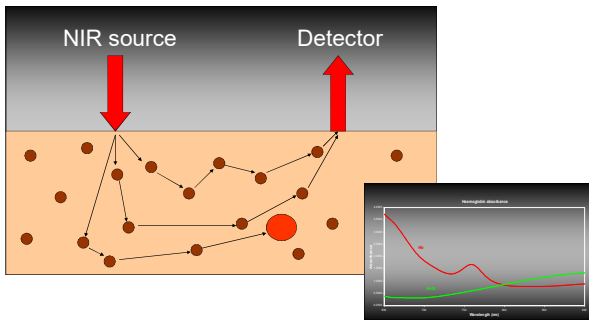


An Instrumental Prototype for in-vivo Measurements of Biological Tissue Oxygenation

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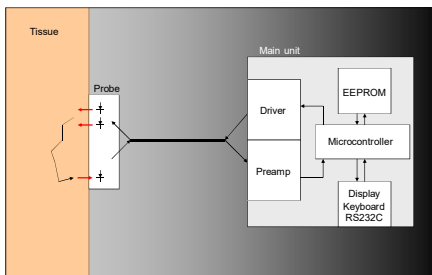
Near Infrared (NIR) spectroscopy on biological (human) tissues:

- NIR light is injected into the tissue
- Injected light is backscattered by tissue constituents and absorbed by chromophores: haemoglobin (HbO_2) and deoxyhaemoglobin (Hb)

NIR absorption at 2 NIR wavelengths
 \downarrow
 Hb and HbO_2 relative quantity
 \downarrow
Tissue oxygenation !
 In a non invasive way !

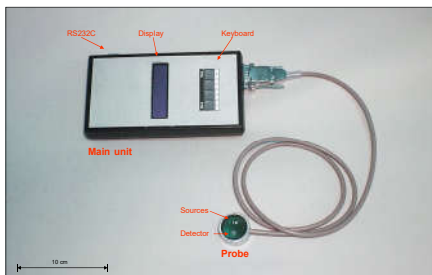
And so:

And moreover: **NIR light penetrates well our tissues, even through bone.**
 So, this technique can be used non-invasively on large muscles and brain.



Our instrument prototype features:

- A probe, which carries two LED sources (660nm - 850 nm) and a photodiode
- A portable main unit, which contains
 - ♦ a driver for the LED sources
 - ♦ a preamplifier for the photodiode
 - ♦ a single-chip microcontroller for
 - time-multiplexing the sources
 - signal Analog-to-Digital conversion
 - communication with I/O devices (display, keyboard, RS232C serial port)
 - ♦ EEPROM (16 KBytes - up to 10 hours acquisition time) for data storage
 - ♦ batteries for stand-alone operation



From a functional point of view:

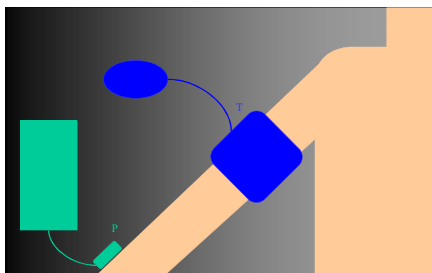
- ♦ it does not need any external acquisition system
- ♦ it is comfortable for the patient
- ♦ it is portable

From a structural point of view:

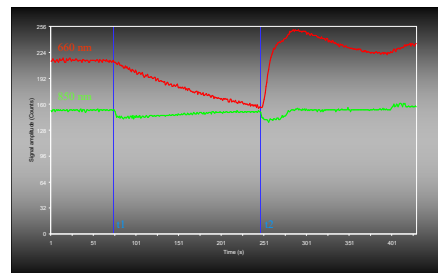
- ♦ it does not use "difficult" technologies
- ♦ it has a low cost

Applications: large muscle oxygenation studies (eg. sport medicine)

A performance test on **tourniquet-induced forearm ischaemia**



A tourniquet **T** is applied on the arm. The probe **P** is placed on the forearm, avoiding bone and large vessels. At time t_1 the tourniquet is inflated, and venous and arterial blood flow are stopped. As blood is progressively deoxygenated, the 660 nm transmission signal decreases. When, at time t_2 the tourniquet is deflated - thus restoring blood flow - the optical transmission signal overshoots the initial baseline and slowly returns to its original value (not shown).



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