



LABSTER

Simulazioni Virtuali di Laboratorio

ETH Zürich

UNE UNIVERSITY OF NEW ENGLAND

UNIVERSITY OF COPENHAGEN

University of Glasgow

香港大學
THE UNIVERSITY OF HONG KONG

HARVARD
MEDICAL SCHOOL

Royal Society of
Biology

MIT
Massachusetts
Institute of
Technology

www.labster.com

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ITALIA 2017

Roma 28-30 settembre 2017 - Sapienza Università di Roma

LABSTER

Agenda:

- Labster e la sfida STEM.
- Il metodo Labster.
- Studi sperimentali su Labster.
- I Laboratori virtuali di Labster.
- Esempi di simulazioni Labster.
- Labster e la Virtual Reality.
- Q&A





Labster e la sfida STEM

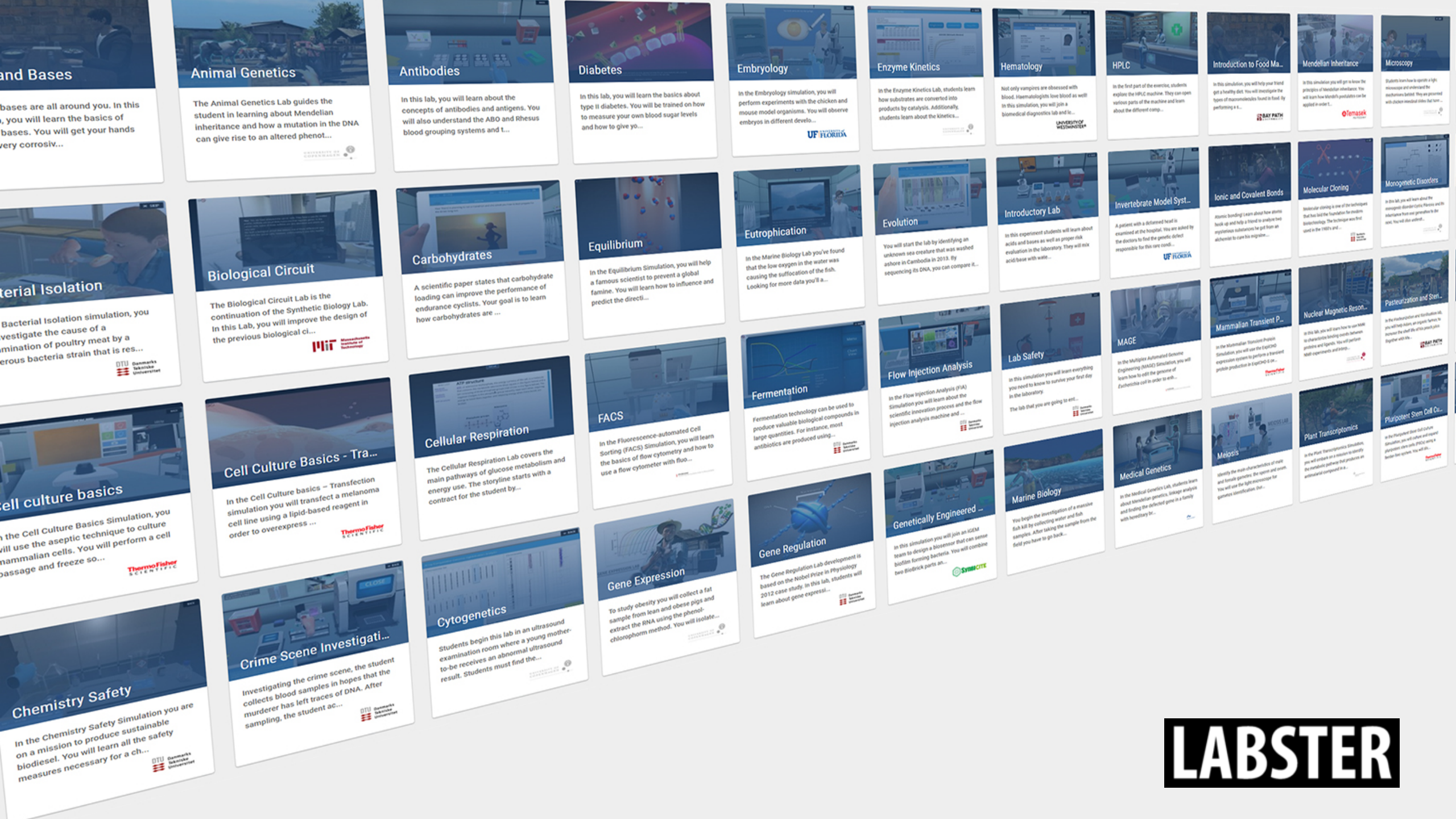


Che cos'è Labster ?



Labster offre simulazioni di laboratorio con l'obiettivo di
**migliorare i livelli di apprendimento e
ridurre i costi di accesso/uso dei laboratori**





Acid Bases

Acid bases are all around you. In this simulation, you will learn the basics of acid bases. You will get your hands dirty with very corrosive...

Animal Genetics

The Animal Genetics Lab guides the student in learning about Mendelian inheritance and how a mutation in the DNA can give rise to an altered phenotype...

Antibodies

In this lab, you will learn about the concepts of antibodies and antigens. You will also understand the ABO and Rhesus blood grouping systems and how to give a blood transfusion...

Diabetes

In this lab, you will learn the basics about type II diabetes. You will be trained on how to measure your own blood sugar levels and how to give insulin...

Embryology

In the Embryology simulation, you will perform experiments with the chicken and mouse model organisms. You will observe embryos in different developmental stages...

Enzyme Kinetics

In the Enzyme Kinetics Lab, students learn how substrates are converted into products by catalysis. Additionally, students learn about the kinetics of enzyme reactions...

Hematology

Not only vampires are obsessed with blood. Hematologists love blood as well. In this simulation, you will join a biomedical diagnostics lab and learn about blood tests...

HPLC

In the first part of the exercise, students explore the HPLC machine. They can open various parts of the machine and learn about the different components...

Introduction to Food Microbiology

In this simulation, you will help your friend get a healthy diet. You will investigate the types of microorganisms found in food by performing a series of tests...

Mendelian Inheritance

In this simulation you will get to know the principles of Mendelian inheritance. You will learn how Mendel's experiments can be applied in real life...

Microscopy

Students learn how to operate a light microscope and understand the mechanisms behind it. They are presented with different microorganisms that have to be identified...

Bacterial Isolation

Bacterial Isolation simulation, you investigate the cause of a food poisoning of poultry meat by a dangerous bacteria strain that is resistant to antibiotics...

Biological Circuit

The Biological Circuit Lab is the continuation of the Synthetic Biology Lab. In this Lab, you will improve the design of the previous biological circuit...

Carbohydrates

A scientific paper states that carbohydrate loading can improve the performance of endurance cyclists. Your goal is to learn how carbohydrates are stored and used...

Equilibrium

In the Equilibrium Simulation, you will help a famous scientist to prevent a global famine. You will learn how to influence and predict the direction of chemical reactions...

Eutrophication

In the Marine Biology Lab you've found that the low oxygen in the water was causing the suffocation of the fish. Looking for more data you'll analyze water samples...

Evolution

You will start the lab by identifying an unknown sea creature that was washed ashore in Cambodia in 2013. By sequencing its DNA, you can compare it to known species...

Introductory Lab

In this experiment students will learn about acids and bases as well as proper risk evaluation in the laboratory. They will mix acid-base with water...

Invertebrate Model System

A patient with a deformed heart is examined at the hospital. You are asked by the doctors to find the genetic defect responsible for this rare condition...

Ionic and Covalent Bonds

Atomic bonding! Learn about how atoms bond together and how this affects the properties of substances. You will learn about ionic and covalent bonds...

Molecular Cloning

Molecular cloning is one of the techniques that has laid the foundation for modern biotechnology. The technique was first used in the 1970s and is still used today...

Monogenic Disorders

In this lab, you will learn about the monogenic disorder Cystic Fibrosis and its inheritance from one generation to the next. You will also learn about the symptoms and treatment...

Fermentation

Fermentation technology can be used to produce valuable biological compounds in large quantities. For instance, most antibiotics are produced using fermentation...

Flow Injection Analysis

In the Flow Injection Analysis (FIA) simulation you will learn about the scientific innovation process and the flow injection analysis machine and how it is used...

Lab Safety

In this simulation you will learn everything you need to know to survive your first day in the laboratory. The lab that you are going to enter...

MAGE

In the Multiplex Automated Genome Engineering (MAGE) Simulation, you will learn how to edit the genome of *Escherichia coli* in order to enter a new market...

Mammalian Transient Protein

In the Mammalian Transient Protein Simulation, you will use the transient expression system to produce a transient protein production in *Escherichia coli*...

Nuclear Magnetic Resonance

In this lab, you will learn how to use NMR to characterize binding events between proteins and ligands. You will perform NMR experiments and analyze the results...

Pasteurization and Sterilization

In the Pasteurization and Sterilization lab, you will help a scientist to optimize the pasteurization process. You will learn about the different methods and their effectiveness...

Cell culture basics

In the Cell Culture Basics Simulation, you will use the aseptic technique to culture mammalian cells. You will perform a cell passage and freeze storage...

Cell Culture Basics - Transfection

In the Cell Culture basics - Transfection simulation you will transfect a melanoma cell line using a lipid-based reagent in order to overexpress a specific protein...

Cellular Respiration

The Cellular Respiration Lab covers the main pathways of glucose metabolism and energy use. The storyline starts with a contract for the student by a company...

FACS

In the Fluorescence-activated Cell Sorting (FACS) Simulation, you will learn the basics of flow cytometry and how to use a flow cytometer with fluorescence...

Gene Regulation

The Gene Regulation Lab development is based on the Nobel Prize in Physiology 2012 case study. In this lab, students will learn about gene expression and regulation...

Genetically Engineered Organism

In this simulation you will join an iGEM team to design a biosensor that can sense biofilm forming bacteria. You will combine two different parts and build a genetic circuit...

Marine Biology

You begin the investigation of a massive fish kill by collecting water and fish samples. After taking the sample from the field you have to go back to the lab...

Medical Genetics

In the Medical Genetics Lab, students learn about Mendelian inheritance, linkage analysis and finding the defective gene in a family with a rare disease...

Meiosis

Identify the main characteristics of male and female gametes, the sperm and ova. You will use the light microscope for gamete identification and analyze the results...

Plant Transcription

In the Plant Transcription Simulation, you will embark on a mission to identify the metabolic pathway that produces an artificial compound in a plant cell...

Pluripotent Stem Cell Culture

In the Pluripotent Stem Cell Culture Simulation, you will culture and expand pluripotent stem cells (PSCs) using a feeder layer system. You will also learn about the different types of PSCs...

Chemistry Safety

In the Chemistry Safety Simulation you are on a mission to produce sustainable biodiesel. You will learn all the safety measures necessary for a chemical synthesis...

Crime Scene Investigation

Investigating the crime scene, the student collects blood samples in hopes that the murderer has left traces of DNA. After sampling, the student analyzes the DNA...

Cytogenetics

Students begin this lab in an ultrasound examination room where a young mother-to-be receives an abnormal ultrasound result. Students must find the cause of the abnormality...

Gene Expression

To study obesity you will collect a fat sample from lean and obese pigs and extract the RNA using the phenol-chloroform method. You will isolate and analyze the RNA...

LABSTER



**Permettere alla nuova generazione di
scienziati di cambiare il mondo**

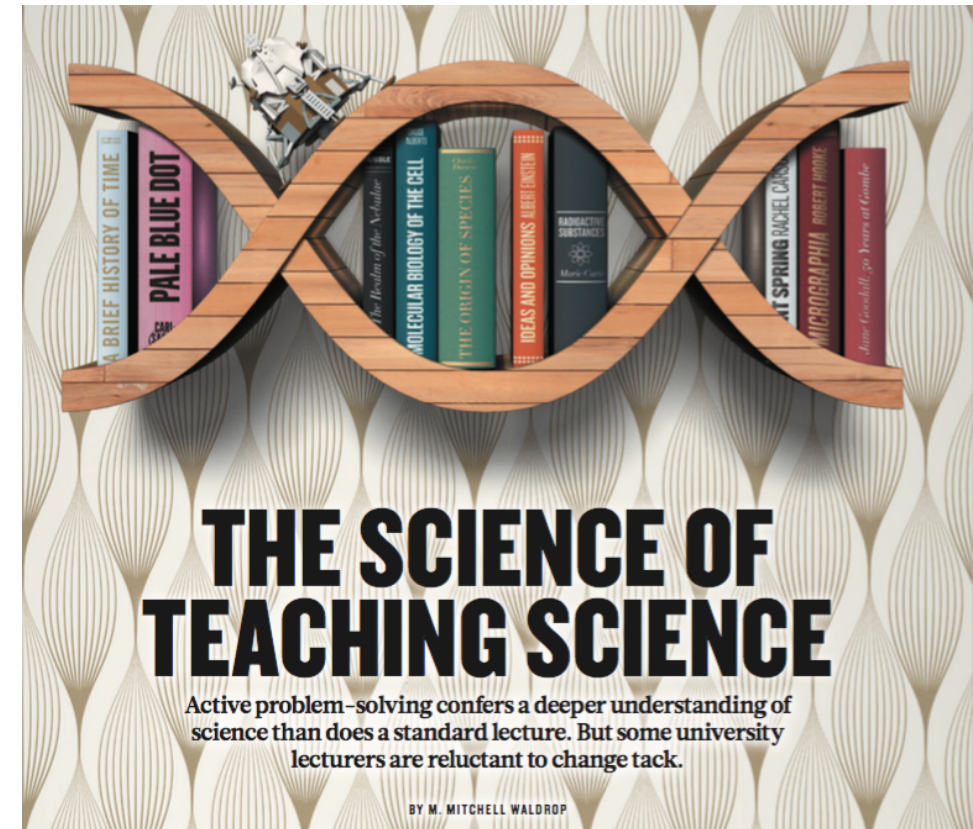
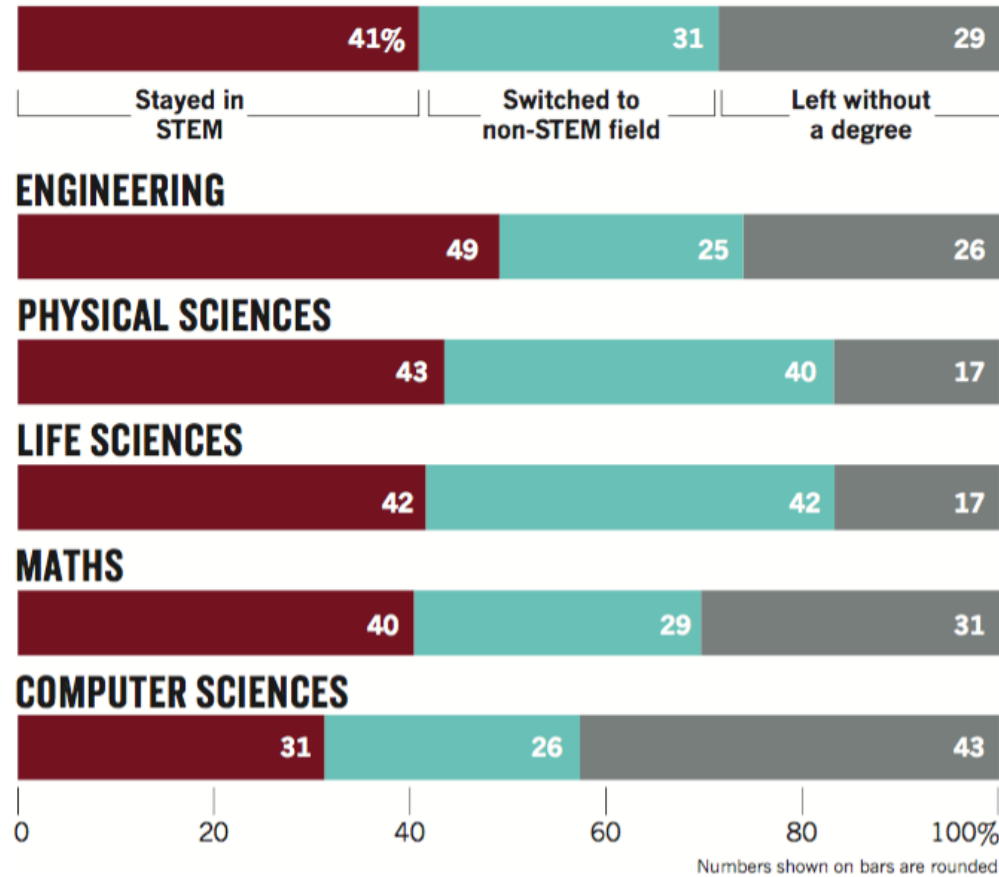


.... ma spesso l'insegnamento delle scienze risulta
noioso, di scarso effetto e costoso

Source: Moskovitz, SCIENCE, 2011, Institute for Technology and Engineering (2008)

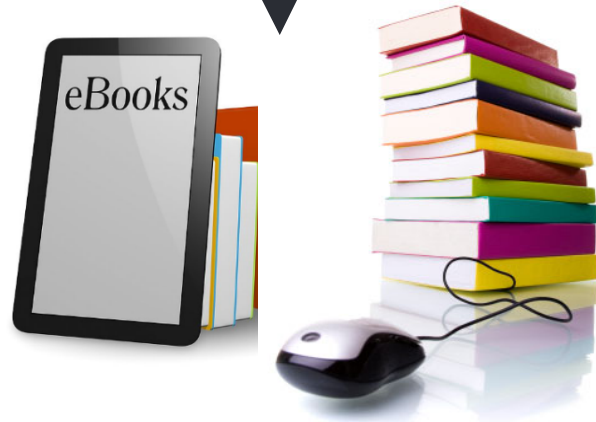
La sfida STEM

STEM AVERAGE



Source: (Waldrop, 2015) - Nature

Stiamo veramente innovando nell'insegnamento?



E-books, YouTube e MOOCs portano gli stessi contenuti a un numero maggiore di studenti, con metodi simili a quelli di decenni fa, senza una vera innovazione.

A large, diverse group of students is seated in a lecture hall, filling the frame from the foreground to the background. They are all looking towards the left side of the image, presumably towards a speaker or a screen. The students are of various ages and ethnicities, and are dressed in casual attire. The lecture hall has wooden paneling on the walls and a large window on the left side, which is letting in bright light. The overall atmosphere is one of a formal educational setting.

Gli studenti sono la forza lavoro di domani



Gli scienziati di domani



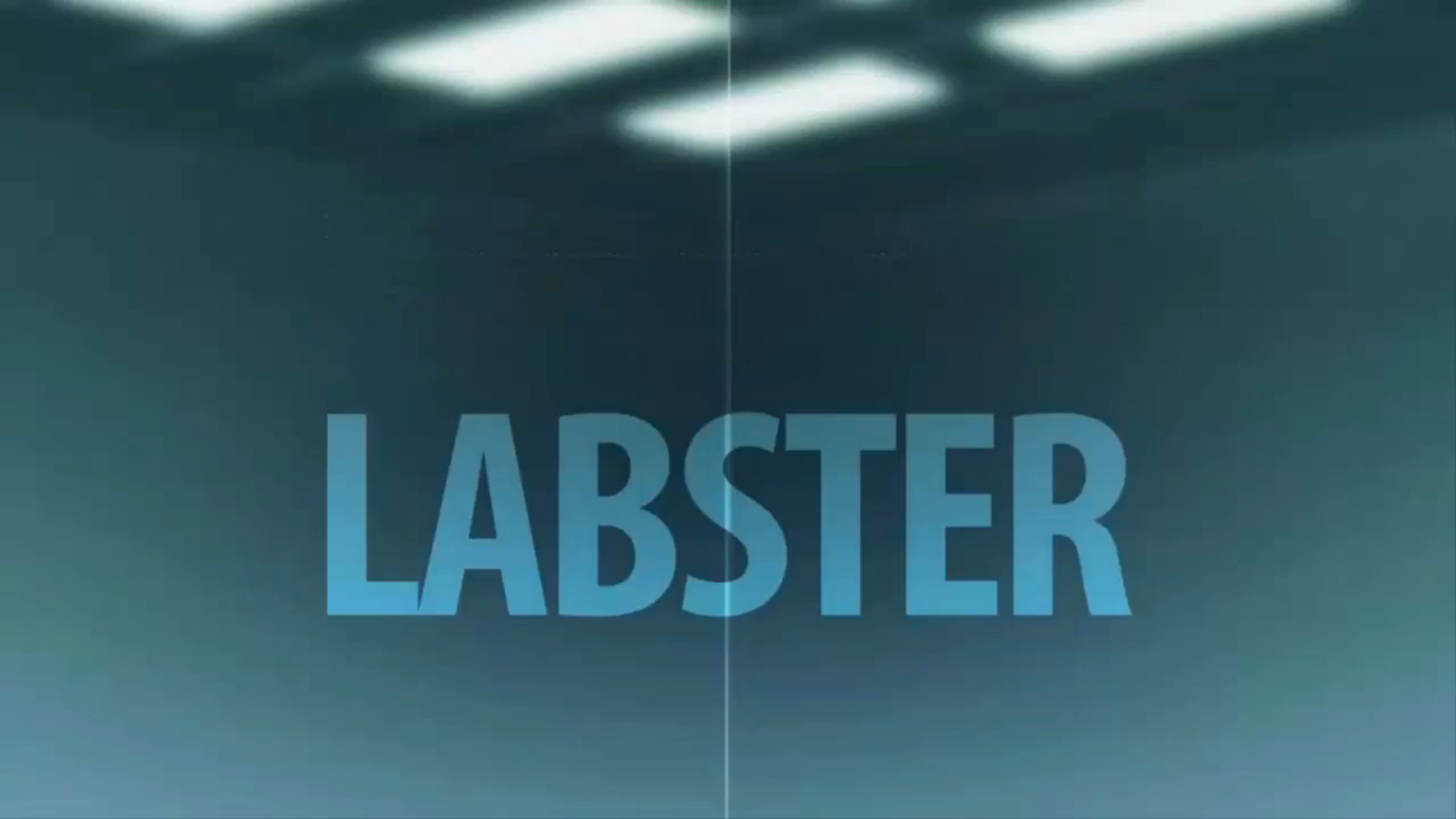
Il metodo Labster



“Oltre il 90% degli studi comparativi sperimentali sono a favore dell’uso combinato di simulatori di volo e voli di addestramento rispetto alla solo formazione di volo tradizionale.”

Source: Hays, Robert T., US Naval Training Systems Ctr, Human Factors Div, Orlando, FL, US (1992)





LABSTER

A wide-angle, high-angle shot of a large lecture hall or computer lab. Numerous students are seated at long wooden tables, each with a laptop open in front of them. The students are mostly seen from the back, looking towards the front of the room. The room is filled with the glow of laptop screens. In the foreground, a student's laptop screen is clearly visible, showing a web application with a dark-themed interface and a video feed of a person. Other laptops in the background show various web pages and documents. The room has a modern, minimalist feel with light-colored walls and wooden furniture. A few students are standing near the front of the room, possibly near a lecture desk or stage area.

**Ogni giorno migliaia di studenti accedono a laboratori
avanzati attraverso la tecnologia di Labster!**



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New Haven



ThermoFisher
SCIENTIFIC

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EXETER



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UNIVERSITY OF CALIFORNIA



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GWINNETT
TECHNICAL COLLEGE



BURGMANN
ANGELAN SCHOOL
GRACE COMMITMENT WISDOM



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**200+ istituzioni su
scala mondiale**

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Stanford
University



BOSTON
MEDICAL
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EXCEPTIONAL CARE. WITHOUT EXCEPTION.



Massachusetts Institute of Technology

novo nordisk **fonden**

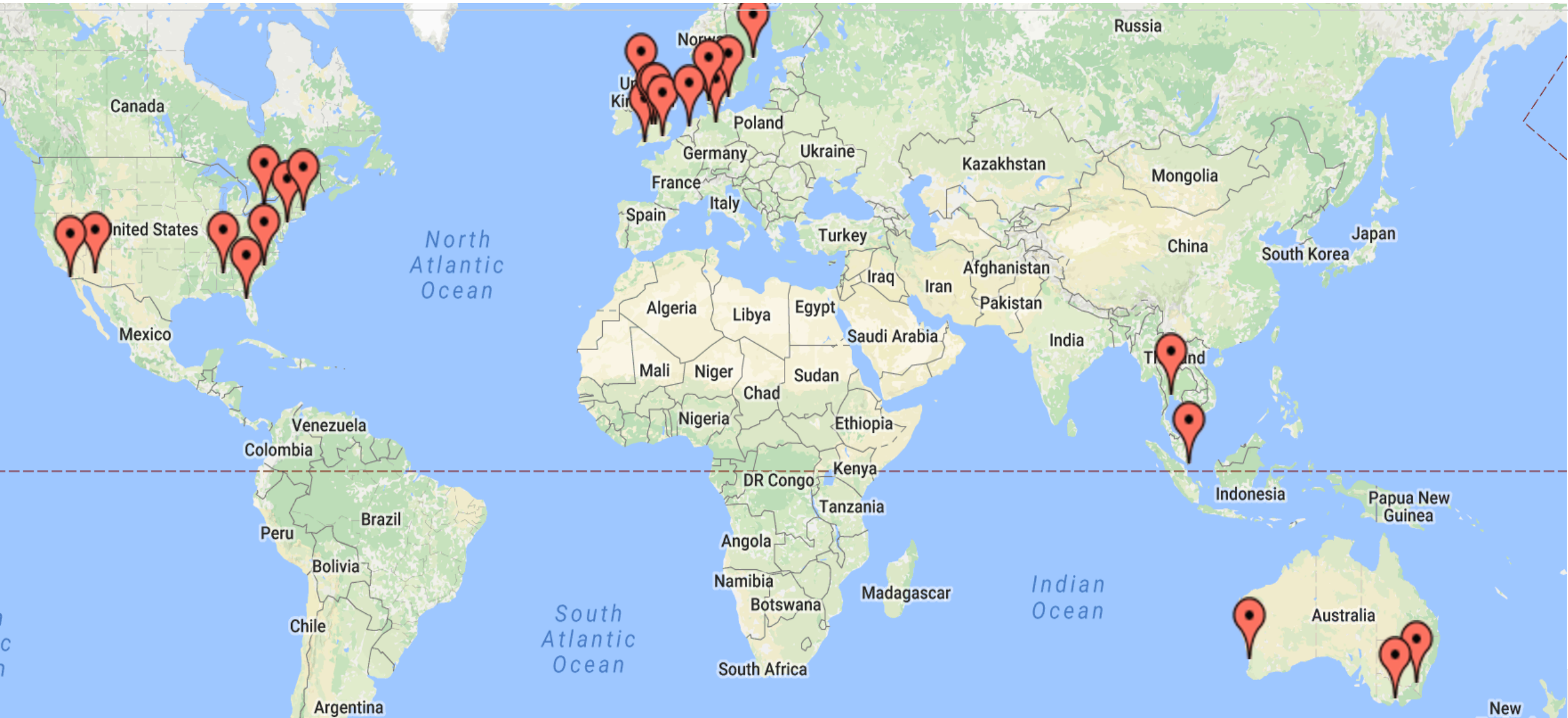
**UNIVERSITY OF
WESTMINSTER**



Studi sperimentali su Labster

Collaborative Research Network

4 Journal papers, 15+ in progress



Studio sperimentale sulla piattaforma Labster



NATURE BIOTECHNOLOGY volume 32 Number 7 July 2014

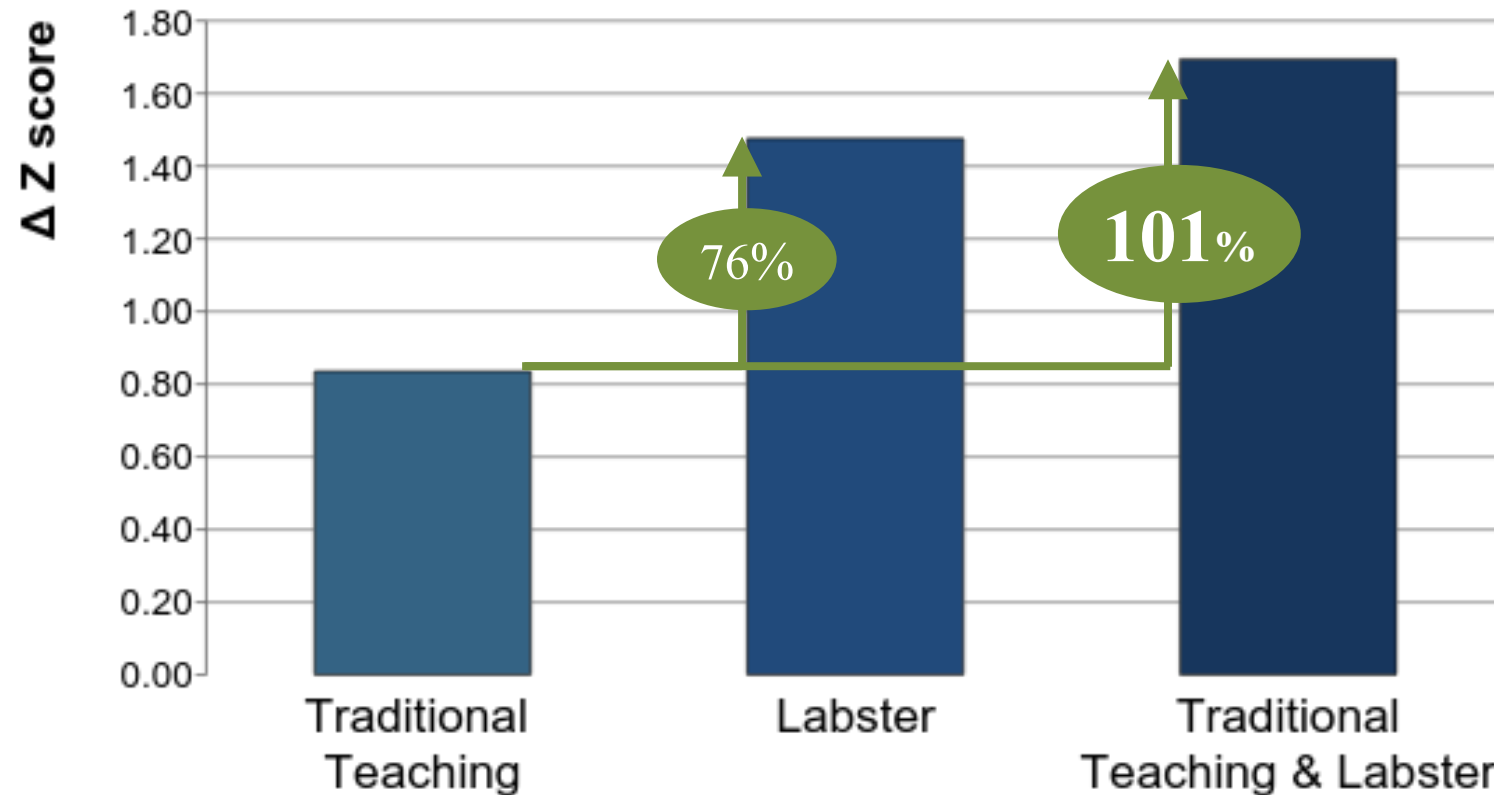
Improving biotech education through gamified laboratory simulations

Mads T. Bonde,^{1,2} Guido Makransky,³ Jakob Wandall,⁴ Mette Voldby Larsen,¹ Mikkel Morsing,⁵ Hanne Jarmer² & Morten O.A. Sommer^{1,2}

¹ Novo Nordisk Foundation Center for Biosustainability, Technical University of Denmark, ² Department of Systems Biology, Technical University of Denmark, ³ Department of Psychology, University of Southern Denmark,

⁴ NordicMetrics, Denmark, ⁵ Department of Biology, University of Copenhagen, Denmark

Labster virtual laboratories are proven to significantly increase learning impact over traditional methods



Source: Nature Biotechnology 2014, Statistically significant ($p < 0.001$)

Caso di studio: Labster e l'Università di Copenhagen

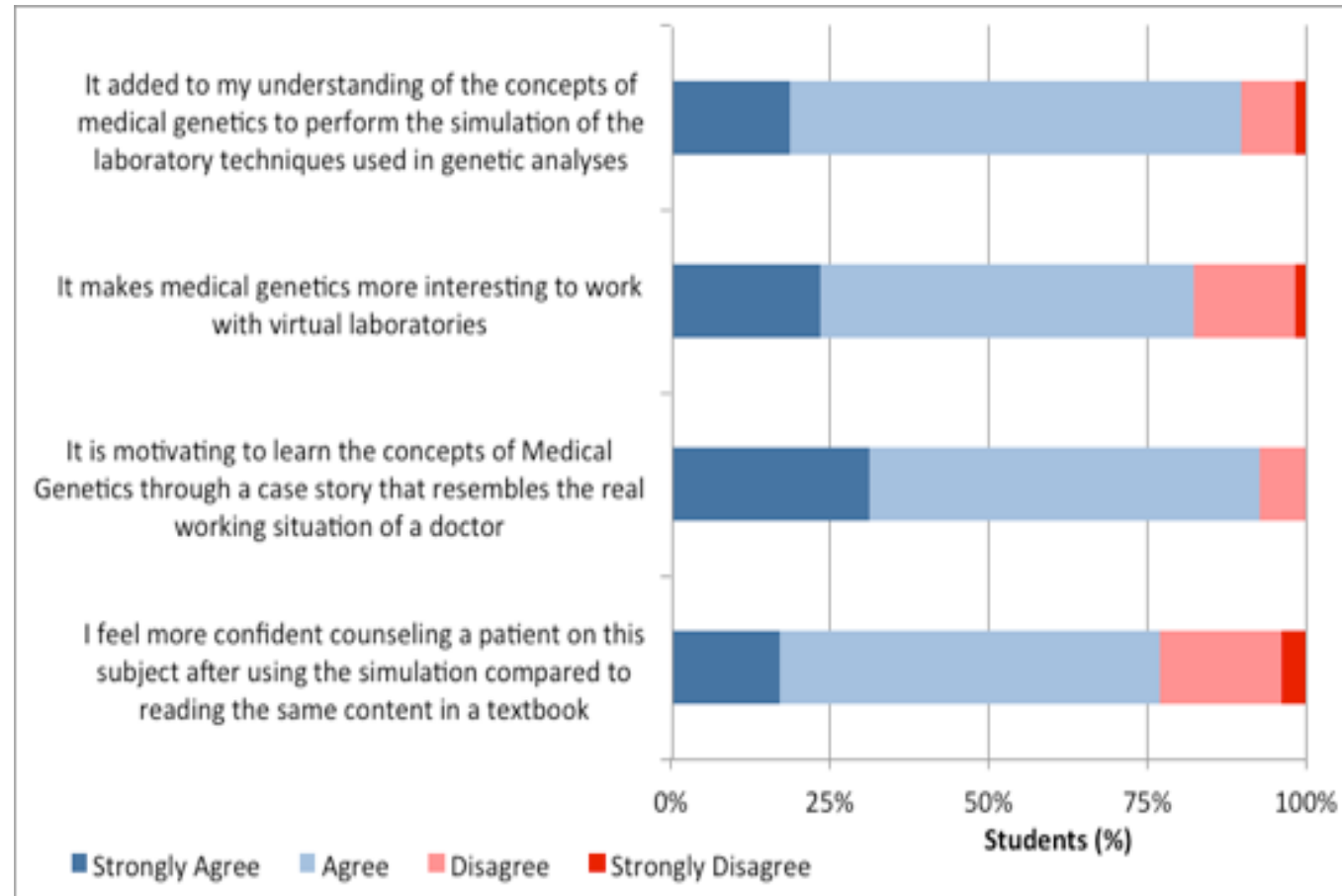
Facoltà di Medicina, Farmacia e Veterinaria

- Diminuzione della percentuale di insuccessi agli esami.
- “Nei laboratori reali, gli studenti finivano gli esercizi di sperimentazione più velocemente rispetto all’anno anteriore”.
- Minor numero di errori da parte degli studenti .



*Dr Lasse Kristoffer Bak,
Professore presso
l'Università di Copenhagen*

Caso di studio: Labster e l'Università di Copenhagen



PERCHE' I NOSTRI CLIENTI HANNO SCELTO E CONTINUANO A SCEGLIERE **LABSTER**?

1

Attracting students.

Using Labster the university is made even more attractive to students due to:

- The use of latest IT technology for learning
- Access to then best high-tech lab-machines at your virtual reach
- Learning science made fun
- Bridging science and career opportunities

2

Save costs and get better data.

Students can use their time more effectively in real labs and teachers receive detailed information of specific tasks.

- Better utilization of laboratory equipment
- Data-driven performance and effect measurement
- Insights to students' performance

3

New forms of learning.

Using 3D/VR immersive teaching the university can teach in new and different ways:

- Visualization of the abstract or the non-visual
- Learning by failure
- The synergies of combining Labster with other learning techniques improves the outcome





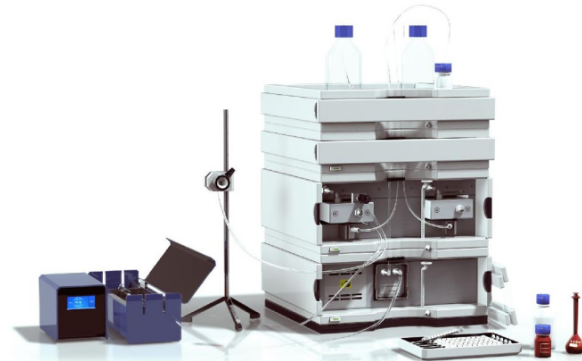
I Laboratori virtuali di Labster

Aumentare il coinvolgimento e il livello di apprendimento dello studente attraverso 3 componenti chiave

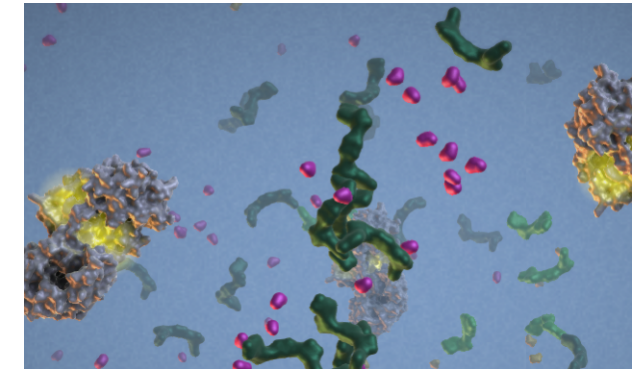
Gamification: problemi basati su casi reali studiati in Università e Centri di Ricerca



Strumentazione avanzata, inaccessibile e costosa



Animazioni guidate in grafica 3D



Utilizzo di macchine e strumenti di laboratorio spesso troppo costosi

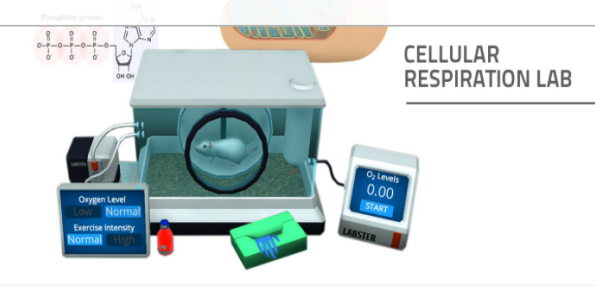


\$600,000 Next-Gen DNA Sequencer

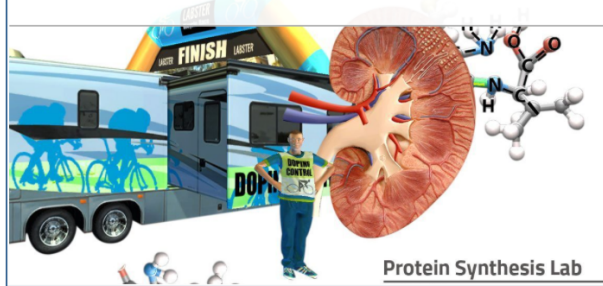


Esempi di Laboratori per corsi introduttivi

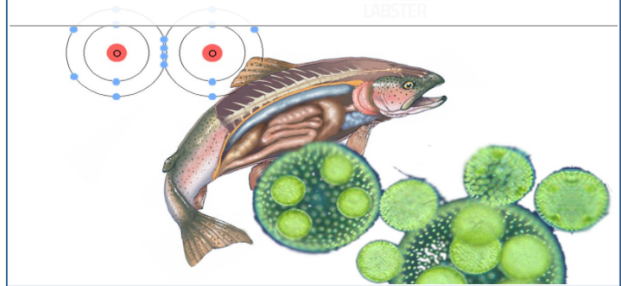
Cellular Respiration Lab



Protein Synthesis Lab



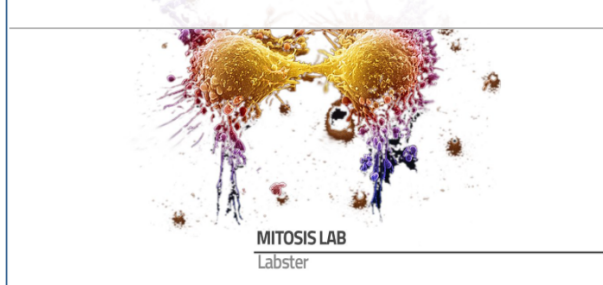
Ecology - Marine Biology Lab



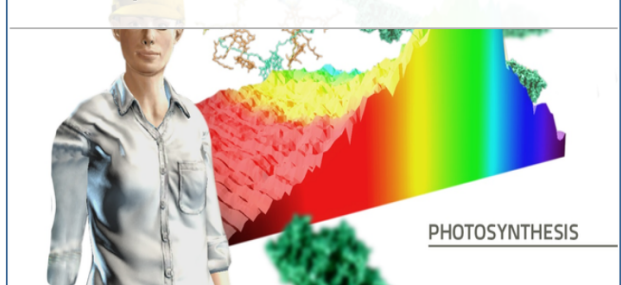
Evolution Lab



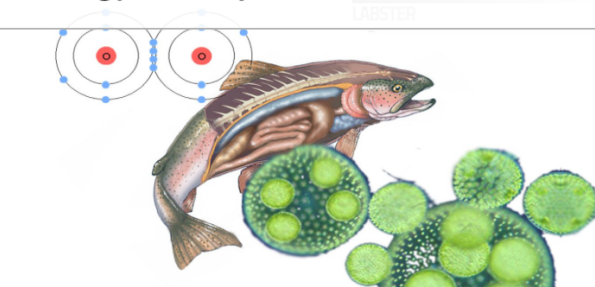
Mitosis Lab



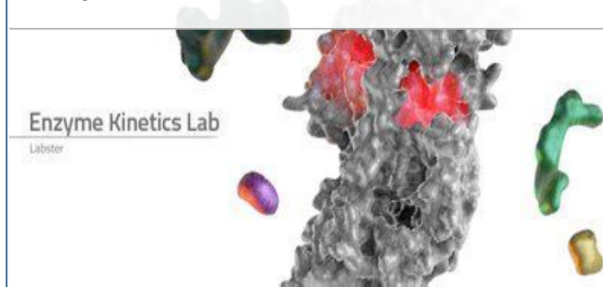
Photosynthesis Lab



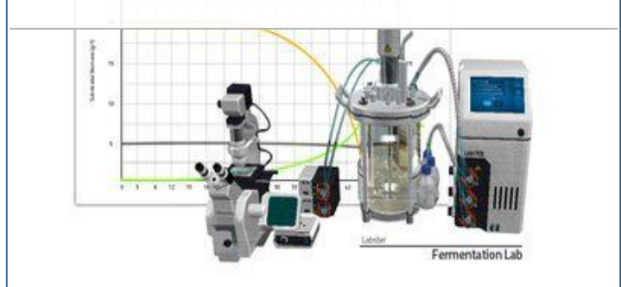
Ecology - Eutrophication Lab



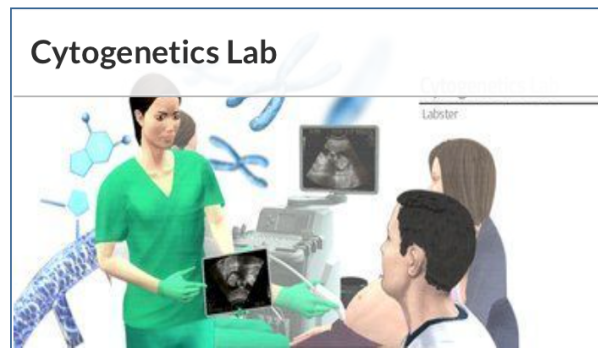
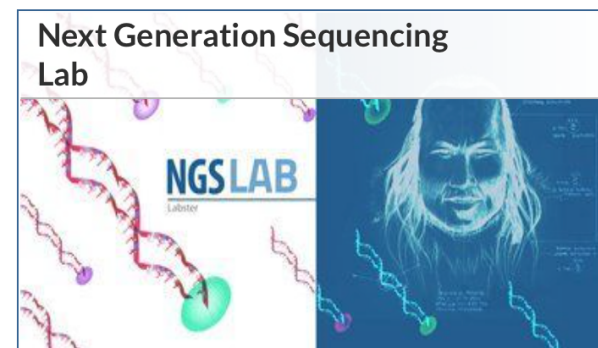
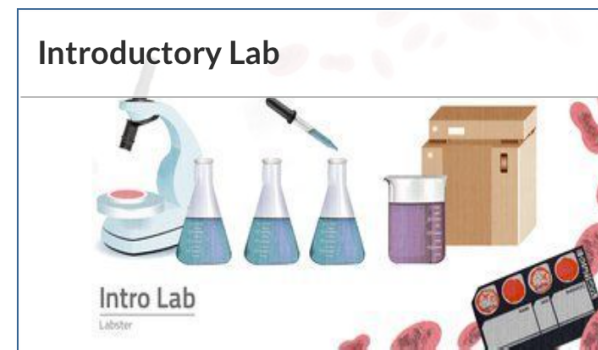
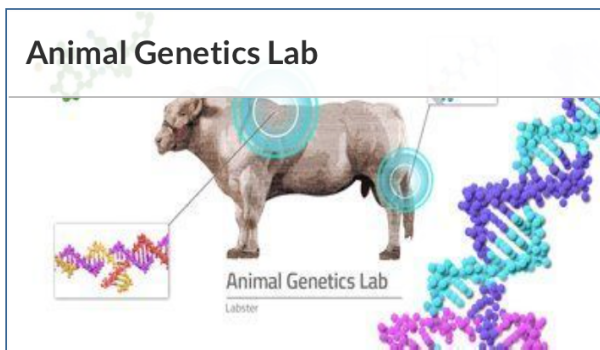
Enzyme Kinetics Lab

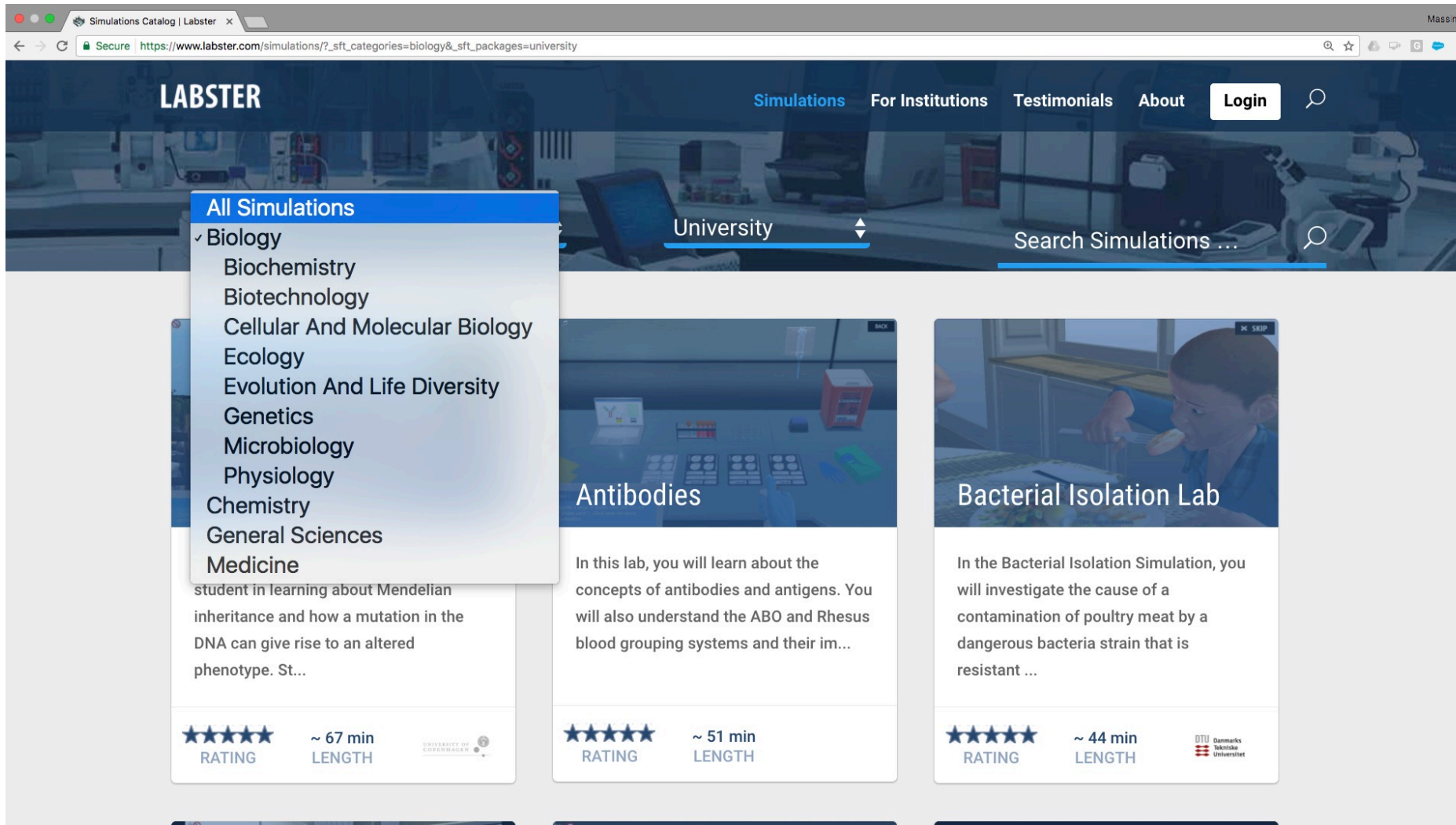


Fermentation Lab



Esempi di Laboratori per corsi avanzati





65 Labs in catalogo,
e nuove simulazioni
pubblicate ogni
mese...

Biologia,
Chimica,
Biotecnologia,
Medicina,
Fisica...

Online Labster virtual Catalogue: <https://www.labster.com/lab-catalogue/>



Esempi di simulazioni Labster

Lab Safety

About This Simulation

In this simulation you will learn everything you need to know to survive your first day in the laboratory. The lab that you are going to enter is a mess: identify the different hazards and remove them. You will get to know all the safety equipment and learn how to dress properly for your first date with a scientist.

In the virtual lab you can do things that would be far too dangerous in the reality. You can take advantage of this and learn by making mistakes. Will you be able to survive all the dangers of a laboratory?

Techniques

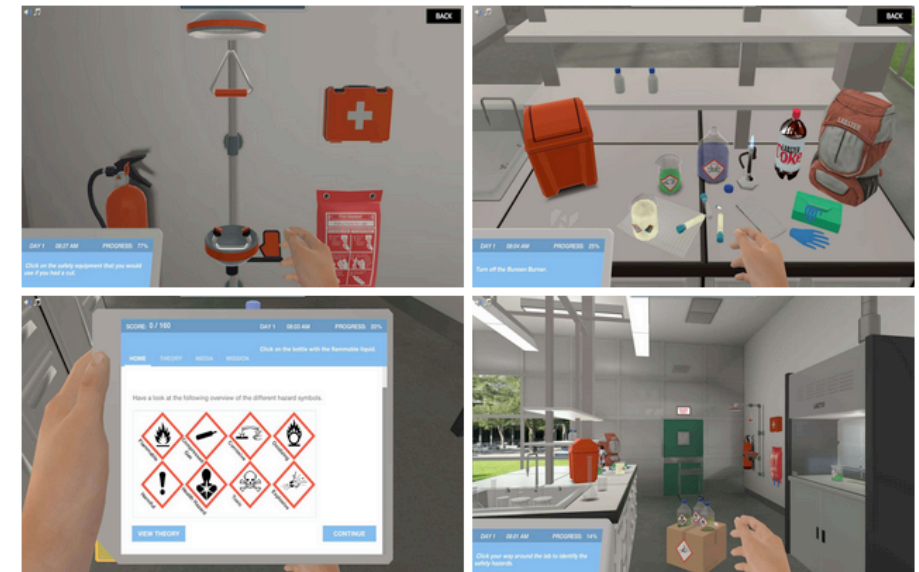
- GHS hazard pictograms
- Working with corrosive chemicals
- Safety station
- Dress code for lab

Collaborator



Learning Objectives

- Learning how you should be dressed for a day in the lab.
- Figuring out the dos and don'ts in a laboratory.
- Learning when and how to use the lab safety equipment.
- Reacting in an emergency situation.





Press Esc to exit fullscreen



DAY 1 08:00 AM PROGRESS: 0%

Welcome to Labster. Let's get ready for this virtual learning session.

Lab Screencast

Crime Scene Investigation

About This Simulation

Investigating the crime scene, the student collects blood samples in hopes that the murderer has left traces of DNA. After sampling, the student accesses a virtual lab to perform DNA analysis.

In the lab, a PCR kit, purified DNA from the crime scene, and a full lab bench set up are available. It is now up to the student to mix the correct reagents and perform PCR in the lab PCR machine. A 3D animation will show the Polymerase Chain Reaction at the molecular level, illustrating DNA structure and replication. Quiz questions will be asked throughout the experimental process, as well as at specific steps of the PCR reaction itself. With the media player function, the students will be able to see the animation several times, pause it, or revisit it at a later time for exam preparation.

Students run a gel on their collected sample and other already prepared samples from suspects. Comparing the patterns that emerged on the gel, students will be asked to identify the murderer. Upon completing the lab, students will have a thorough understanding about DNA profiling and Small Tandem Repeats. Additionally, quiz questions accompanying the experimental steps will check on the students understanding of the content. A Labster Learning Wiki is also supplemented to provide the student with background theory.

Learning Objectives

- Learning about the function of DNA polymerase in DNA replication and synthesis.
- Understanding the Polymerase Chain Reaction (PCR) technique using DNA from a blood sample as the template.
- Understanding the Gel Electrophoresis technique that separates DNA according to its size.
- Learning about the unique signature of the human genome and the use of Tandem Repeated Region (TRR) in DNA profiling.

Techniques

- PCR
- Gel electrophoresis
- DNA profiling

Collaborator





Blood from suspect

Blood contains a variety of cell types.
Some of these contain DNA.

DAY 1 08:01 AM

PROGRESS: 7%

First, pick up a blood sample from the suspect at the crime scene.

Lab Screencast



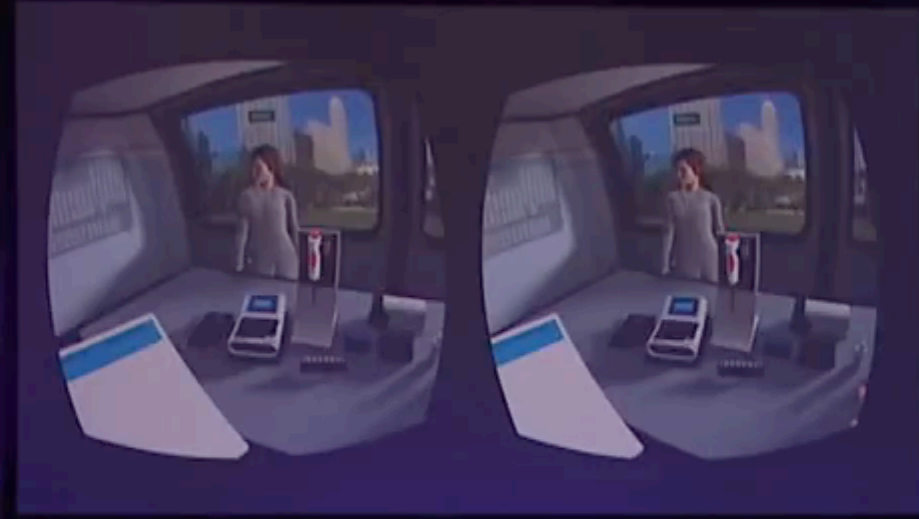
Labster e la Virtual Reality

Molti studi attuali
propendono per un
aumento del livello
di apprendimento
attraverso la
realtà virtuale

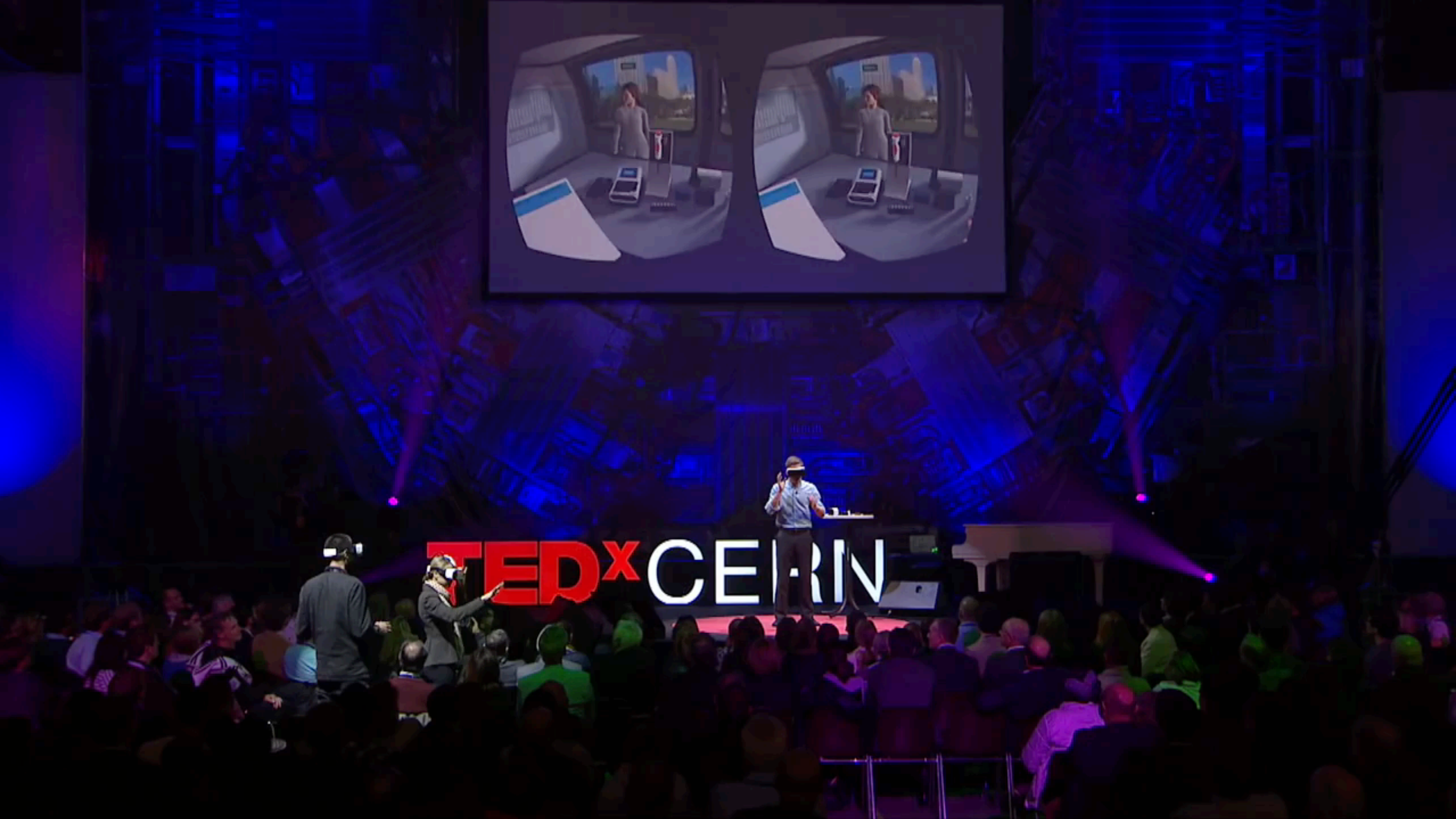


Labster è un'azienda leader nello sviluppo di laboratori virtuali per Virtual Reality





TEDxCERN





Q&A



LABSTER

Simulazioni Virtuali di Laboratorio

ETH Zürich

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UNIVERSITY OF
COPENHAGEN

University
of Glasgow

香港大學
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ITALIA 2017

Roma 28-30 settembre 2017 - Sapienza Università di Roma

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