



A Taste of Experimental Sciences at  
Reykjavík University

Margrét Jónsdóttir PhD, MBA, Director of  
International Affairs

Looking over the shoulders of some  
researchers at RU:

- Researchers come mostly from the School of Computer Science and the School of Science and Engineering although one is from our School of Business.

# Videntifier Forensic

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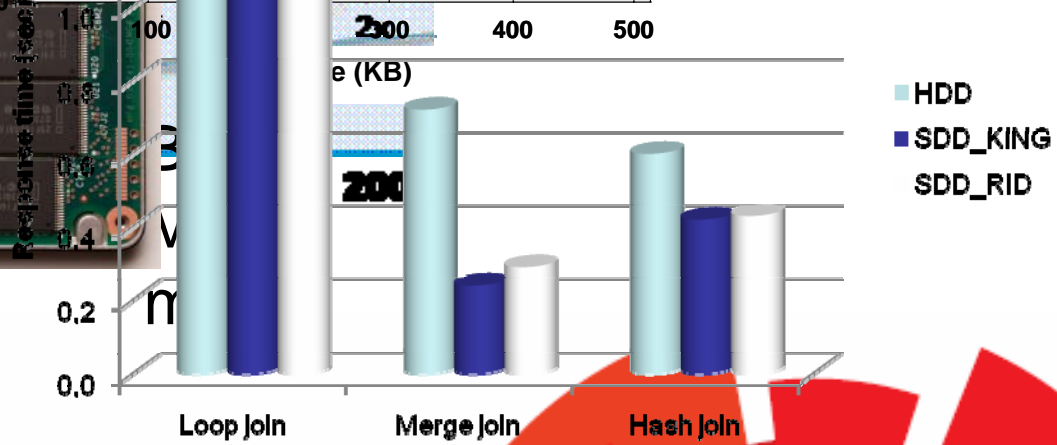
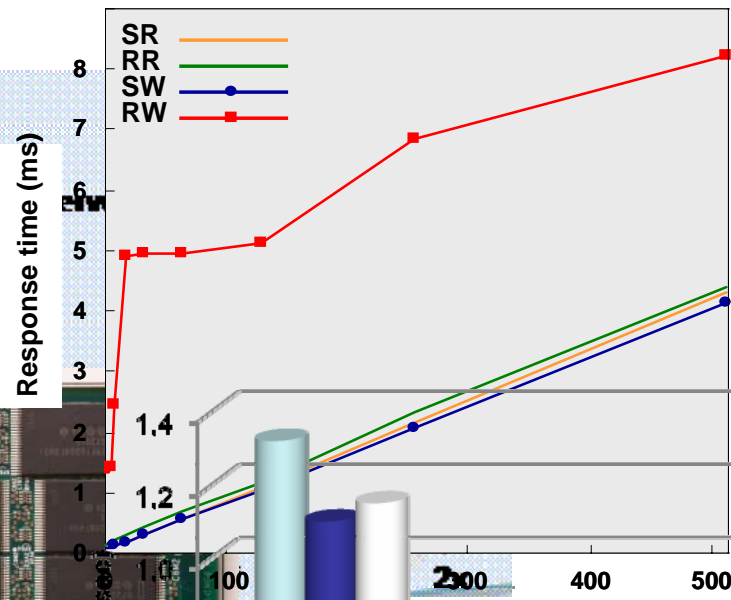
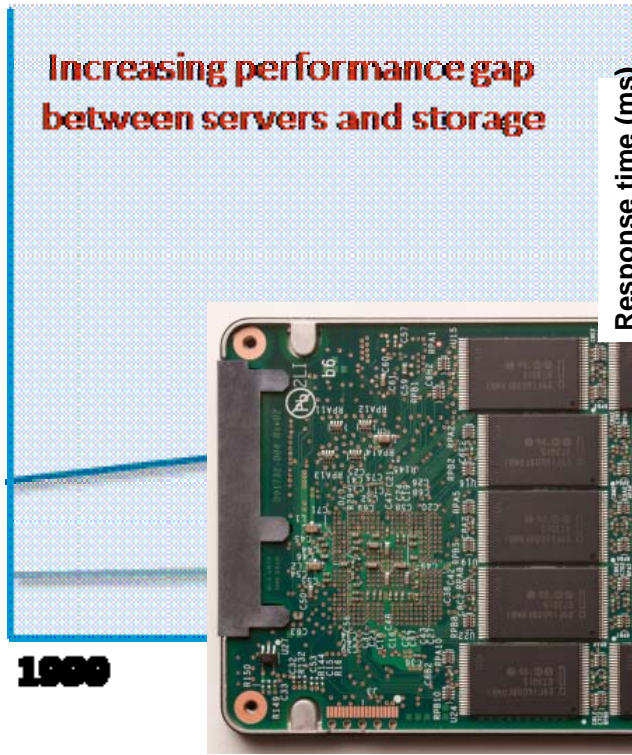
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Watch Introduction Video

What is it?

WWW.HR.I

# uFLIP



# BASALT FIBER BARS AS REINFORCEMENT

Non-corrosive reinforcement

Basalt having a high modulus of elasticity and excellent heat resistance



Bridge deck reinforced by Fiber bars

Civil Engineering Laboratory

[www.nrc.is](http://www.nrc.is)

# BASALT FIBERS

various products - use for  
strengthen concrete sections

Basalt roving



Basalt fiber



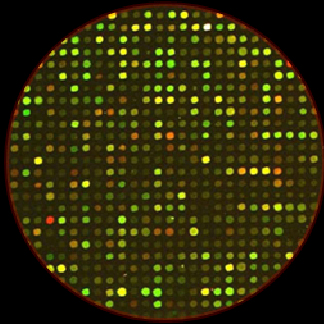
Basalt bar

## RU NEUROLAB

- At the RU NEUROLAB there are multiple research opportunities for graduate and post-doctoral level scientists.
- In the lab engineering principles are applied with rigour to solve problems in the neural sciences. We mainly use the zebrafish as a animal model and focus on elucidating the neural mechanisms for sleep and circadian rhythms.
  - **Lab strenghts include:**
  - **Electrophysiology (in vivo and in vitro)**
  - **Quantified behavioral analysis**
  - **Genetics**

# The zebrafish model of sleep model

## Molecular biology



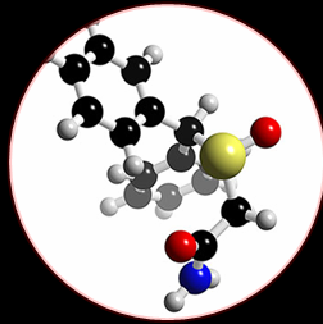
### Primary goal:

To reveal candidate genes for sleep regulation

### Projects:

Microarray expression studies  
Forward genetics  
Reverse genetics

## Pharmacology



### Primary goal:

Testing of novel agents

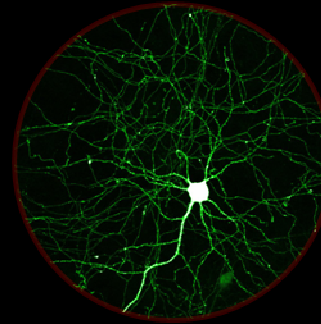
### Secondary goal:

Commercial applications

### Projects:

Testing: PF-670462  
Testing: Modafinil

## Electrophysiology



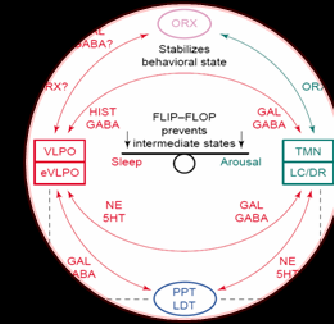
### Primary goal:

Map state-dependent discharge rates of sleep-wake active nuclei

### Projects:

In vivo recording  
In vitro recording  
LFPs

## Simulation



### Primary goal:

Simulation of a full circuit that supports sleep in zebrafish

### Secondary goal:

Comparative simulation

### Tertiary goal:

Support electrophysiology

### Projects:

Simulation

*Understanding and controlling sleep*

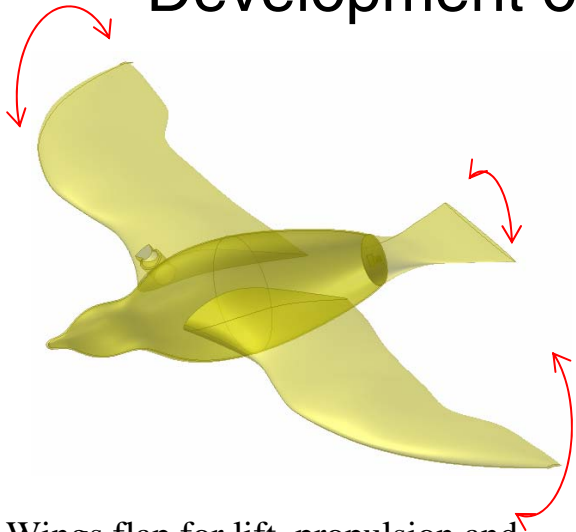
RU NEUROLAB

Please visit: [www.karlstofa.is](http://www.karlstofa.is)

[WWW.HR.IS](http://WWW.HR.IS)



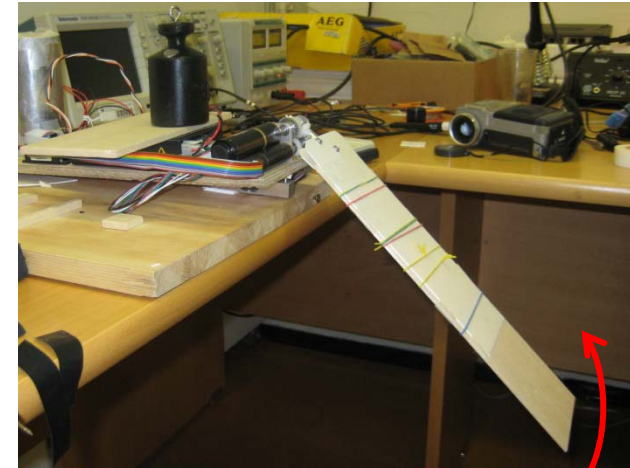
# Development of Flapping-Wing Unmanned Air Vehicles



Wings flap for lift, propulsion and control forces. Wingspan < 0.8 m.

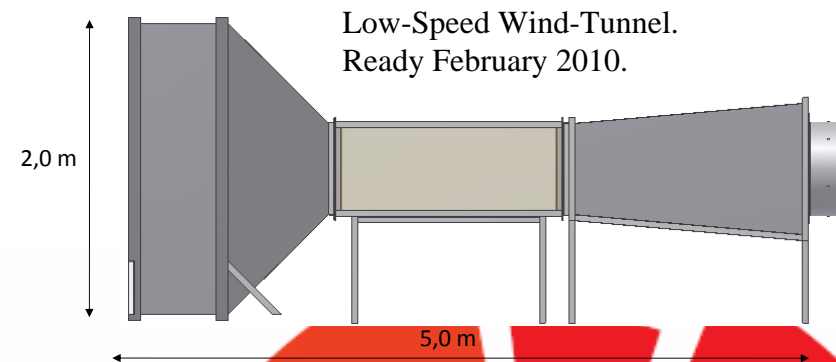


Wing flapping mechanism.



Flat-plate flapping-wing experiment.

- Research topics
  - Computational and experimental aerodynamics and structures
  - Flight stability and automatic control
  - Vehicle design and optimization

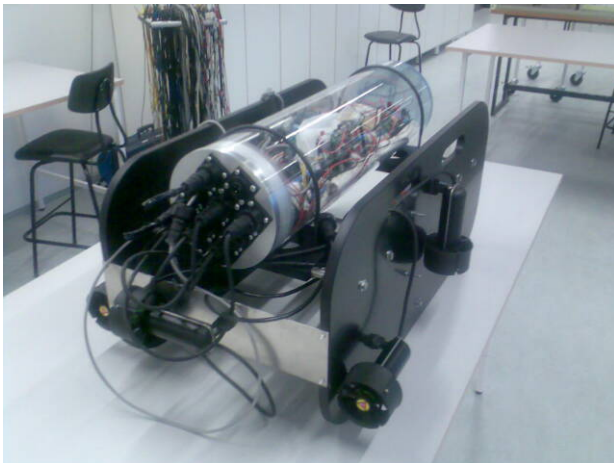


# Autonomous Underwater Vehicles

Gavia AUV – <http://www.gavia.is>

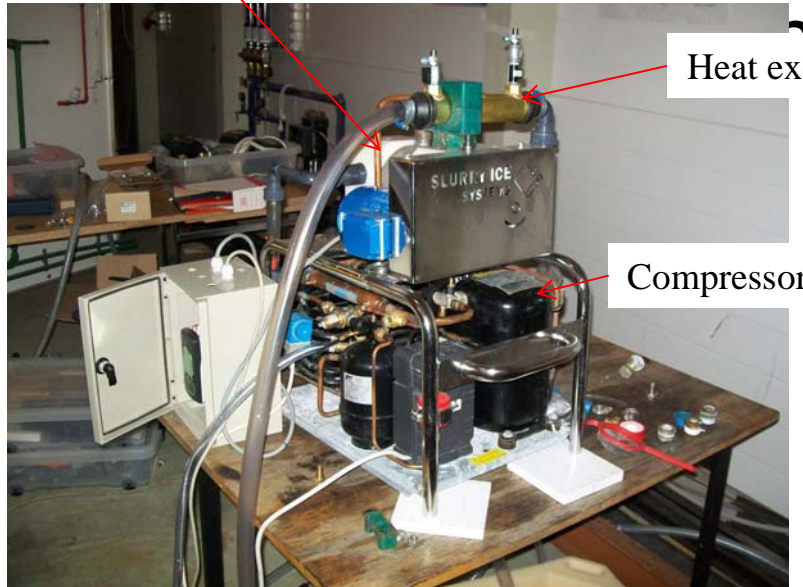


RU AUV – <http://ruauv.ru.is>



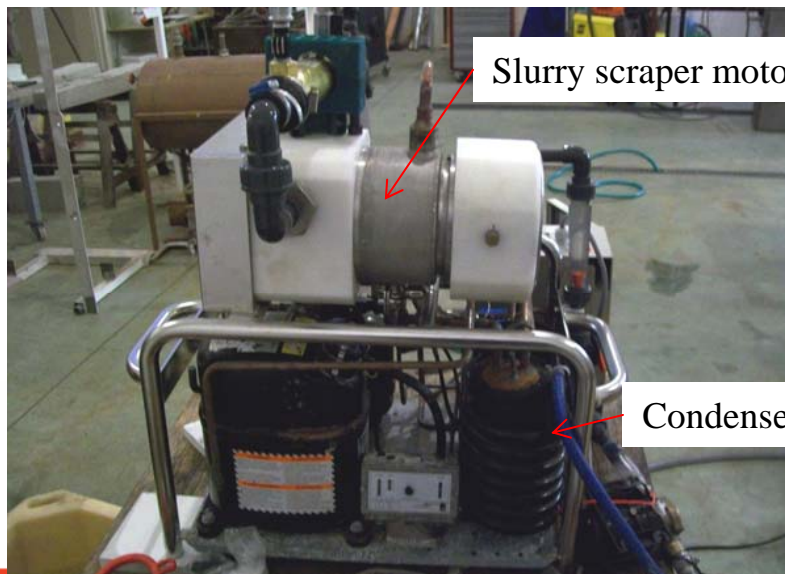
- Development of Autonomous Underwater Vehicles (AUV's)
  - Offshore, military and scientific usage
- Collaboration with Hafmynd ehf. (an Icelandic company developing AUV's).
- Research conducted using Gavia AUV's and Reykjavik University AUV.
- Research topics
  - Vehicle drag reduction
  - Propulsion system enhancement
  - Low-speed control system
  - Underwater docking
  - Image processing
  - Collision avoidance

Slurry scraper motor



Heat exchanger

Compressor



Slurry scraper motor

Condenser

- Ice-slurry can be used for refrigeration
  - Food refrigeration (fish, chicken, etc.)
  - Air-conditioning of buildings
- Development of energy efficient and environmentally friendly ice-slurry machines
- Collaboration with Jarteikn ehf.
- Computational and experimental research
  - Refrigeration system enhancement
  - Novel ice-slurry generation techniques
  - Control of ice-slurry properties



# Agent-based Modelling and Simulation of Social and Economic Systems

Marco Raberto

Reykjavik University

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# Mainstream approach to economics

- Based on models characterized by representative agents (e.g., a representative firm, a representative household, etc..)
- Only centralized and market interactions are foreseen (this means e.g. unrealistic labor and credit markets where interaction should be indeed dispersed and decentralized)
- Markets always clear thanks to the instantaneous adjustment of prices (this means e.g. that no involuntary unemployment should exist in the labor market , and that credit markets never freeze!)
- Representative agents are characterized by full rationality, perfect information, and optimizing behavior (this means e.g. no bubbles and crashes in the financial or real estate markets due to irrational behavior )

# 2008-2009: What happened to the mainstream approach?



# The agent-based approach (I)

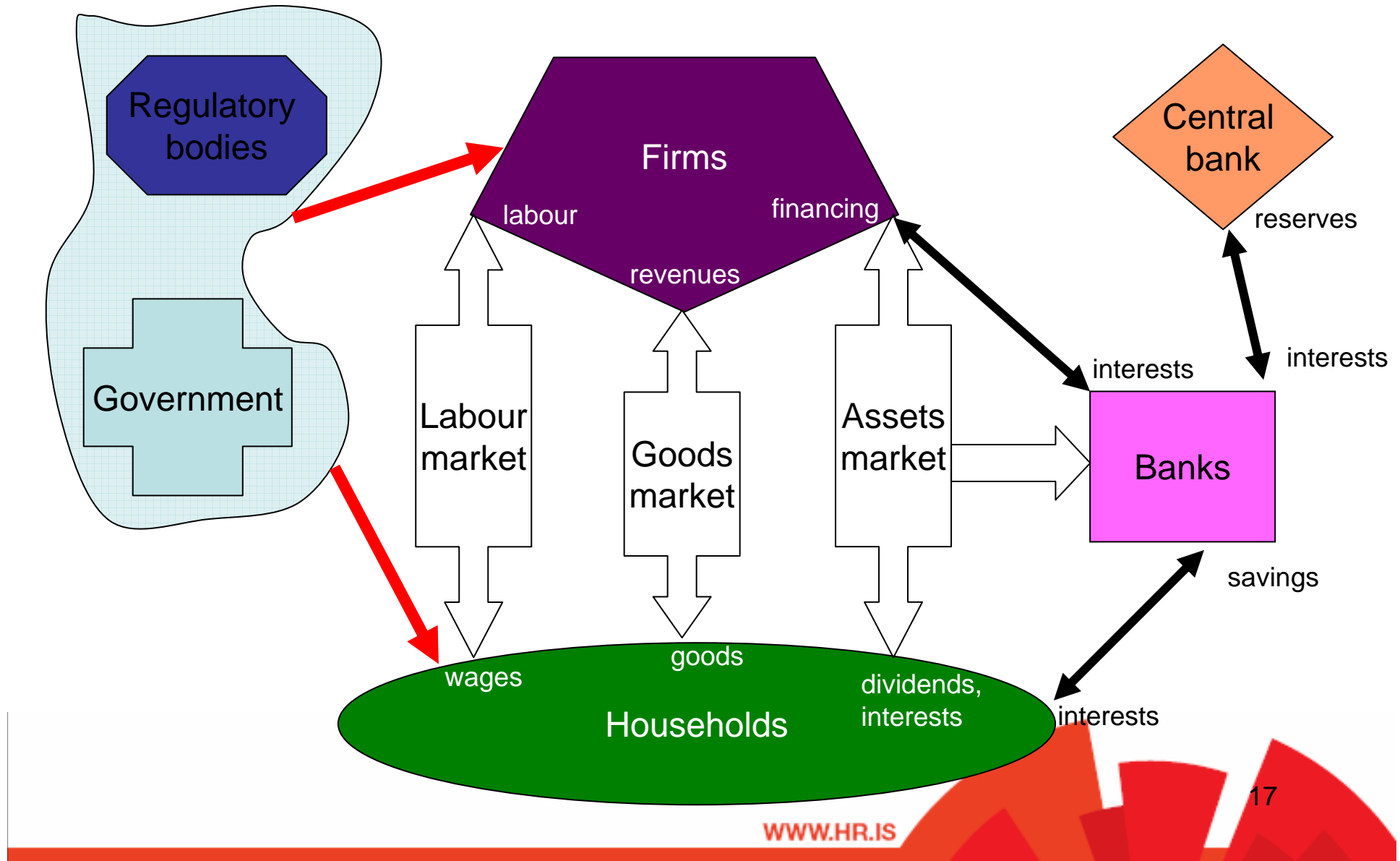
- It fully addresses the interaction and the coordination processes of heterogeneous economic agents by modeling and simulating the direct and market interactions of large numbers of bounded rational, heterogeneous agents.
- It allows the study of the emergent aggregate statistical regularities in the economy, which cannot be originated by the behavior of a representative individual but is the result of agents' behavior and interaction.
- Example: It takes into account the complex pattern of interactions in the credit markets, like networks topologies, credit rationing, bankruptcy waves and cascade effects, which are very important

# The agent-based approach (II)

- It is a relatively new field which dates back to the 90s when the availability of cheap computing power.
- The simulation of artificial economies on the computer is becoming now a promising approach to the study of economic systems, able to overcome the limitations of elegant, yet unrealistic, mainstream analytical economic models (see e.g. Nature vol 460, August 2009).
- Example: EU-FP6 project 2006-2009 EURACE “An agent-based software platform for European economic policy design with heterogeneous interacting agents: new insights from a bottom- up approach to economic modeling and simulation” ([www.eurace.org](http://www.eurace.org)).
- Ongoing project: “Agent-based simulation of the Icelandic economy for policy design”



# Scheme of an agent-based model





## Researching Usability Evaluation

Marta Kristin Larusdottir, [marta@ru.is](mailto:marta@ru.is)

Assistant professor | School of Computer Science  
Icelandic Center for Research on Software Engineering

# RESEARCH ON USABILITY EVALUATION



The IT systems should be usable for the defined users solving their tasks in their context of use

The goal of usability evaluation is to measure to what extent the IT system is usable

The goal of my research is to study methods for usability evaluation and how these are used in the industry

Marta Kristin Larusdottir, [marta@ru.is](mailto:marta@ru.is)  
Assistant professor | School of Computer Science  
Icelandic Center for Research on Software Engineering

# MY RESEARCH QUESTIONS

1. How different are the results of using various usability evaluation methods for evaluating the same system?
2. How useful are the results of usability evaluation to the recipients?
3. What impact does a new software system have on users for achieving their goals?
4. To what extent are usability evaluation methods used in the software industry?
5. Why is usability emphasized in software development practice and why not?

# Fees and Efficiency of Tradable Permit Systems: an Experimental Approach

Fridrik Mar Baldursson and Jon Thor Sturluson

- Increased use of transferable permits in resource management
  - Pollution quotas
  - Telecommunications spectrum
  - Agricultural quotas
  - Water rights
  - Fisheries quotas
- Permits are often grandfathered - especially when the resource has been in use for some time
- Special **fees** (taxes or reallocation by auction) are often suggest for **distributive** reasons
- If fees are imposed – do they matter for **efficiency**?

# Experimental setup

- Grandfathered initial endowments
- Production conditional on permits
- Double auction asset market (Smith, Suchanek and Williams, 1988)
- 15 periods (4 x 4 in re-run)
- Fixed supply of permits: 15
- Fixed output price: 75
- Cost function is private information
- No Transactions costs
- Three treatments
  - Without fees
  - With fixed taxes
  - Reallocation by auction

- 6 Different players (roles)
- Production possibilities (3)
  - Initial endowment (2)

## Cost and endowment

Role	Production units					Endowment	
	1.	2.	3.	4.	5.	Initial	Eff.
1	35	35	35	45	55	0	4-5
2	35	35	35	45	55	5	4-5
3	35	45	55	65	65	0	2-3
4	35	45	55	65	65	5	2-3
5	55	65	65	75	75	0	0-1
6	55	65	65	75	75	5	0-1

Efficient units

Viable without fees

Inefficient units

# Conclusions

- Speculative trading significantly and negatively affect efficiency
- Fees have **impact on efficiency**
  - Withdrawal/auction reduces efficiency
  - Taxes increase efficiency
- The method of fee impositions differ
  - **Who** makes the decision
  - How the decision is **framed**



## Research on Algorithms

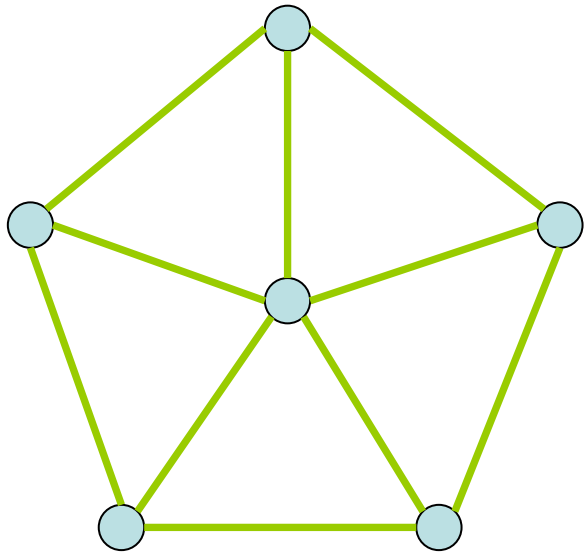
Magnús M. Halldórsson, [mmh@ru.is](mailto:mmh@ru.is)

Professor | School of Computer Science

Icelandic Center of Excellence in Theoretical Computer Science



# RESEARCH ON ALGORITHMS AND COMBINATORICS



We seek methods to solve fundamental problems with applicability in diverse fields. Our focus is particularly on ***approximation*** and ***online algorithms*** for computationally hard problems. Our work also overlaps graph theory, combinatorics.

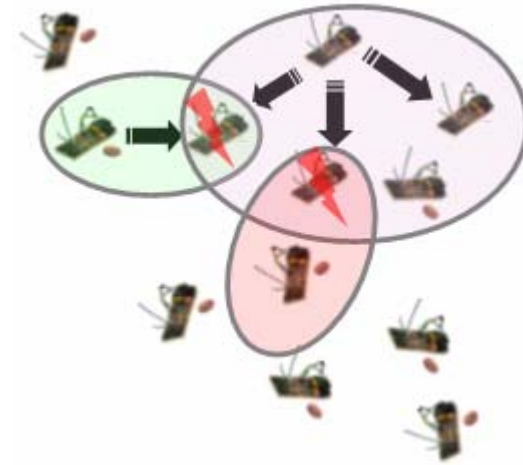
**Center:** Icelandic Center of Excellence in Theoretical Computer Science (ICE-TCS), hosts conferences, visitors, post-docs.

Magnús M. Halldórsson, [mmh@ru.is](mailto:mmh@ru.is)

[WWW.HR.IS](http://WWW.HR.IS)

# Project: Scheduling Wireless Communication

**Motivation:** We aim to better understand fundamental algorithmic properties of wireless communication, such as how much wireless communication is possible simultaneously.



**Recent work:** INFOCOM '09, ICALP '09, ESA '09

**Workshop** on Realistic Models for Algorithms in Wireless Networks ([wrawn.ru.is](http://wrawn.ru.is)), 19-20 June 2010

**Funding:** Icelandic Research Fund, 2009-2011

## The EHG Group [ElectroHysteroGram]

- There are many **open questions** concerning the **functioning of the human uterus**. One of these open questions concerns exactly how the uterus operates as an organ to perform the very organized act of **contracting in a synchronized fashion** to expulse a new human in to this world. If we don't understand how it works when it is working normally it is obvious that we will not be as capable of intervening or **preventing when**, sometimes with tragic consequences, it does not do its job properly and **a child is born before it is ready**.

- The aim of our research **is twofold**: we want to be able to **understand** what the electrical activity of the uterus can tell us about **the risk of premature birth** and we simply want to **understand** better **how the uterus works**.

This idea of using the **externally detected electrical activity** of the uterus (**electrohysterogram or EHG**) to predict preterm labor is not new and lot of work has already been put in to it..

- **The novel approach in this work** is not to use the signal from one or two isolated places on the abdomen of the expectant mother but **to map the propagation of the signals** and to investigate the auto organization of the contractions and **to use a matrix of electrodes** to give us a much more **complete picture** the organisation and operation of the uterus as pregnancy reaches its conclusion

**EHGCompEngine**, A database system for storing, analysing and presenting EHG recordings.

**Piecewise stationary pre-segmentation** as a pre-treatment for EHG recordings and other strongly non stationary bio-electrical signals.

**Recordings of the propagation of the EHG** signal on the maternal abdomen. A world first.

# Icelandic Institute for Intelligent Machines

- Independent non-profit research center
- Innovative “subscription” model
  - Sponsors subscribe to IIIM research
- Research topics
  - Intelligent machines
    - Artificial intelligence, robotics & cognitive machines
- Simulations, complex systems
  - Ecosystems, human society, economics
- Innovative organizational structure

## Benefits for Industrial IIM Sponsors

- Access a large portfolio of innovative solutions
- Exploration of solutions to upcoming problems
  - Source of new ideas
- Scalable project participation
  - IIM enables participants to adjust and control their involvement in projects
- Immediate access to experts
- Increased resource availability for R&D
  - Solutions, methods, expertise, connections, products, ideas, standards



## Who Works With IIIM ?

- Industry
  - Companies and organizations
- Academia
  - Engineering, computer science, business departments
  - Academic research laboratories
  - M.Sc. Students, Ph.D. Students, Post-docs, Professors

# Flow of Ideas, People & Research

