NYU-MRSEC Outreach
DIY Workshop

Wesley Francillon NYU-MRSEC
Co-Education Director

Acknowledgments:
Biobase.org -- Dr. Ben Dubin-Thaler & Francesca Anselmi
Dr. David Grier – NYU MRSEC, Department of Physics

Educational outreach: Core programs

Building excitement, competence, and confidence

Scientific Frontiers Program

Enriching science education and instilling excitement about science in the K-12 sector

Research Experiences for Undergraduates (REU)

Undergraduates from a national base of four-year colleges and research universities

College Faculty-Student Research Teams

Research for faculty mentors and accompanying undergraduates from minority-serving institutions and four-year colleges

Faculty Development

Material World Workshops

High-Impact Scientific Communication

Mobile science labs (The BioBus)
Cross-generational science videos
Strategic partnerships
Educational technology (Jin Montclare)

Probing the Microscopic World with Holographic Microscopy

Stakeholders-
K-12, undergraduate

Leveraged Resources
Biobus/Biobase, MRSEC based Start-up: Spheryx Inc (3D printed parts), MRSEC Faculty, Expand to STEP/CSTEP programs.

Backend Cost
Building microscopes at a modest cost:
~$50 for parts

Nominal Cost
Approximately 12 microscopes were built and used during workshop. Microscopes donated to k-12

An in-line holographic microscope uses laser illumination and a conventional video camera to record holograms of microscopic objects ranging from nanoparticles to biological cells. Using techniques from computer vision to analyze the resulting stream of holograms yields astonishingly precise information about the positions and properties of the individual particles as they move.


TRIAD

DIY Microscope Workshop Outline

Demystifying Microscope

The first microscopes...

Robert Hooke
(1635-1703)

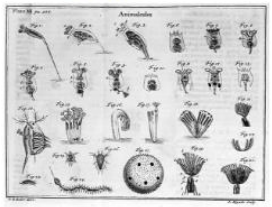
- Discovery of cells
- Observation of fossils: fossil wood has the same structure as rotten wood
- First detailed observations of insect bodies

http://www.ucmp.berkeley.edu/history/hooke.html

Antony van Leeuwenhoek
(1632- 1723)

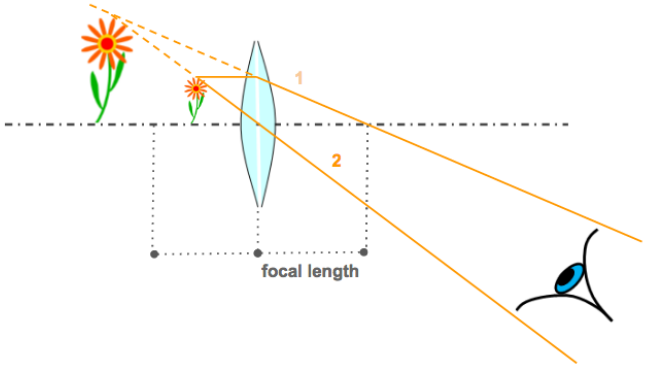
- First ever observation of microorganisms
- Discovery of the existence of protists, bacteria, unicellular algae, nematodes and rotifers

http://www.ucmp.berkeley.edu/history/leeuwenhoek.html

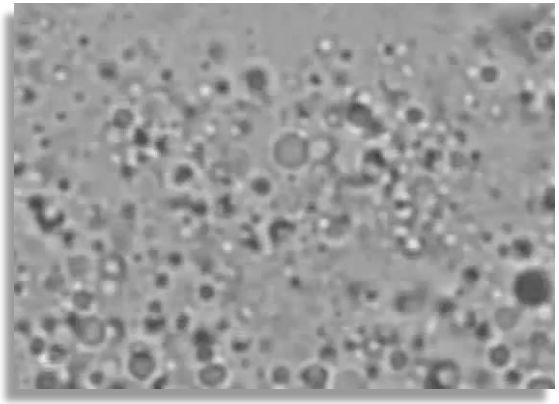


Imaging

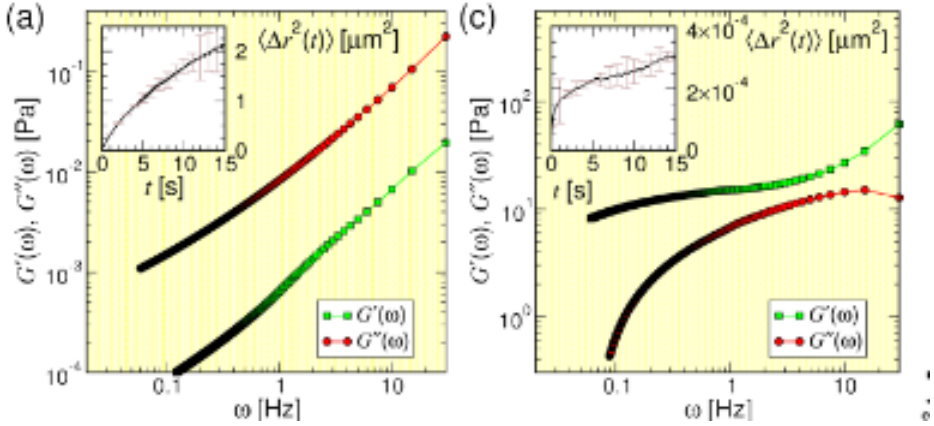
Forming an image with a lens: magnifying glass



Holographic video microscopy Applications --Tracking particles



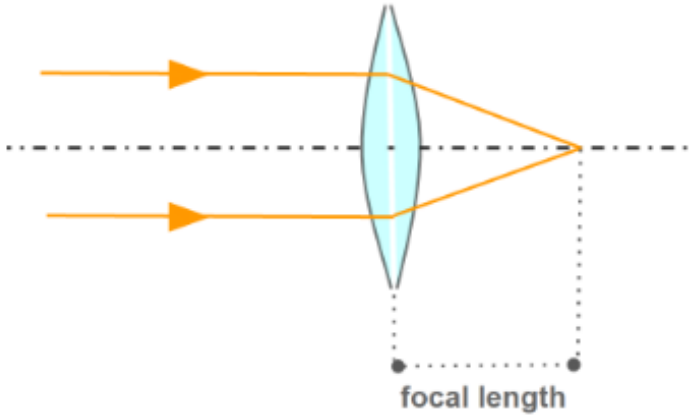
Getting Quantitative



Student Exercises and Activities

LENS EXERCISES

1) What is the focal length of your lenses?



A convex lens, generally made of glass or plastic, bends light rays parallel to the optical axis in such a way that they all converge into a point called the **focus**. The distance between the center of the lens and the focus is called **focal length**. The larger the curvature of the lens, the more the light rays are bent, and the shorter the focal length.

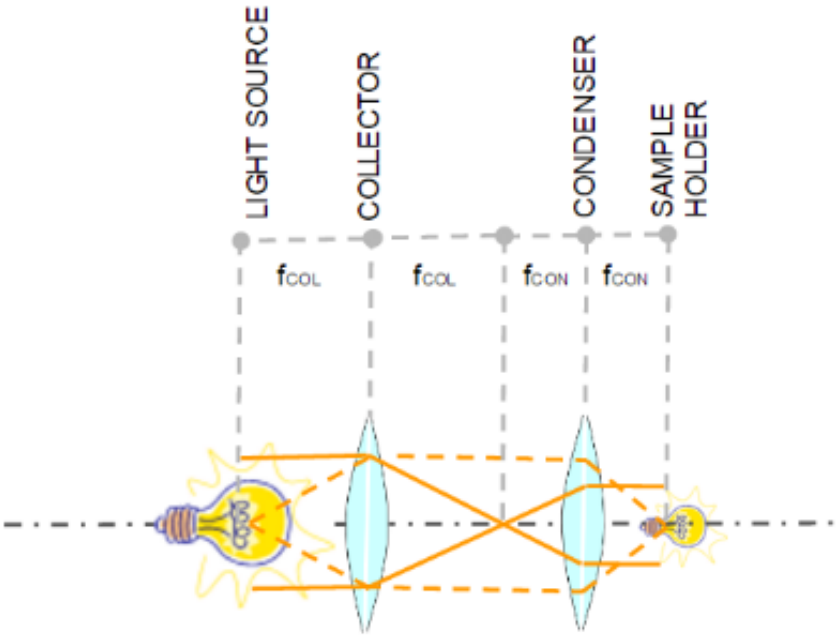
Activity 1.

Look at the lenses in your setup. They all have different diameters and curvatures. How can we precisely measure the focal length of these lenses?

Tip: light rays from a light source hit the lens from many different angles. What happens to these angles when the light source is moved farther and farther from the lens? And if the light source was as far away as the other side of the room or even the sun?

MAKE YOUR OWN MICROSCOPE

Part 1: aligning the illumination system

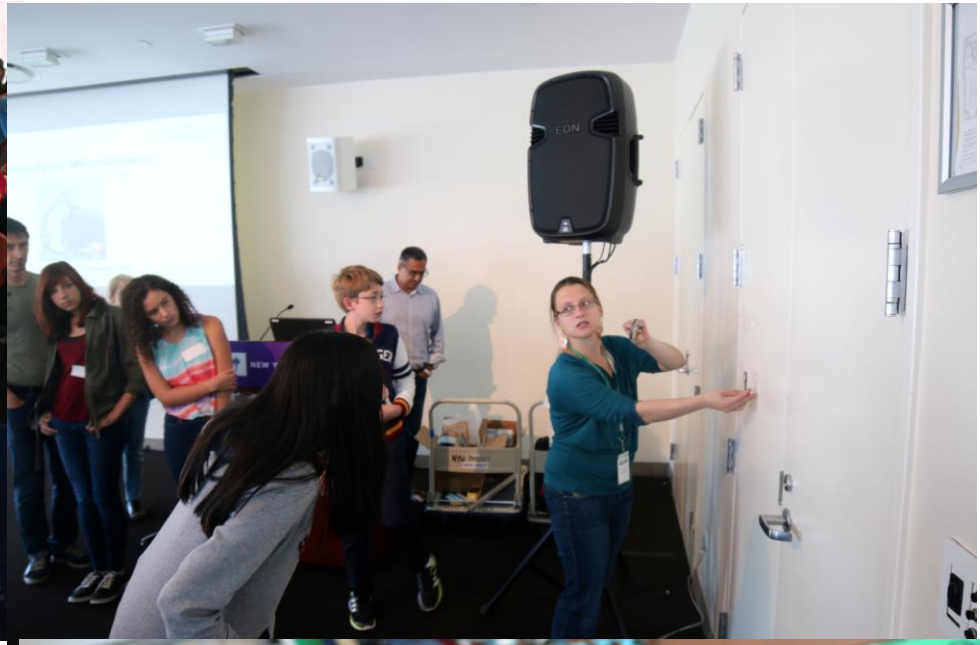


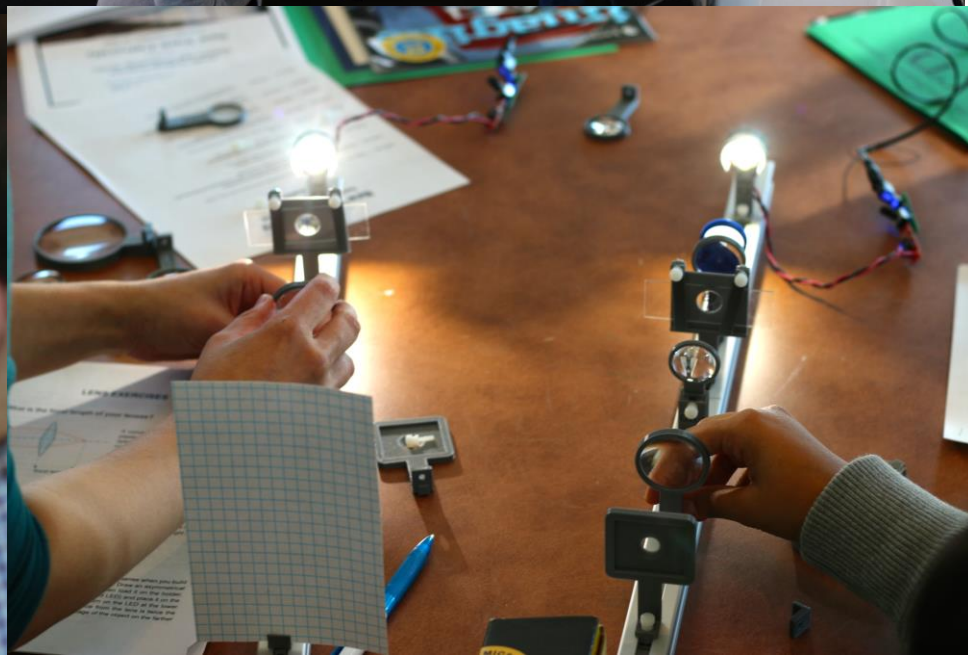
1. Make sure that at least 10 clamping platforms are loaded in the rail.

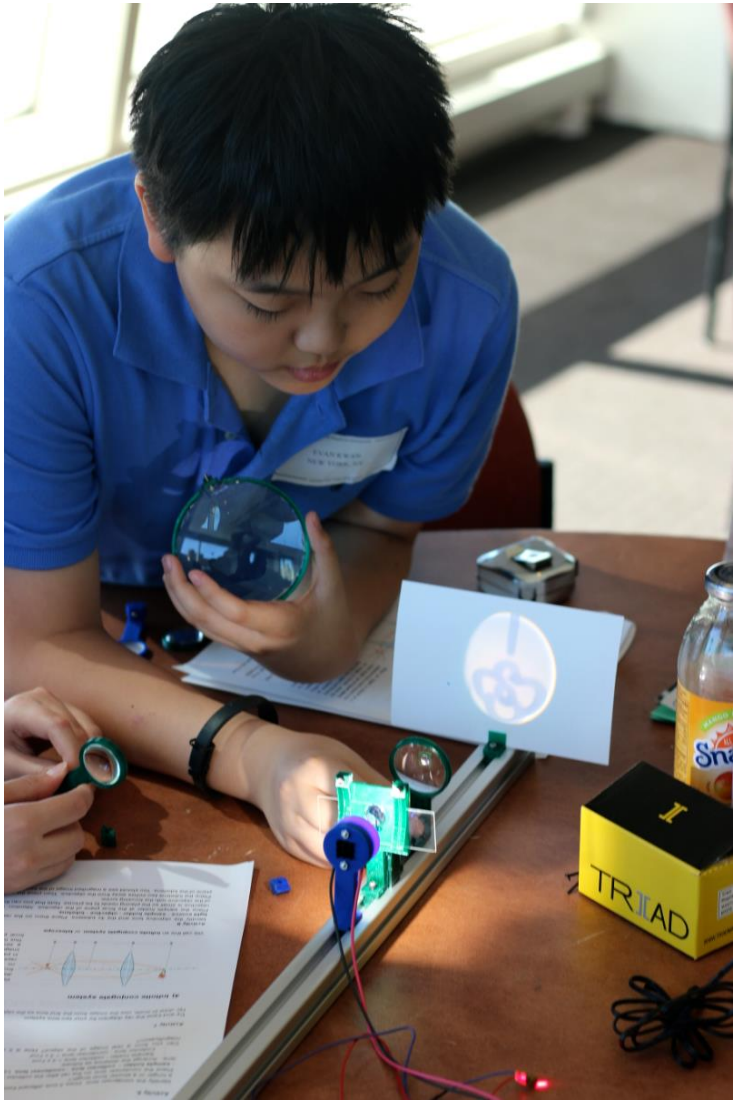
2. Position the light source on the first platform, near the border of the rail.

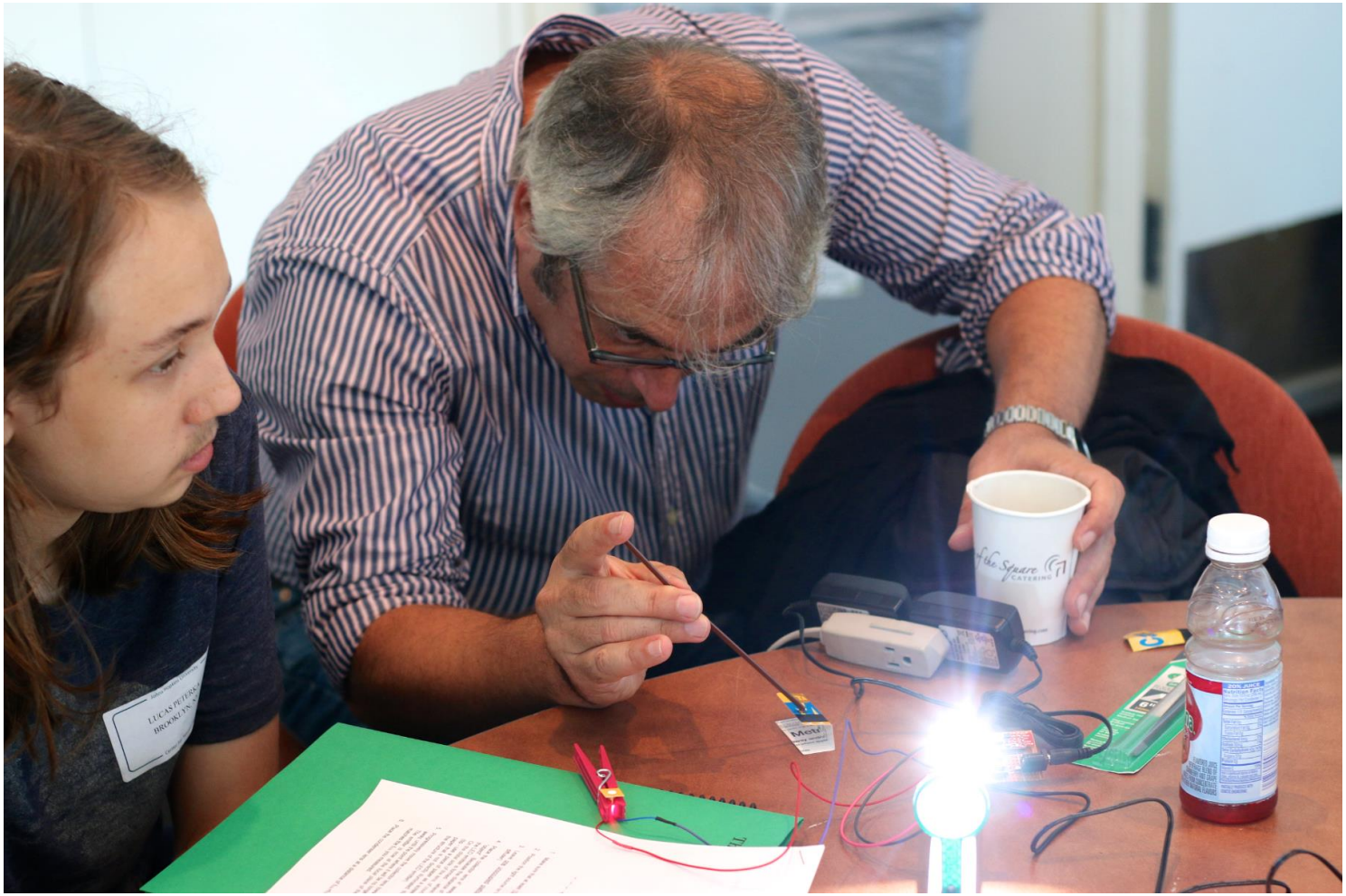

OBJ
COND
EYE
COLL
Diff


TRIAD
TRIAD


EON

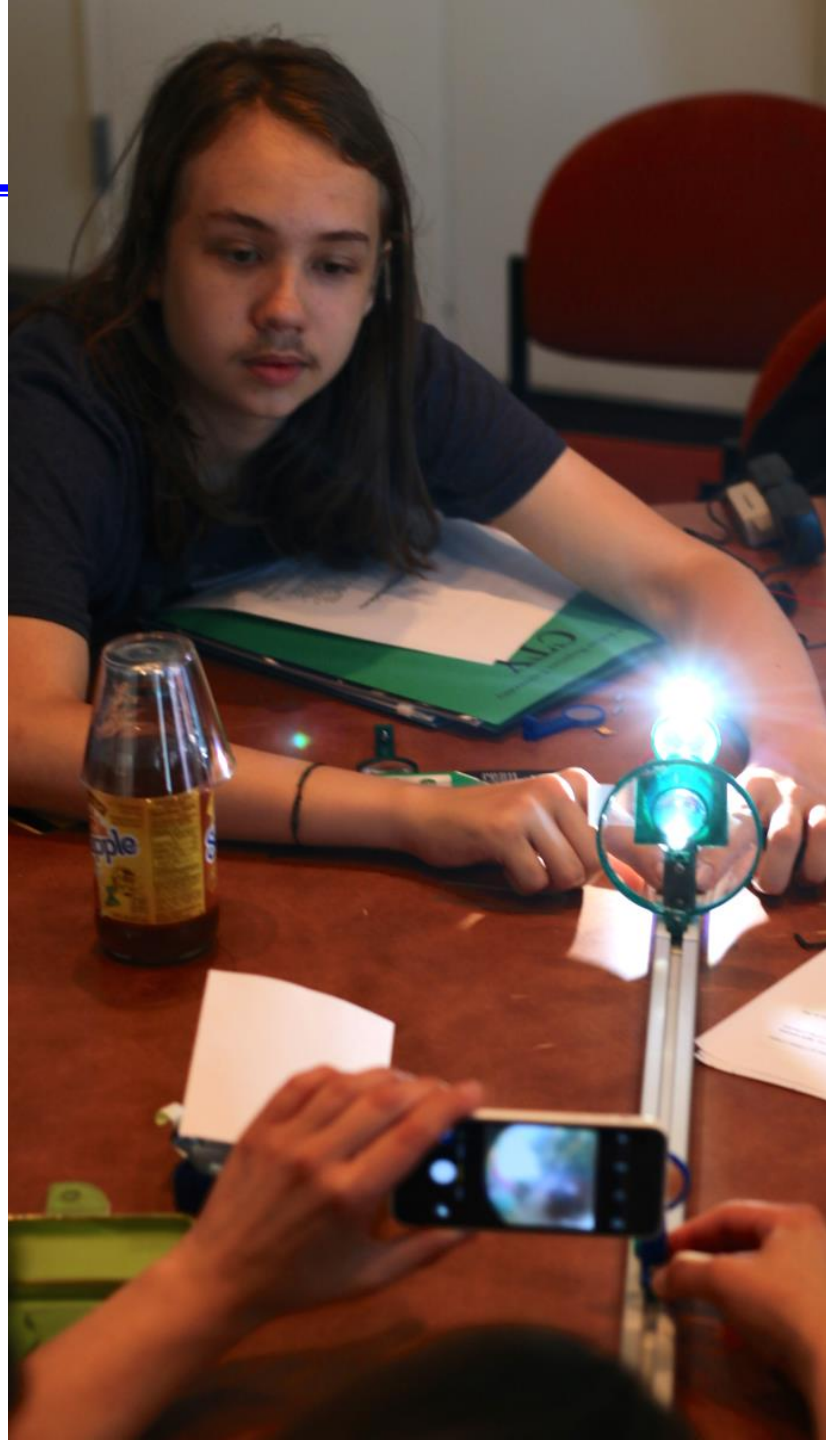



TRIAD



Holographic Microscope

Holographic Microscope



Workshop: Strength of Materials –
Optimization on building structures based on biological samples

Stakeholders-
K-12 – NYS STEM Enrichment program (STEP)

Leveraged Resources
Biobus/Biobase, MRSEC

Students:
Approximately 200 students @ NYU

Volunteer Team:
NYU-MRSEC REU students


Straws
Paperclips
TRUNK


BIOBUS.org
NYU

Thank you

Video Tape presentations
Photo
General Talk
Opportunity for speakers
Porting info to website
Venue – Washington Square
DIY
Student centered build
Concepts
First, talks about background information (Fun, exciting , dynamics)
Communicating science to K-12 and parents
aligning the cell phone camera
Once a year – Possibly once a semester
New Initiative
Outcomes

BNL


WB
White Balancing


DELL