



# STEM on the Move

## Menorca



**COSINUSS**

Vital signs . mobile . continuous . convenient

26 de abril 2022

## Què és “STEM on the move”?

- Projecte per atreure l'atenció de les generacions més joves cap a les disciplines acadèmiques de STEM
- STEM: ciència, tecnologia, enginyeria, matemàtiques
- Objectiu: Vincular classes d'educació física i STEM a les escoles per promoure l'entusiasme per l'exercici i l'èxit de l'aprenentatge en assignatures STEM

# cosinuss°

- des de 2011
- basat a Munic
- 31 treballadors
- vital sign company



# Cosinuss GmbH

## In-ear Sensor Technology



Source: <https://www.cosinuss.com/>

## Seguiment a temps real dels signes vitals

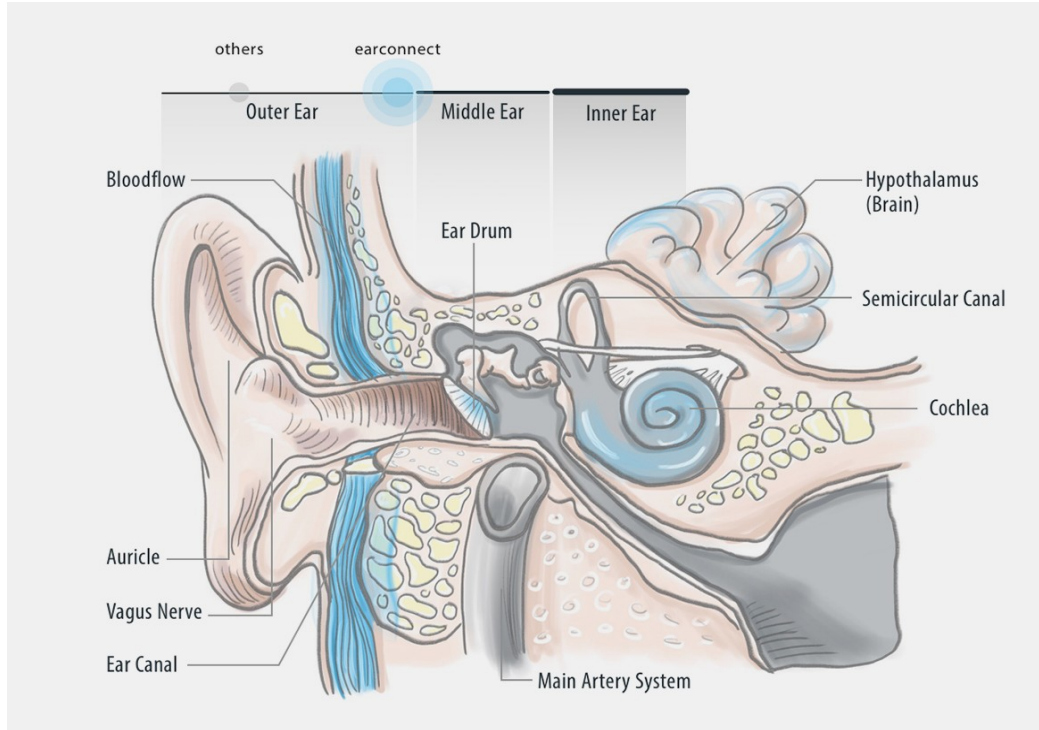


Status Quo



**COSINUSS**<sup>o</sup>

# Mesurament de signes vitals dins del canal auditiu extern.



Source: <https://www.cosinuss.com/>

## Per què és millor?




- col·locació protegida
- entorn fosc
- moviments lents
- millor subministrament de sang
- contacte adequat amb els teixits
- ús acceptat

## cosinuss<sup>o</sup> Two



Source: <https://www.cosinuss.com/>

### Signes vitals:

- Temperatura corporal central 
- Freqüència cardíaca 
- Saturació d'oxigen a la sang (SpO<sub>2</sub>) 

# Use case - Performance Diagnostics



Bundesministerium  
für Bildung  
und Forschung

GERMAN  
DESIGN  
AWARD  
NOMINEE  
2016

Google  
for Entrepreneurs

blackbox

PLUGANDPLAY

CODE\_n

European  
Commission  
Horizon 2020  
European Union Funding  
for Research & Innovation  
DIGITAL  
EXCELLENCE

# Use case - TeleCOVID



The image shows two men, one in a white lab coat and one in a dark suit, both wearing face masks and looking at a large digital display. The display shows a data table with columns for 'person', 'HR', 'T', and 'Q'. The data is organized into rows, each representing a different person. The table is divided into two main sections by a vertical line. The left section contains data for 10 people, and the right section contains data for 10 people. The data is presented in a grid format with alternating colors for rows. The table is titled 'TeleCOVID' and includes a 'Feedbackregeln' section on the right side.

| person | HR  | T  | Q   |
|--------|-----|----|-----|
| 3TKZ6D | 98  | 12 | 1.5 |
| 6YU8H  | 98  | 13 | 1.4 |
| 4U7BTZ | 98  | 13 | 1.5 |
| Z8KB4N | 97  | 13 | 1.5 |
| R6Q1P6 | 93  | 12 | 1.5 |
| FRT49K | 96  | 12 | 1.4 |
| PGD9XB | 92  | 14 | 1.4 |
| EESVSU | 97  | 14 | 1.5 |
| C3FTH5 | 91  | 13 | 1.5 |
| 667W9Z | 96  | 13 | 1.4 |
| 8RDNPM | 100 | 14 | 1.2 |
| ZGFVKE | 95  | 13 | 1.4 |
| AQ7ISY | 91  | 12 | 1.4 |
| 971F95 | 93  | 14 | 1.5 |
| QJM1PL | 99  | 12 | 1.3 |
| FVORVJ | 93  | 13 | 1.4 |
| SUON10 | 94  | 14 | 1.5 |
| M18U99 | 90  | 14 | 1.4 |

Feedbackregeln

- = konstruktiv
- = konkret und präzise
- = Stärken stärken
- = Schwächen schwächen



# Use case - Mountain Rescue



# What are vital signs of exercise and why are they important to measure?

Before we start, some questions to you.

Online**TED**<sup>®</sup> LIVE

Participation options for your students:

Website address:  
**tum.onlineded.de**  
Participation code:  
**3778**

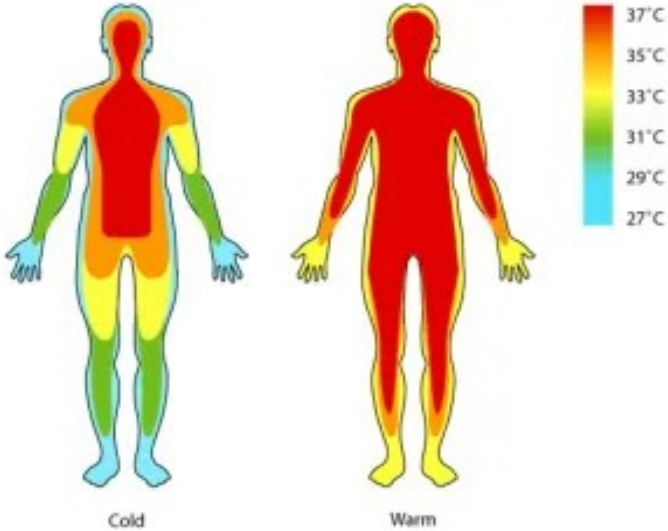
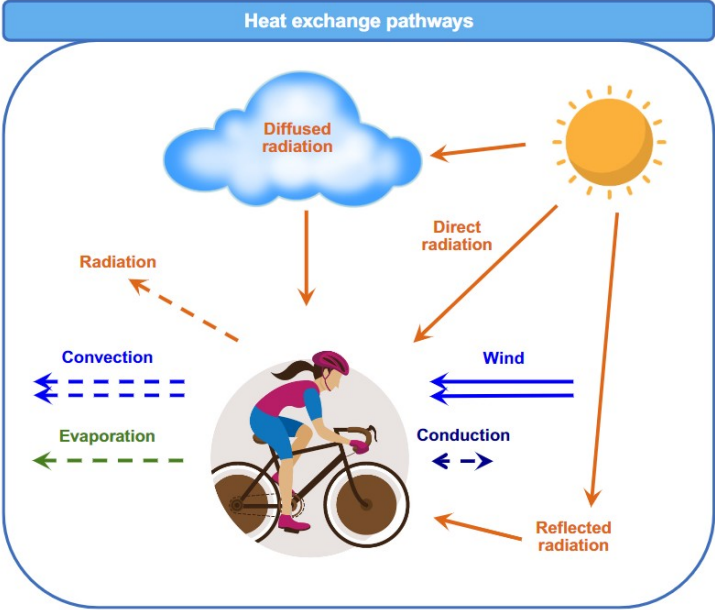
Participants: 0

START >

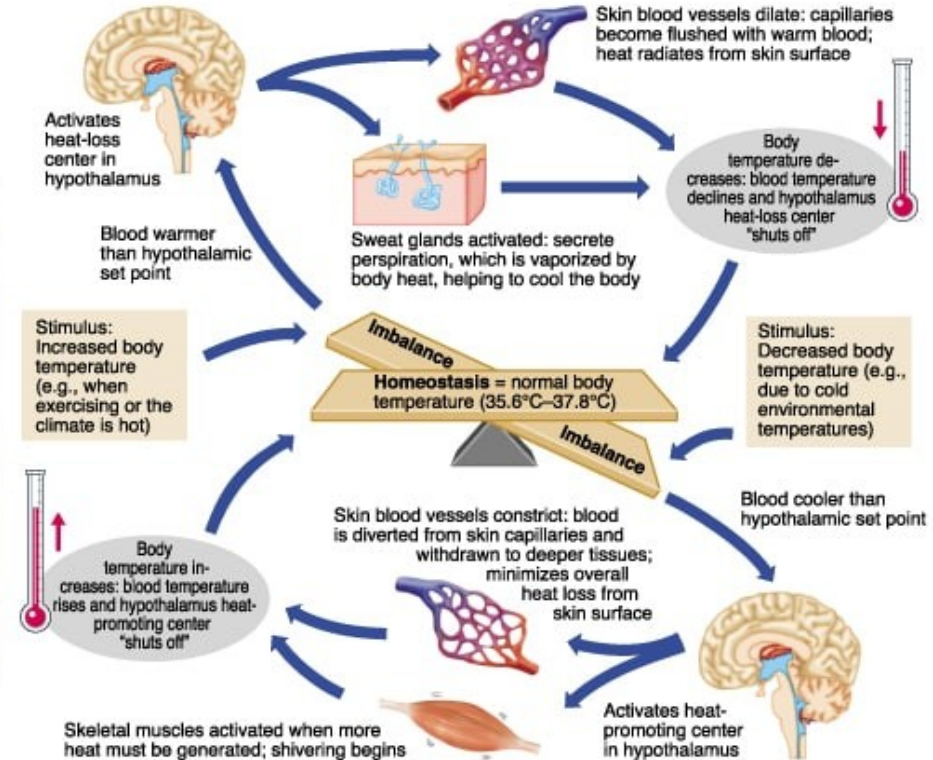
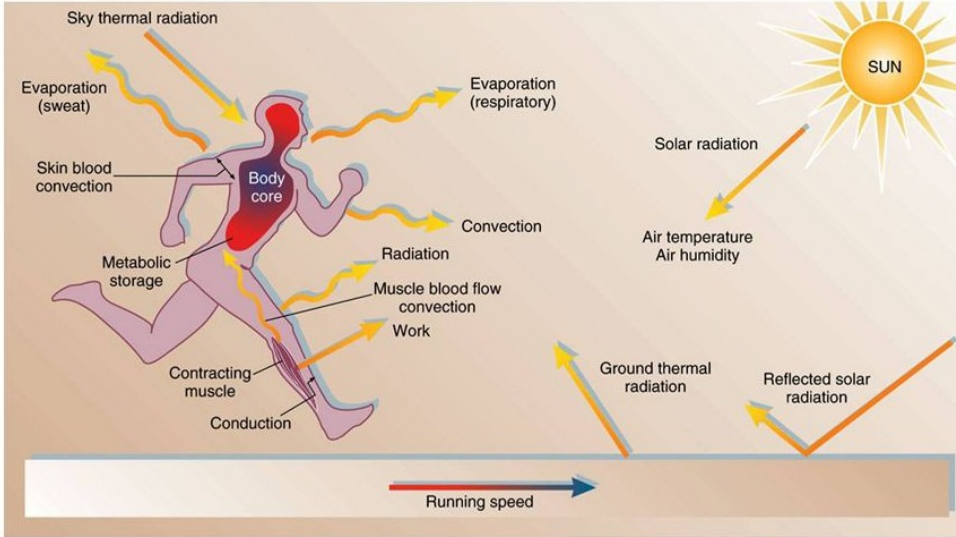
... or scan QR-Code:



# Muscle Efficiency and why do we heat up during exercise?

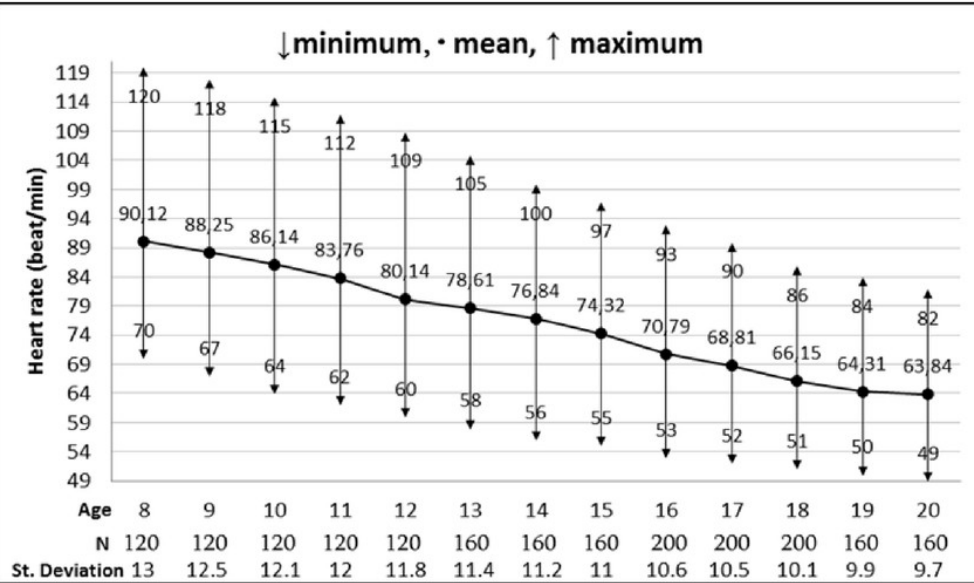


# Thermal regulation

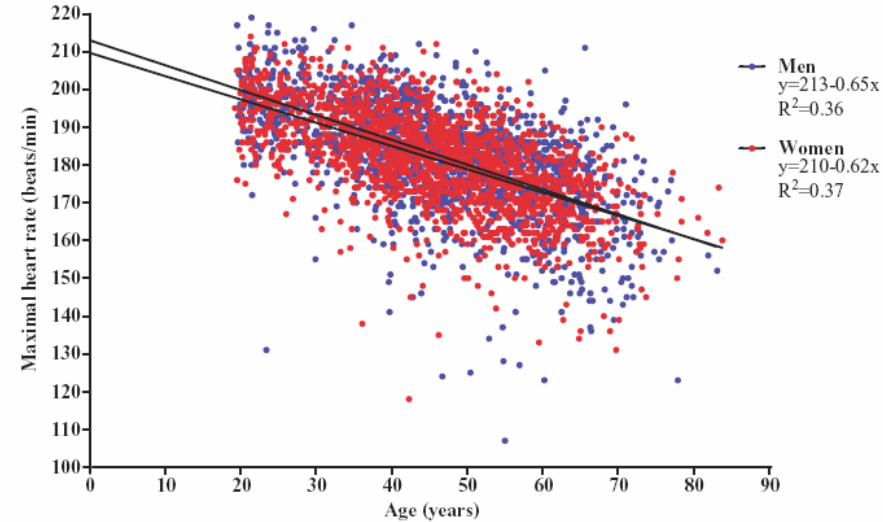


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# What is a normal heart rate at your age?

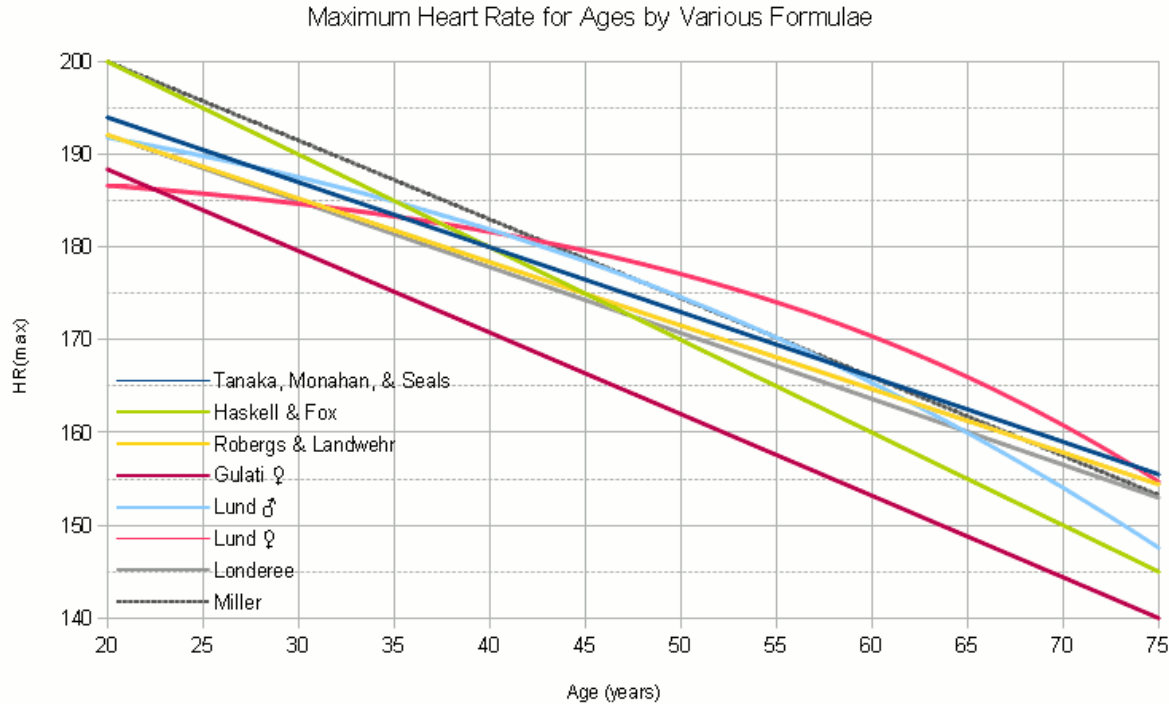


Resting heart rate








Maximum heart rate

# How you can estimate your maximal heart rate?

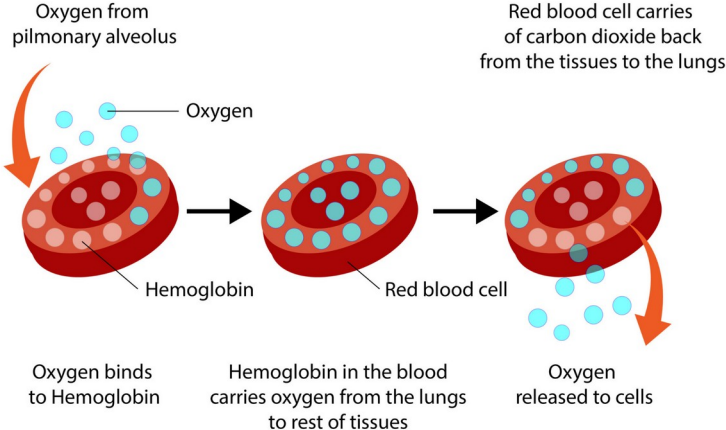
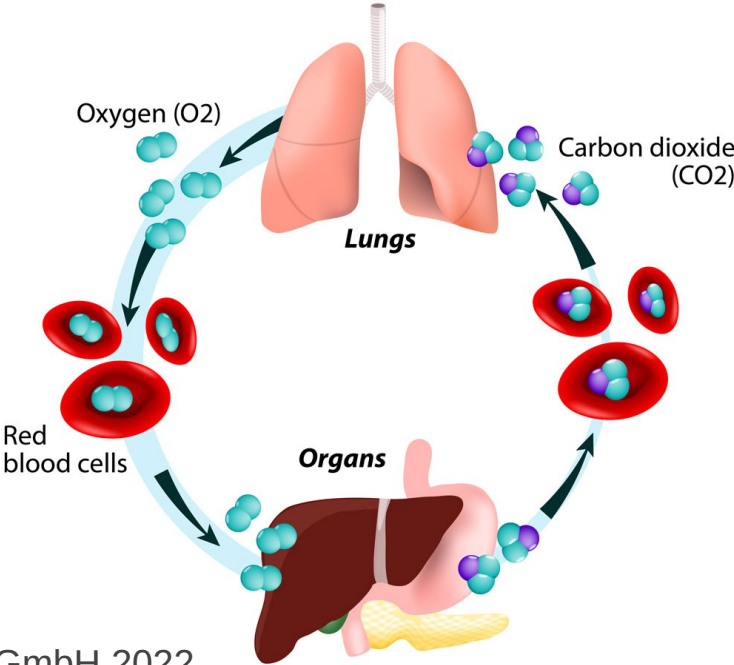


# What is a common heart rate at your age during sports?

|                      | Target zone   | % of max HR bpm range  | Example duration    | Training benefit  |
|----------------------|---|------------------------|---------------------|---|
| Maximize Performance | <b>5</b> MAXIMUM     | 90–100%<br>171–190 bpm | Less than 5 minutes | <b>Benefits:</b> Increases maximum sprint race speed<br><b>Feels like:</b> Very exhausting for breathing and muscles<br><b>Recommended for:</b> Very fit persons with athletic training background  |
| Performance          | <b>4</b> HARD        | 80–90%<br>152–171 bpm  | 2–10 minutes        | <b>Benefits:</b> Increases maximum performance capacity<br><b>Feels like:</b> Muscular fatigue and heavy breathing<br><b>Recommended for:</b> Fit users and for short exercises   |
| Improve Fitness      | <b>3</b> MODERATE    | 70–80%<br>133–152 bpm  | 10–40 minutes       | <b>Benefits:</b> Improves aerobic fitness<br><b>Feels like:</b> Light muscular fatigue, easy breathing, moderate sweating<br><b>Recommended for:</b> Everybody for typical, moderately long exercises                                     |
| Lose Weight          | <b>2</b> LIGHT       | 60–70%<br>114–133 bpm  | 40–80 minutes       | <b>Benefits:</b> Improves basic endurance and helps recovery<br><b>Feels like:</b> Comfortable, easy breathing, low muscle load, light sweating<br><b>Recommended for:</b> Everybody for longer and frequently repeated shorter exercises |
| Lose Weight          | <b>1</b> VERY LIGHT  | 50–60%<br>104–114 bpm  | 20–40 minutes       | <b>Benefits:</b> Improves overall health and metabolism, helps recovery<br><b>Feels like:</b> Very easy for breathing and muscles<br><b>Recommended for:</b> Basic training for novice exercisers, weight management and active recovery  |

# How does the blood gets saturated with oxygen?







## GAS EXCHANGE IN HUMANS



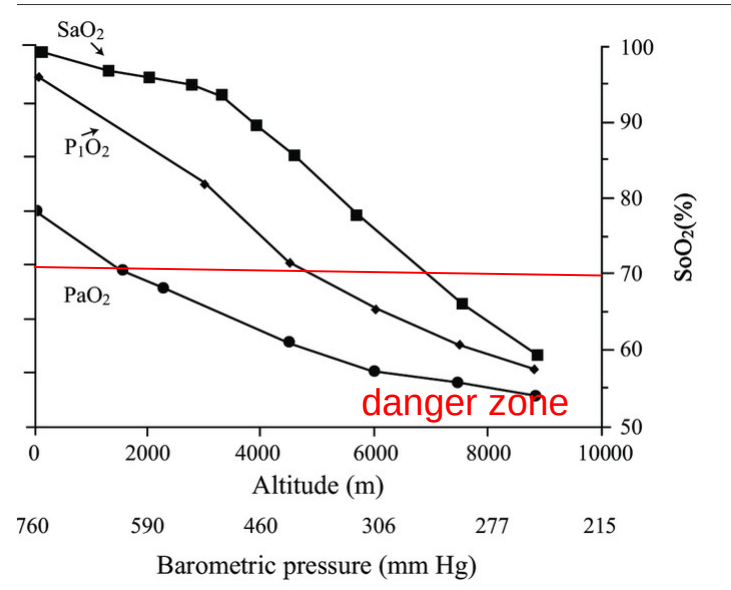


# What is a normal oxygen saturation (SpO<sub>2</sub>) in your blood?

Blood oxygen saturation (SpO<sub>2</sub>)

|            |   |   |
|------------|---|---|
| 100 - 98 % |  | Normal  |
| 97 - 95 %  |  | Insufficient<br>Tolerable, patient hardly notices any influence |
| 94 - 90 %  |  | Decreased<br>Immediate intervention (eating, exercise)          |
| < 90 %     |  | Critical<br>Referral to specialist                              |
| < 80 %     |  | Severe hypoxia<br>Hospitalization                               |
| < 70 %     |  | Acute danger to life  |

Reference values



Saturation at higher altitude

# Summary: examples where we need the measurement of vital signs!

## Acclimatation to heat!

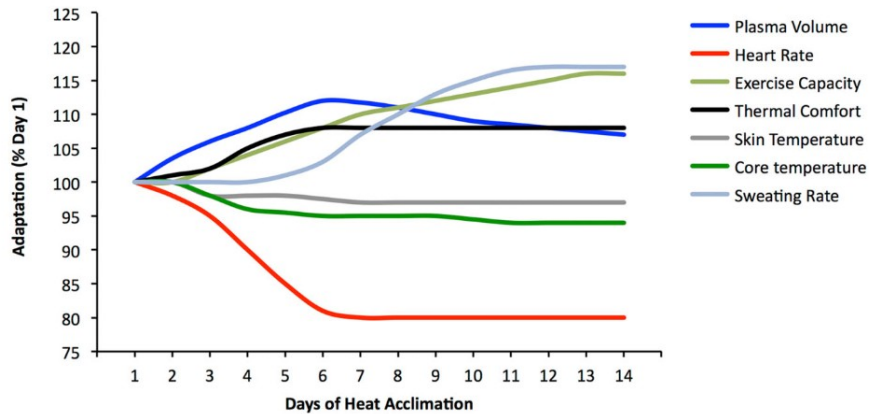


Fig. 5. Time course of induction in human adaptations to heat stress. Within this first week of exercise heat acclimation, plasma volume expands and heart rate decreases during exercise at a given work rate. Perceptually, the rating of thermal comfort improves. From a thermoregulatory perspective, core and skin temperature are reduced during exercise at a given work rate, whereas sweat rate increases. Consequently, aerobic exercise capacity is increased. Of note, the magnitude of these adaptations is dependent on the initial level of acclimation, the environmental conditions (i.e., dry or humid), exercise intensity, and acclimation regimen.

## Acclimatation to high altitude!

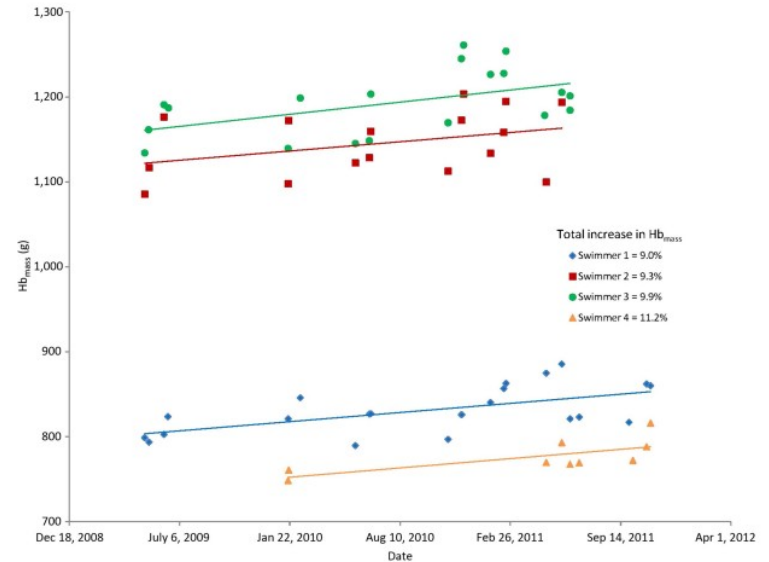


Figure 2 — Progression of  $Hb_{mass}$  in four elite Australian swimmers over a 4-year period. All data are absolute  $Hb_{mass}$  in grams over eight altitude camps, including both LHTL in Canberra (3,000/600 m) and LHHT in Sierra Nevada, Spain (2,300 m). LHHT = live high:train high (natural); LHTL = live high:train low (natural or simulated);  $Hb_{mass}$  = hemoglobin mass.

# 5 minutos de pausa

Después: workshop con  
el cosinuss° Two sensor

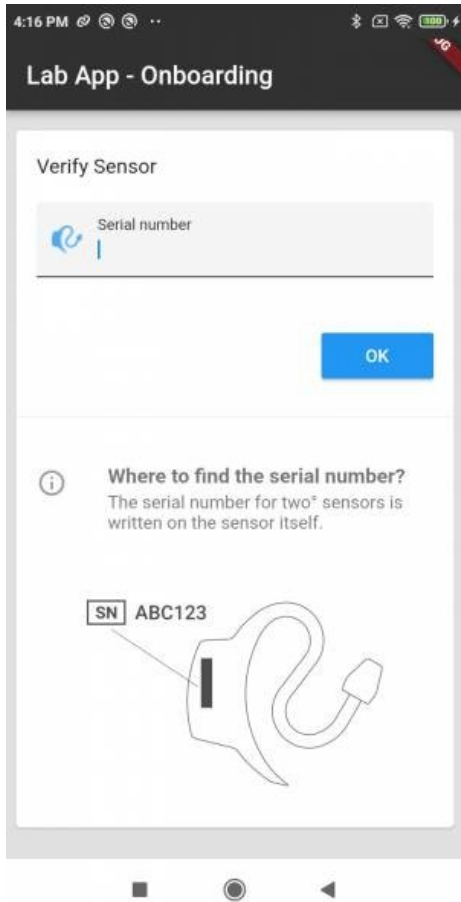


# Workshop cosinuss° Two

Medir tus propios parámetros vitales con el cosinuss° Two

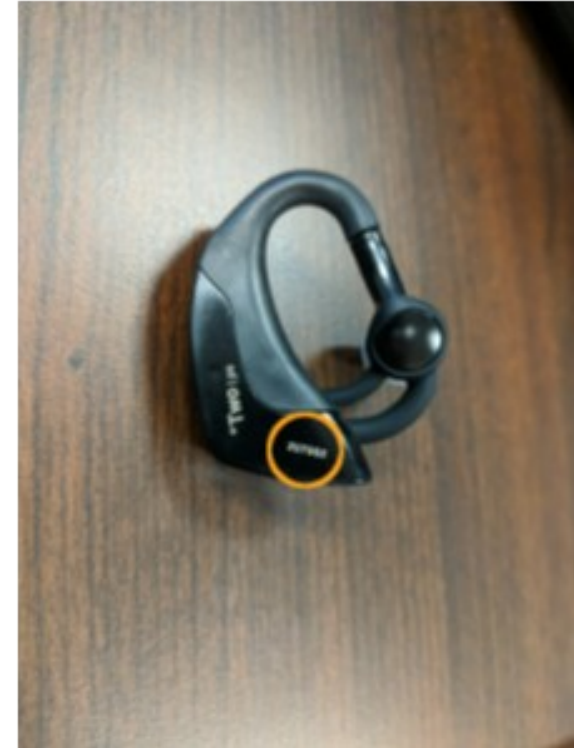
1. Limpia tu oído derecho
2. Enciende el sensor haciendo doble click en la parte plana
3. Abre el cosinuss° LabApp



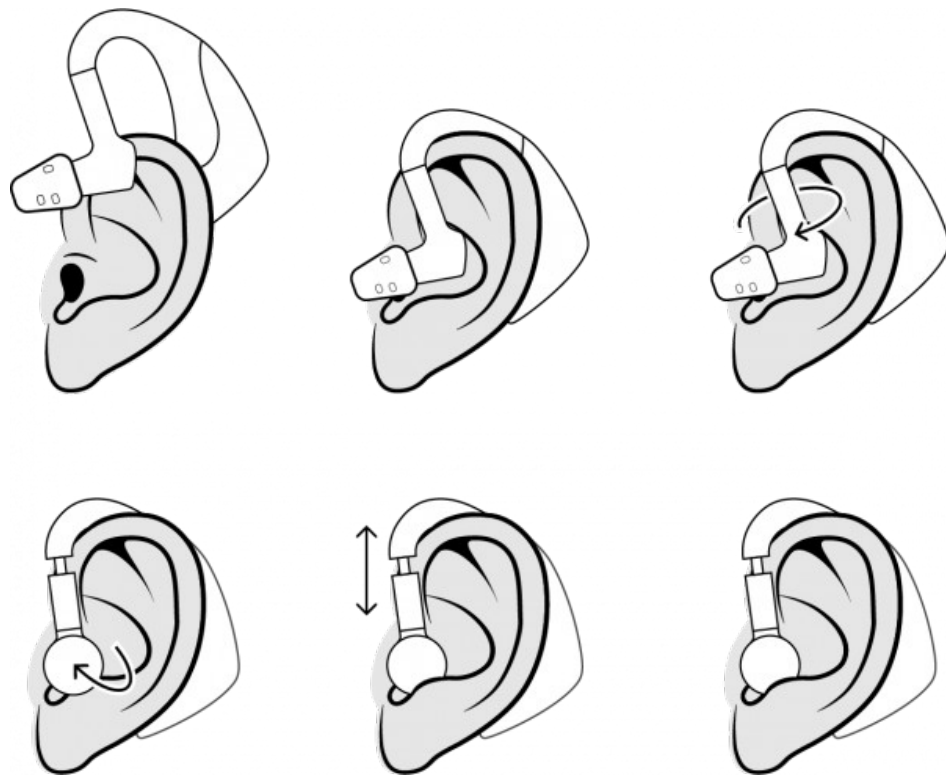


← Escribe el número de serie de tu sensor en el LabApp

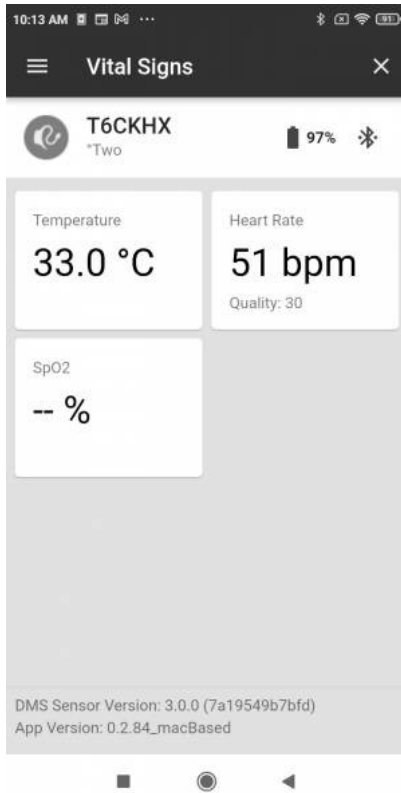
El número de serie se encuentra aquí →



# Coloca el sensor en el oído derecho



Observa los parámetros vitales

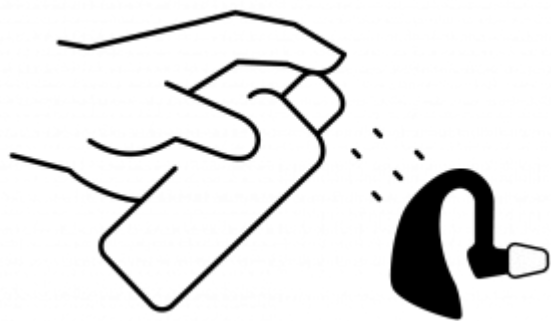


**Mide tu frecuencia cardíaca durante las siguientes actividades:**

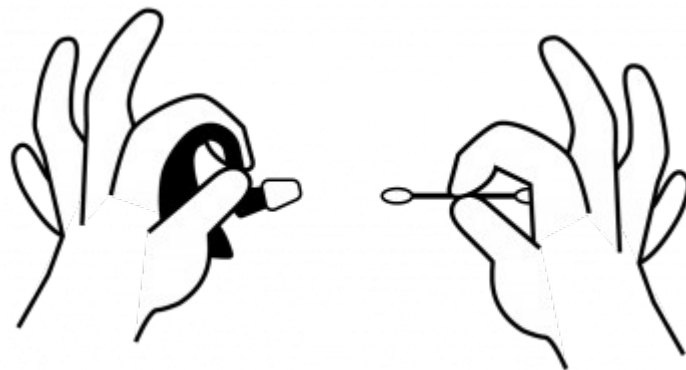
1. 1 minuto sentado
2. 1 minuto parado
3. 1 minuto subiendo las piernas
4. 30 segundos saltando

## Limpia el sensor

1.



2.



3.





¿Hay alguna pregunta?



## Grupos para la piscina

- Haced grupos de 5 personas
- Escribe tu nombre en tu gorro de piscina
- Plan para el resto del día: 4 estaciones diferentes en el agua, competición y diversión!

Gracias por vuestra atención!

Vamos a nadar! :)

