Madrid–MIT m+Visión Consortium

From bench to bedside and back again

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From bedside to bench and back again: The Catalyst and Converter programs

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Catalyzing change in the health technology innovation ecosystem

By changing how people think and work

For long-term societal and economic benefit

What is M+Visión?

An international collaboration for biomedical technology innovation led by Comunidad de Madrid and MIT

A new way of working that integrates the clinic, the research lab, and the office

A proven method to deploy R&D+i investment to reach patient impact

M+Visión: From concept to proof

Established a seasoned management team and **a community of 350 faculty, collaborators, and program contributors**

Developed and tested a **new innovation method, IDEA^3**

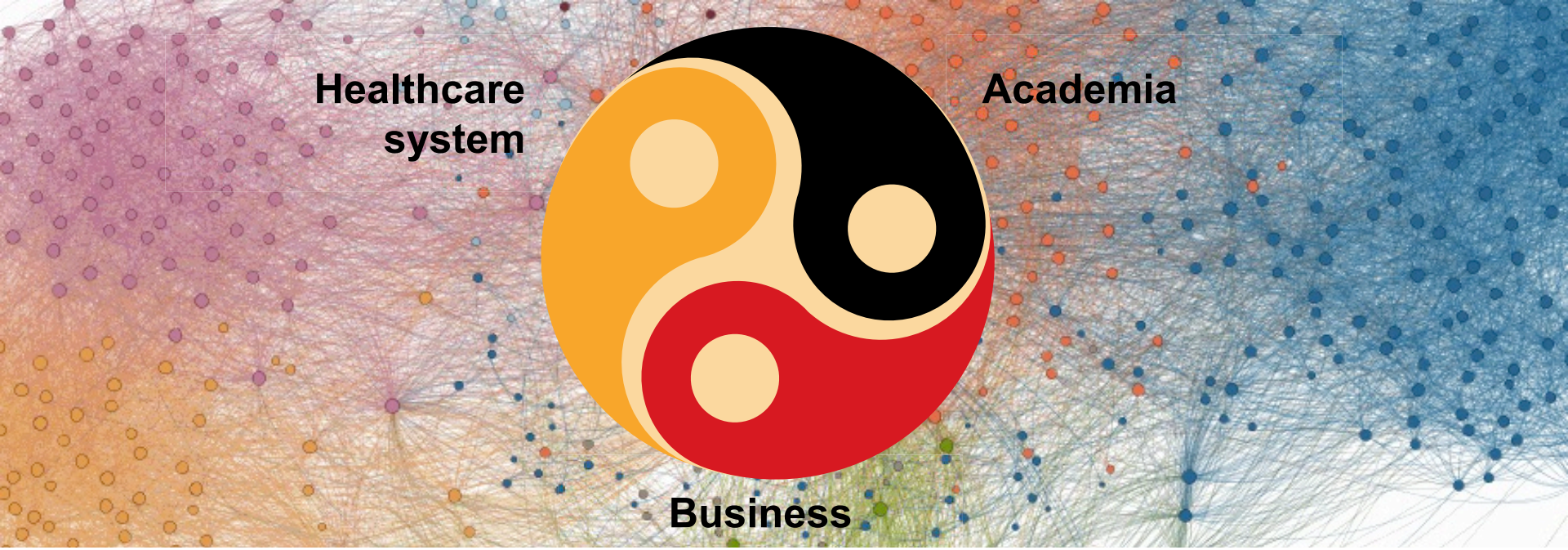
Demonstrated results in impact-oriented biomedical technology R&D

Our ethos: Focus on people

Open, multi-professional community, sharing experiences through **meaningful work**

Developing people and ideas that will drive healthcare innovation

Leveraging existing institutions and infrastructures



Our community: A model ecosystem

Research universities

The ingenuity to invent new solutions

Healthcare institutions

The inspiration for change and the field of opportunity

Business sector

The expertise to translate ideas into successful innovations

Start up phase: Bets

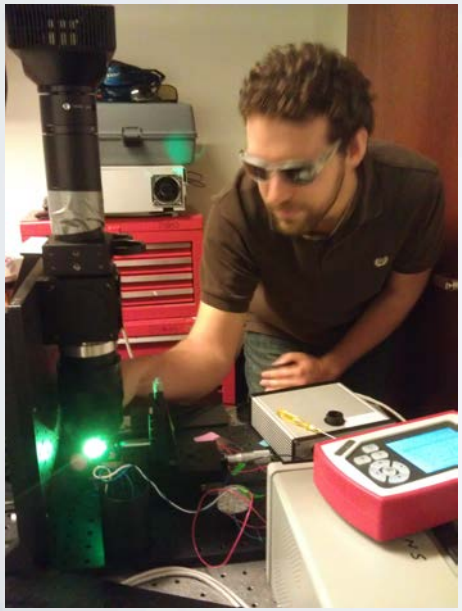
1. Young talent would be capable of playing a central role
2. Community would embrace the opportunity
3. Need-driven approach would drive innovations and ecosystem development
4. Effort would yield follow-on benefits to MIT and Madrid

The Catalyst program

Block 1: Project Definition	*Needs*	*Solution ideas*	*Validate*	*Proposal*
4-5 months *All fellows in cohort* Throughout, they regularly test assumptions and impact proposition directly with diverse stakeholders	Identify medical needs and specify the "impact proposition" for addressing them.	Propose and assess solutions that would address the medical need.	Define the use case and outline definitive evidence or study that would demonstrate the impact	For selected opportunities (= need + idea), propose an action plan for a project to realize the opportunity. Each Fellow is a member of from 1-3 project teams.

The Catalyst program

Block 2: Proof-of-Project	*Project launch*	*Early experiments*	*Proof of project*	*Updated project plan*
6-9 months *By each project team* Throughout this block they aggressively seek to produce preliminary evidence for their idea	Recruit collaborators who can provide key expertise and infrastructure. Finalize initial resource requirements.	Initial exploration into project execution. Training and approvals as needed.	Studies and other actions that provide evidence that project is viable.	Define a set of milestones, objectives, and associated resources needed to achieve proof-of-principle



The Catalyst program

Block 3: *Case for continuity*	*Project execution*	*Documenting evidence*	*Continuity opportunities*	*Graduation*
12-24 months *By each project team* Overall aim is to have clear continuity plan for the project and each Fellow	Project priority is to provide evidence that idea is viable for the envisioned use case	Document progress through IP disclosure and prosecution and publication in conferences and journals	Identify needs and opportunities to continue project development after the program ends. Identify and secure next stage career opportunities for Fellows	Fellows: proceed to academic, medical, or business positions. In some cases they will continue to be involved in project development.

Our results: Flagship *Catalyst* program

20 › projects with healthcare impact potential

131 collaborators

88 research groups at 31 institutions

25 invention disclosures and 15 patent applications

7 new grants awarded

75% collaborators opening new lines of research

Catalyst projects, 2012–2015

Diverse in subjects and technical areas

Early intervention
Projects that can enable earlier, better responses to disease and injury

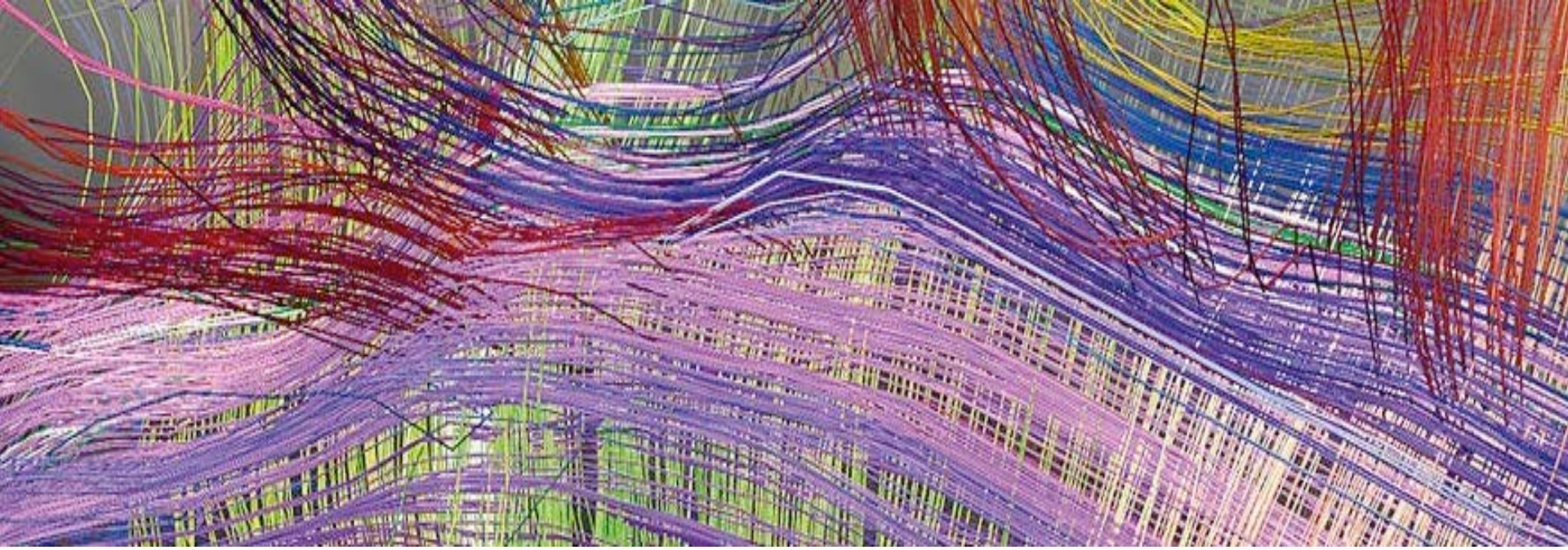
+ Cell
+ Colo
+ Fetal
+ NeuroQWERTY
+ Skin

Managing health
Projects that can help people achieve and maintain better health

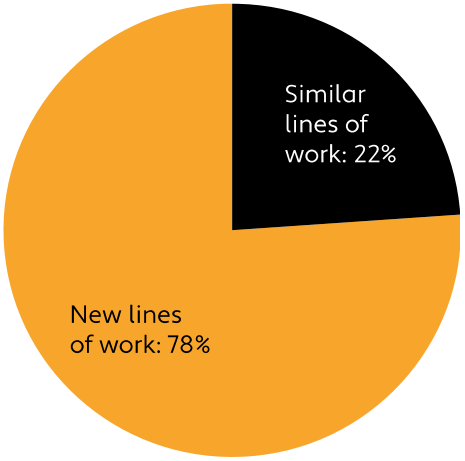
+ Brain
+ Eye
+ Hydration
+ Leuko
+ Scolio

Better care delivery
Projects that can make clinical care safer and more effective

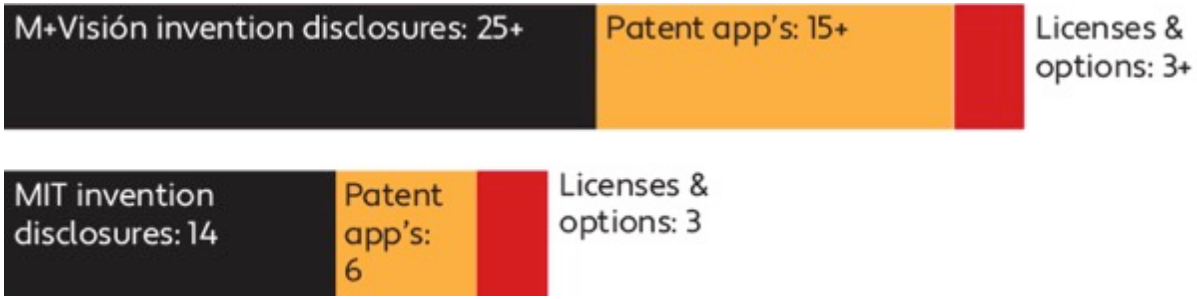
+ CT
+ Lumbar
+ mPET
+ MS-SAR
+ Pancreas



Our results: New lines of work, accelerated IP

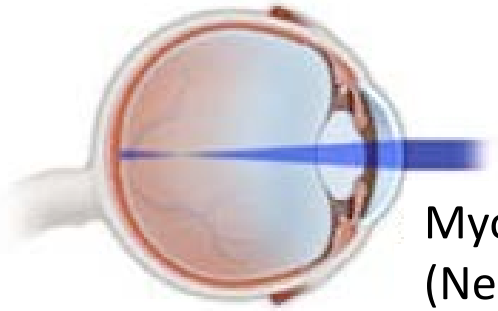


New lines of research expand opportunities

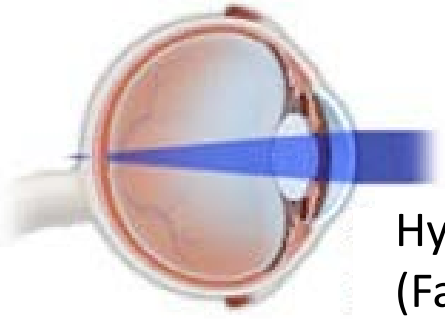


Volume and pace of IP development exceeds institutional norms

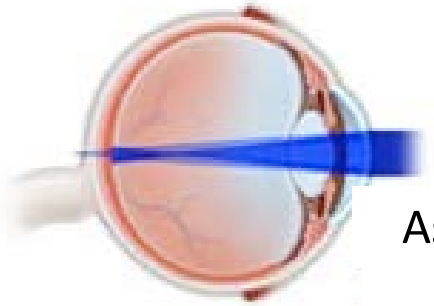
Refractive errors can lead to visual impairment



Myopia
(Near sightedness)



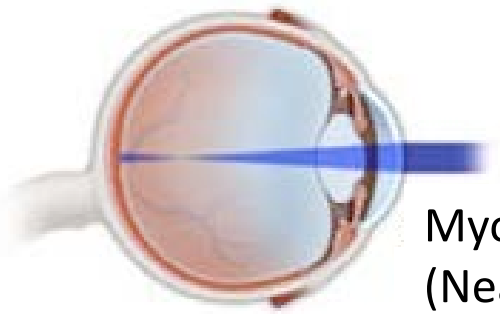
Hyperopia
(Far sightedness)



Astigmatism

www.eagleeyecentre.com.sg/lasik.html

Refractive errors can lead to visual impairment



Myopia
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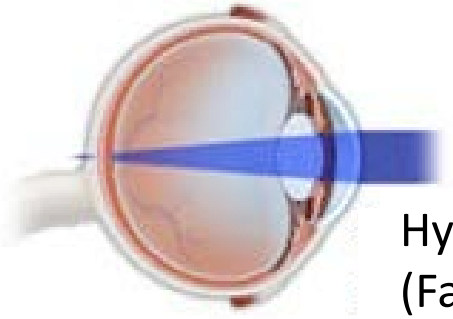

Hyperopia
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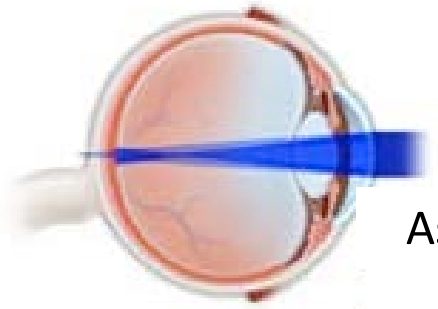
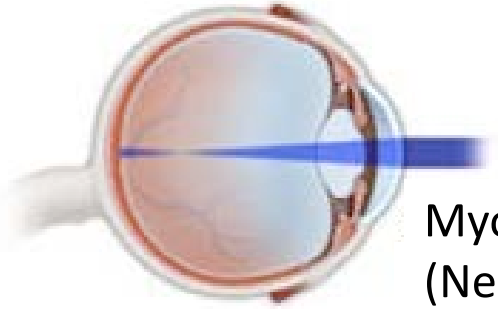


Astigmatism

There is still no effective prevention method

www.eagleeyecentre.com.sg/lasik.html

Refractive errors can lead to visual impairment



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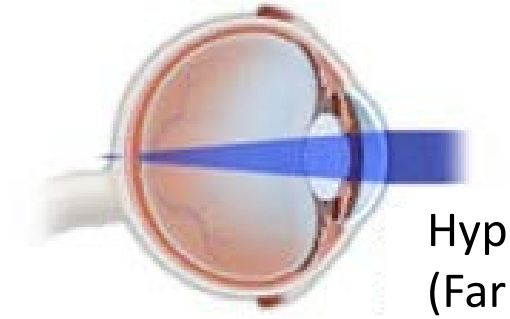
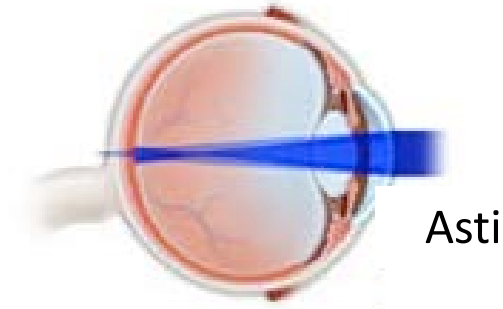


Hyperopia
(Far sightedness)



Astigmatism

Cost-effective treatment

http://www.eagleeyecentre.com.sg/lasik.html

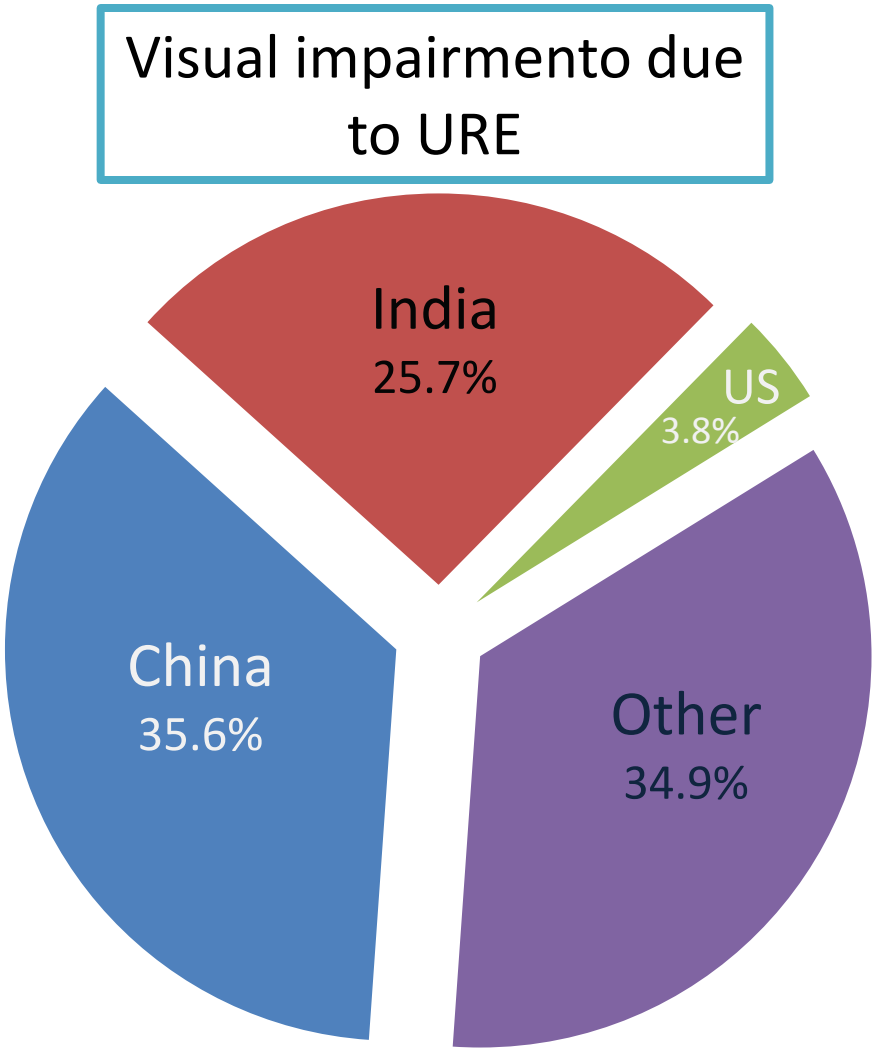
Visual impairment
due to

Uncorrected
Refractive Errors
(URE):

153 million

>10% children

Prevalence of URE is high everywhere



Country	Prevalence
China	4.4%
India	4.0%
USA	1.9%
Global	2.7%

Barriers for correction

Cost of lenses

2 €

Access to prescription

- Trained optometrists
  - United Kingdom
    - 1 optometrist: 8000 people
  - Ghana
    - 1 optometrist: 500,000 people
- Technological limits
  - Expensive
  - Difficult to use

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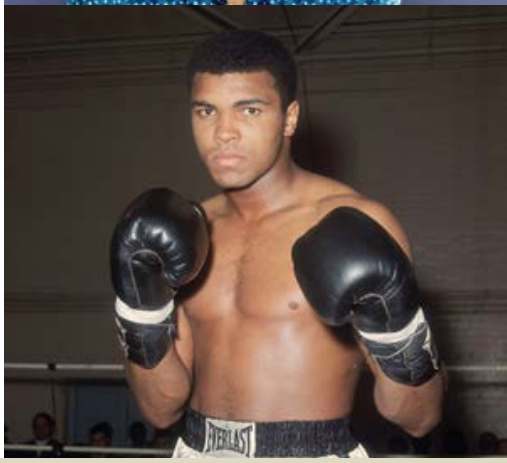
  - Expensive
  - Difficult to use

Solution

A simple and autonomous device that prescribes aberrations automatically

plenoptika.com



Affects more than 5 M people worldwide

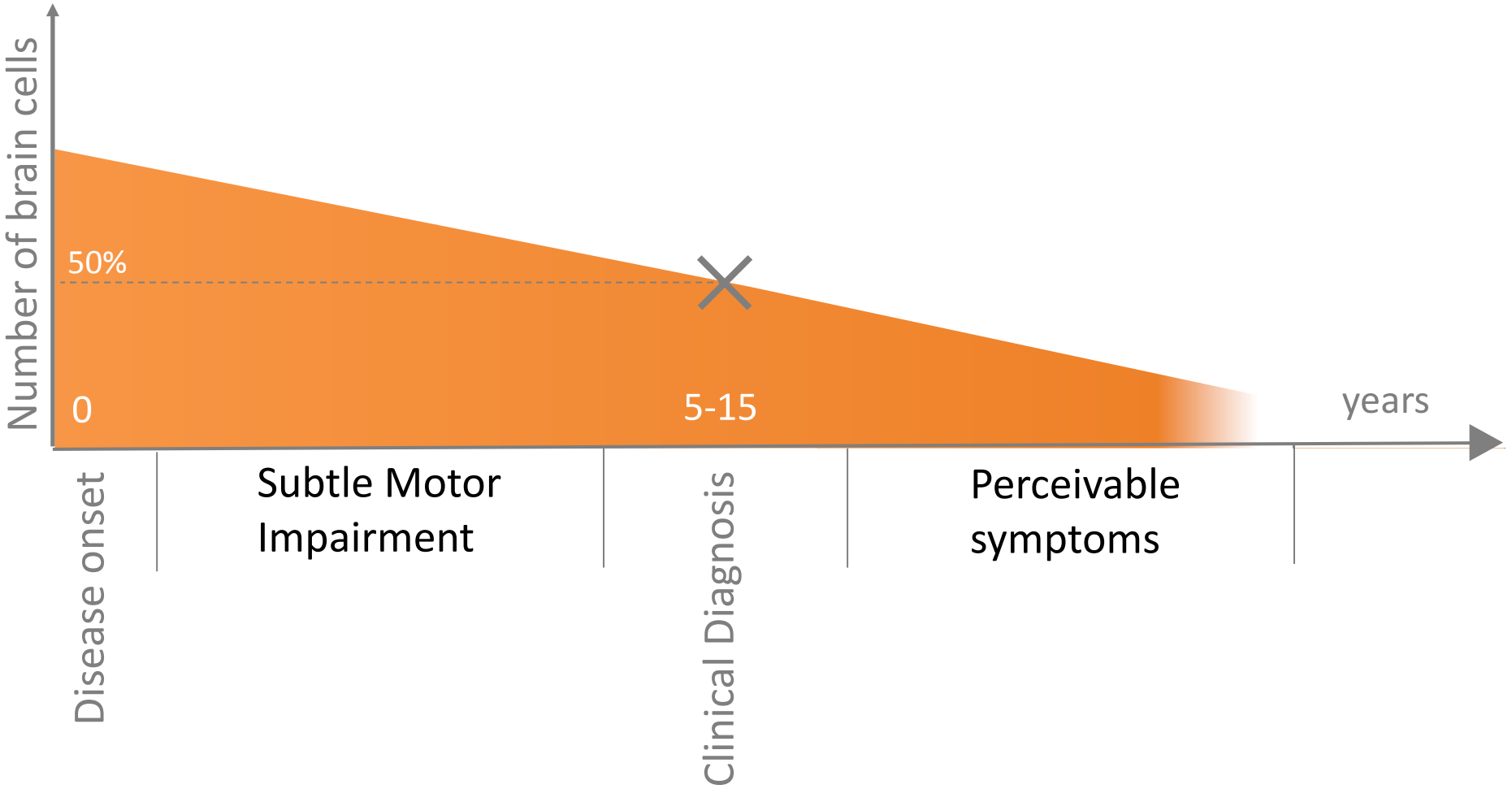
The prevalence is expected to double by 2040

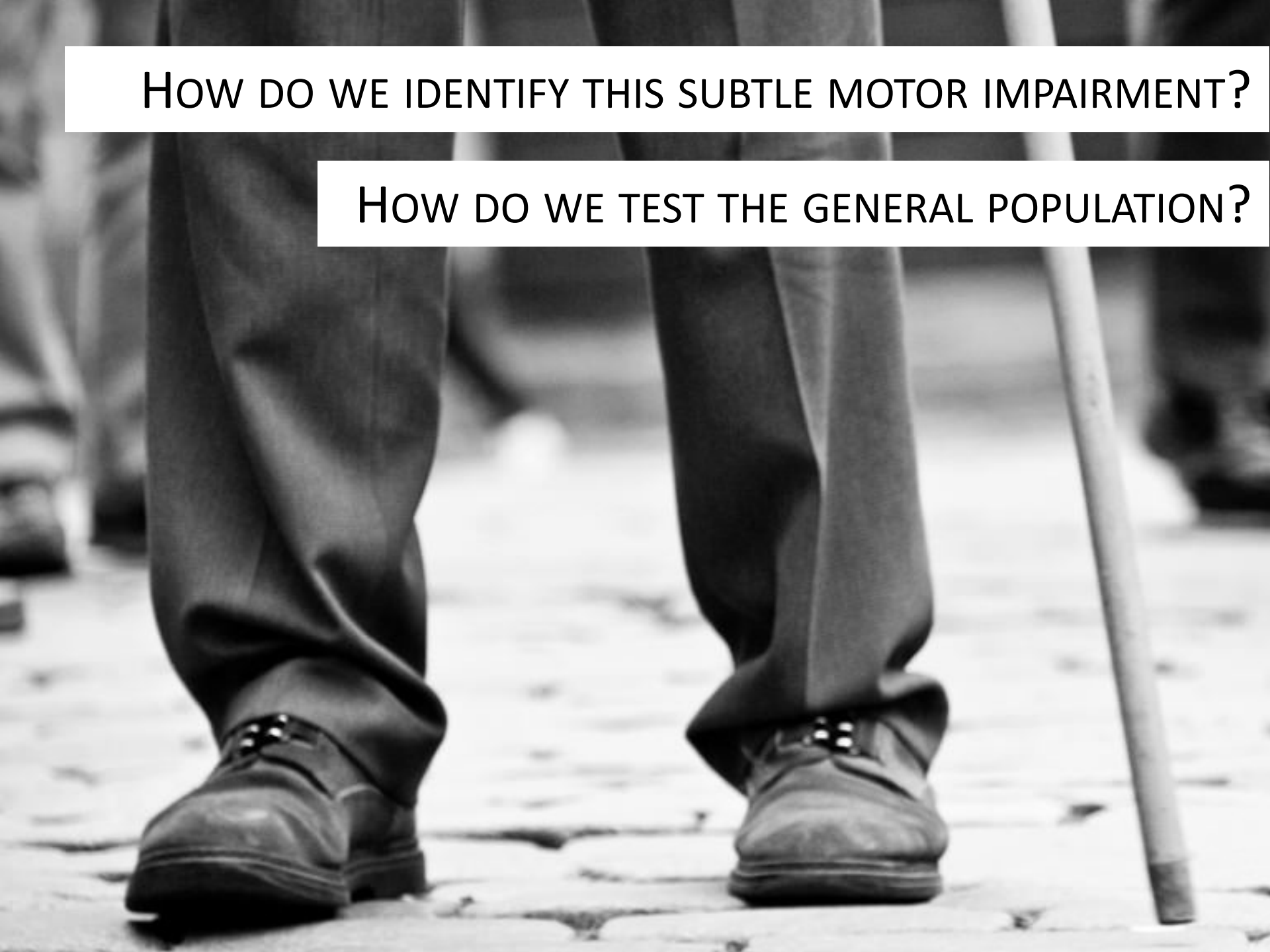
Health providers costs: $ 29.3 Bn (US and Europe)

No cure exists, only symptoms are treated

PARKINSON'S DISEASE

The second most frequent neurodegenerative disorder in the western world


Number of brain cells
50%
0
5-15
years
Disease onset
Subtle Motor Impairment
Clinical Diagnosis
Perceivable symptoms



How do we identify this subtle motor impairment?

How do we test the general population?


We have the neurological information at our fingertips

and we collect it all the time…

and we collect it all the time…



neuroQWERTY

A transparent tool to detect prodromic symptoms in Parkinson's Disease

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MGH 1811

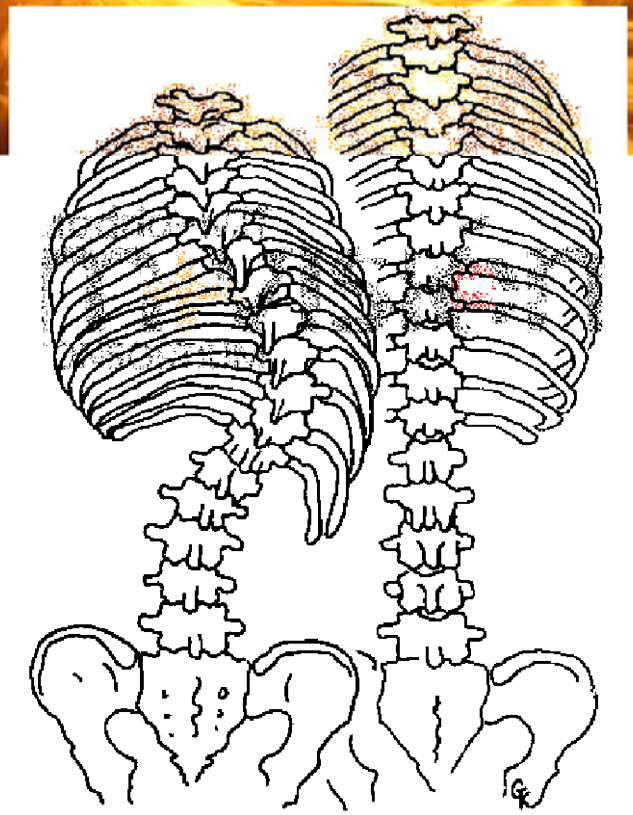
i+12 Instituto de Investigación Hospital 12 de Octubre

IdISSC INSTITUTO de INVESTIGACIÓN SANITARIA Hospital Clínico San Carlos

MIT

earlybird.io

UN NUEVO PARADIGMA TERAPEUTICO PARA LA ESCOLIOSIS



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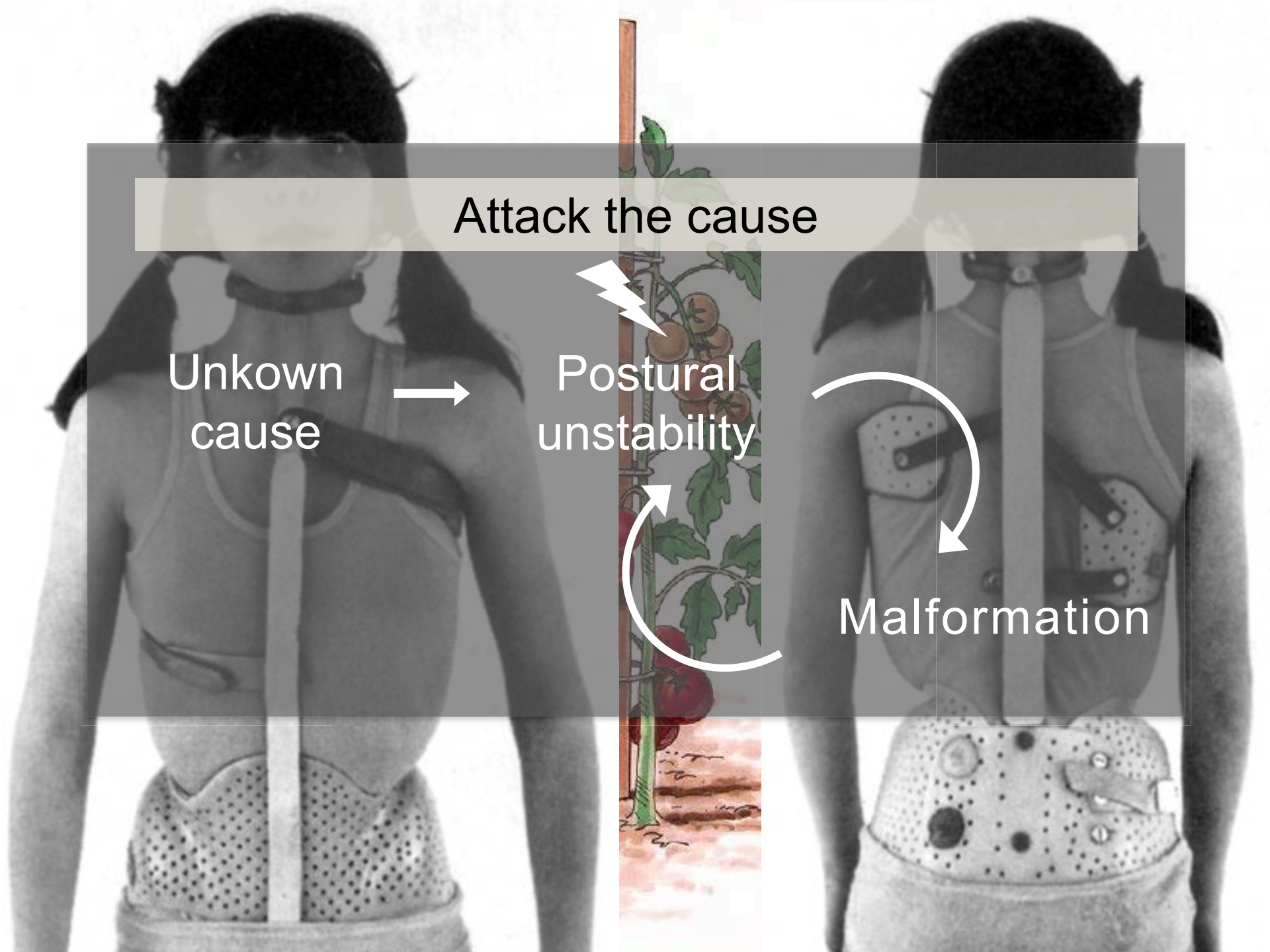
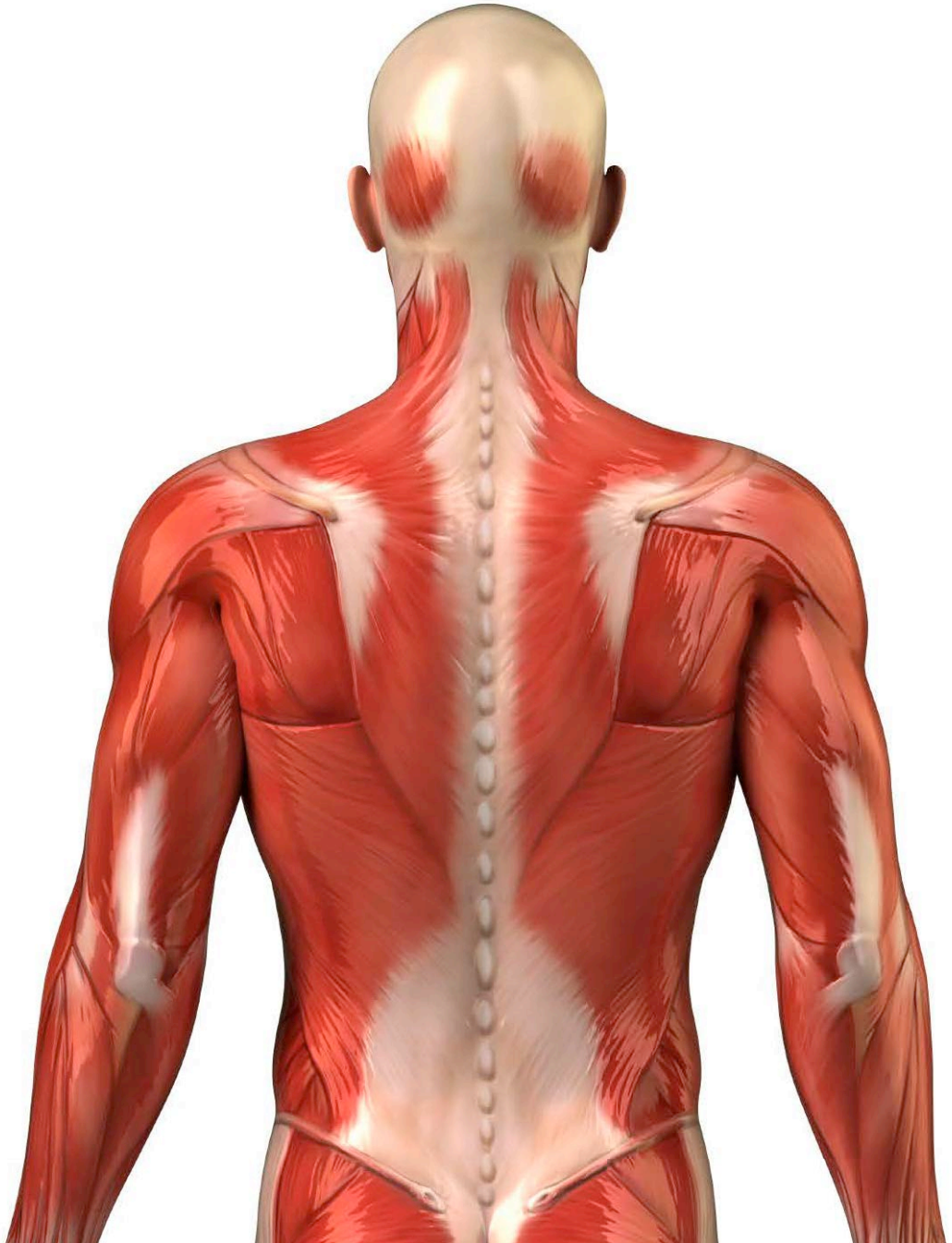
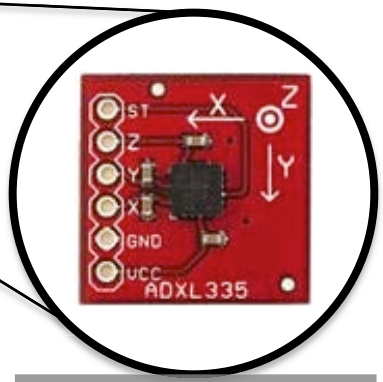
centro Coras


2-3% of adolescents
suffer some degree of
SCOLIOSIS


Attack the cause
Unkown cause
Postural unstability
Malformation





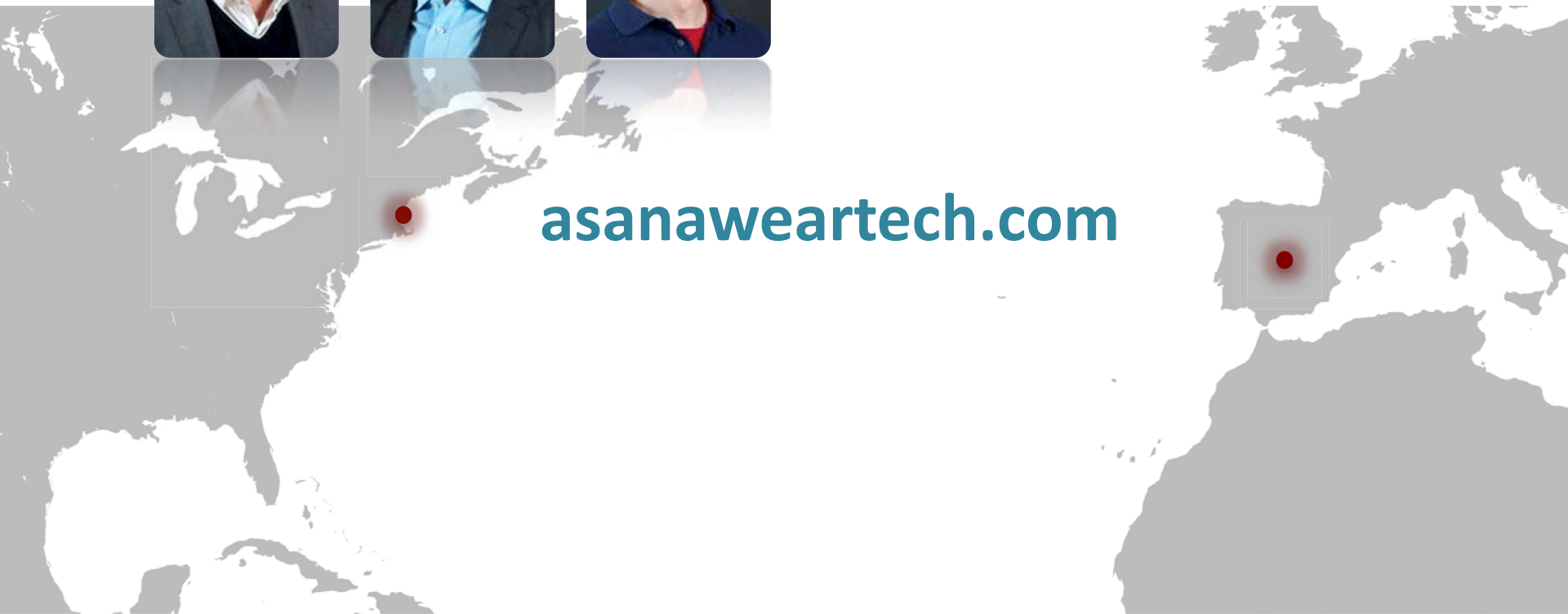
Orientation sensor

“Congratulations, Maria. Your posture is almost perfect”

Carlos S. Mendoza
PhD
Aurélien Bourquard
PhD
Luca Giancardo PhD



Alicia Trallero, DP



asanaweartech.com

Bacterial Meningitis is a potentially lethal infection provided it is promptly detected and treated, difficult in the asymptomatic baby

NEWBORN
.SOLUTIONS

Lumbar puncture (LP) is the only to draw a sample of cerebrospinal fluid (CSF).
If CSF white blood cell count (WBC) is high, medication is immediately administered while waiting for diagnostic bacteriologic results, available after 48h

NEWBORN .SOLUTIONS

In under-resourced countries, the lack of laboratory facilities to analyse the sample leads to increased misdiagnosis and mortality

NEWBORN
.SOLUTIONS

Neosonics

The first device to non-invasively screen for infant meningitis

Non-invasive measurement of CSF WBC through the infant fontanel, the area of the head where bones are not fully closed.

Non-invasive

Real time

At the push of a button

Treatment monitoring

Cost-effective

NEWBORN
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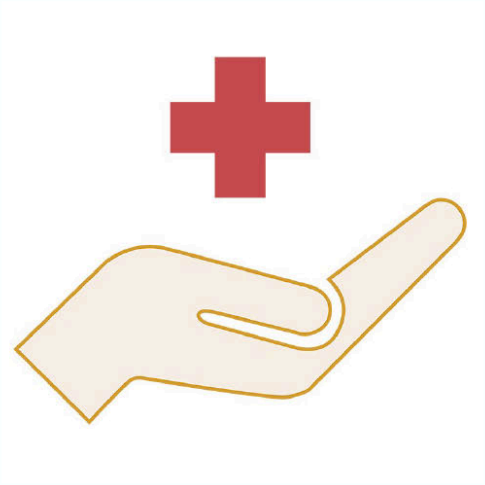
PLACE, PUSH, DETECT

PLACE

on the infant fontanel, the head area where bones are not yet closed

PUSH THE BUTTON

to get the cerebrospinal fluid (CSF) white blood cell (WBC) count



DETECT

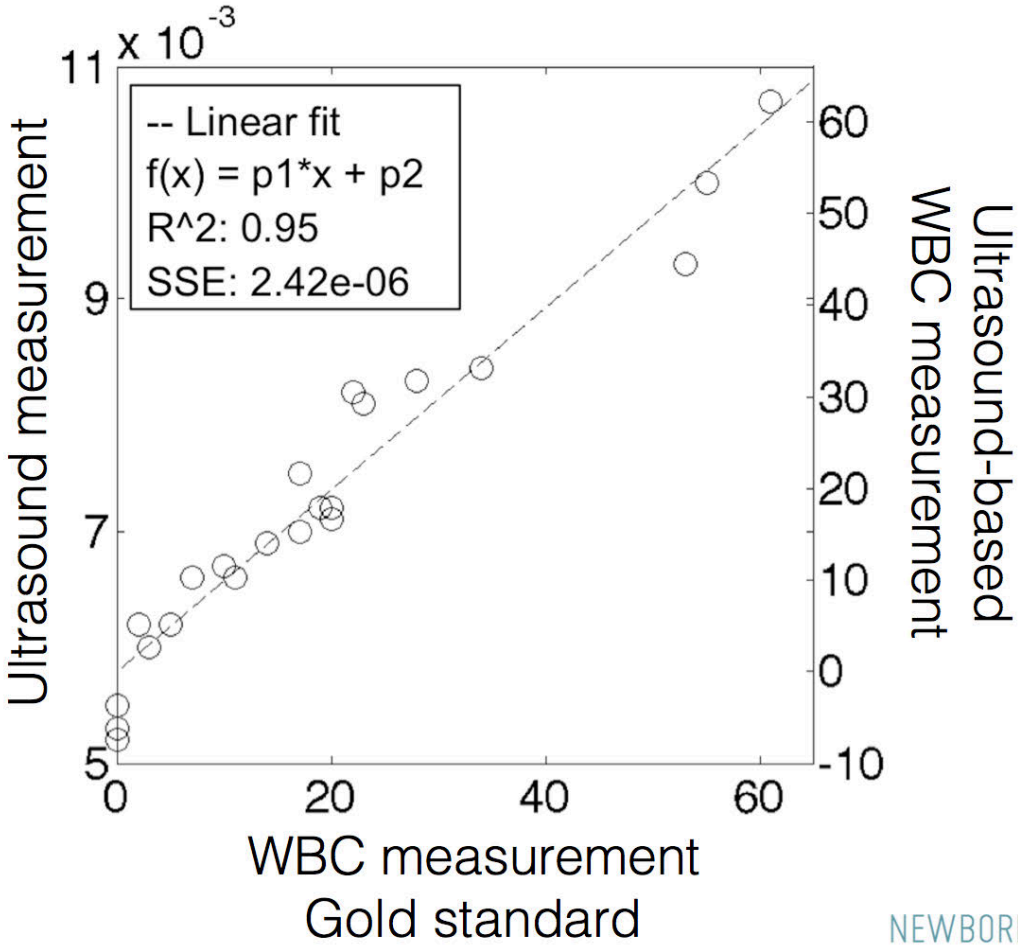
abnormal CSF WBC count to immediately trigger medication or to follow-up patient's response to treatment

Results

Scientific publication

Journal of Ultrasound
in Medicine and Biology
Approved Jan. 2016

Precise detection of any WBC concentration in the meningitis diagnostic range



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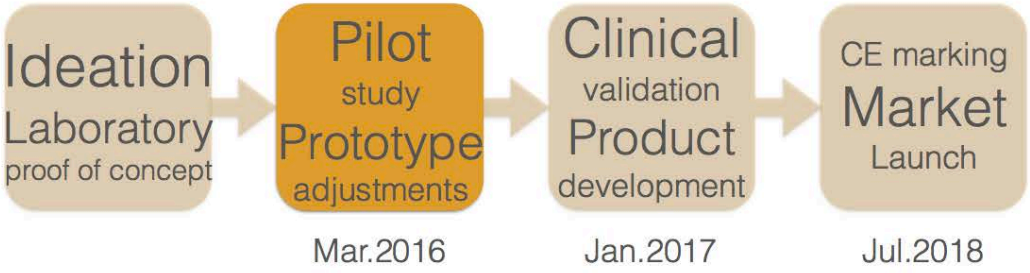
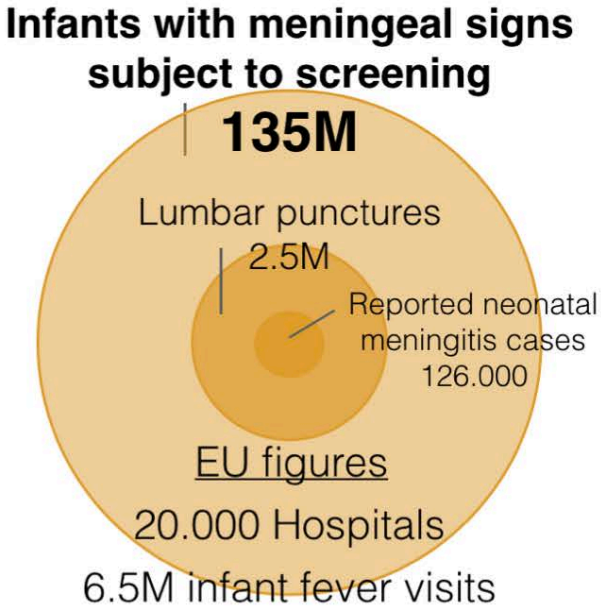
Project status



Market



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Team

Javier Jiménez
Founder and CEO
MIT trainee | EAE MBA
Biomedical Image Processing

Pablo García
CFO
Over 20 years as CFO
Business Expert, Economist

Luis Elvira
Principal Investigator, CSIC
23 years expertise in ultrasounds
Madrid, Spain

Adelina Pellicer
Director of Neonatology
Hospital La Paz
Madrid, Spain

Fernando Cabañas
Director of Paediatrics
Hospital Quirón
Madrid, Spain

Quique Bassat
Paediatrician, Epidemiologist
ISGlobal, Global Health
Barcelona & Mozambique

Patent

CSIC
Consejo Superior de Investigaciones Científicas
fundación madrid+d para el conocimiento
Massachusetts Institute of Technology

Industrial partner

CORTEX TECHNOLOGY

Clinical partners

Hospital Universitario La Paz
SaludMadrid
Comunidad de Madrid

Hospital Universitario Quirón Madrid

ISGlobal Barcelona Institute for Global Health

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neosonics

The first hand-held device to non-invasively screen for infant meningitis

Contact information

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+34 626 536 144

www.newborn.solutions

NEWBORN
.SOLUTIONS

Leucemia y linfoma

>130,000 diagnósticos estimados[1]

44,000 muertes[1]

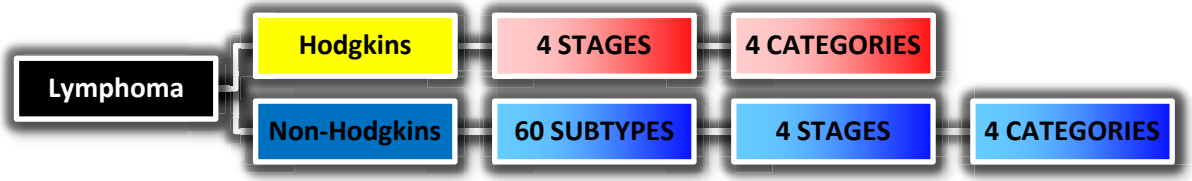
>1 millón de personas viviendo con ello[1]

El diagnóstico preciso de la clase y subtipo de la enfermedad es crítico para un tratamiento correcto y eficiente[1,2]

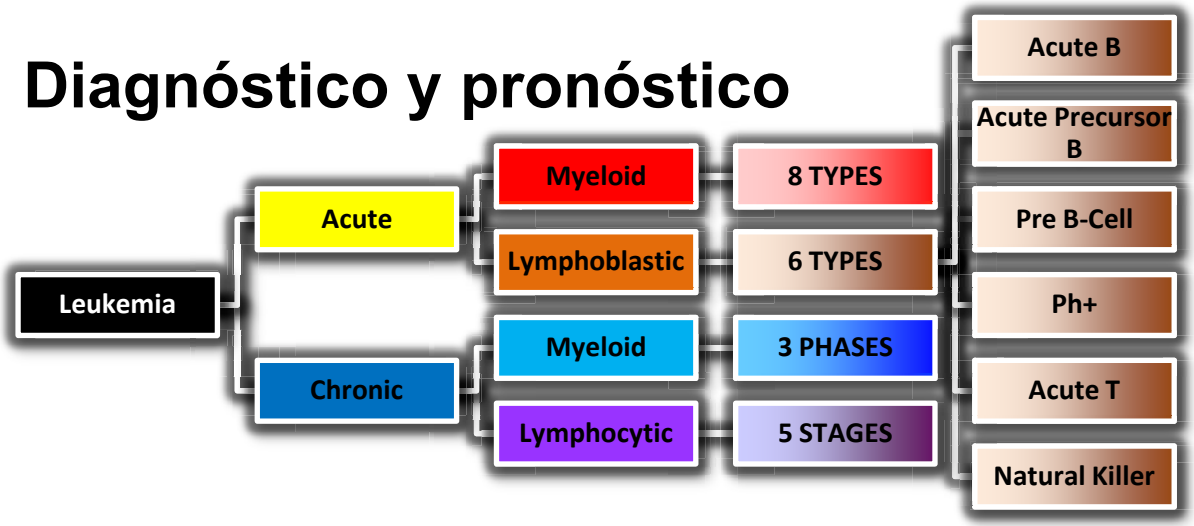
*USA Statistics, 2014

[1] Leukemia and Lymphoma Society Fact Sheet, 2014
[2] National Comprehensive Cancer Network. Guidelines. 2014

Disease Classification



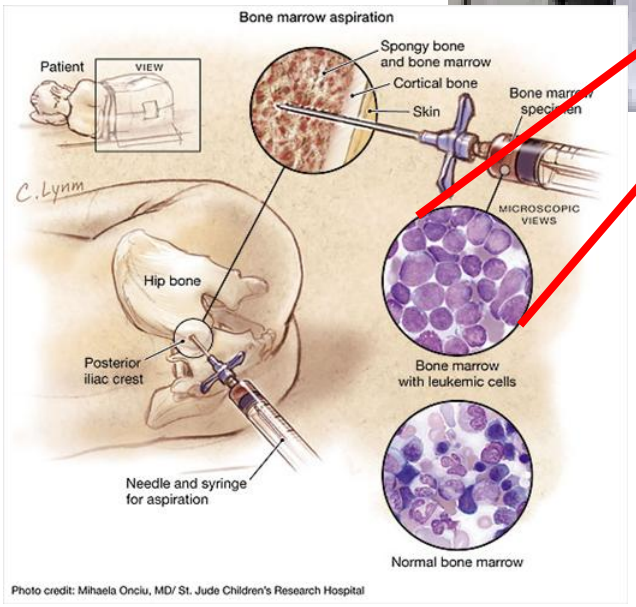
Diagnóstico y pronóstico



Treatment Plan

Amplio espectro de tipos de enfermedad y fenotipos que deben ser detectados antes del tratamiento

Fenotipado cualitativo: Microscopía



Muestras de sangre/marcado

Identificación de morfología, tipo celular, fenotipo

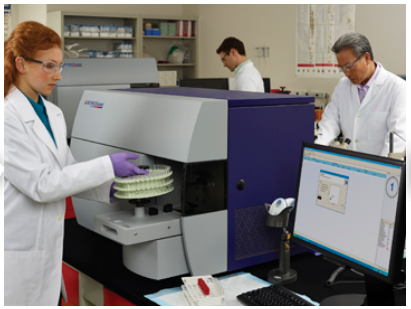
Cualitativo

Baja eficiencia

Fenotipado cualitativo: Citometría de flujo

Processed Cells

Flow Cytometer



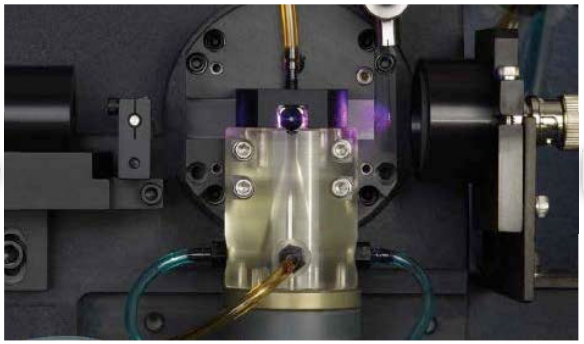
Cell Characterization

High throughput

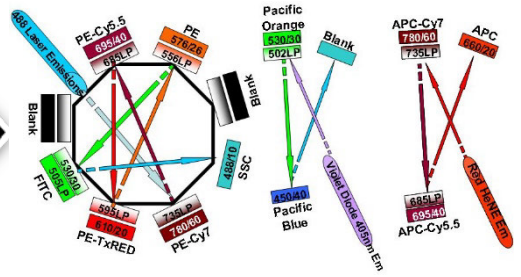
Análisis cuantitativo

Laser Illumination

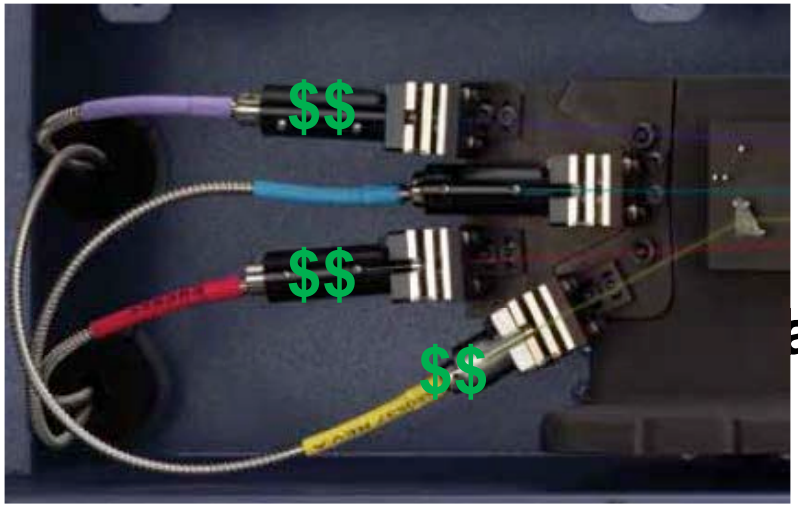
Fluidics System



Cell-by-Cell Event Detection



Laser Illumination



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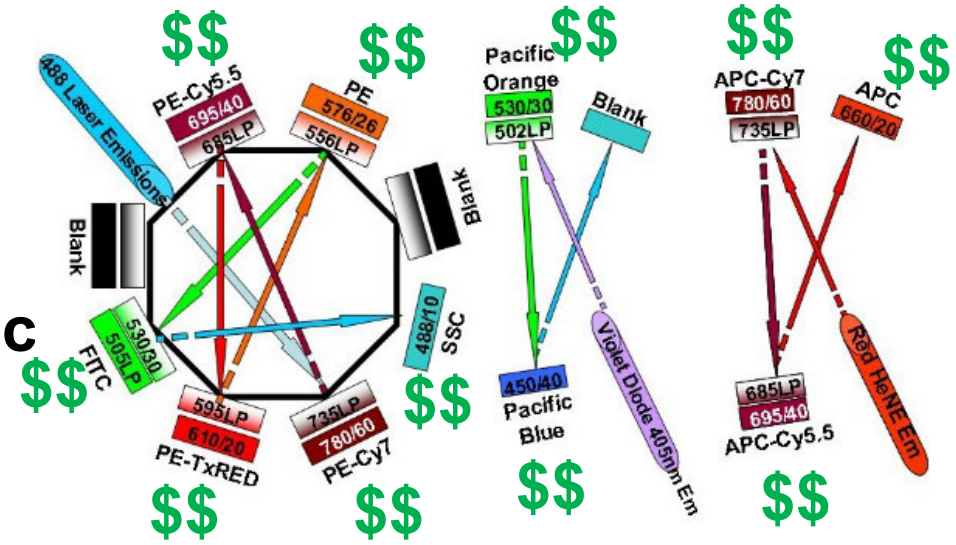
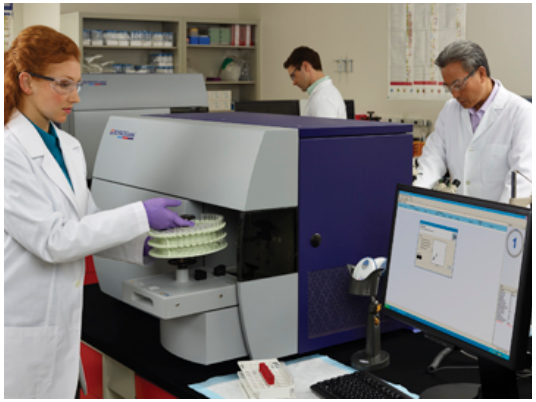


Multi (8+) color flow cytometry requires extensive components for illumination, flow, and detection:

- **High cost**
- **High complexity**

Presencia baja de la citometría



Alto coste, complejidad

Poco disponible para el usuario final

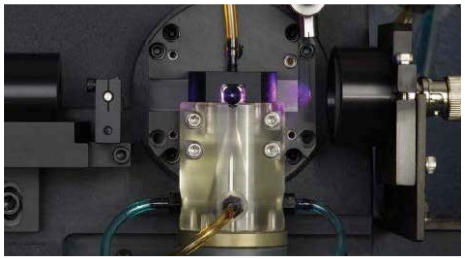
>75% de hospitales sin citómetro de flujo

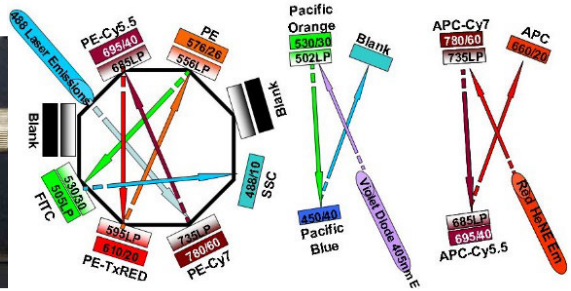
El paciente debe acudir a un centro especializado

Retraso en el diagnóstico

Retraso en el diagnóstico comercial

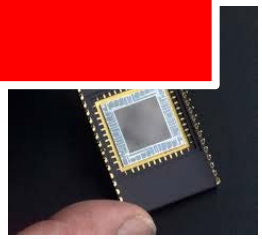
Degradación de la muestra



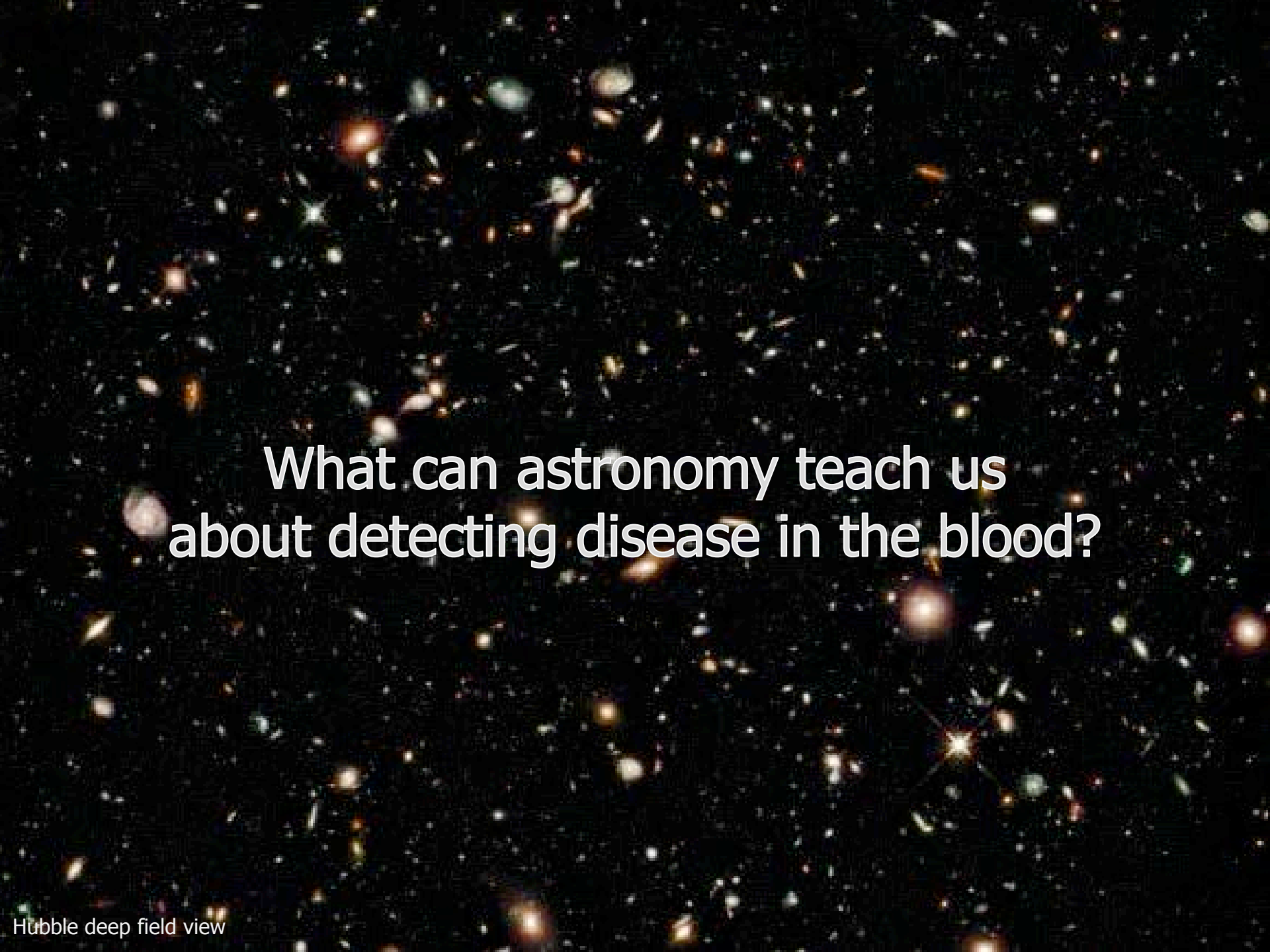


¿Por qué no usamos un microscopio para hacer citometría sin flujo de alto rendimiento?

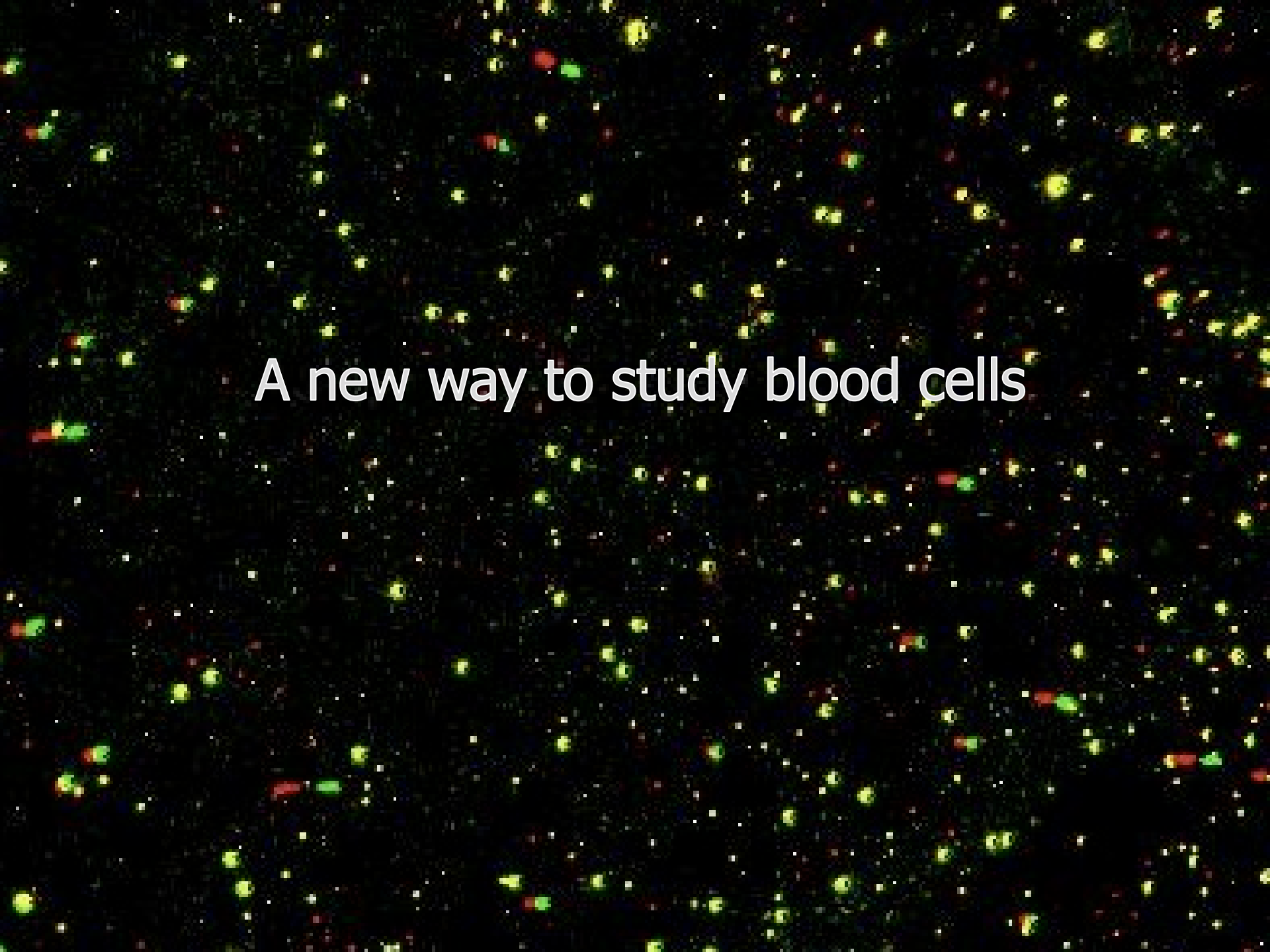
Citon

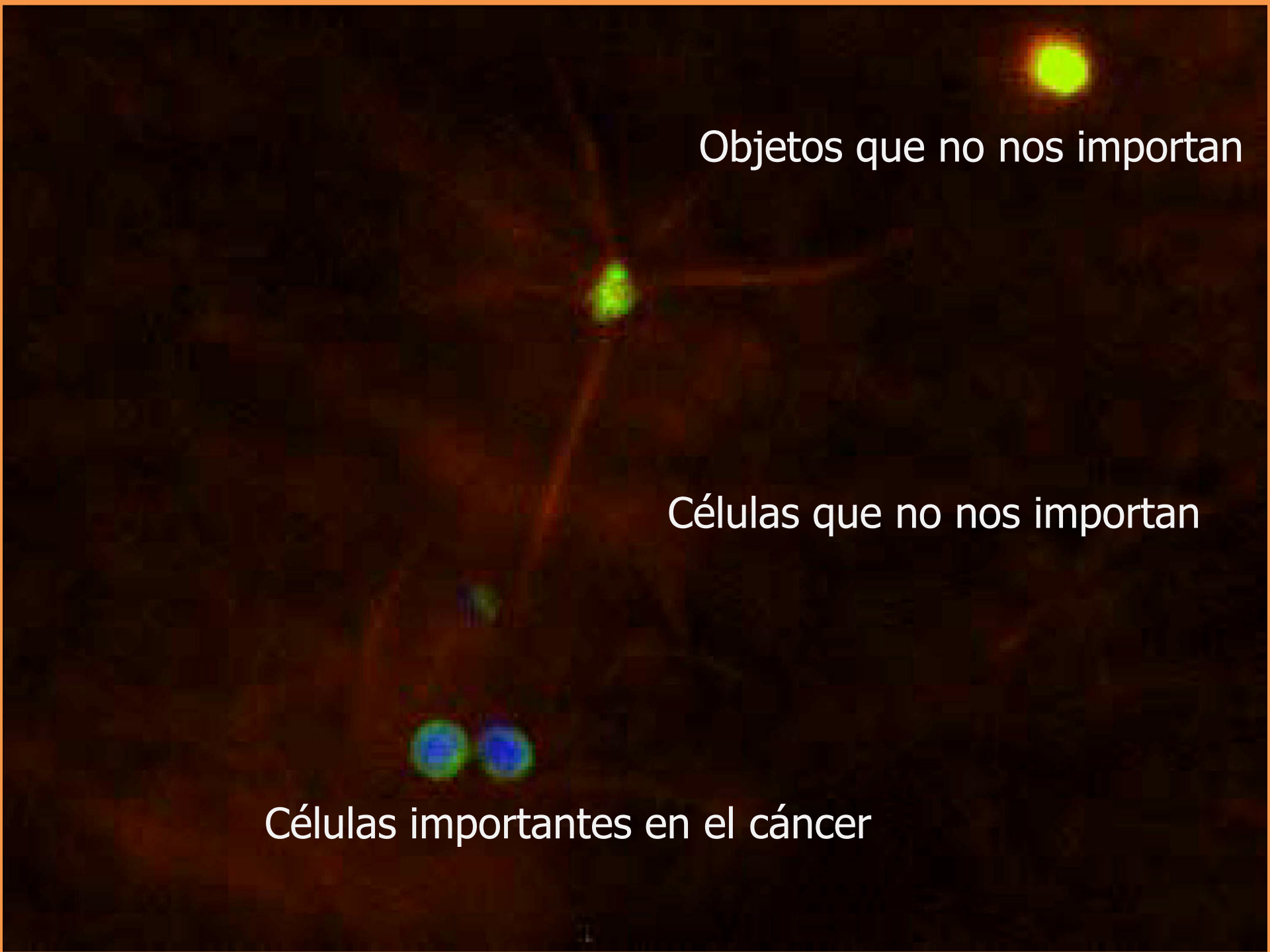


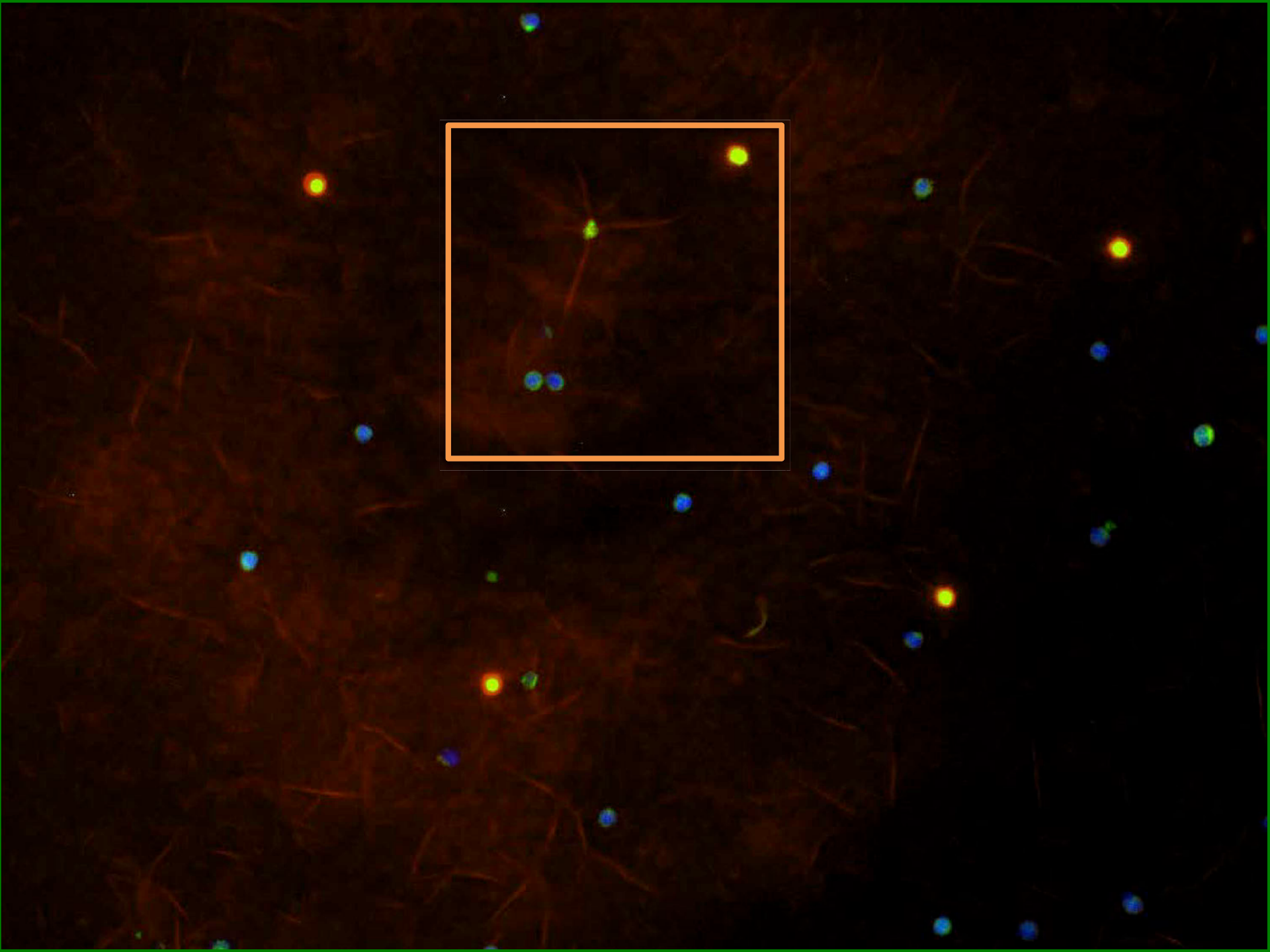
Los avances en electrónica, procesado de imagen, y LEDs de alta potencia permiten ***la imagen cuantitativa de alto rendimiento*** sensible y asequible

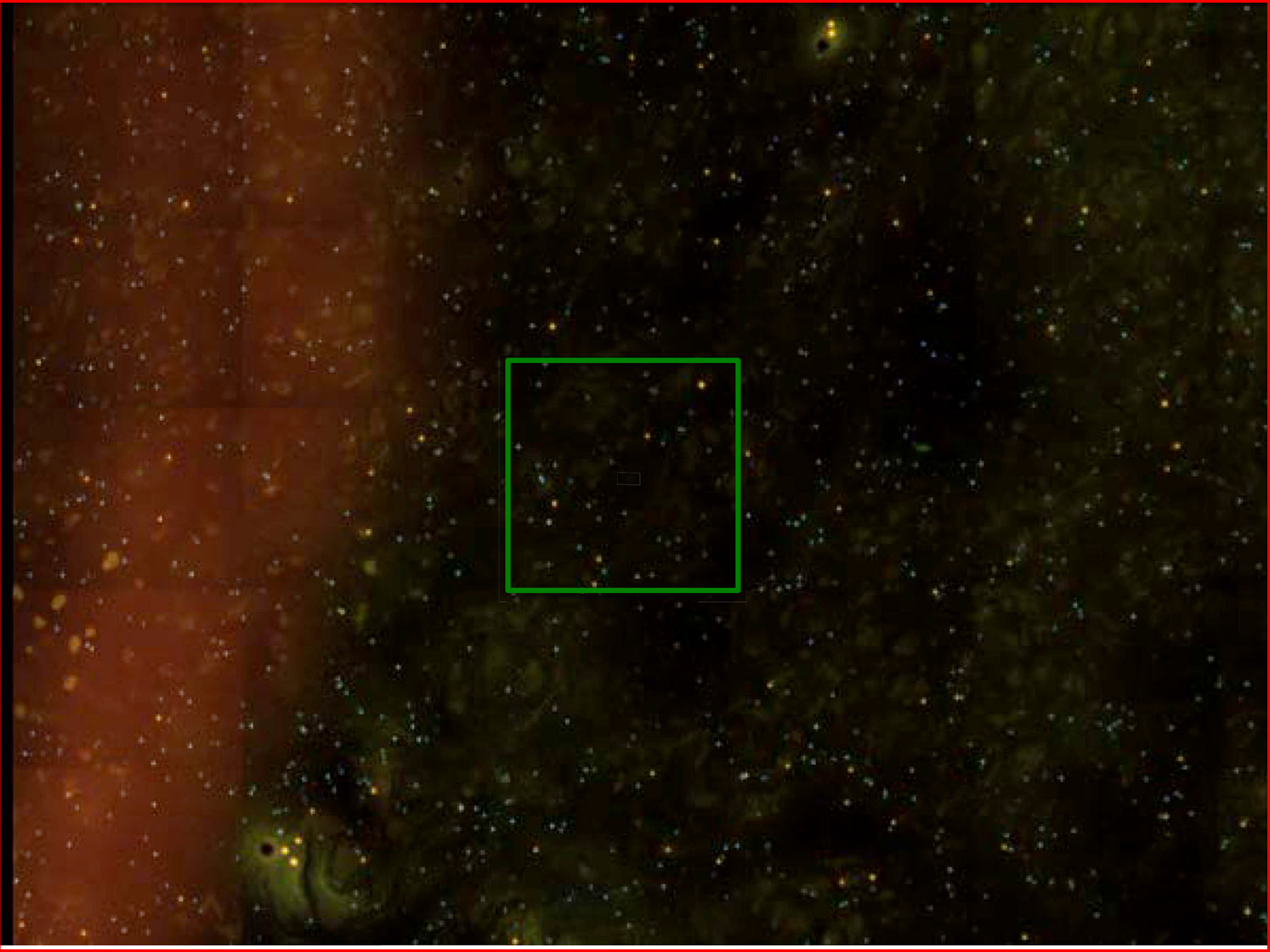


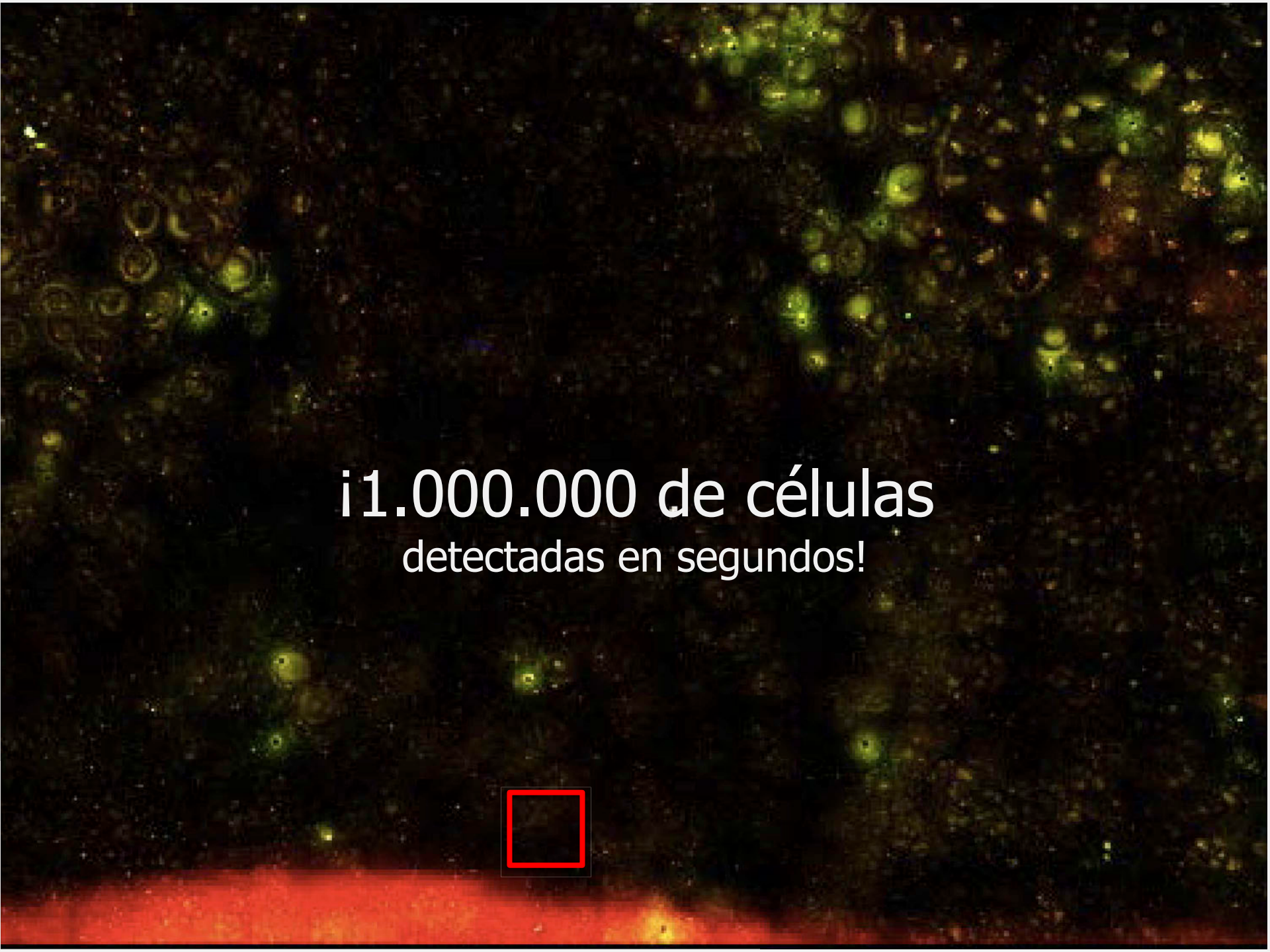
Hubble deep field view


A new way to study blood cells

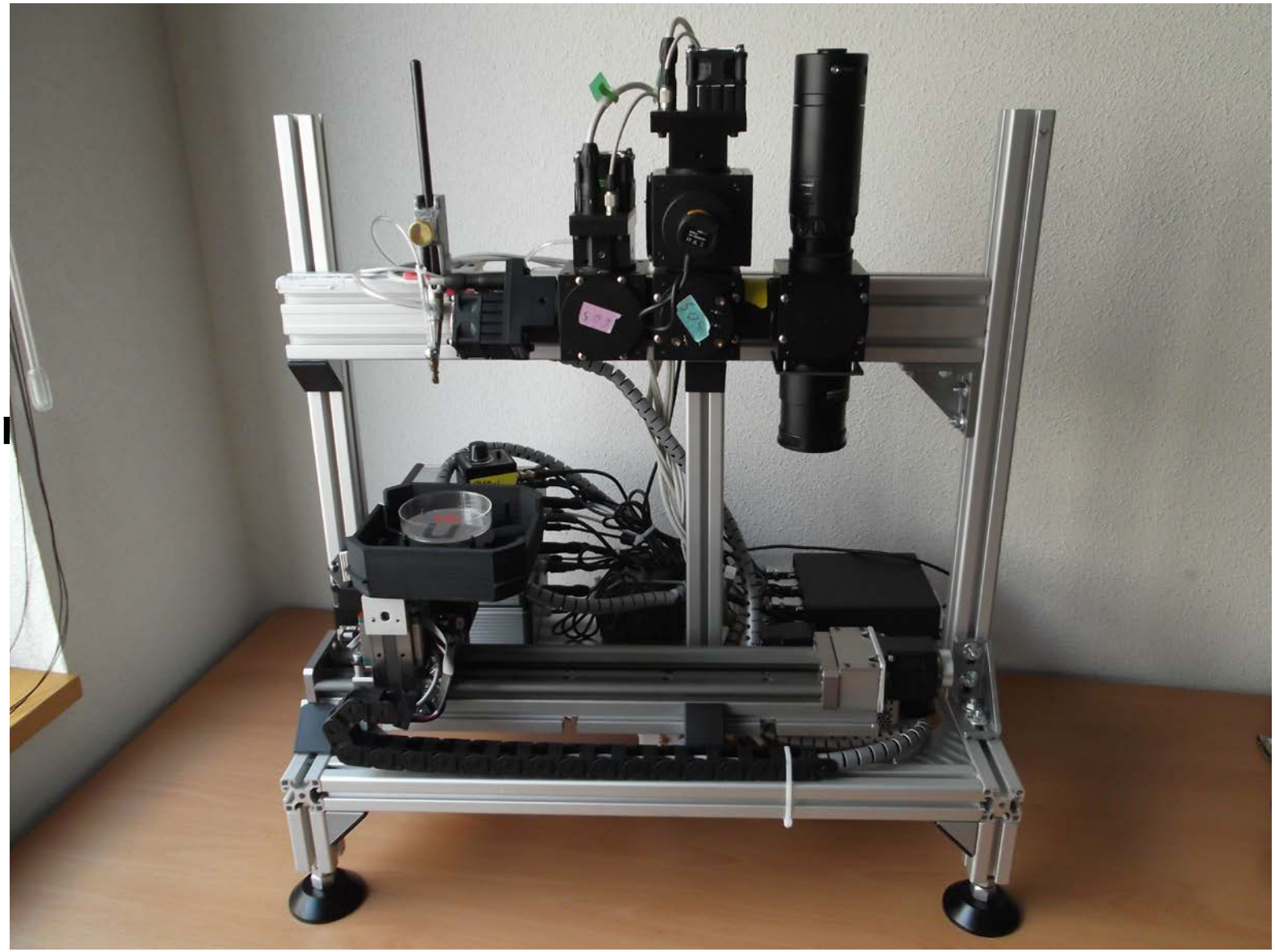

Objetos que no nos importan
Células que no nos importan
Células importantes en el cáncer

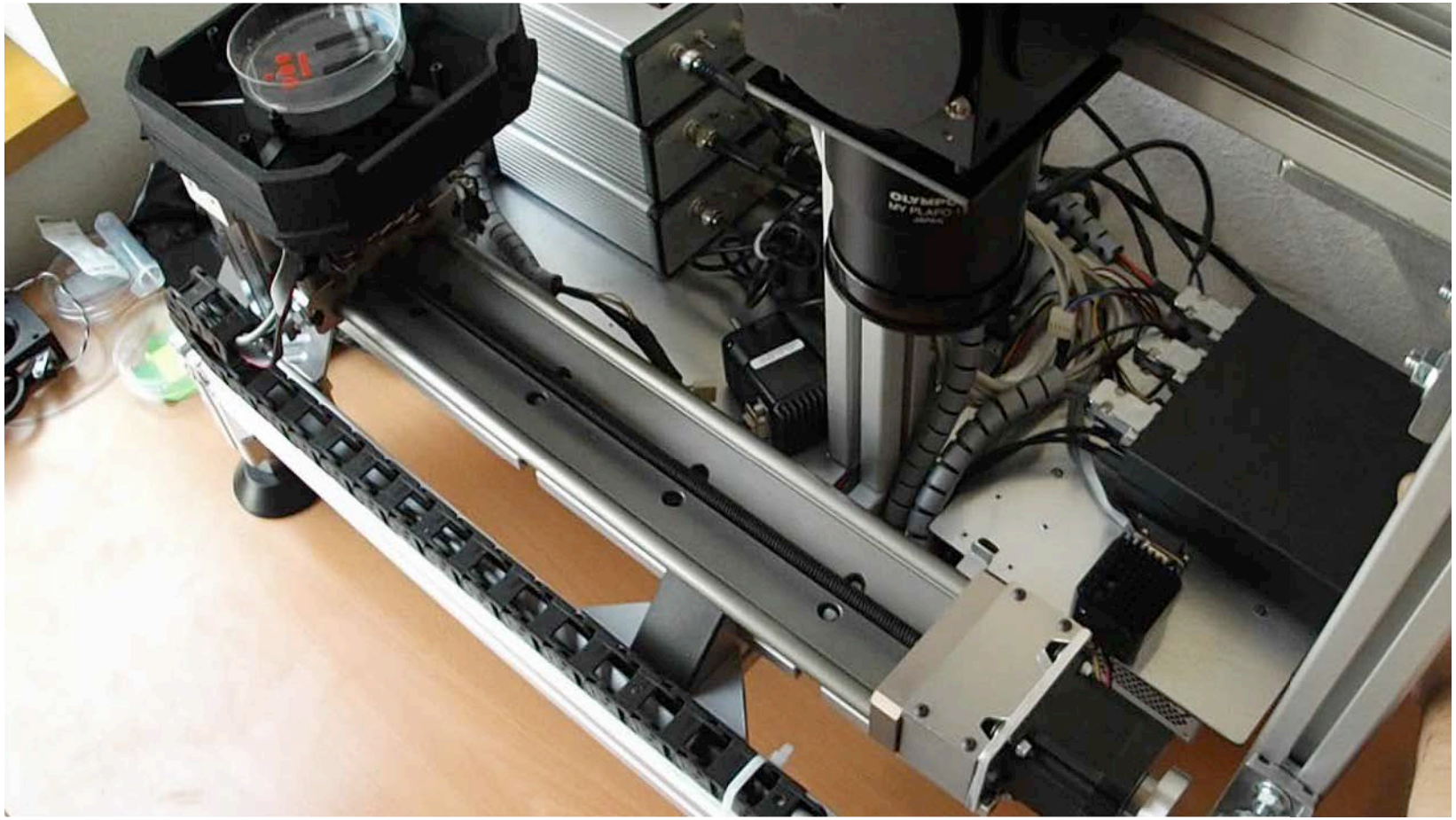


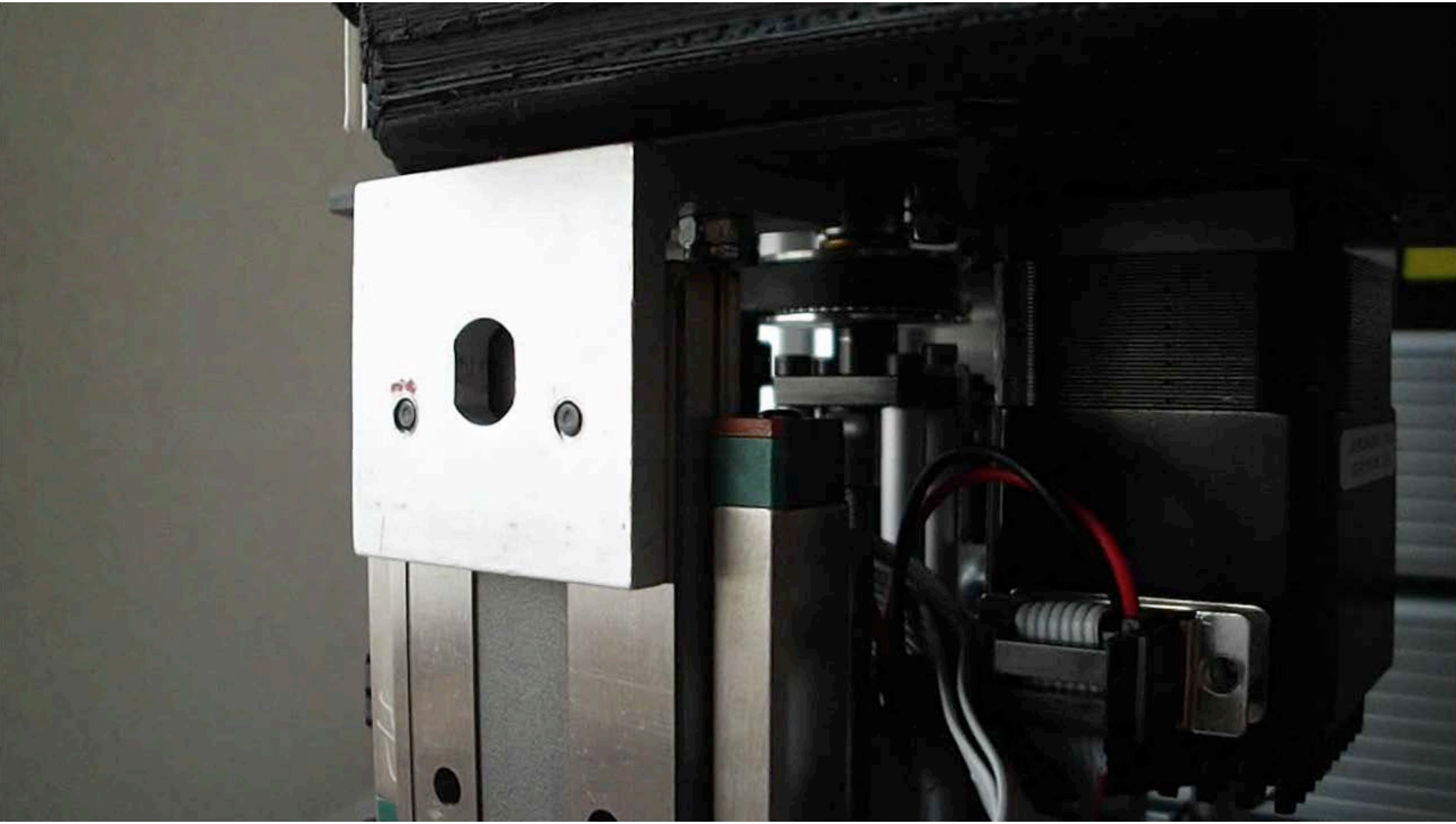


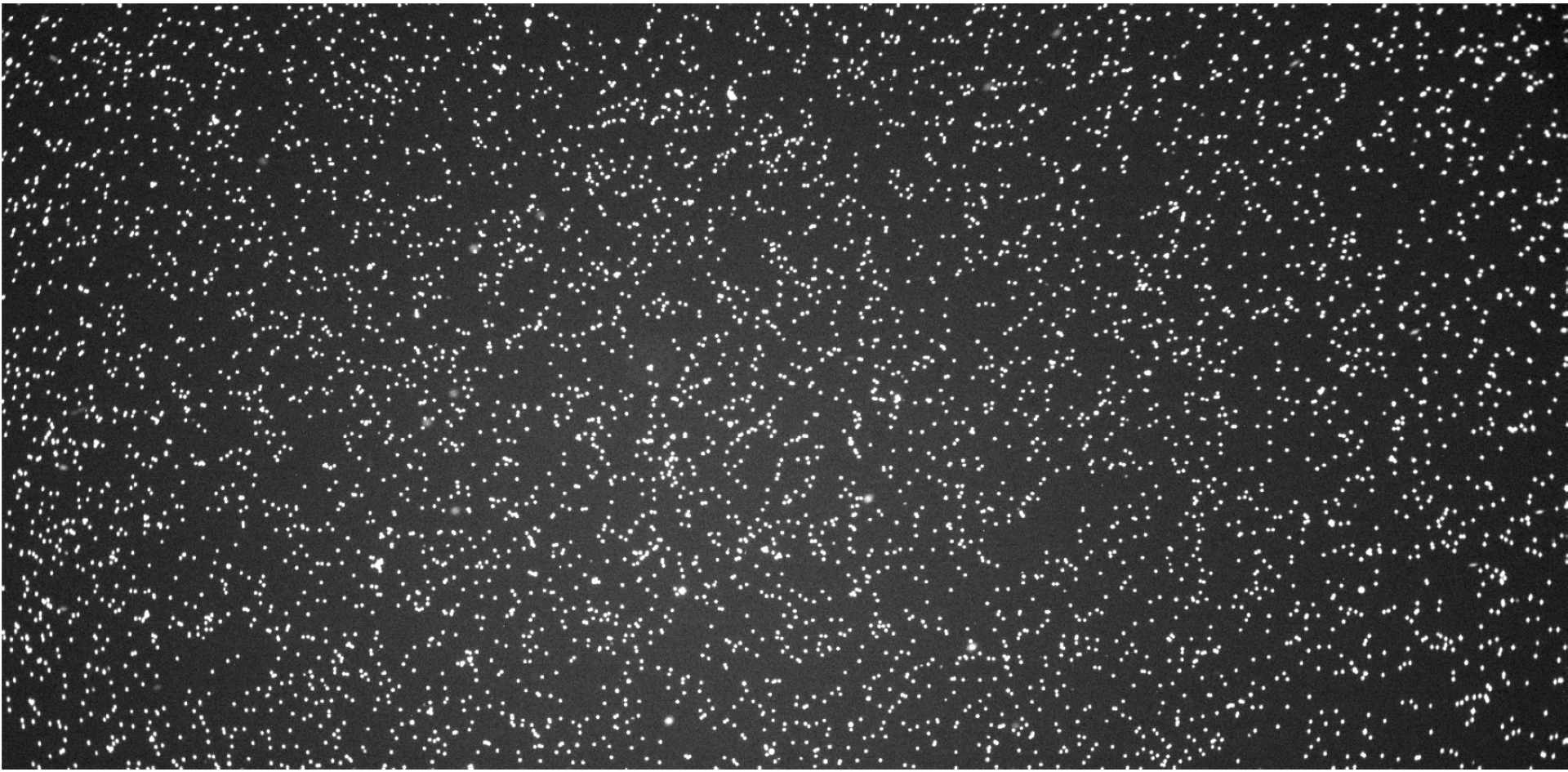

¡1.000.000 de células
detectadas en segundos!

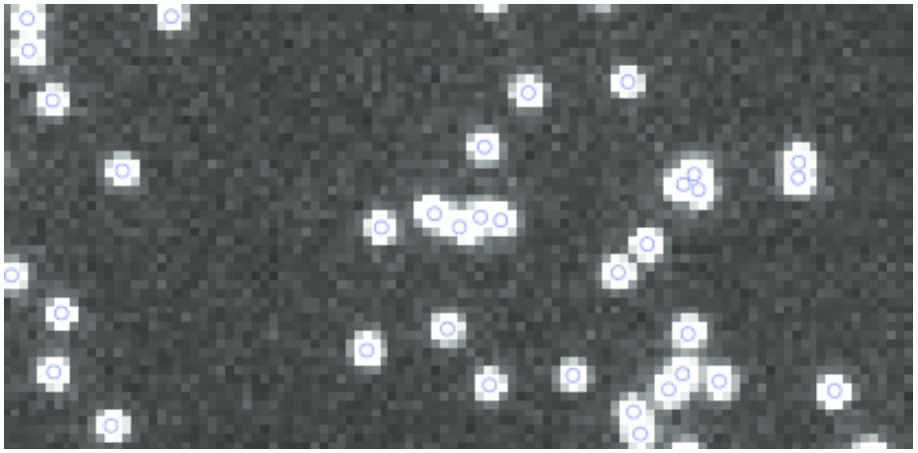
Ui

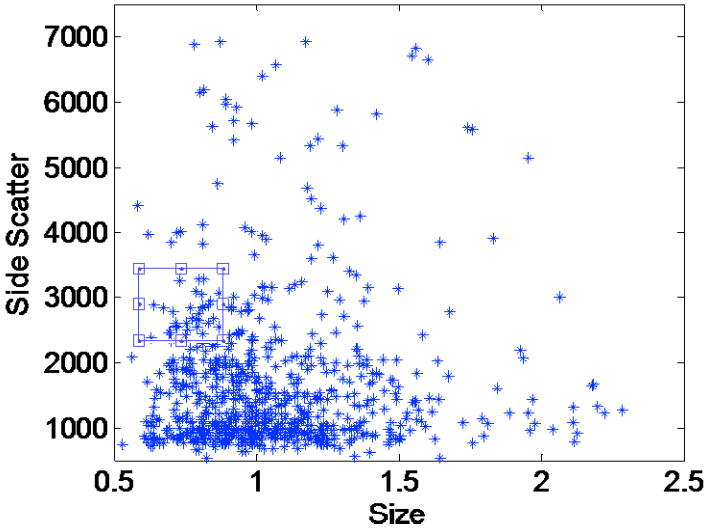




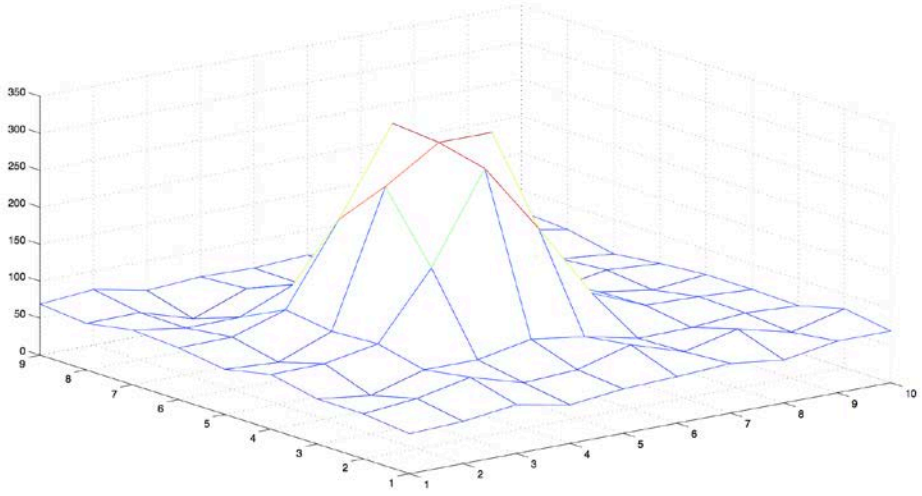


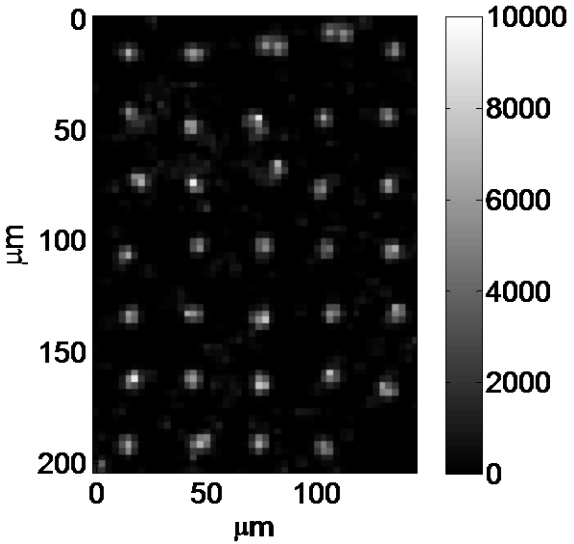






Análisis de imagen

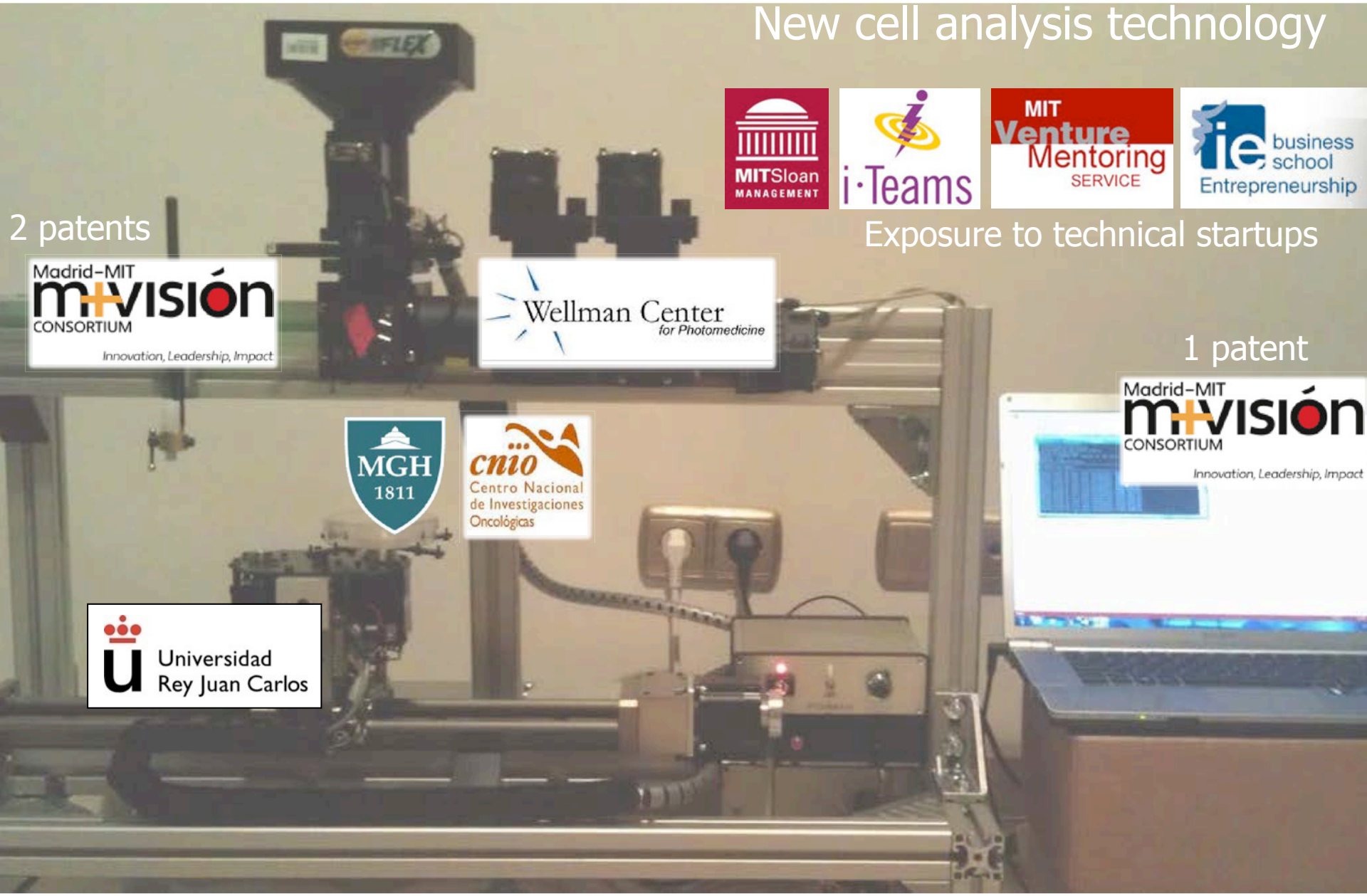




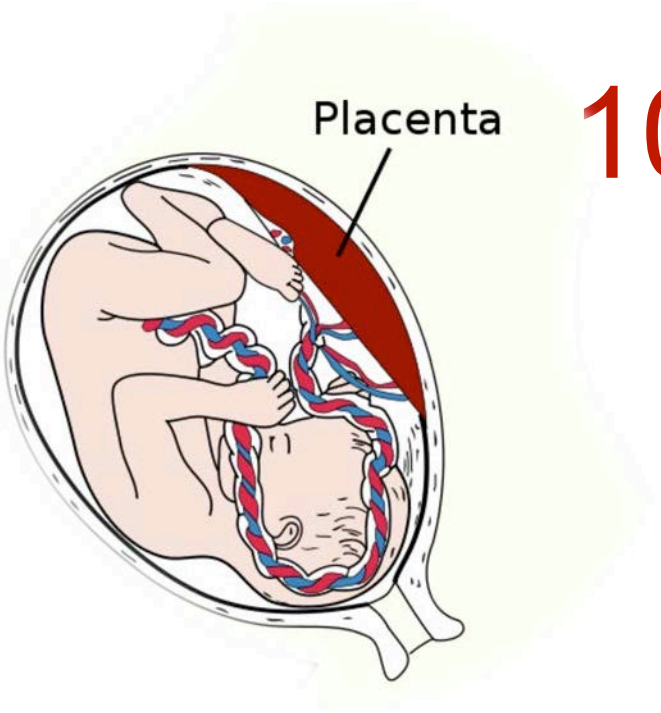
Impact of Team Cell

Comunidad de Madrid

La Suma de Todos



4% de todos los fetos en riesgo de morir en el útero debido a un transporte insuficiente de oxígeno y nutrientes a través de la placenta

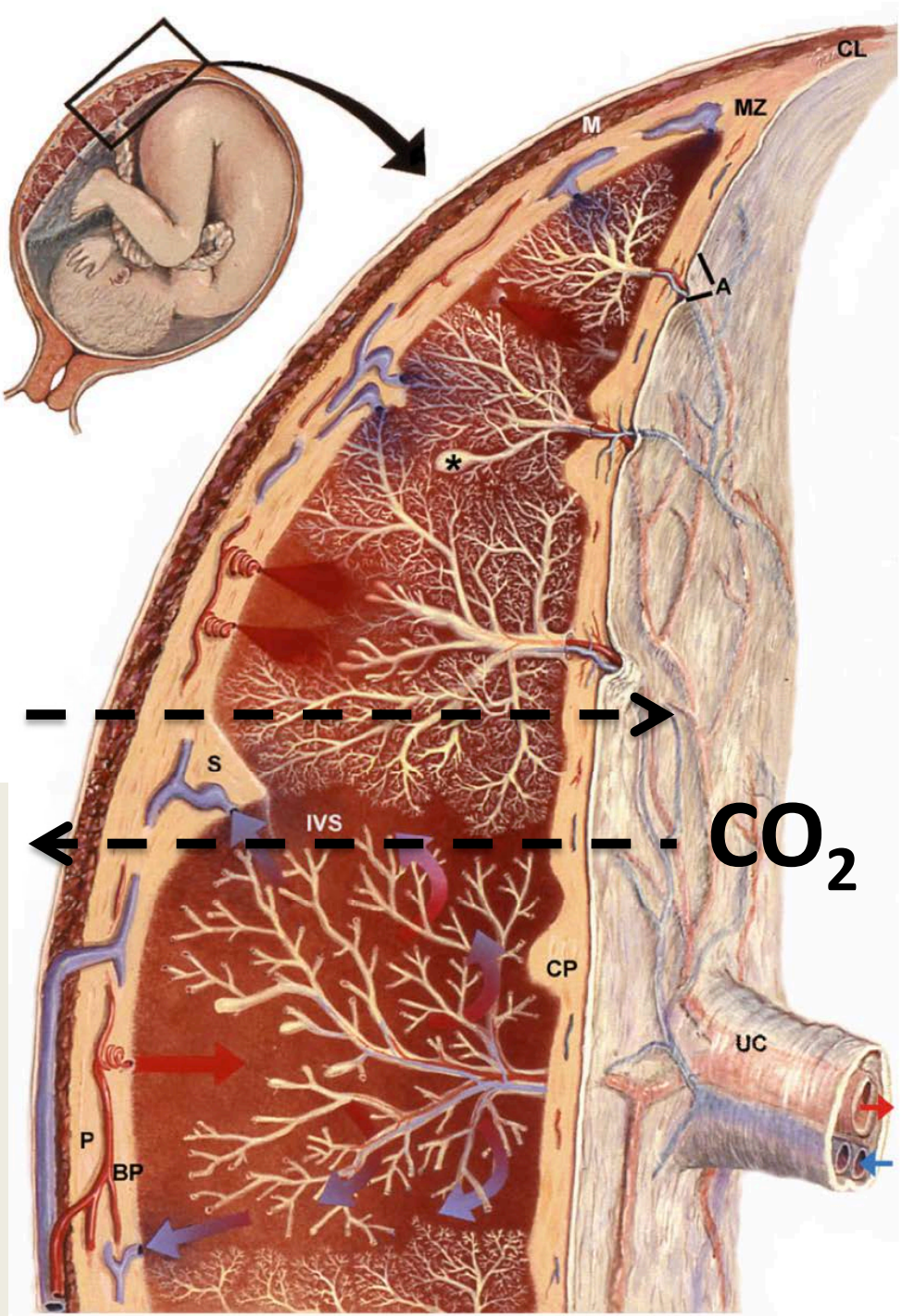


10% de los fetos en riesgo de **crecimiento intrauterino restringido (IUGR)**

Actualmente, no existe una manera de medir el transporte placentario.

NO hay forma de detectar si llega suficente O_2 y nutrientes al feto.

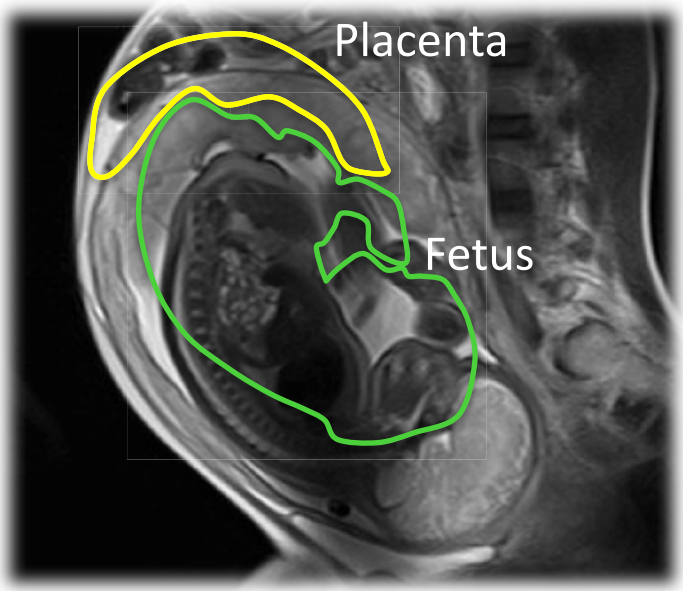
Fig. 4.6 The mature human placenta in situ is composed of the chorionic plate (*CP*) and the basal plate (*BP*) surrounding the intervillous space (*IVS*) as cover and as underside, respectively. The fetally vascularized villous trees project from the chorionic plate into the intervillous space and are directly surrounded by the maternal blood that circulates through the intervillous space. The loose centers of villous trees, arranged around the maternal arterial inflow area, are frequent features. *P* placental bed; *M* myometrium; *CL* chorion laeve; *A* amnion; *MZ* marginal zone between placenta and fetal membranes, with obliterated intervillous space and ghost villi; * cell island, connected to a villous tree; *S* placental septum; *UC* umbilical cord (*Source:* From Kaufmann and Scheffen (1992), with permission)



O_2

CO_2

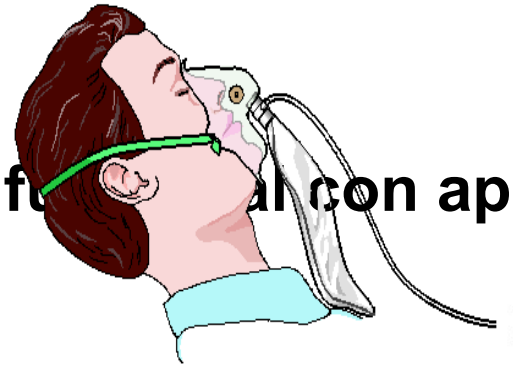
- No mixing between blood on maternal and fetal side
- O2 carried by hemoglobin in the blood
- transport by diffusion

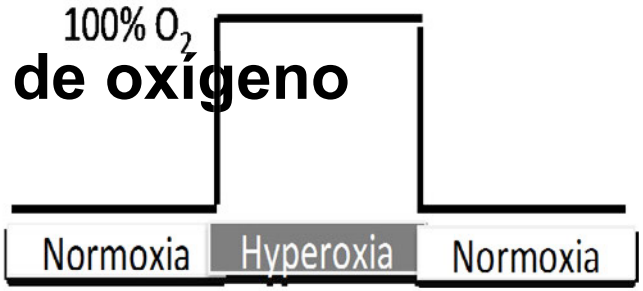


Objetivo:

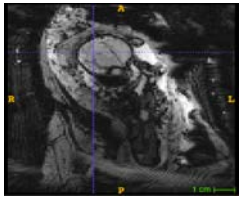
Desarrollo de técnicas de resonancia para medir el transporte de oxígeno a través de la placenta

M f[illegible]al con aporte de oxígeno





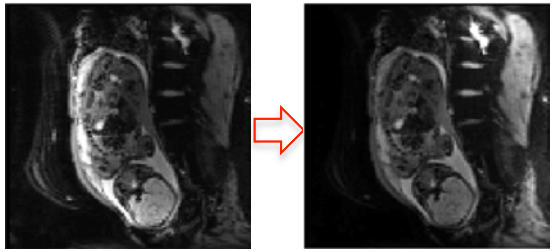
1. Data Acquisition



3T Scanner
2D multi slice single-shot GRE-EPI
In plane resolution: 3 x 3 mm^2
Slice thickness 3 mm, Interleaved
TR: 6 ~ 7 sec; Total 30 minutes

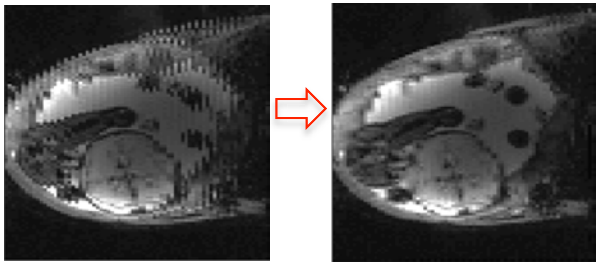
2. Data processing

Signal non-uniformity correction



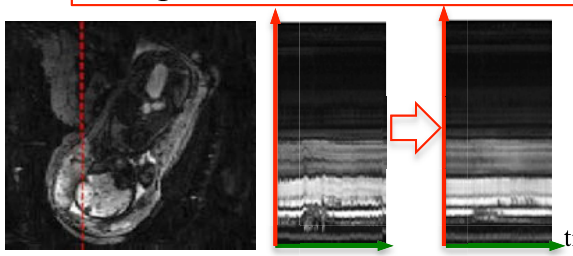
Used N4ITK based correction approach

Volume Correction



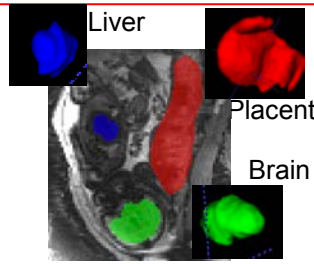
Non-rigid transformation using **Elastix^N** with customized parameter file

Registration and Transformation



Non-rigid transformation using **Elastix^N**

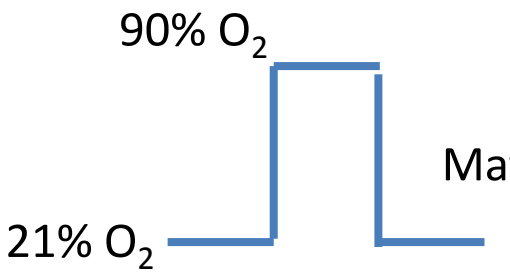
Manual segmentation on reference volume



Using ITK-SNAP*

3. BOLD signal change curve generation:

Data Acquisition-BOLD MRI with oxygen exposure



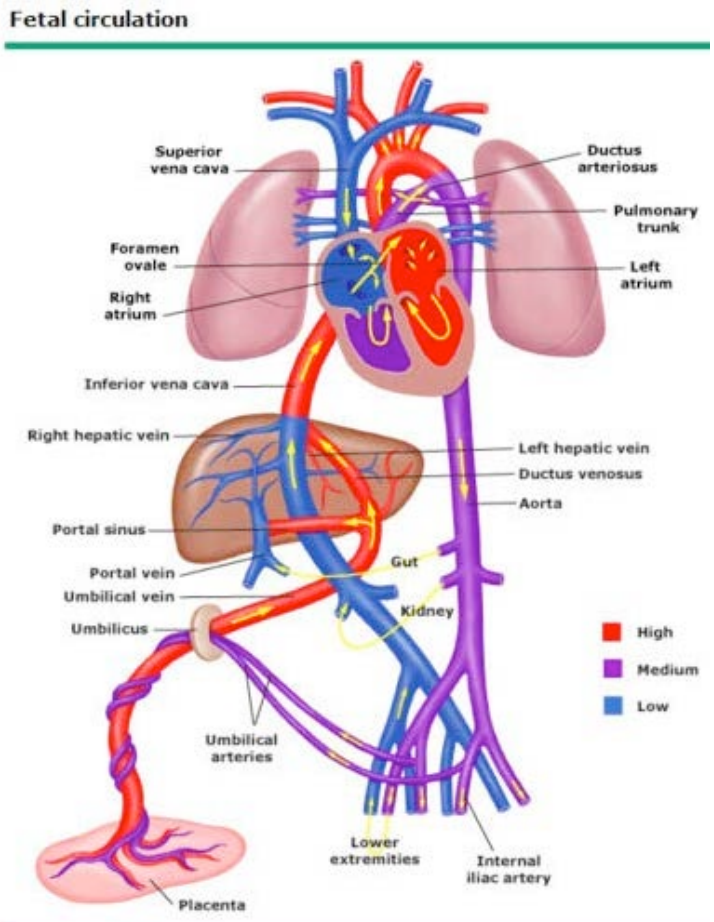
Maternal Oxygen exposure

dHb + O2 <-> HbO2 , MRI signal ↑

-> Placenta

-> fetal liver

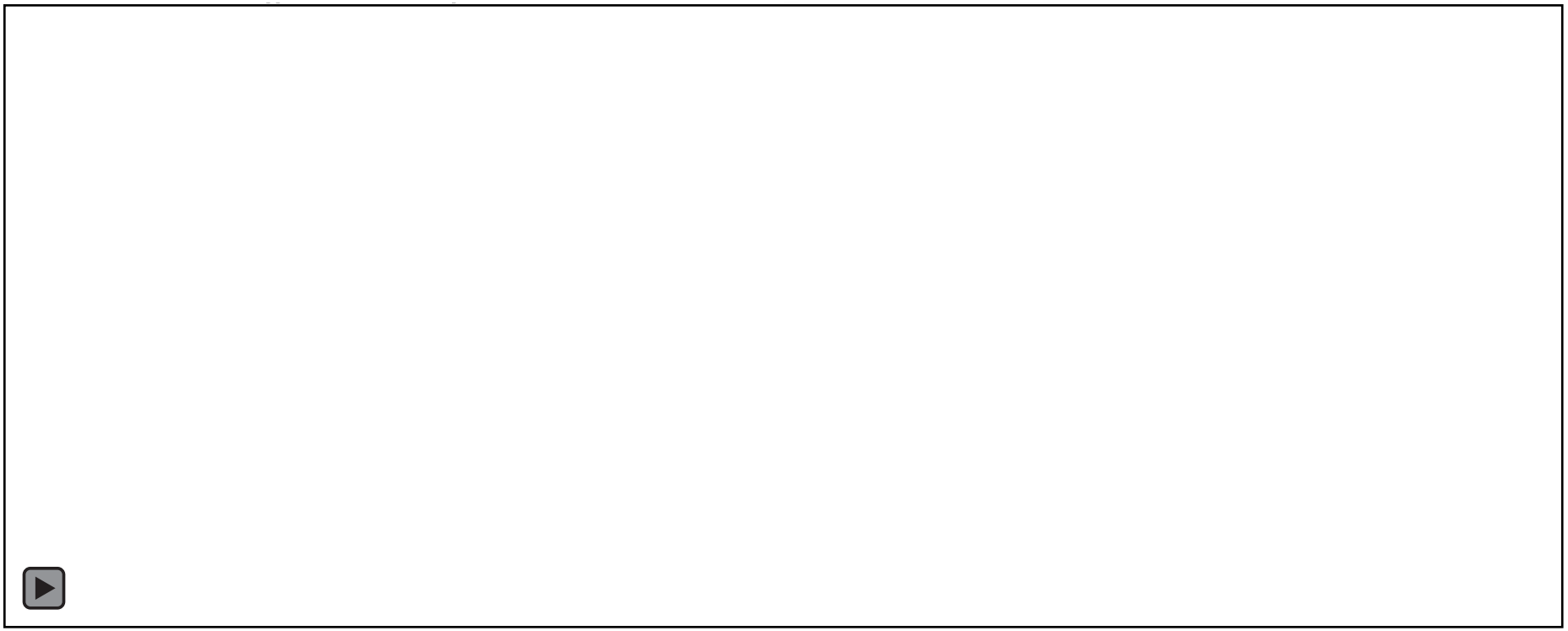
-> fetal brain



OxyMRI – oxygen enhanced MRI based on BOLD effect

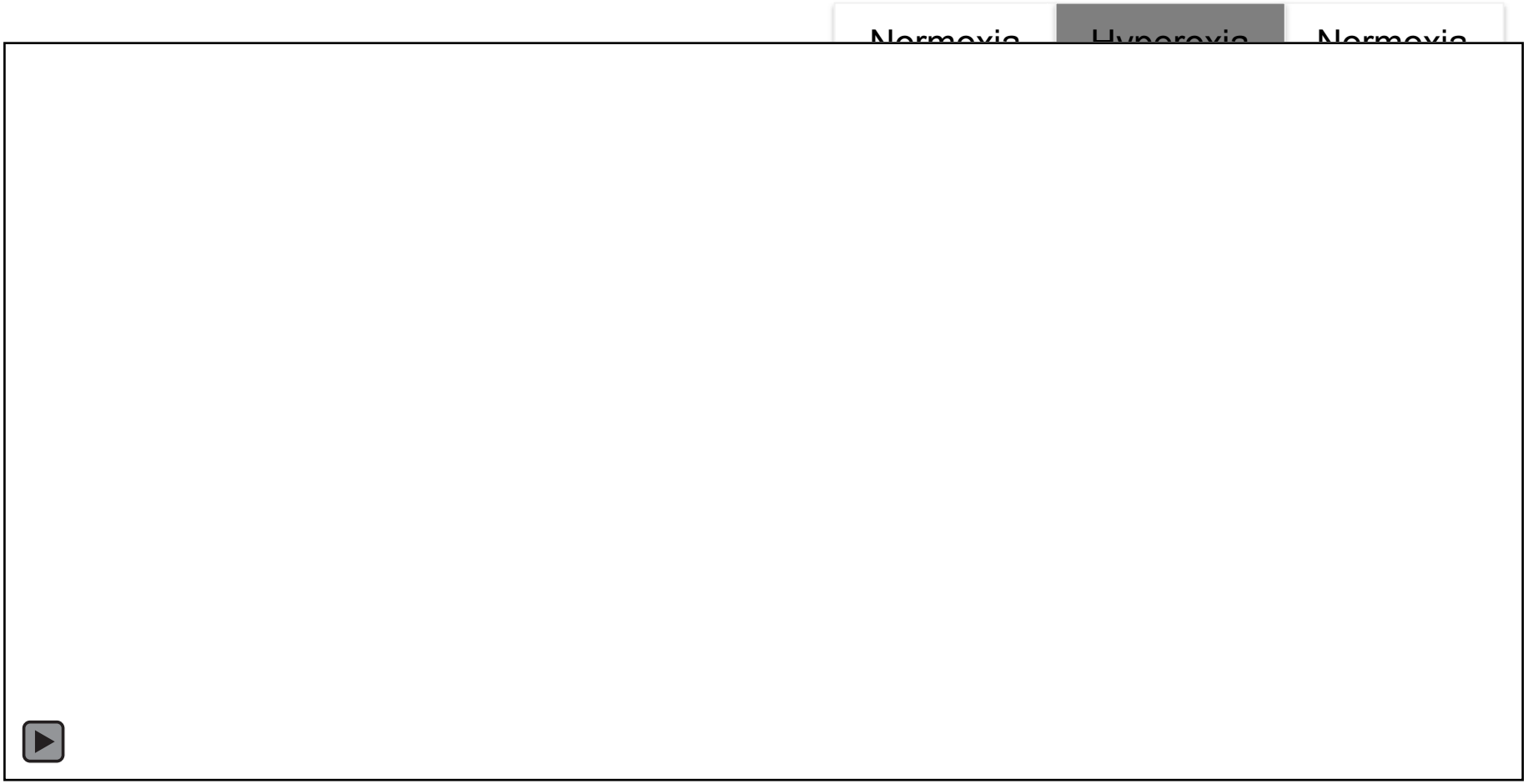
$$Hb + O_2 \rightleftharpoons HbO_2$$

paramagnetic

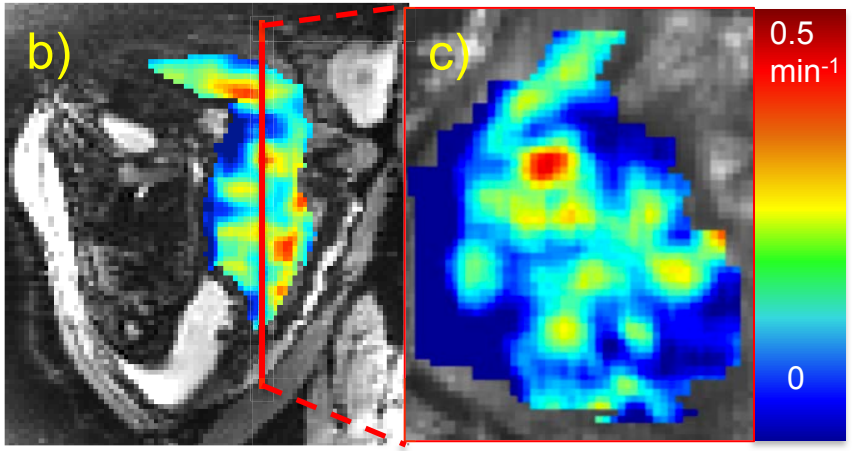


Oxygen Paradigm: 10 min normoxia, 10 min hyperoxia, 10 min normoxia
Total time: 30 min

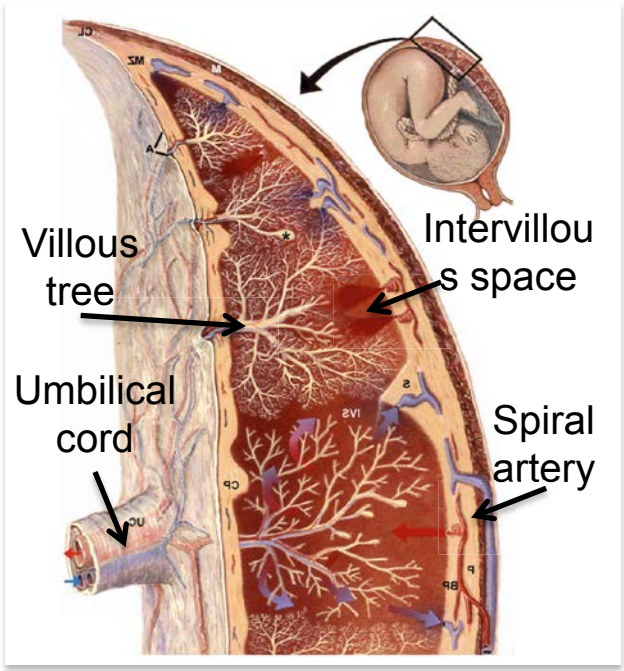
Results - placenta

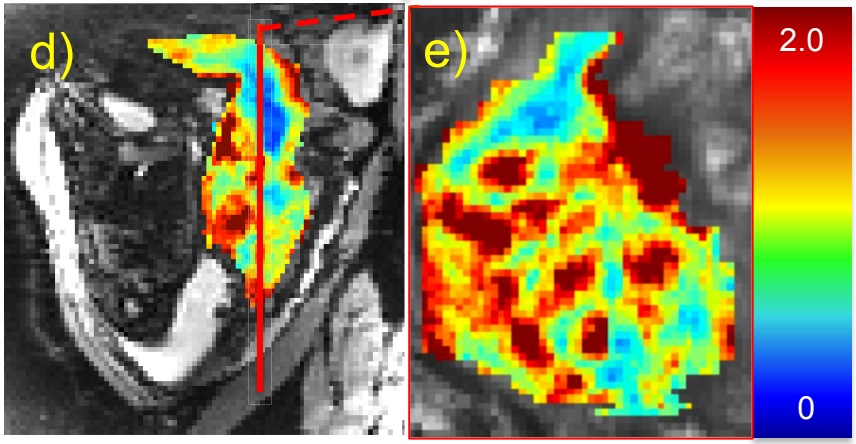


Heterogeneous response of placenta to hyperoxia



“slope map”

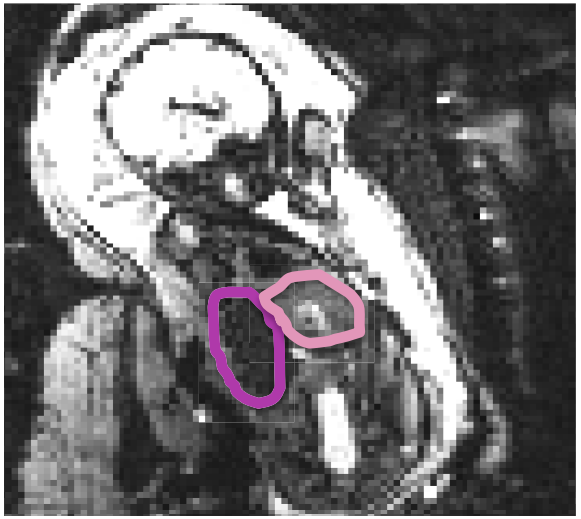


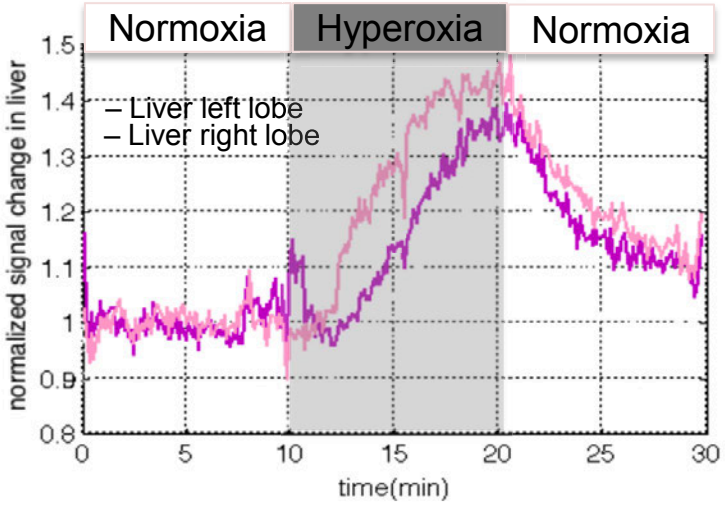


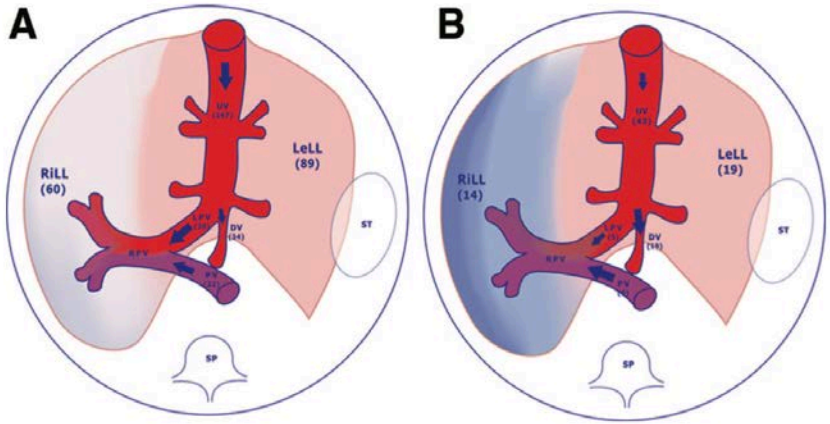
“residual map”

Fetal Liver

IUGR case



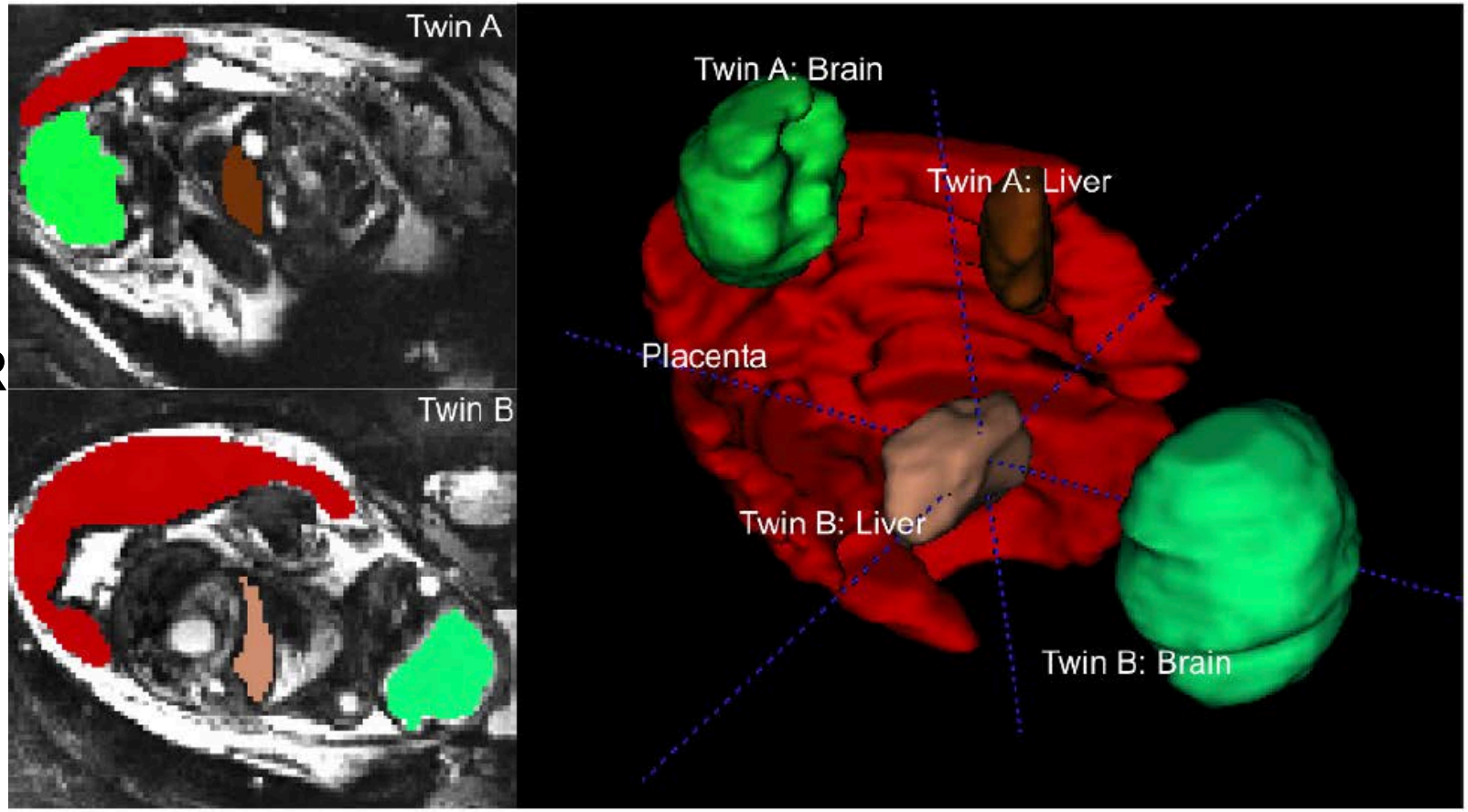




A: Healthy
B: Growth restricted

J. Kessler *et al.,* PEDIATRIC RESEARCH, 2009, Vol. 66, No. 1:113

R


Twin A
Twin B
Twin A: Brain
Twin A: Liver
Placenta
Twin B: Liver
Twin B: Brain

Converter: From technology to product

Real-world product development immersion for recent graduates and mid-career innovators

Designed to help bridge the gap between proven technology and readiness for new business startup or outside investment

Teams are supported by mentors in engineering, business, and product development to achieve viability by “de-risking” their technology, market plan, and financial model.

Converter: How it works

+ Teams chosen for two-year term
+ Selected for proven technology and viable strategy
+ Focus on successful exits

Four phases:

+ Project Definition
+ Risk identification
+ Risk mitigation
+ Pitch preparation

Support:

+ Senior mentor
+ Expert review panel
+ Targeted consulting / contractors
+ International community
+ Supplies, travel, indirect cost coverage

Benefits to partners

Scalable, effective strategies to cultivate a technology innovation ecosystem

+ Improve returns on R&D investment
+ Focus on excellence through elite training
+ Enable change-makers
+ Promote an innovation culture

Improve returns on R&D resource investment

A fraction of R&D investment deployed through the M+Visión system. Objective to drive research toward economic and healthcare impact

+ Identify champions who can inspire and drive innovation projects
+ Projects developed through Catalyst and Converter programs
+ International collaboration
+ Leverage Boston innovation cluster

Focus on excellence through elite training

Talent development for science- and technology-driven MS, MD, PhD and MBAs—tomorrow's innovation leaders

+ Participants explore and develop their own ideas
+ Training a mix of academic and practice

Enable change-makers

Close collaboration with leaders in positions to effect system-wide change.

+ Focus high impact policy evolution
+ Create environment for cross-institutional collaborations
+ Enable translation-oriented research initiatives

Promote an innovation culture

Short duration, high volume activities that inspire innovators, create connections, and build innovation capacity

+ Hacking Medicine
+ IDEA^2 Madrid
+ Workshops and courses
+ Conferences and network events

mvision.madrid.org

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