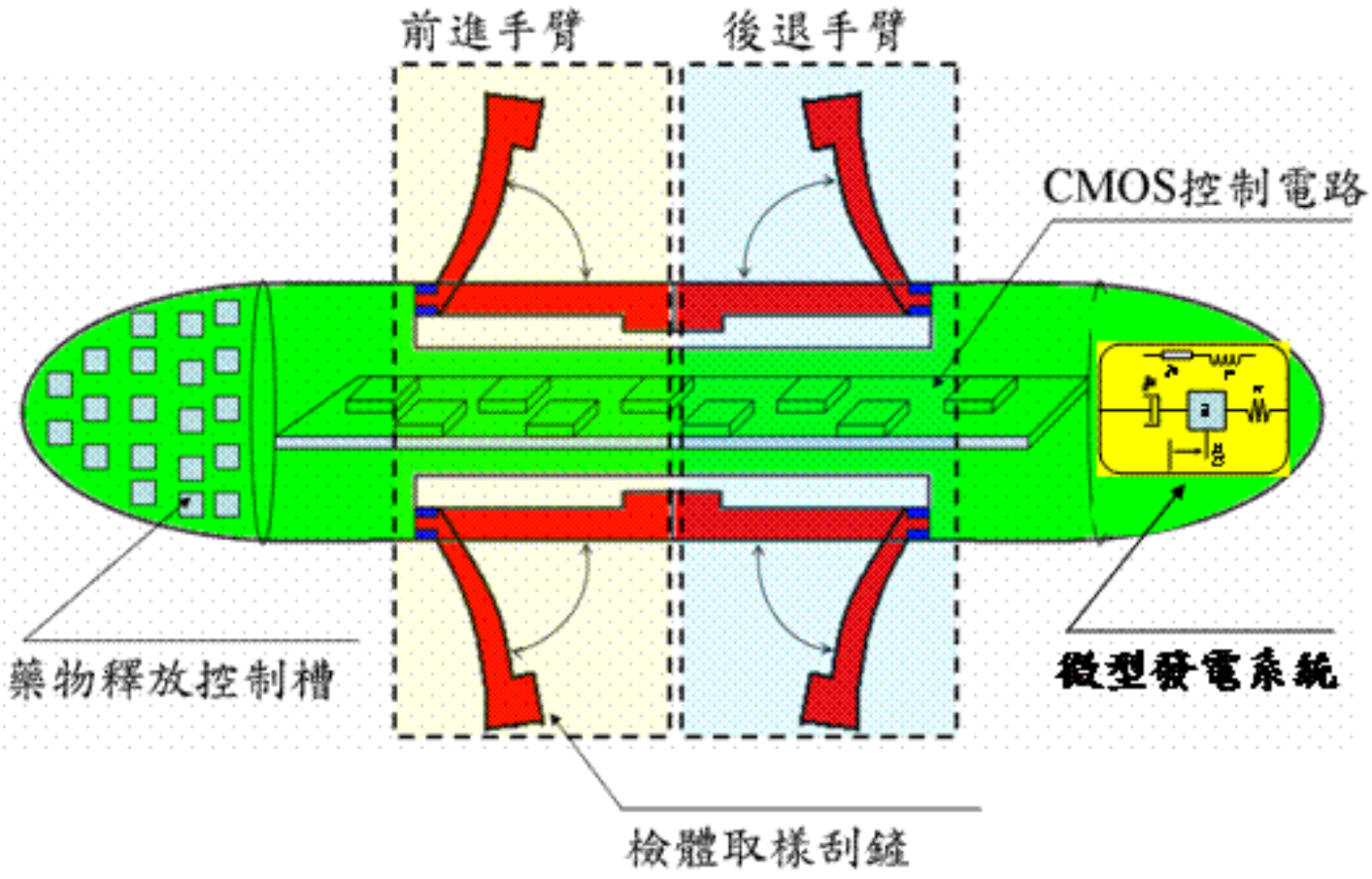
生物晶片應用範例


Bloodstream Glucose
Biocompatible membrane
Competition / Signaling Component
Glucose Binding Environment (Receptors in crystal)
Reference Environment (No receptors)
Mass Signal Detection
ASIC
Application Specific Integrated Circuit (electrical sensor circuitry)
Antenna coil (RFID enabled communication)
(血糖)測量系統
SENSING SYSTEM
電子訊號傳輸裝置
SENSOR ELECTRONICS

體內給藥的革新 – 微機電

- 生物微機電系統為整合生醫感測及微流體系統於單一晶片上之系統，用以達到自動化生醫檢測、藥物釋放或藥物篩檢等功能。微投藥系統最主要之組成元件必需含有類似微幫浦 (Micro Pump) 之裝置以及微流量感測器(Micro flow sensor)，然而欲發展一完整之微投藥系統則必需整合微流管道、微致動器、微流量感測器、以及控制電路等元件。主要應用於一些慢性病(如糖尿病,高血壓..等等)以及一些突發的病症(如腦中風,心臟病..等等)。利用微機電製程技術將此系統微小化,將其附著餘人體表皮上或植入人體中,可以適時的對於病患注射適量的藥劑,達到治療以及預防的效果。

生物晶片應用範例



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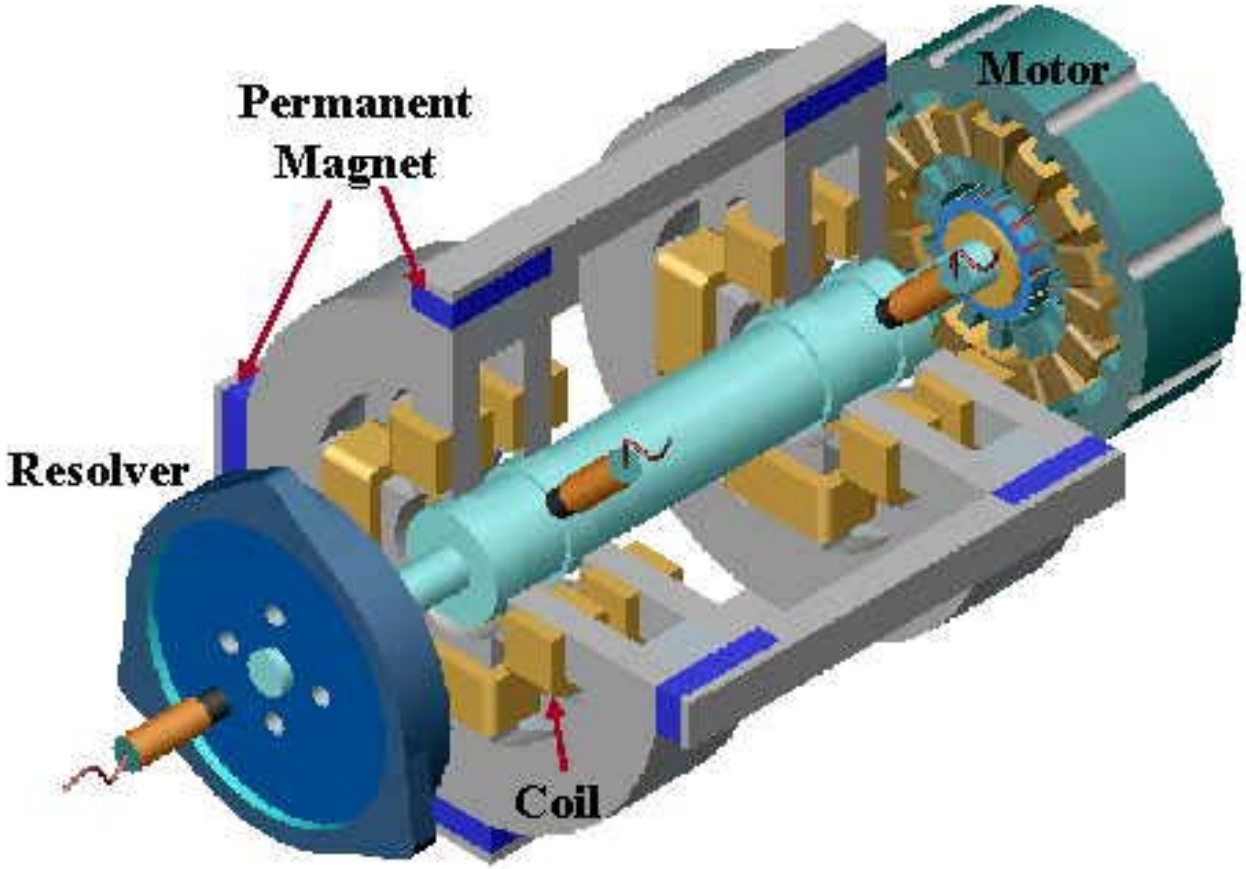

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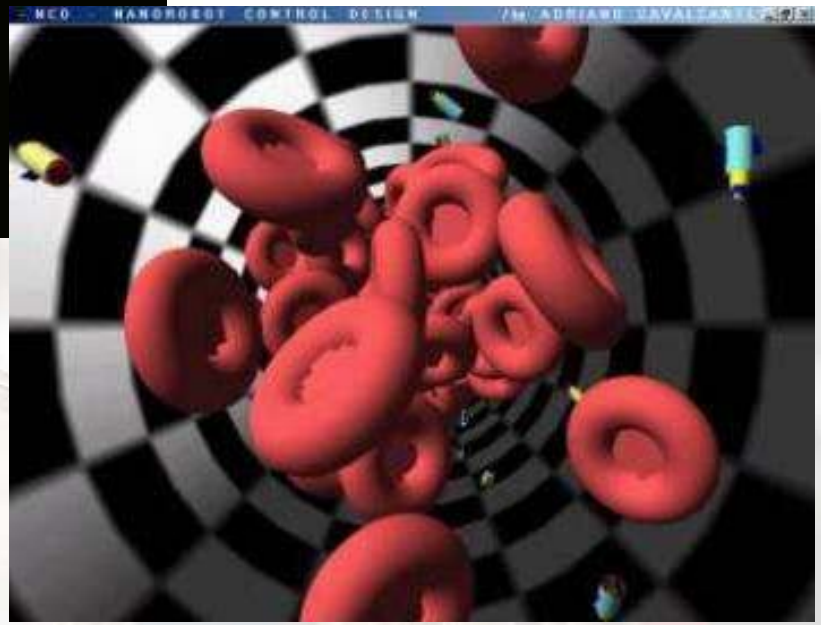
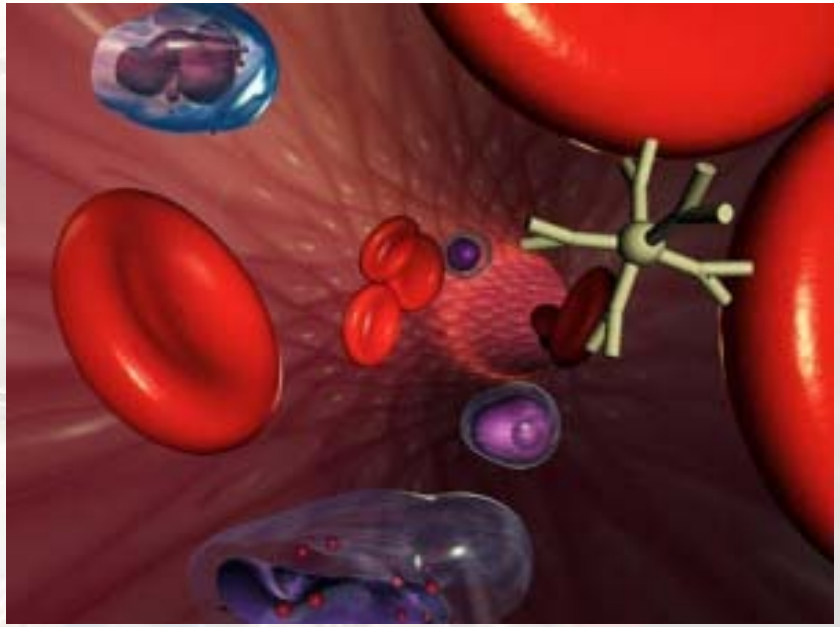


生物晶片應用範例



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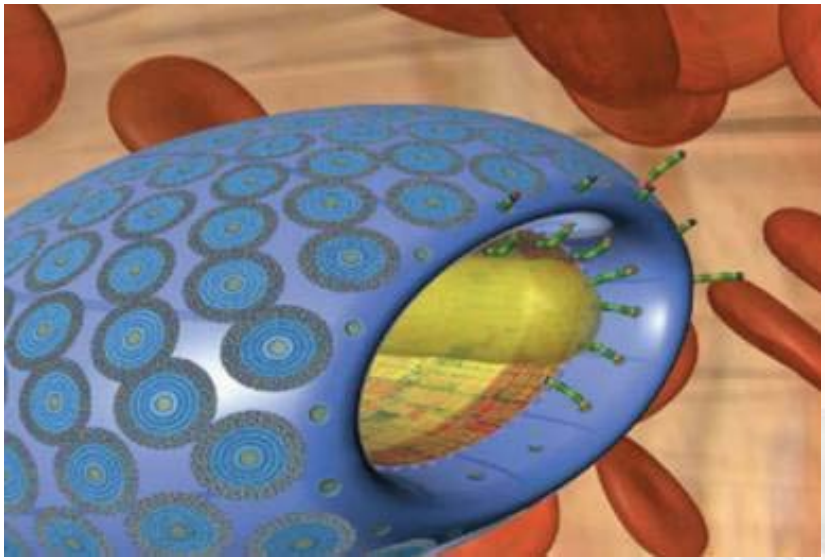
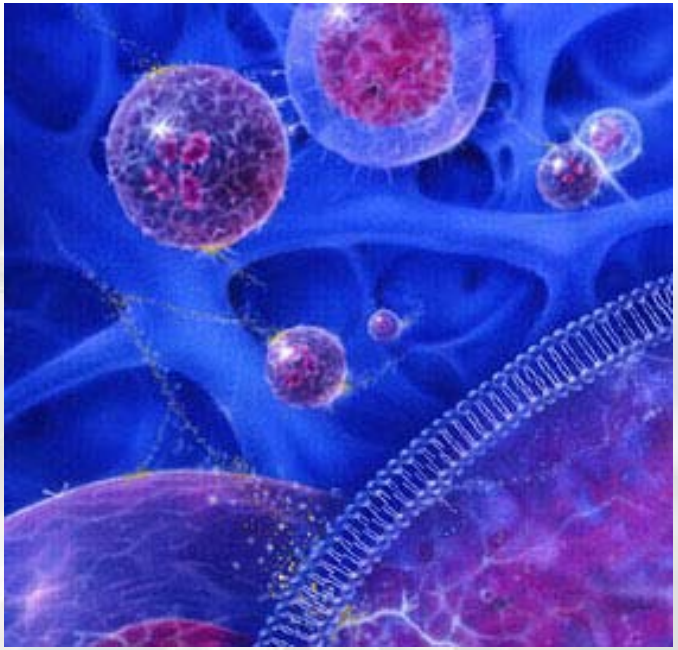
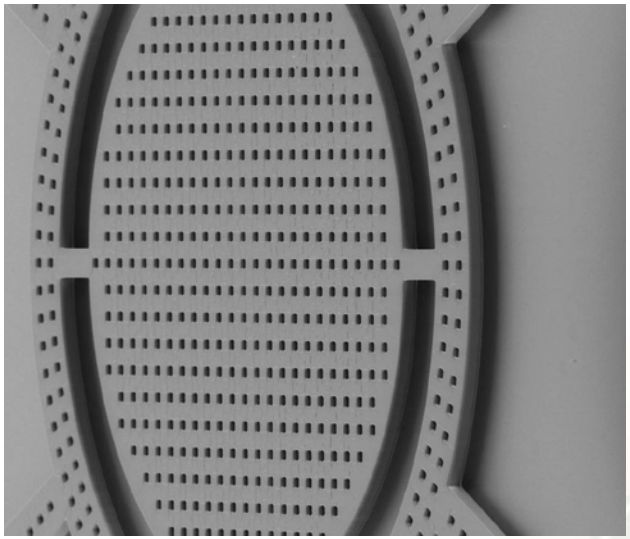
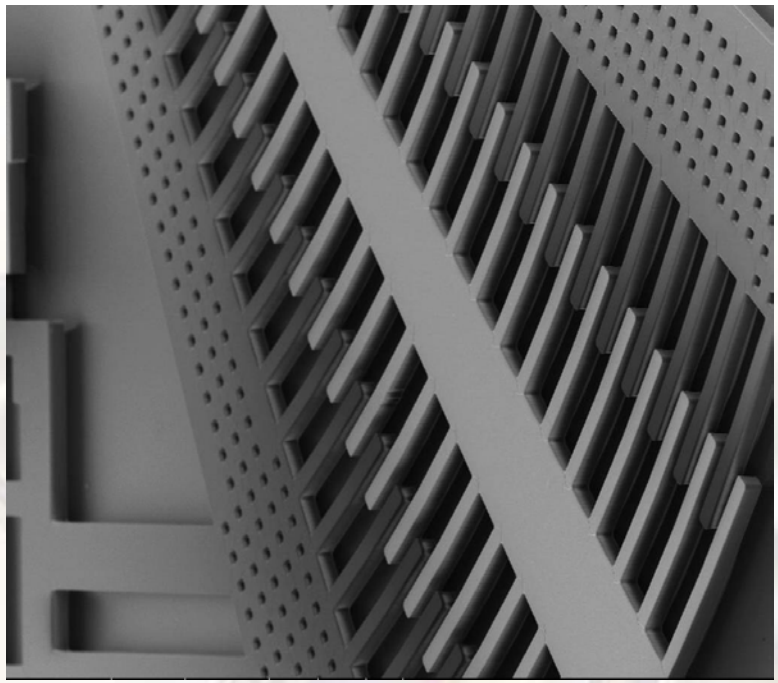




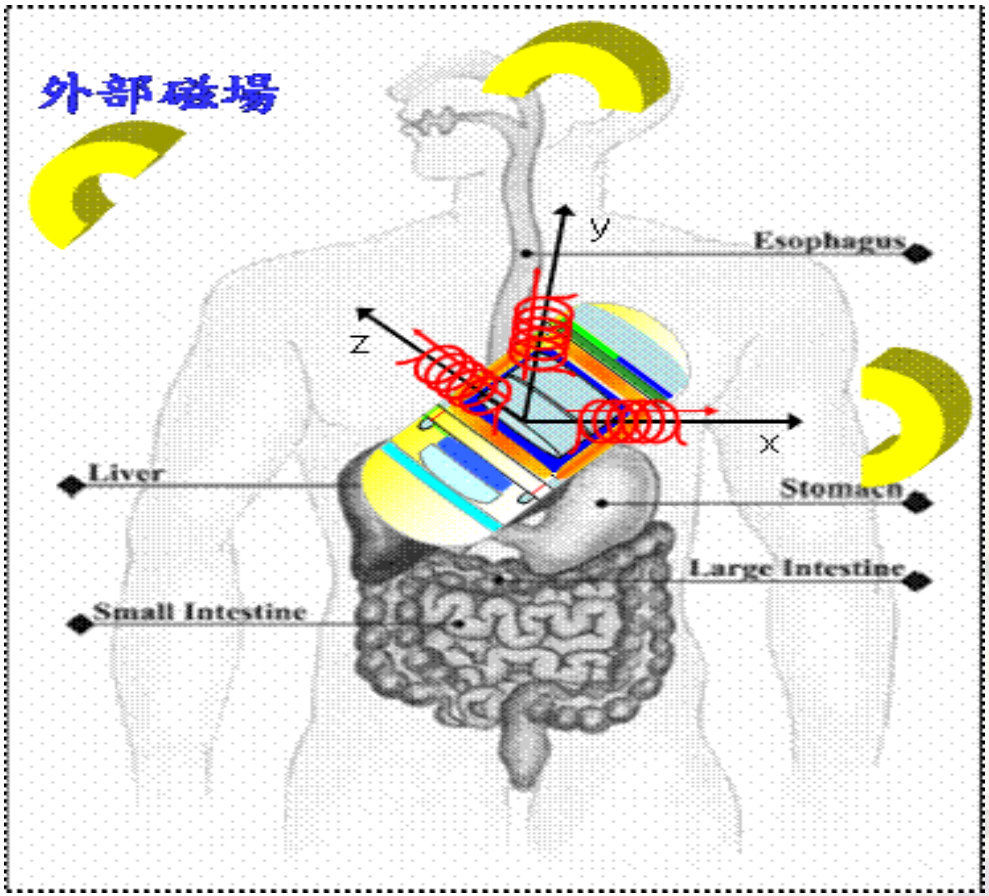
生物晶片應用範例



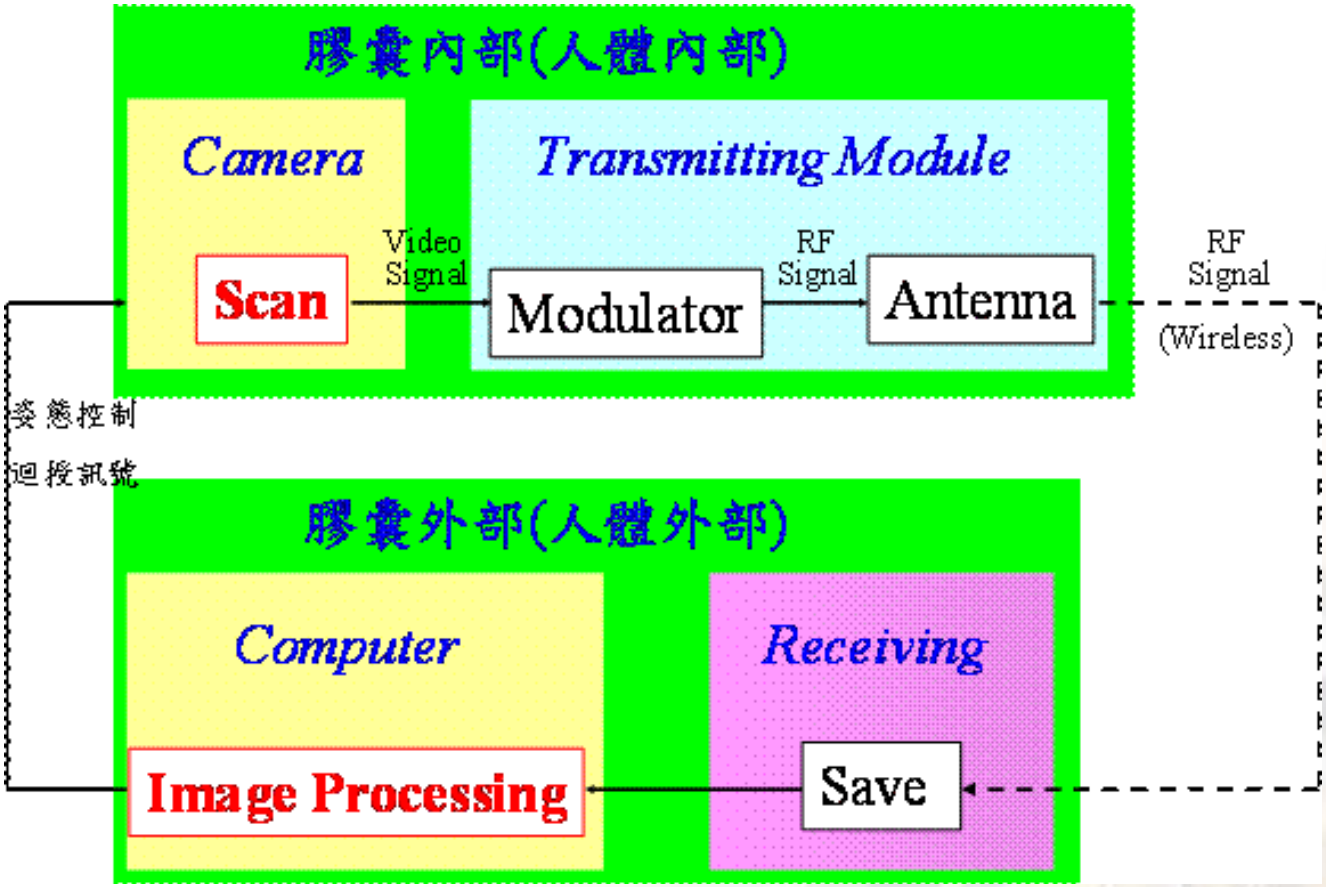


體內機器人

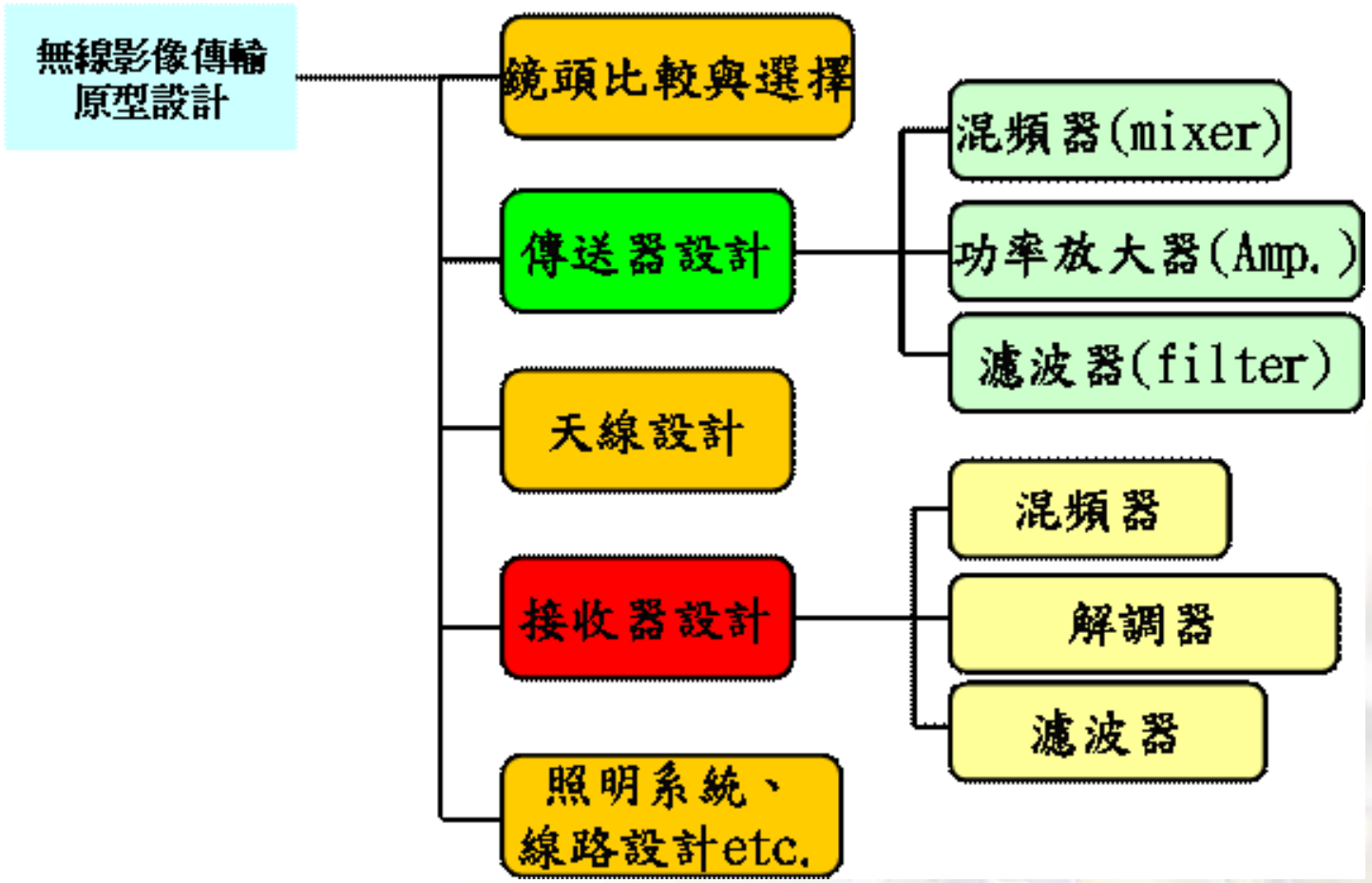
生物晶片應用範例


外部磁場
y
Esophagus
z
x
Liver
Stomach
Large Intestine
Small Intestine

生物晶片應用範例


膠囊內部(人體內部)
Camera
Transmitting Module
Scan
Video Signal
Modulator
RF Signal
Antenna
RF Signal
(Wireless)
姿態控制
迴授訊號
膠囊外部(人體外部)
Computer
Receiving
Image Processing
Save

生物晶片應用範例


無線影像傳輸
原型設計
鏡頭比較與選擇
傳送器設計
混頻器(mixer)
功率放大器(Amp.)
濾波器(filter)
天線設計
接收器設計
混頻器
解調器
濾波器
照明系統、
線路設計etc.