



# BioHydrogen



**Mark D. Redwood**

m.d.redwood@bham.ac.uk  
Research Fellow

**Unit of Functional Bionanomaterials  
School of Biosciences**

[www.hydrogen-wm-scratch.info](http://www.hydrogen-wm-scratch.info)

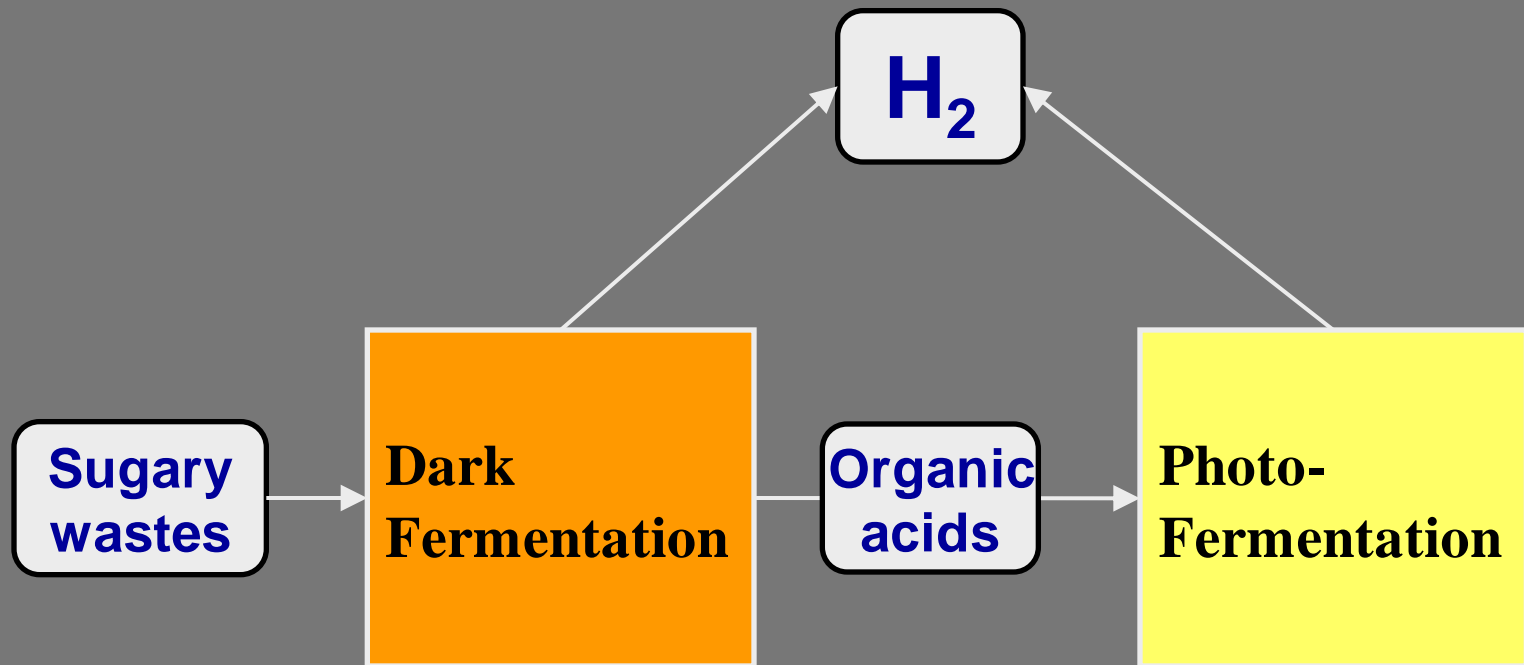
SCRATCH workshop, 16<sup>th</sup> Sept 2009

# Research area: Biohydrogen

- Green hydrogen
- “Green” means clean *and* renewable
- Renewable – made from renewable energy sources like sun, wind, hydroelectric and biomass. Not from gas.
- Clean – without environmental pollutants
  - Hydrocarbons, CO<sub>2</sub>, NO<sub>x</sub>, SO<sub>x</sub>, soot, smog
- Clean – inherently without key impurities
  - Carbon monoxide (CO)
  - Hydrogen sulphide (H<sub>2</sub>S)

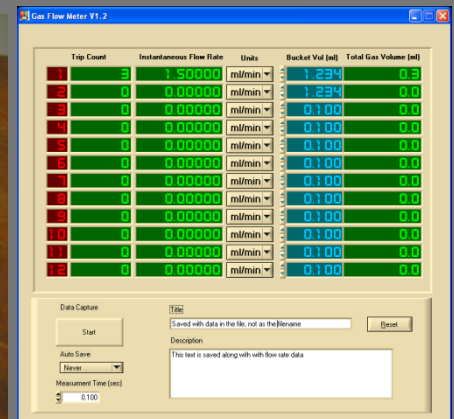
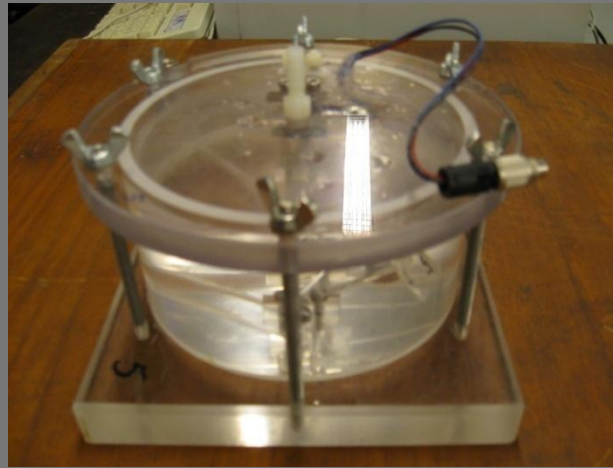
Technical focus:

A dual-bioreactor system for bio-H<sub>2</sub>

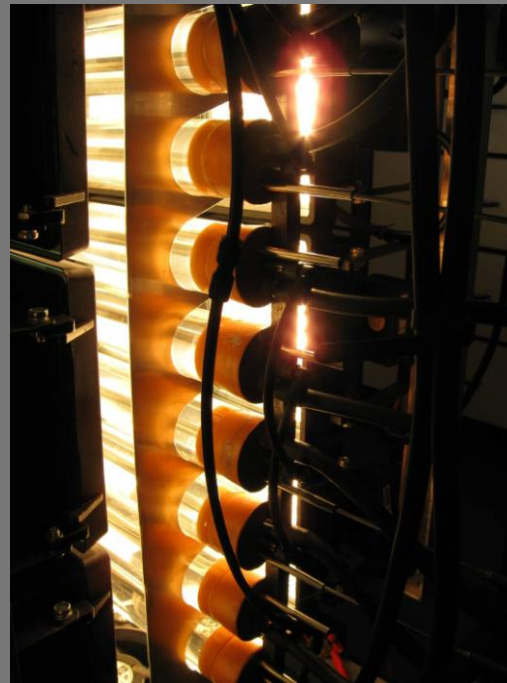


# Results

□ **Built** new equipment for low gas-flow monitoring



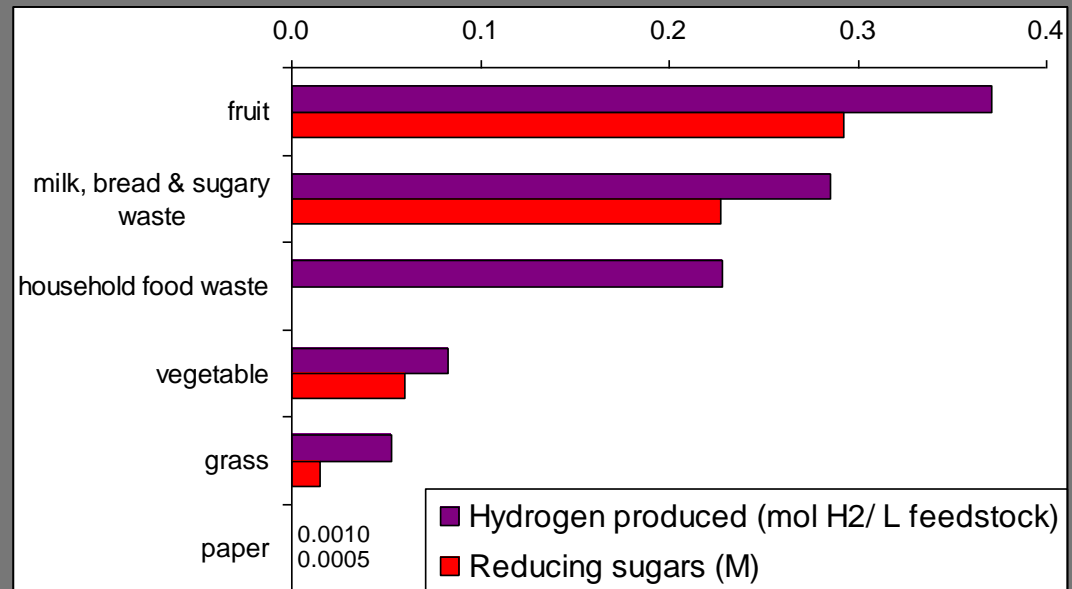
□ **Built** new equipment for detailed study of solar biohydrogen



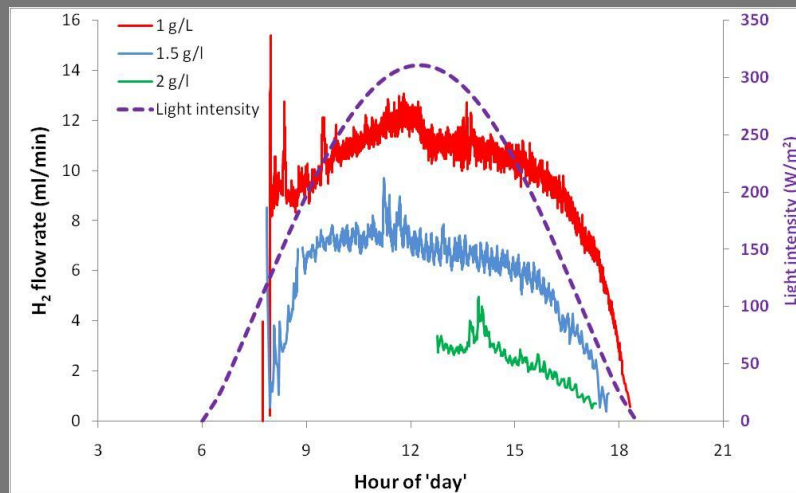
UNIVERSITY OF  
BIRMINGHAM

# Results

□ Shown fermentation of waste (ongoing APOC)



□ Shown solar biohydrogen production in Birmingham



# Research papers published (wrt SCRATCH)

- The challenge of combining dark fermentation and photofermentation
- The roles of hydrogenases during hydrogen production by *E. coli*
- Review on the microbiology of biohydrogen production

# Research papers planned

- Towards an integrated system for bio-energy: Hydrogen production by *E. coli* and use of palladium coated waste cells for electricity generation in a fuel cell (Collaboration with UoDundee)
- Efficient BioH<sub>2</sub> production from NH<sub>4</sub>-rich feed using extractive fermentation
- Hydrogen production from food wastes by *E. coli* strain HD701 (DW Penfold's experiments)
- Local factors affecting hydrogen production and yield prediction from solar intensity data (collaboration with Bw2E).
- Integration of a biohydrogen reactor with a solid-state H-store (Collaboration with A. Bevan and D. Book)
- Comparison of learning curves for future hydrogen production technologies (Collaboration with R. Green and H. Hu).

# Conference talks (wrt SCRATCH)

- Society for General Microbiology AGM, Edinburgh. Sept 2009.
- Bacteriology in Birmingham, Sept 2009.
- Institute for Energy Research and Policy, Birmingham, Jan 2009
- Solar & Bioenergy Symposium, Glasgow, Sept 2008
- Anaerobic Treatment Conference, Birmingham Institute, May 2008

# Completed Business Assistance

- ❑ Formed in early 2008 with investment from ModernWaste and IP from UoB, and EKB Technology Ltd (Oxford).
- ❑ Aim to commercialise a process to generate clean energy from organic waste.
- ❑ Currently seeking partners and funding for pilot-scale operations.



# Ongoing Business Assistance

- ❑ Manufacturers and suppliers of Endothermic roofs
- ❑ The roof harvests solar energy to provide heating and hot water
- ❑ Fundamental concept study on an “endothermic photobioreactor (endo-PBR)”
- ❑ Opportunity to incorporate hydrogen generation



UNIVERSITY OF  
BIRMINGHAM