（2）招聘外国人研究者の若手研究者への助言

本拠点では，招聘研究者制度により，多くの海外著名研究者を招聘している．一定期間滞在する招聘研究者に対して，大学院における特別講義と共に大学院学生を含む若手研究者に対する個別研究指導，「招聘研究員による個別研究指導制度」，を企画し実行している．招聘研究者から若手研究者に寄せられた助言のいくつかを紹介する．

UNIVERSITÄT DES SAARLANDES
Fachrichtung 6.1 - Mathematik

Univ.-Prof. Dr. S. Rjasanow

2. März 2007

Report on the work of Hyroaki Yoshida

Department of Aeronautics and Astronautics, Kyoto University, Japan

On February 23d, 2007, Hyroaki Yoshida presented to me the results of his scientific research obtained during his PhD study at the Kyoto University under supervision of Prof. K. Aoki. At this time, he had already defended his PhD thesis. The main subject of his study is the cylindrical flow of a two-component gas mixture, whereby one of the component is a vapour evaporating and condensating on the surfaces of the cylinder. The second component is non-condensable.

H. Yoshida investigated the flow for small Knudsen numbers, which is a challenge for both numerical (using DSMC) and theoretical (asymptotic expansions) studies of the problem due to some non-trivial effects (small radial velocity of the flow, bifurcations, etc).

His presentation was very clear and well-organised. In my opinion his work is a remarkable contribution to the kinetic theory and should be published in an international journal.

Rjasanow

Univ.-Prof. Dr. S. Rjasanow

UNIVERSITÄT DES SAARLANDES
Fachrichtung 6.1 - Mathematik

Univ.-Prof. Dr. S. Rjasanow

2. März 2007

Report on the work of Carl-Johan Tor Laneryd

Department of Aeronautics and Astronautics, Kyoto University, Japan

On February 20th, 2007, Carl-Johan Tor Laneryd presented to me the results of his scientific research obtained during his PhD study at the Kyoto University under supervision of Prof. K. Aoki. At this time, he was in the third year of his study. The main subject of his research is the convectional flow of rarefied gas due to the temperature gradient on the surface of the vessel containing the gas. The resulting flow is very slow, thus this effect is called "thermal creep".

C.-J. T. Laneryd investigated the flow using fluid-dynamic equations obtained from the kinetic theory for small Knudsen numbers. These equations were solved numerically for non-trivial two-dimensional geometries by the use of finite volume methods.

His presentation, based on his talk on the 25 International Symposium "Rarefied Gas Dynamics", St Petersburg (Russia), 2006, was very clear and well-prepared. In my opinion his work is an intersting contribution for understanding an important physical phenomena and I have no doubt, in 2007, he will successfully finish his PhD study at the Kyoto university.

Univ.-Prof. Dr. S. Rjasanow

VISITING PROFESSOR REPORT

ACTA-Vrije Universiteit
Jenneke Klein-Nulend

Period of visit: 14-30 October, 2006
Host university: Kyoto University, Dept Mechanical Engineering & Science
Hosts: Professor Masaki Hojo
Associate Professor Taiji Adachi
Associate Researcher Mototsugu Tanaka

1. General

This is a report written to report on my visit from October 14 to 30, 2006, to the Department of Mechanical Engineering & Science, Kyoto (Prof. Taiji Adachi, Prof. Masaki Hojo, Dr. Mototsugu Tanaka). Prof. Adachi and Dr. Tanaka's research on the response of osteocytes to mechanical loading is a research area involving many academic disciplines. For example, I am a biologist and Prof. Adachi and Dr. Tanaka are engineers, and the basic problems we are trying to address in our research have application in promoting the long term stability of bone implants, osteoporosis, and long term space flight. The basis of my visit comes from the contributions of Prof. Adachi and Dr. Tanaka to our common research area.

For the last couple of years, Prof. Adachi and Dr. Tanaka have studied the biochemical response of osteocytes to localized mechanical loading. This work is basic as it is directed at determining the mechanosensory system in bone, that is to say, the physiological system that converts information on the mechanical loading of a bone into a signal that activates or deactivates bone cells in the process of adding or resorbing bone tissue. The time varying mechanical loading of the bone causes the bone fluid to flow and the flowing bone fluid excites the osteocytes. The osteocytes are the bone cells buried in bone; they are located in a connected system of passages through which bone fluid flows.

Prof. Adachi and Dr. Tanaka have shown that the biochemical response of osteocytes is very sensitive to localized mechanical deformation. The implications of the results are quite significant. It means that physical activity of the body (e.g., running, walking, etc.) is sensed by the bone cells. Prof. Adachi's and Dr. Tanaka's work has been a valuable contribution to the development of our understanding of the mechanical adaptation of bone.

The quality of the group's work of Prof. Adachi and Dr. Tanaka is excellent, that their research is directed at important problems and that they are making significant contributions toward the solution of these problems.

I will be happy to collaborate on their studies to determine osteocyte responsiveness to mechanical loads. Specifically, I will search for possibilities to collaborate on effects of microgravity conditions on osteocyte mechanoresponsiveness in space flight studies.

I will be happy to host Prof. Adachi and Dr. Tanaka in Amsterdam within the coming year, if possible, in order to also introduce them into the research performed by our group in Amsterdam, which definitely helps to build a collaboration.

2. General impression of department

My impression of the research group as a whole, as well as the individual scientists and students, is excellent. The education program for PhD students appeared strong. The department was a knowledge environment. I was encouraged to help/support MSc and PhD students, as well as post-docs. The MSc and PhD students and post-docs were eager to learn from me, and to exchange ideas.

Our mutual interest in the topic of bone adaptation and regeneration has made my visit to the department as a visiting professor highly interesting. I was ensured access to key leaders in the field (a.o. Prof. Kamioka and Prof. Takano-Yamamoto from Okayama University), and to an international group within which to network and learn.

3. Premier department

The department visited is a premier mechanical engineering and science department and has dedicated itself to studying the field of bone adaptation and regeneration for the last decade. The department hosted me as a visiting professor to explore the complex mechanosensory mechanism of osteocytes in bone remodeling.

4. Innovative research

The department has been most innovative in the field of nano-biomechanics (Prof. Adachi and Dr. Tanaka), and its international reputation is outstanding. Publications from the department appear in first rate journals, and the department holds regular meetings distinguished for their scientific content, to serve its students. The department has provided support to me in that it organized meetings with the MSc and PhD students who are working in highly interesting specialty fields.

5. Lecture

I presented a lecture on the cell biology of mechano-adaptive bone remodeling, which was very well received. The audience showed great interest and there was a lively discussion. The combination of my own lecture with the lectures by Dr. Bacabac (Amsterdam) and Prof. Kamioka (Okayama) in one symposium was highly interesting, since it provided an excellent overview for the audience.

6. Visit to Okayama University

Prof. Kamioka and Prof. Yamamoto hosted me in Okayama. I presented here also a lecture on the cell biology of mechano-adaptive bone remodeling, and received a similar response from the audience as in Kyoto (see above). Several PhD students were invited to present their scientific work to me, which enabled me to provide my input. My impression was here too that the students were keen on hearing my ideas, and that their work was of excellent quality.

7. My specific activities while at Kyoto University

• I presented a lecture during the special symposium.
• I had meetings with: Prof. Hojo, Prof. Adachi, Dr. Tanaka.
• I had a meeting on osteocyte mechanosensing with the Bio-experimental group (Prof. Adachi, Dr. Tanaka, Dr. Bacabac, Ms Aonuma, Mr Ito, Prof. Klein-Nulend). During this meeting, Dr. Tanaka gave a presentation on the calcium response in isolated chicken osteocytes and osteoblasts to direct deformation. A microneedle was used to explore the mechanosensory mechanism in the osteocytes. Emphasis was on the importance of the actin cytoskeleton in this process, and the location of mechanical stimulation of the osteocyte (cell body or cell process). In addition, 13-day chicken calvariae, which were partly decalcified, were used to study the calcium response of osteocytes in their natural 3D environment. Another presentation was given by Dr. Bacabac to summarize his work on calcium and nitric oxide signaling in osteocytes.
• I had meetings with the following students:

Mr Ito, 2nd yr MSc student. He works on the mechanosensory system in bone. He performs mechanical stimulation by microneedle of primary osteocytes in whole 13-day-old chicken calvariae and measures the calcium response.

Ms Aonuma, 2nd yr MSc student from Kobe University. She works on the relation between mechanical stimulation by localized deformation and the calcium signaling response in single isolated osteocytes. She compares the calcium response after mechanical stimulation by microneedle of the cell body and the proximal base of a cell process.

Mr Okeyo, 2nd yr MSc student. He works on keratocyte cell motility – the role of actin

dynamics in micropodia. He found that the calcium influx into a cell causes contraction, and focal adhesion assembly causes retraction.

Mr Shimada, 2nd yr MSc student. He studies actin monomer polymerization to actin filament by a Brownian dynamics method. The calculation costs of this method appear low in comparison with that of the molecular dynamics method.

Mr Suzuki, 1st yr MSc student. He studies bone defects and the use of biodegradable polymers.

Mr Kameo, 1st yr MSc student. His work is on fluid flow in trabecular bone remodeling.

Mr Matsudo, 2nd yr MSc student. His work is on molecular dynamics simulation of actin polymerization.

Mr Matsushita, 4th yr BA student.

Mr Yasumuro, 2nd yr MSc student. He attempts to construct nano-structural elements using single-stranded DNA. His goal is to use biomaterials in tissue engineering, 1) construct nano-structural elements using single-stranded DNA, and 2) using biostructures to make mechanical systems. He uses two approaches: 1) top-down approach (lithography), and 2) bottom-up approach (lego). Self assembly of blocks (single stranded DNA) are important for 1) design, 2) fabrication, and 3) assembly.

Mr Ueda, 2nd yr MSc student; Yukiko Maruoka, 4th yr BA student. They work on liposomes, as microreactor. Polymerization of actin occurs within a liposome. Their goal is to make fascin protein from DNA in vitro.

Mr Yokota, 4th yr BA student. His goal is to develop a device to stimulate an osteocyte process by fluid flow. This micro-fluid device has to be transparent, and control adhesion of osteocytes to the device. Furthermore, the dimensions need to be similar as in vivo. He uses poly-dimethyl-siloxane (PDMS), which is transparent, durable, and not toxic for cells.

Ms Kihira, 4th yr BA student. She studies actin expression in liposomes.

Mr Inoue, RIKEN postdoctoral fellow. His work is focussed on keratocyte movement. He developes a simulation model from the viewpoint of dynamics. Actin polymerization drives the membrane, resulting in motility. He explains the mechanism of motility as follows: 1. Protrusion of membrane (lengthening membrane, and actin filament growth), 2. attachement of leading edge, 3. release of tail; retraction, 4. tail adheres to substratum, focal adhesion formation by tail. Currently he makes a simulation model for (1).

Mr Yamaoka, RIKEN postdoctoral fellow. He performs mathematical physics. He works on the reduction of few bodies on basis of differential geometry, and is setting up mechanics of N-particles. Furthermore, he studies the relation shape change and system dynamics, and the generation of finite rotations by small vibrations. He works on computational cell biomechanics (with Prof. Adachi, Dr. Inoue, Dr. Sunaga, and Dr. Yamaoka). Dr. Yamaoka is performing the modeling of the actin filament, and the fiber network. He addresses the question of polymerized elongation versus tensile elongation.

Mr Tawara, postdoctoral fellow.
Ms Sunaga, research associate.

8. Plans for continuing collaboration

We will look into the possibilites of a research collaboration initiated by mutual visitation. In addition we wish to explore the possibilities for research collaboration via existing funding ties between Japan and The Netherlands.

9. Personal impressions

I was highly impressed by the hospitality of the people at Kyoto University, as well as at Okayama University. During my stay at Kyoto University everybody was extremely friendly, and doing their utmost to make my stay very pleasant. I loved the tradions of Kyoto, the beautiful temples and shrines, it all has made an unforgettable impression on me!

Farewell party with students

Dinner party with professors

Pottery making at Kurashiki with Prof. Kamioka

My lecture at Kyoto University