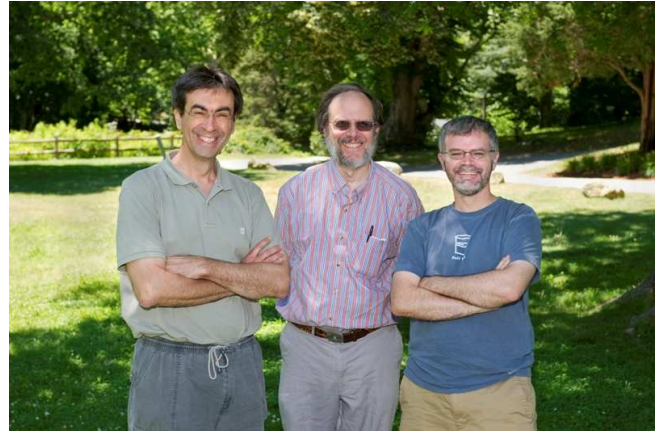


## GFD Newsletter 2010

### Faculty of Walsh College



*The 2010 GFD Photograph.*



*Our Principal Lecturers*

### *A Sketch of the Summer*

*Swirling and Swimming in Turbulence* was the theme at the 2010 GFD Program. Professors Glenn Flierl (M.I.T.), Antonello Provenzale (ISAC-CNR, Turin) and Jean-Luc Thiffeault (University of Wisconsin) were the principal lecturers. Together they navigated an elegant path through topics ranging from mixing protocols and efficiencies to ecological strategies, schooling and genetic development. The 2010 GFD Public Lecture was given by Jim Murray (Oxford University and the University of Washington) on “Mathematics in the Real World: From Brain Tumors to Saving Marriages”, and advertized the use of mathematical models in biological and social problems.

Neil Balmforth and Jean-Luc Thiffeault acted as the co-directors for the summer (once Jean-Luc’s Lectures were over). New GFD Faculty member Colm Caulfield (University of Cambridge) nimbly acted as assistant, as well as putting in a stout performance on the Staff by supervising a good fraction of the fellows. Anders Jensen worked his usual magic in the Lab, and Janet Fields, Jeanne Fleming and Kathy Ponti smoothly ran the program behind the scenes.

### *Schedule of Principal Lectures*

#### Week 1:

*Monday, June 21:* Stirring and Mixing, Jean-Luc Thiffeault

*Tuesday, June 22:* Introduction to Biological models, Glenn Flierl

*Wednesday, June 23:* Effective Diffusivity and Swimming Organisms, Jean-Luc Thiffeault

*Thursday, June 24:* Local Stretching Theories, Jean-Luc Thiffeault

*Friday, June 25:* Social Behavior, Mixing, and the Evolution of Schooling, Glenn Flierl

#### Week 2:

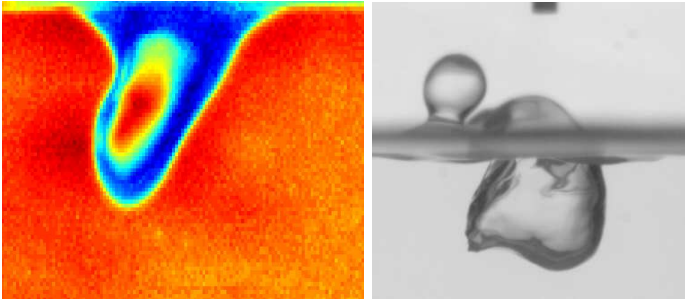
*Monday, June 28:* Mixing in the Presence of Sources and Sinks, Jean-Luc Thiffeault

*Tuesday, June 29:* Examples at the Mesoscale, Antonello Provenzale

*Wednesday, June 30:* Dynamics of Heavy Impurities with Finite Size, Antonello Provenzale

*Thursday, July 1:* Plankton Sinking and the Role of Turbulence, Antonello Provenzale

*Friday, July 2:* Evolutionary Models: Movement and Mixing in Trait and Physical Space, Glenn Flierl



*Air-jet-driven cavities in Renske's experiments, with a false colour image of a rotating dimple, and a photograph of a turbulent, bubbling cavity*



*Acrobatics from David in the season closer.*

## Fellows' Reports

Michael Allshouse, MIT

*Finding Lagrangian structures via the application of braid theory*

Emma Boland-Thompson, University of Cambridge

*Cave Rings*

Renske Gelderloos, Utrecht

*Dynamics of air-blown dimples*

David Goluskin, Columbia University

*Who ate Whom? Age-Structured Trophic Dynamics*

Georgy Manucharyan, Yale University

*Mixing in Stratified Sheared Flows - Dynamics of the Staircases*

Woosok Moon, Yale University

*On-Off Intermittency in Locally Connected Maps*

Kiori Obuse, Kyoto University

*Trajectories of a Treadmilling Swimmer - Can it Escape from its Image?*

Amanda O'Rourke, Princeton University

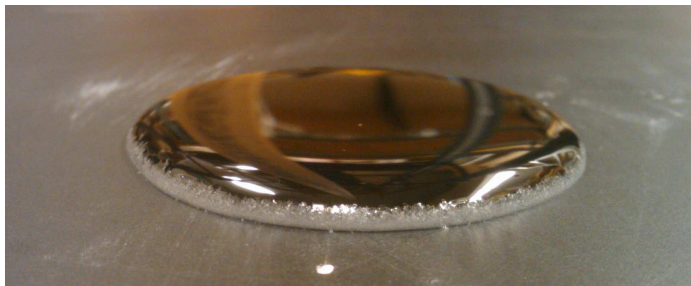
*Optimal mixing on the surface of a sphere*

Sam Pegler, University of Cambridge

*Snail locomotion*

Anubhab Roy, Jawaharlal Nehru Centre for Advanced Scientific Research

*Dynamics of vorticity defects in stratified shear*



*An evaporating salty drop in Emma's laboratory model of cave rings*

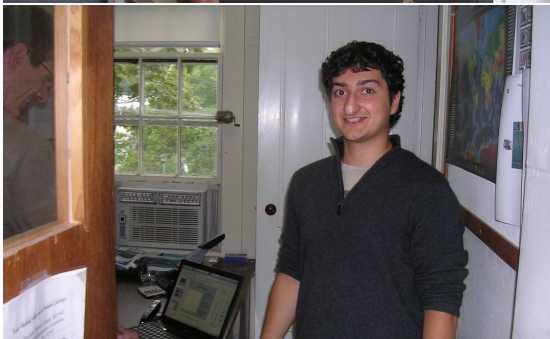
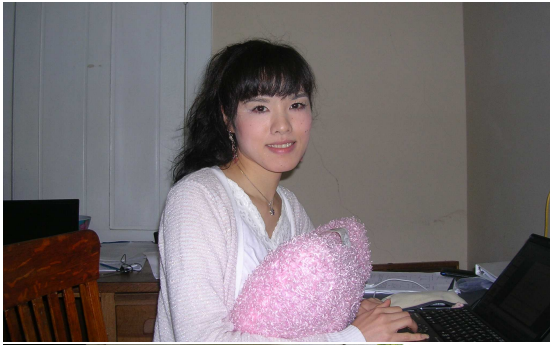
## Softball Report

We started out the softball season with one-run losses to the first two opponents, so the prospects looked good for a team with little experience. Unfortunately, we never won a game on the field, although we did register "wins" when three opponents didn't show. We had an unusual number of tennis elbows and sore shoulders that kept some of our more talented players out of important positions. The lack of experience, particularly with base-running, showed throughout the season. Our close games ended when Charlie snapped the ligaments to both kneecaps simultaneously and was carted off to the hospital and then to Michigan the next day. No one in the emergency room had ever heard of such an accomplishment.

In the season's closer, the staff managed to claw their way back to level terms in the final inning after trailing for most of the match, only for the fellows to make an immediate counter and emerge as victors. Still, Matt Finn's stalwart batting effort and Neil's home run on a grounder to second to achieve that tie will certainly be fondly remembered.

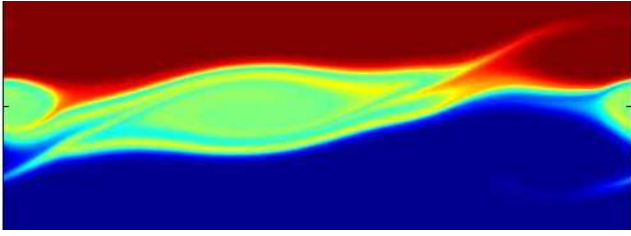


*Andrew Fowler's stare fails to stop Woosok*



The fellows: (1) Kiori and the Pink Pillow,  
(2) Michael, (3) David, (4) Anubhab, (5) Georgy

(6) Sam, (7) Emma, (8) Woosok,  
(9) Amanda, (10) Renske (and Colm)



Anubhab's simulations of a "Taylor billow" metamorphosing into Holmboe waves

## The Sears Public Lecture

In 2010 the Sears Public Lecture was delivered by Professor Jim Murray, of Oxford University and the University of Washington. Jim challenged us to use mathematics in real world problems, citing examples from biology and sociology. Specifically, Jim argued how one could exploit mathematical modelling to assist in the prediction of tumour growth, and to gauge the successfulness of marriage partnership. Over a hundred listeners filed into Redfield for the occasion, and we enjoyed refreshments in the evening air afterwards at the back of Redfield.

Geophysical Fluid Dynamics Program  
Sears Lecture  
**Mathematics in the Real World: from Brain Tumors to Saving Marriages**  
Wed. 11 August, 5 pm  
Redfield Auditorium  
Water Street, Woods Hole  
Public reception to follow

James D. Murray  
FRS, Acad. Sci. (Paris)  
University of Washington and University of Oxford

The Geophysical Fluid Dynamics Program at Woods Hole is funded by

## The GFD Website

The lectures notes and reports are available online at [gfd.whoi.edu](http://gfd.whoi.edu). The GFD website also contains:

- lecture and seminar schedules
- electronic versions of proceedings and newsletters
- lists of alumni and visitors
- application materials
- picture galleries of life at GFD
- useful information and links.

## The GFD Faculty

Neil Balmforth *University of British Columbia*  
Oliver Buhler *New York University*  
Claudia Cenedese *W. H. O. I.*  
Eric Chassignet *University of Miami*  
Steve Childress *New York University*  
Charles Doering *University of Michigan*  
Glenn Flierl *M. I. T.*  
Pascale Garaud *University of California at Santa Cruz*  
Karl Helfrich *W. H. O. I.*  
Lou Howard *M. I. T. and Florida State University*  
Joseph Keller *Stanford University*  
Norman Lebovitz *University of Chicago*  
Stefan Llewellyn Smith *University of California at San Diego*  
Willem Malkus *M. I. T.*  
Philip Morrison *University of Texas at Austin*  
Antonello Provenzale *ISAC-CNR, Torino*  
Edward Spiegel *Columbia University*  
Jean-Luc Thiffeault *University of Wisconsin*  
George Veronis *Yale University*  
John Wettlaufer *Yale University*  
Jack Whitehead *W. H. O. I.*  
William Young *Scripps Institution of Oceanography*

## Contributions

The GFD program has established an endowment fund to help support the program in the future and for a specially funded position intended to help finance the extended visit of a key participant, such as the summer's Principal Lecturer. The fund is administered by WHOI, under the guidance of George Veronis. If you would like to contribute, please send your check (made payable to WHOI) to

Woods Hole Oceanographic Institution  
GFD Fund, MS 40  
Woods Hole, MA 02543

Donations can also be made by credit card by calling the Development office at 508-289-4895.

Please send comments to [njb@math.ubc.ca](mailto:njb@math.ubc.ca) or [jeanluc@math.wisc.edu](mailto:jeanluc@math.wisc.edu) if you have any suggestions regarding this newsletter or the GFD Program.

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