

**INSTITUTO DE
MEDICINA MOLECULAR**

FACULDADE DE MEDICINA DA
UNIVERSIDADE DE LISBOA

10th

***IMM 10th
21 Sept 2013***

Teaching Science to Medical students

Bruno Silva-Santos, PhD

Head of Unit & Assistant Professor

When the great physiologist and pharmacologist Sir Henry Dale arrived at St. Bartholomew's Hospital to study Medicine in 1900, he was advised by a senior doctor, Samuel Gee, to forget all the Physiology he had learned at Cambridge, as Medicine was not a Science but an empirical Art.

D. J. Weatherall. Medical education history. Blackwell Ltd 2006.

Medicine:

an **Art** founded on bedside **observations** and **skills**

or / and

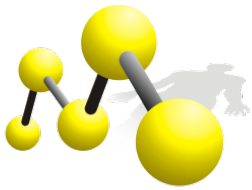
a form of **Science** based on **theory** and **research**

Role of Science in Medical education

1993 General Medical Council of the UK

Tomorrow's Doctors: Recommendations on Undergraduate Medical Education

- **More** exposure to patients and their families from the start;
- **More** emphasis on ethics, communication skills, humanities;
- **Less** emphasis on the basic **Sciences**...



**INSTITUTO DE
MEDICINA MOLECULAR**
FACULDADE DE MEDICINA DA
UNIVERSIDADE DE LISBOA

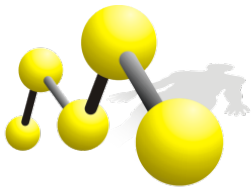
Role of Science in Medical education?

1. Understand the etiology of disease (pathophysiology)

Typical criticism by students:

The INFORMATION is LOST since they FORGET...

Although MDs “**forget**” much of the Science they are taught, the **learning process** allows more **rapid action** via **recollection** (“flashback”) or **interpretation** of **new** information, which translates into **better patient care**.



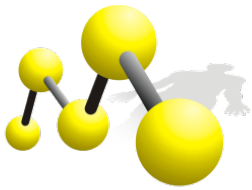
**INSTITUTO DE
MEDICINA MOLECULAR**

FACULDADE DE MEDICINA DA
UNIVERSIDADE DE LISBOA

Role of Science in Medical education

1. Understand the etiology of disease (pathophysiology)
2. Understand biological **diversity and individuality**

@ molecular level: epigenetics, polymorphisms, splicing, etc.



**INSTITUTO DE
MEDICINA MOLECULAR**

FACULDADE DE MEDICINA DA
UNIVERSIDADE DE LISBOA

Role of Science in Medical education

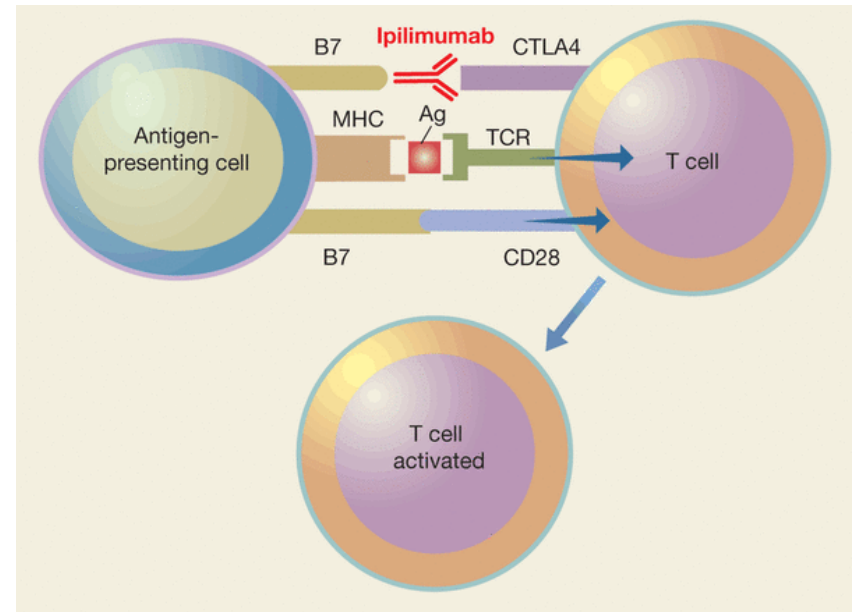
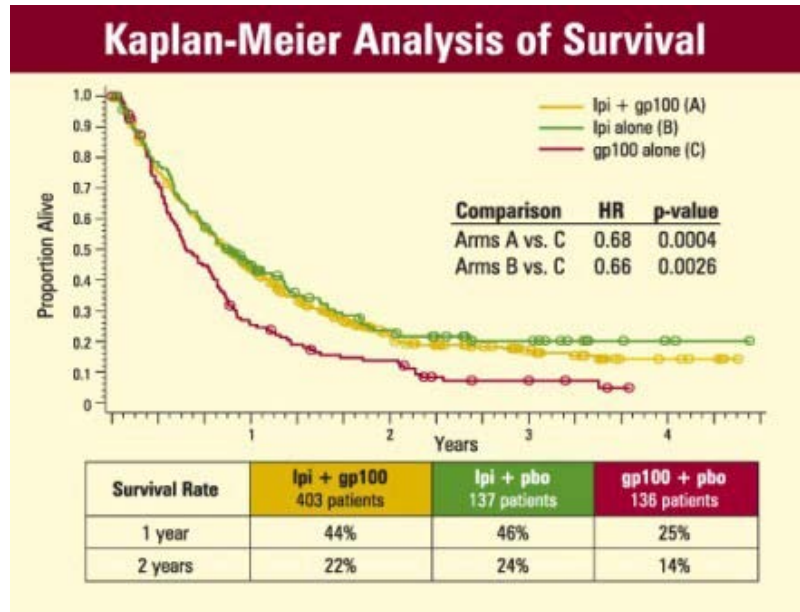
1. Understand the etiology of disease (pathophysiology)
2. Understand biological diversity and individuality

@ molecular level: epigenetics, polymorphisms, splicing, etc.
3. Develop a critical approach towards medical

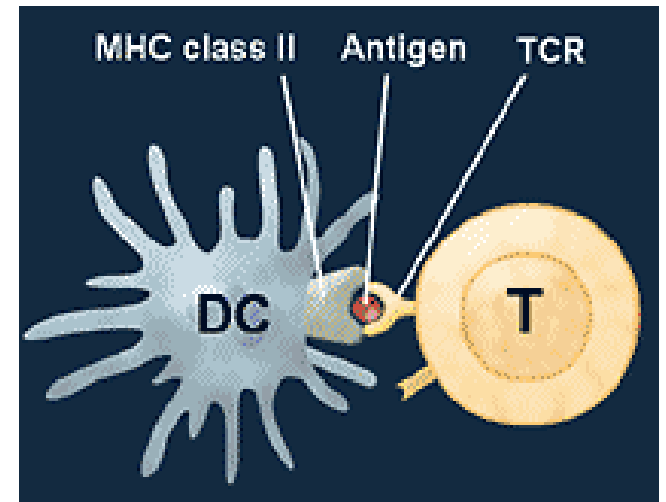
advances and applications

Science provides a conceptual **framework** to
interpret and **criticize new** information
which is key to **better patient care**

IPIILIMUMAB (anti-CTLA-4 mAb), 2011



PROVENGE (PAP-loaded DC vaccine), 2010



15 February 2001

nature

www.naturejpn.com

the human genome

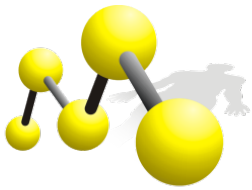
Nuclear fission
Five-dimensional
energy landscapes

Seafloor spreading
The view from under
the Arctic ice

Career prospects
Sequence creates new
opportunities

07 >





**INSTITUTO DE
MEDICINA MOLECULAR**

FACULDADE DE MEDICINA DA
UNIVERSIDADE DE LISBOA

Role of Science in Medical education

1. Understand the etiology of disease (pathophysiology)
2. Understand biological diversity and individuality

@ molecular level: epigenetics, polymorphisms, splicing, etc.
3. Develop a critical approach towards medical

advances and applications
4. Develop doubt and self-criticism

*Humans love to **doubt**,
and that is the seed of Science.*

Ralph Waldo Emerson

Scientific doubt vs. self-certainty

T. Lewis, W. Bynum & others:

Self-doubt is the basis for **scientific research**

BUT

The **practice** of Medicine is based on **self-confidence**

W. Bynum et al. *Medicine as a dogma*. In *Science in Medicine*. London, 1993.

D.J. Weatherall. *Science and the Quiet Art*. Oxford, 1995

Facts are not Science

- as the dictionary is not literature.

Martin H. Fischer

DISCOURS
DE LA METHODE

Pour bien conduire la raison, & chercher
la verité dans les sciences.

Plus
LA DIOPTRIQUE.
LES METEORES.
ET
LA GEOMETRIE.

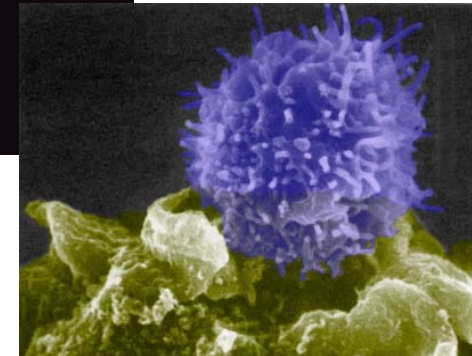
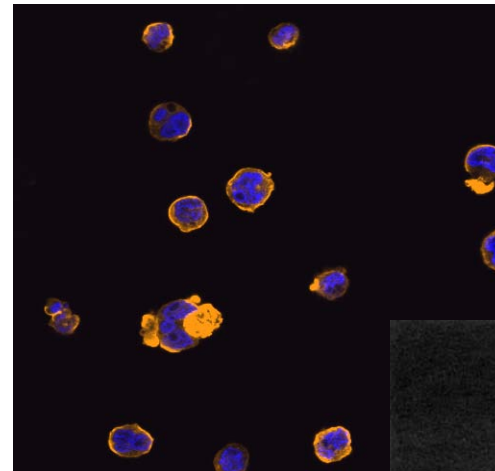
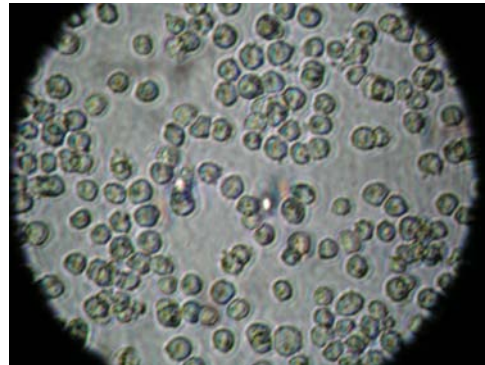
Qui sont des essais de cete METHODE.



A LEYDE
De l'Imprimerie de IAN MAIRE.
c 1 6 5 0 c x x x v i i .
Avec Privilège.

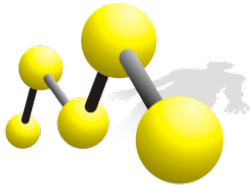


- QUESTION
& HYPOTHESIS
- TESTING
- CONCLUSION
- NEW HYPOTHESIS
- NEW TEST, etc.



A scientist is not a person who gives the right answers, but who asks the right questions.

Claude Lévi-Strauss, *Le Cru et le cuit*, 1964



**INSTITUTO DE
MEDICINA MOLECULAR**
FACULDADE DE MEDICINA DA
UNIVERSIDADE DE LISBOA

The need for an analytical approach

Medical practice:

75% routine cases

25% complicated cases

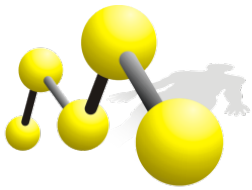
Approach:

Pattern recognition (non-analytical)

Scientific approach (analytical)

BUT

**HOW TO PROMOTE THE SCIENCE
DURING THE UNDERGRADUATE YEARS?**



**INSTITUTO DE
MEDICINA MOLECULAR**
FACULDADE DE MEDICINA DA
UNIVERSIDADE DE LISBOA

How to promote Science in Med education?



1. MAKE COURSES RELEVANT AND INTERESTING

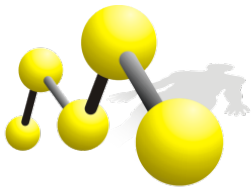
*The science base of the medical curriculum must function to **activate** the student, and **not** simply perpetuate the **passive role** induced by obsolete didactic methods.*

Henry Walton, MD, PhD

MAJOR AIM:

PRESENT **SCIENCE** IN A WAY THAT
CONVINCES MEDICAL STUDENTS
THAT IT **IS RELEVANT TO** THEIR
FUTURE **CLINICAL PRACTICE**

& CREATE **EXCITING ENVIRONMENTS** FOR
LEARNING SCIENCE



**INSTITUTO DE
MEDICINA MOLECULAR**
FACULDADE DE MEDICINA DA
UNIVERSIDADE DE LISBOA

How to promote Science in Med education?



1. MAKE COURSES RELEVANT AND INTERESTING

Activate the students!

2. (Part-time) LAB RESEARCH for 2nd-3rd year Med Students Programa Educação pela Ciência (GAPIC)

LAB RESEARCH for 2nd-3rd year Med Students



Programa Educação pela Ciência (GAPIC)

Arlindo J. Ferreira (2006/ 2007): *Papel da família Bcl-2 na sobrevivência e função de linfócitos T $\gamma\delta$*

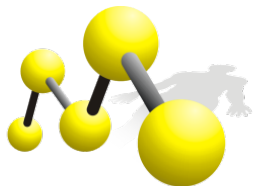
Diogo Bruno (2006/ 2007): *O co-receptor CD27 na activação de linfócitos T $\gamma\delta$*

Duarte Saraiva Martins (2007/ 2008): *Identification of novel tumor antigens for $\gamma\delta$ T lymphocytes*

Francisco Goiana da Silva (2008/ 2009): *Mechanisms of lymphoma resistance to $\gamma\delta$ T cell-mediated immunotherapy*

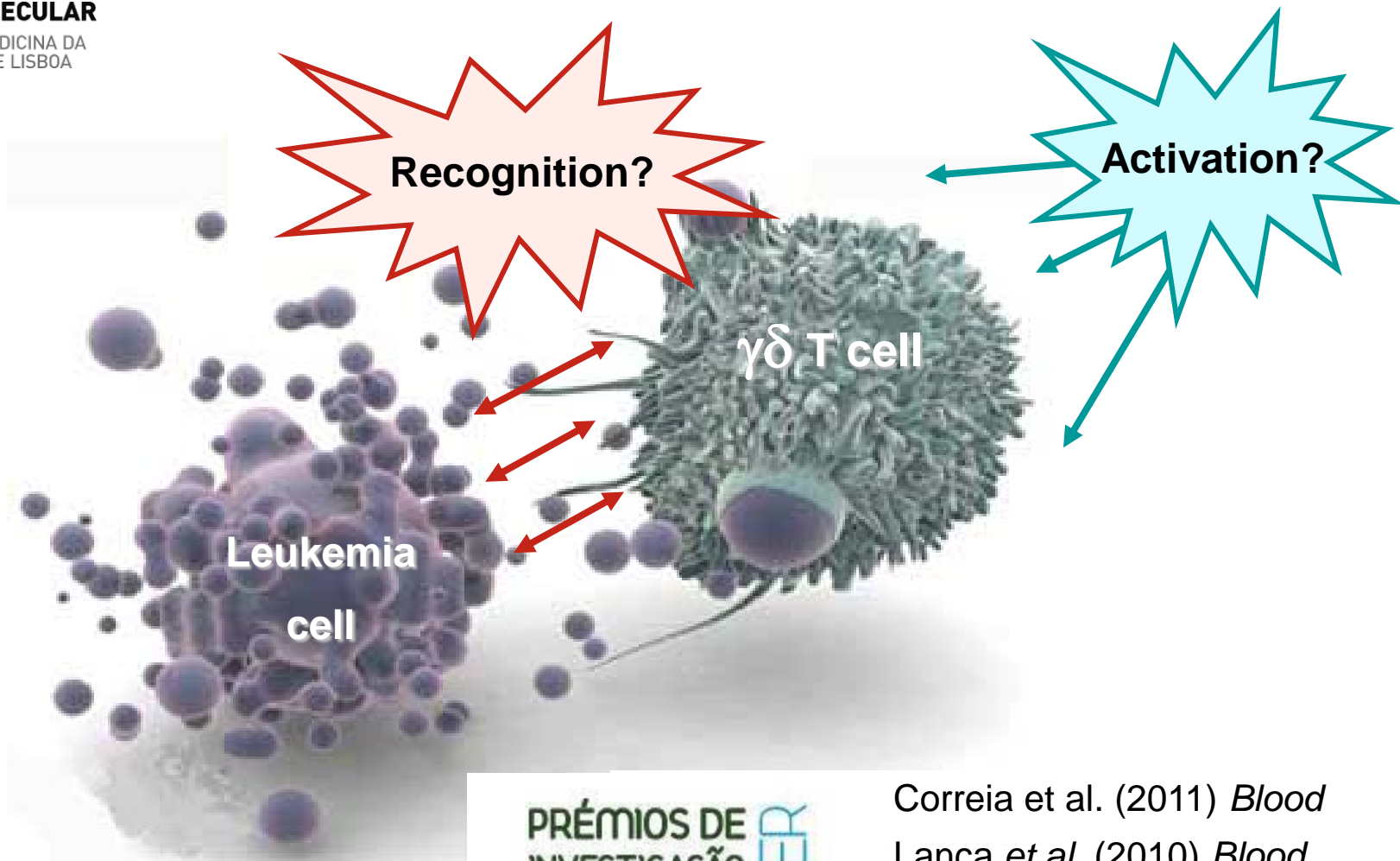
Artur Nixon Martins (2012/ 2013): *Combining innate and adaptive immune mechanisms of cancer cell recognition at the single lymphocyte level*

Tomás Laia McGuire (2012/ 2013): *Characterization of the molecular determinants involved in $\gamma\delta$ T cell targeting of AML subtypes*



**INSTITUTO DE
MEDICINA MOLECULAR**
FACULDADE DE MEDICINA DA
UNIVERSIDADE DE LISBOA

How do $\gamma\delta$ T lymphocytes kill tumor cells?



PRÉMIOS DE
INVESTIGAÇÃO
2009 PFIZER

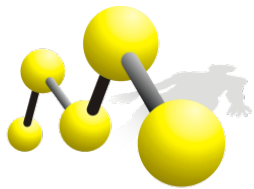
Correia et al. (2011) *Blood*
Lança et al. (2010) *Blood*
Gomes et al. (2010) *Haematol*
Correia et al. (2009) *PloS One*

*Science is always **incomplete**. It never solves a problem without creating ten more.*

George Bernard Shaw

The important thing in Science is not so much to obtain new facts as to discover new ways of thinking about them.

William Lawrence Bragg



**INSTITUTO DE
MEDICINA MOLECULAR**
FACULDADE DE MEDICINA DA
UNIVERSIDADE DE LISBOA

How to promote Science in Med education?



1. MAKE COURSES RELEVANT AND INTERESTING

Activate the students!

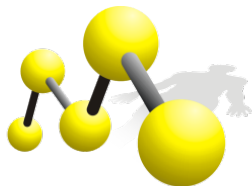
2. (Part-time) LAB RESEARCH for 2nd-3rd year Med Students
Programa Educação pela Ciência (GAPIC)

3. (Full-time) LAB RESEARCH in INTERCALATED BSc (after 3rd year)



KING'S
College
LONDON

University of London



**INSTITUTO DE
MEDICINA MOLECULAR**
FACULDADE DE MEDICINA DA
UNIVERSIDADE DE LISBOA

How to promote Science-based Medicine?



1. MAKE COURSES RELEVANT AND INTERESTING

Activate the students!

2. (Part-time) LAB RESEARCH for 2nd-3rd year Med Students
Programa Educação pela Ciência (GAPIC)

3. (Full-time) LAB RESEARCH in INTERCALATED BSc (after 3rd year)

4. (Full-time) LAB RESEARCH in (MD/)PhD programmes

MEDICAL PRACTICE VS RESEARCH:

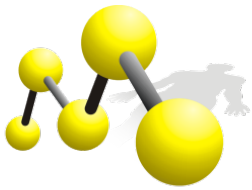
APPLY KNOWLEDGE

(FOR DIRECT BENEFIT OF THE PATIENT)

VERSUS

PRODUCE KNOWLEDGE

(FOR INDIRECT BENEFIT OF THE SOCIETY)



**INSTITUTO DE
MEDICINA MOLECULAR**

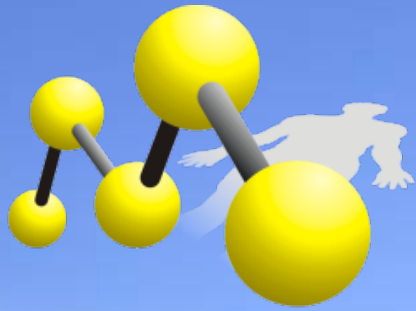
FACULDADE DE MEDICINA DA
UNIVERSIDADE DE LISBOA

And after the PhD?

1. THE CLINICIAN-SCIENTIST
(clinic & lab)

2. THE SCIENTIST (lab)

3. THE CLINICIAN “WITH A SCIENTIFIC MIND”
(clinic)



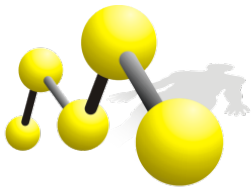
10th

**INSTITUTO DE
MEDICINA MOLECULAR**

FACULDADE DE MEDICINA DA
UNIVERSIDADE DE LISBOA



> 3000 Medical students since 2005



**INSTITUTO DE
MEDICINA MOLECULAR**

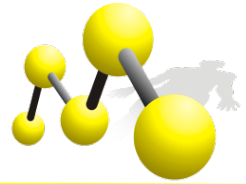
FACULDADE DE MEDICINA DA
UNIVERSIDADE DE LISBOA

Brief history of Science in Medical education

- 1850s Science in Medical Universities in France & Germany
- 1870s Johns Hopkins University pioneers Med Sciences in US
- 1870s Cambridge pioneers Med Sciences in the UK
- 1910 Abraham Flexner's report on Med education in US
 - calling for strong scientific foundation
- 1913 Flexner & Osler's report on Med education in UK
- 1935 Hammersmith Hospital is first University Hospital in UK



Bruno Silva-Santos



**INSTITUTO DE
MEDICINA MOLECULAR**
FACULDADE DE MEDICINA DA
UNIVERSIDADE DE LISBOA

- 1991-1996 **BSc/ MSc** (Biochemistry)
Faculdade de Ciências, U. Lisboa, PT
- 1996-1997 **Research Grantee** (Microbiology)
ITQB-Oeiras, U. Nova Lisboa, PT
- 1997-1998 **Gulbenkian PhD Programme** (Biology and Medicine)
Advanced courses, IGC-Oeiras, PT
- 1998-2002 **PhD thesis work** (Immunology)
Cancer Research UK, London, UK
- 2002-2005 **Post-doctoral work** (Immunology)
King's College London, UK
- 2005- **Assistant Professor** (Immunology)
Faculdade de Medicina, U. Lisboa, PT
- 2006- **Principal Investigator** (Immunology)
Instituto Medicina Molecular, U. Lisboa, PT