Biophysics at GSU

Gary Hastings
Research Interests: garyhastings.org

Vibrational Spectroscopy for the Study of Biological Problems

A large range of both experimental and computational research projects are available.

Spectroscopy Laboratory Projects

FTIR microscopy and imaging of biological cells.

- Harmful algal blooms.
- Microalgal cells for biofuel production.
- Microalgal cells for wastewater treatment.
- Cellular composition of cells grown on different substrates.
- Lipids and cancer cells.
- Lipid composition in diatoms (temperature dependence).

Time resolved visible and infrared difference spectroscopy

- **Many** projects aimed at studying biological molecules involved in solar energy conversion in both artificial and natural systems.

Computational Projects

Quantum mechanical vibrational frequency calculations

- **Many** projects aimed at calculating the properties of biological molecules in protein complexes.

Infrared Spectroscopy Laboratory Projects. Part 1

Infrared spectroscopy and microscopy of biological cells and materials.

Harmful algal blooms.

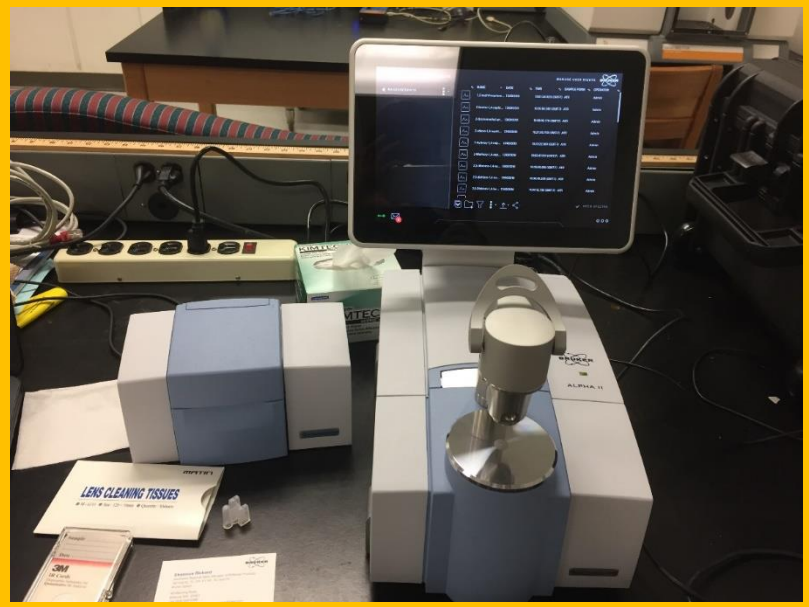
Microalgal cells, lipids for biofuel production.

Microalgal cell identification.

Bacterial cells (e.g. *E. coli*), identification and susceptibility to antibiotics.

Lipids in yeast cells and in cancer cells.

Lipid composition in diatoms (temperature dependence).



Hundreds of fish die at Piedmont Park's Lake Clara Meer (Update)

By Thomas Wheatley

Sunday August 9, 2009 09:43 pm EDT

It was an eerie and stinky scene at Piedmont Park today as hundreds of dead fish floated on the
up on the shores of Lake Clara Meer.

Parkgoers were baffled by the event, which a Georgia Department of Natural Resources official interviewed
AJC said was most likely caused by algae bloom. When the algae die off, the water's oxygen can dissolve. If that was
what caused today's die-off, then the fish essentially suffocated to death.

Infrared microscopy of microalgae - biofuel production.

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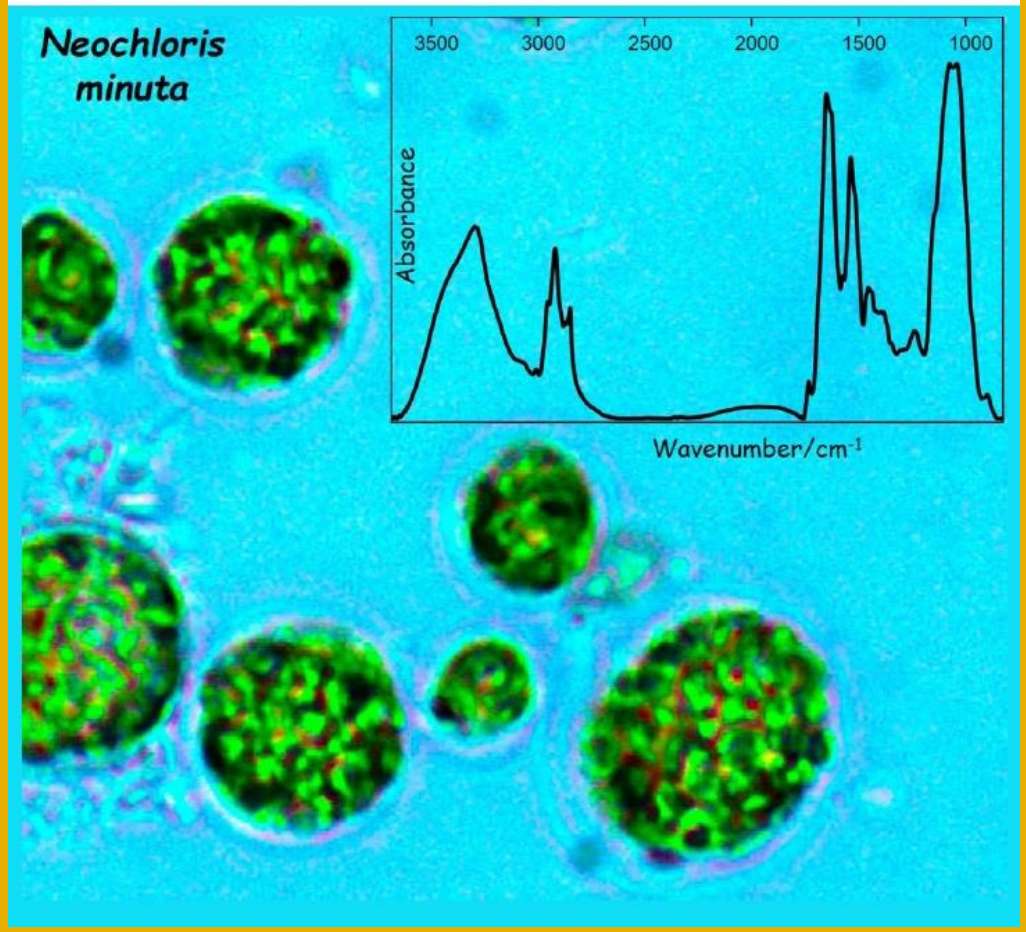
Frontiers

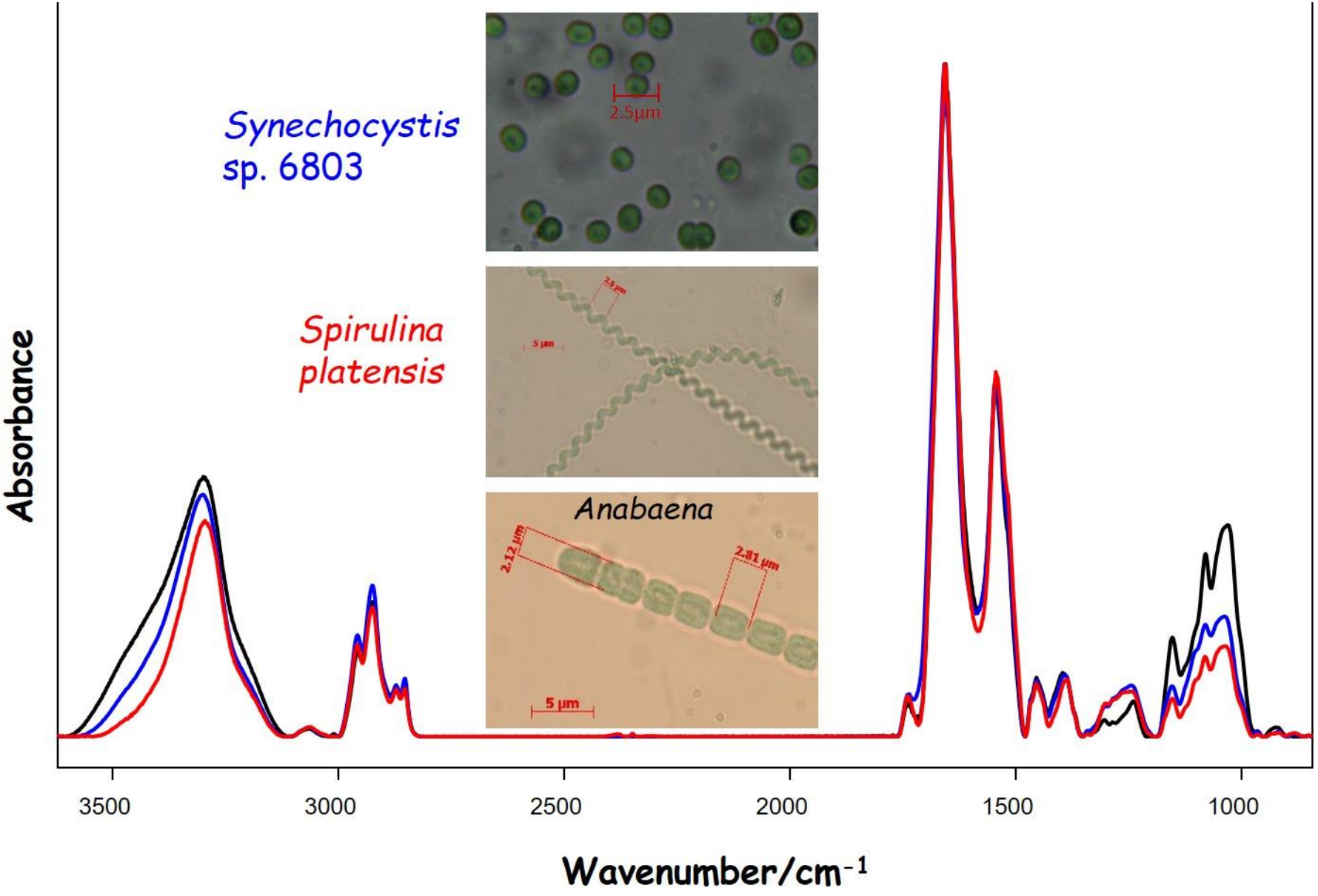
in Science, Technology, Engineering and Mathematics



On the Cover

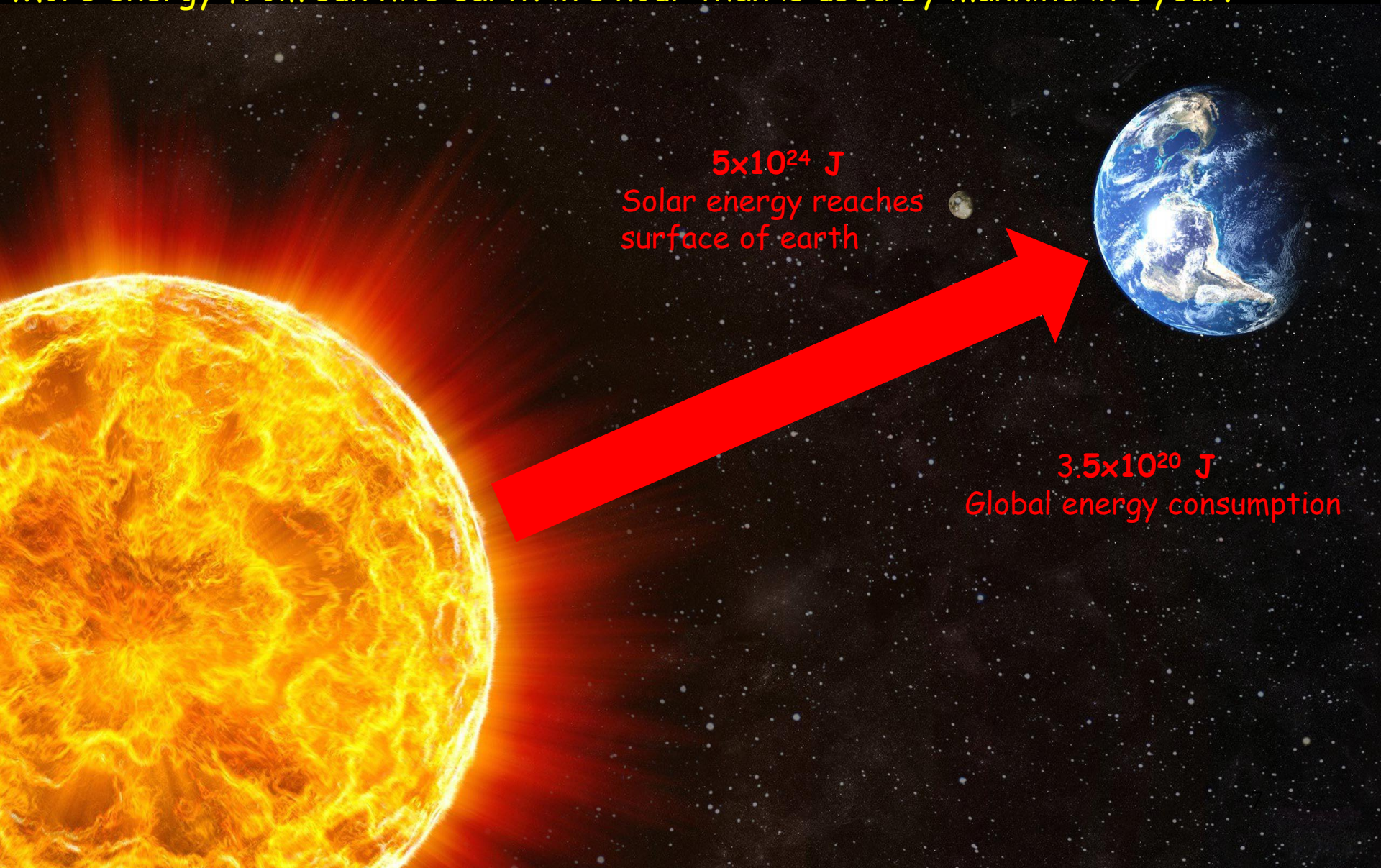
Hastings and his students developed a FTIR methodology to examine the contents of starch, lipid, and protein in microalgal cells. This methodology may provide a valuable tool in probing the distribution of biological materials in cells (see the article by Hastings et al on page 121 for details).

Infrared Spectroscopy for distinguishing different cyanobacterial strains

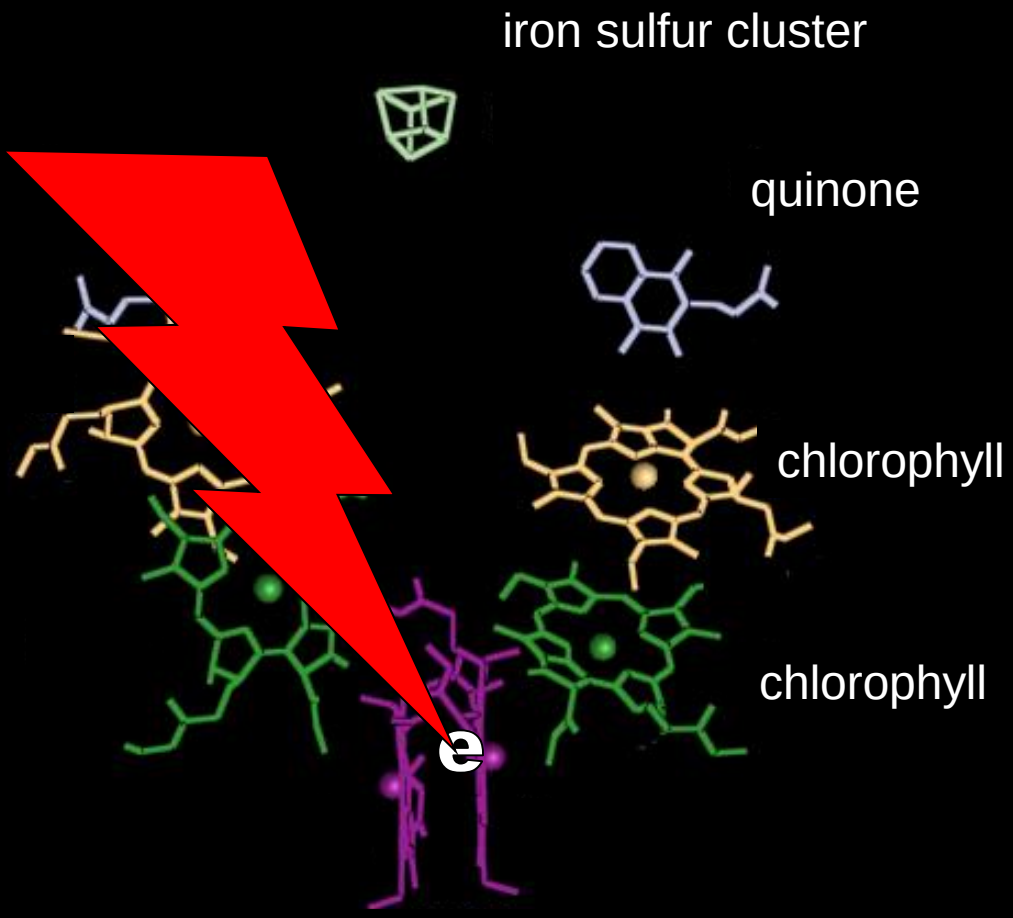


Motivation:

More energy from sun hits earth in 1 hour than is used by mankind in 1 year.



Basis Mechanism of Solar energy conversion: Light Energy Drives Electrons Across A Barrier.



Infrared Spectroscopy Laboratory Projects. Part 2.

Time-resolved infrared difference spectroscopy

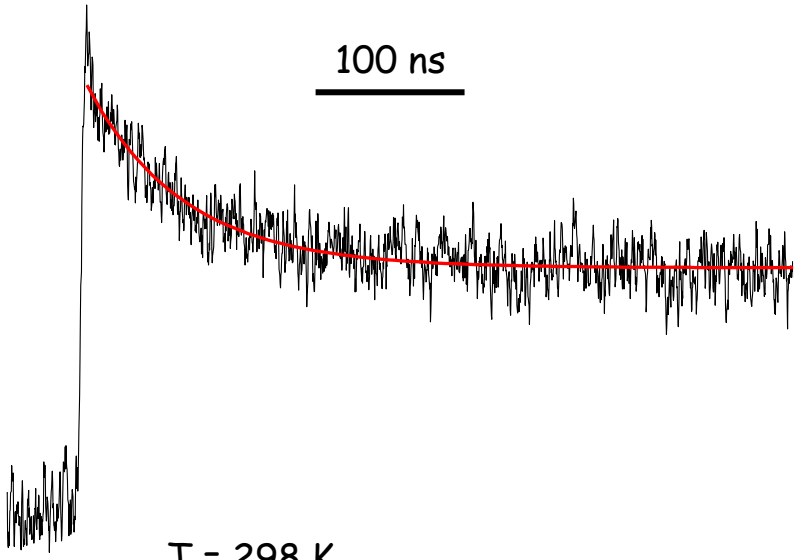
Many projects aimed at studying solar energy conversion processes in both artificial and natural systems.

Visible Spectroscopy Laboratory Project

Microsecond to seconds time resolved visible spectroscopy
Possibility for single laser flash experiment.

Visible Spectroscopy Laboratory Project

Time-resolved visible absorption spectroscopy (femtoseconds – seconds)

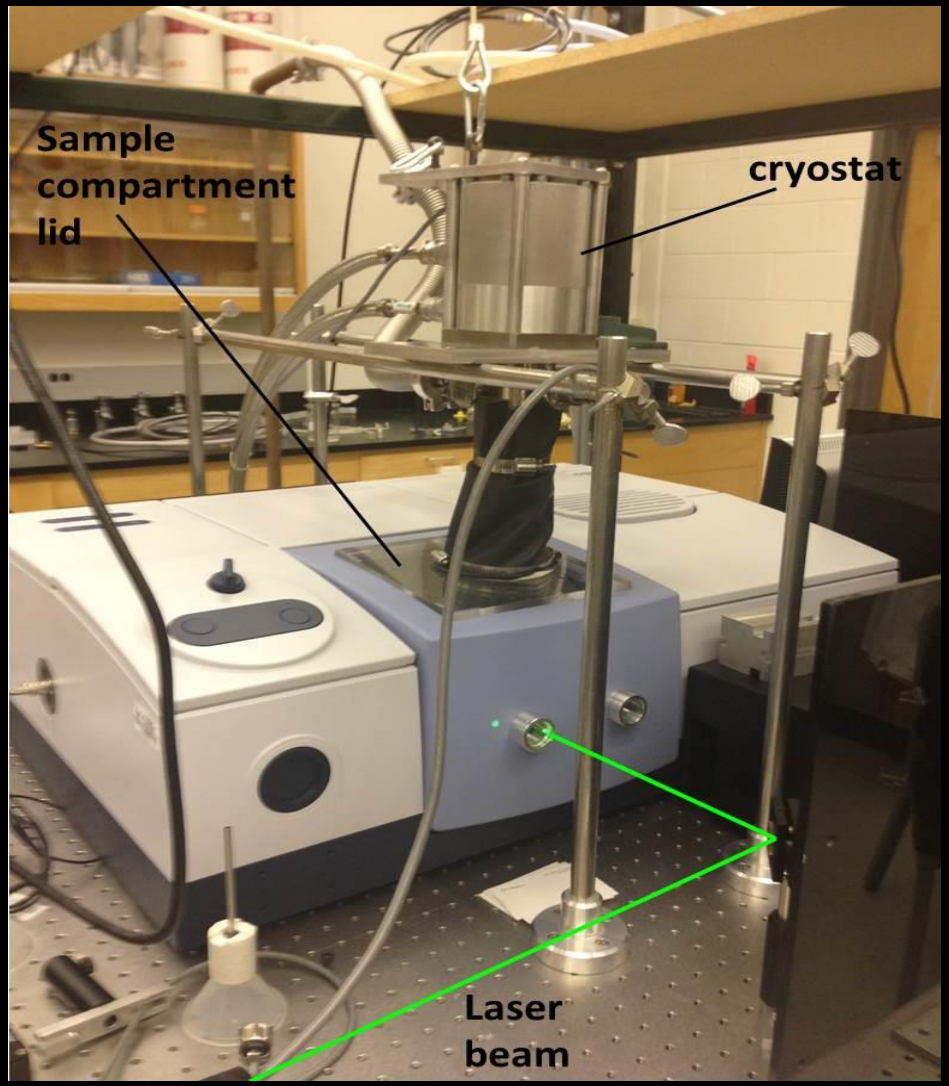


T = 298 K

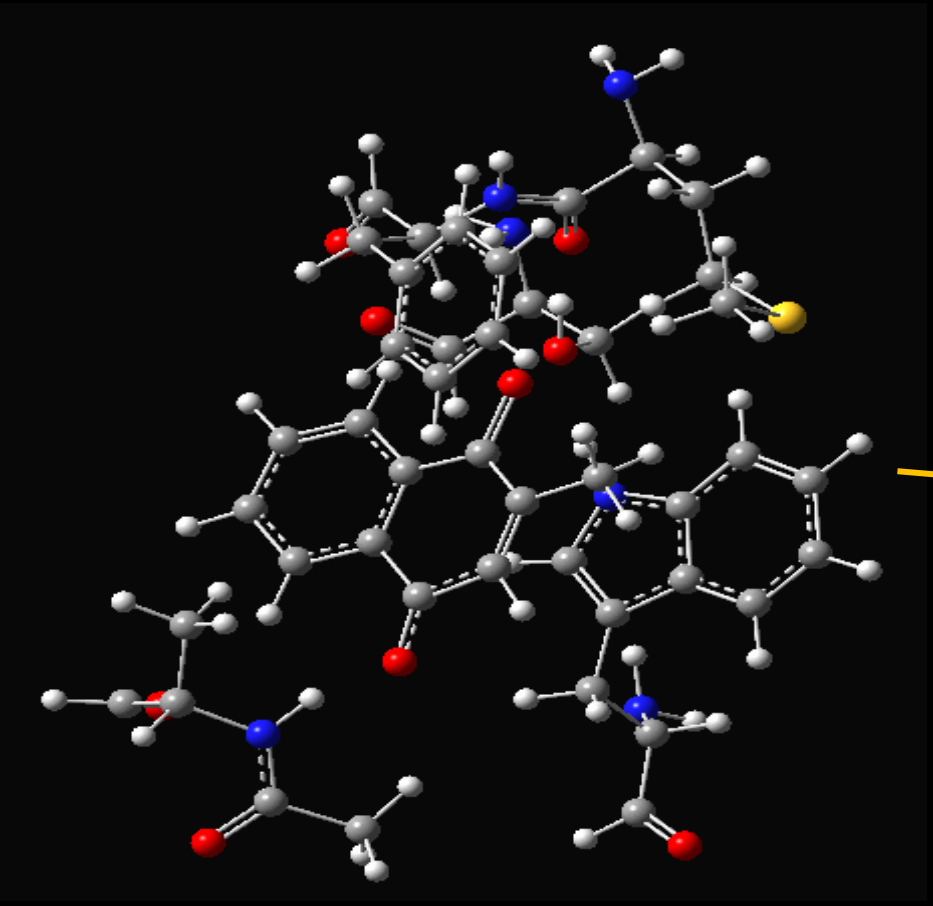
λ_{pump} = 532 nm (green)

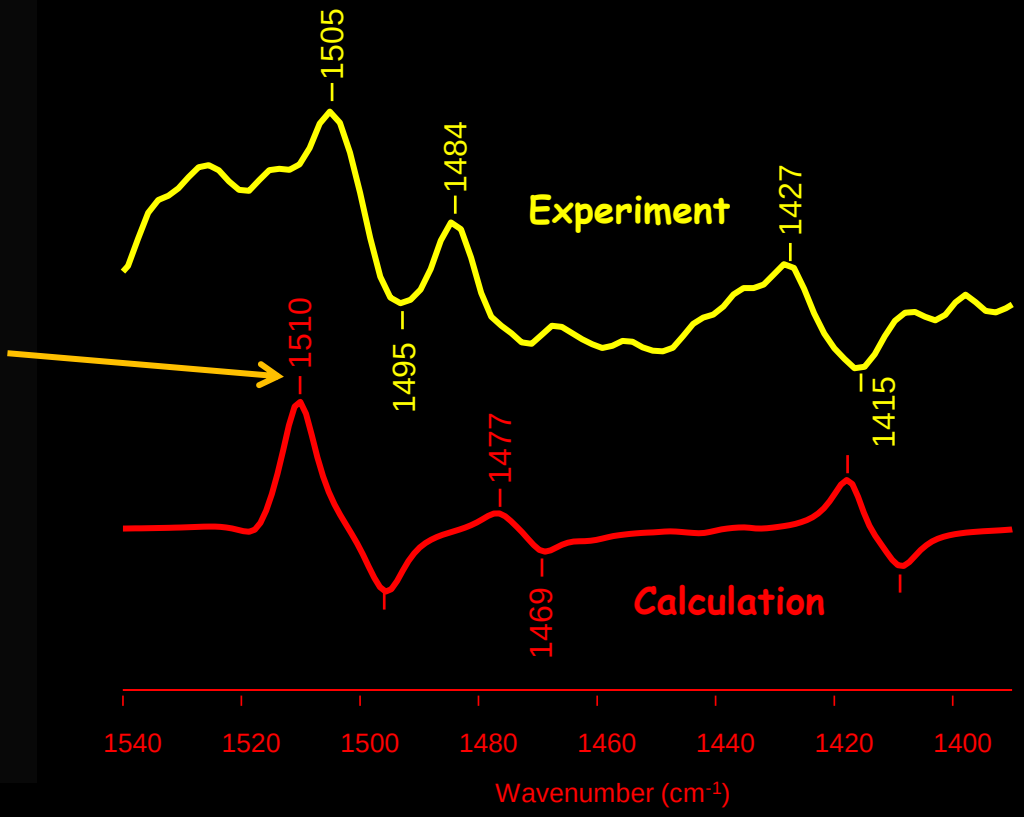
λ_{probe} = 487 nm (blue)

Information on electronic structure of molecules: INFRARED SPECTROSCOPY
Rapid chemical reactions: TIME RESOLVED INFRARED SPECTROSCOPY
Low temperature simplifies measurements also:

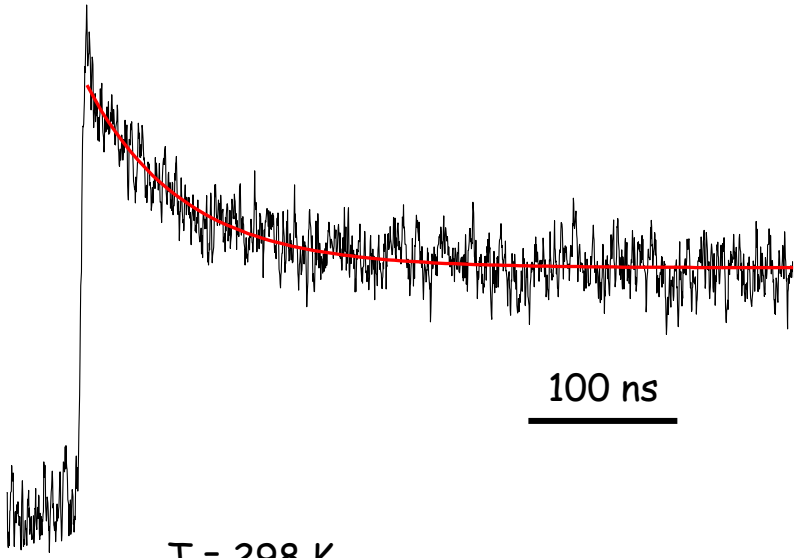


Computational Project:
Quantum mechanical vibrational frequency calculations aid in interpreting experimental data:





Computational Project:
Modeling the bioenergetics of solar energy conversion:



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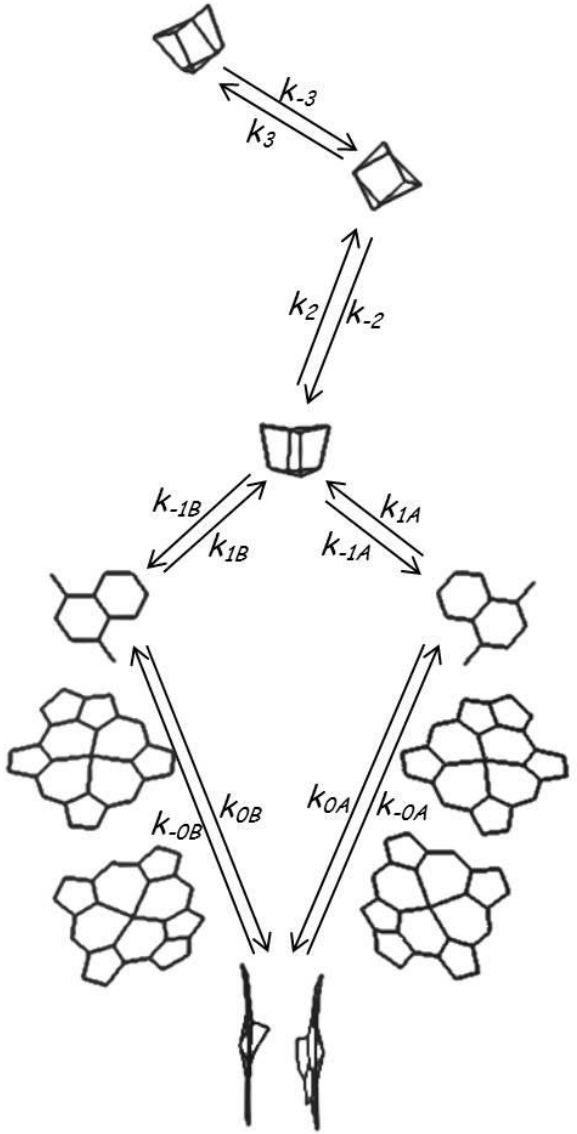

Out and about with Biophysics at GSU

email: ghastings@gsu.edu