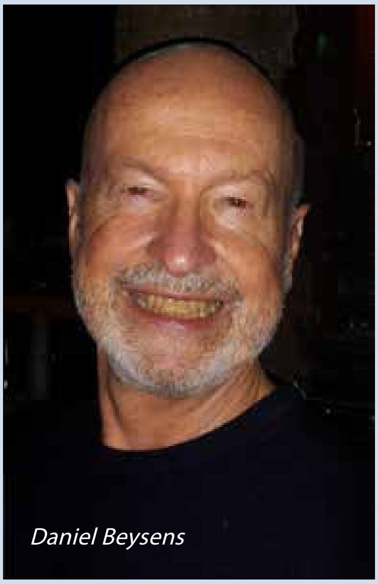

Daniel Beysens

This creates a community and strengthen the professional and personal relationships between the members, who can influence in all Europe 'countries the policy of their government in favor of space related projects.

More than fostering the actions for the access to space – and this was a major step initiated in the first years of the new millennium - ELGRA has also a strong commitment for promoting microgravity (and more generally various gravity conditions) among the young scientists and students through support, organization of competition, educational programs. ELGRA also promotes the use of alternate means such as drop towers, parabolic flights, magnetic and electric fields, density matching systems, bed rest/head-down-tilt, clinostats to provide an alternative to extra-terrestrial environment. In support and/or in addition of the weightless studies, acceleration can be provided by vibrations and centrifuges.

I believe that the future of ELGRA is firstly to continue the way initiated 40 years ago by the founding fathers: foster close relationship between life and physical scientists in Europe, promote low gravity among the young generations and stimulate the governments and government agencies. 40 years is the maturity age. ELGRA should however remain inventive and look into the future to challenge itself.

Prof. Daniel Beysens, ESPCI Paris

Jack van Loon, 2007–2011: An overview about the past developments of gravity science over the last 40 years

Jack van loon monitoring crew operations of his 'BONES' experiment in the Experiment Monitoring Area (EMA) at the Kennedy Space Center (KSC) in Florida during the STS-42 / IML-1 flight launched 22 Jan. 1992.

As for quite some young human beings, space, the solar system and space flight where subjects that appealed to one's imagination. Especially when, as a young boy from 8 years, you are watching TV showing people walking and jumping on the surface of our Moon.

So I was very happy to enroll in a project at the Free University in Amsterdam in 1986 where the PI of this study, Paul Veldhuijzen, had received a grant to explore the impact of micro-gravity on the development of embryonic mouse bone rudiments in vitro. I was hired first as technician and later as the PhD student whose task was to prepare for this complex Space Shuttle experiment. The study was planned to be performed during the first International Microgravity Laboratory mission, IML-1 [1], initially targeted for a May 1987 launch. However, due to the tragic Challenger accident on 28 January 1986, the IML-1 mission was delayed for nearly 6 years till 22 January 1992.

Later that same year, on 29 December, we had the opportunity to also fly an experiment on the Russian Bion-10 mission [2] that was launched form Plesetsk. The preparation were done in Moscow where ESA had built a dedicated mobile laboratory to prepare for the various biological experiments. So one winter working in Florida at +25°C while the other winter in that same year working in Moscow at -25°C.

For a young enthusiastic scientist these times were a real venture. The experience was not only in the actual lab work but also with the social elements associated to space flight experiments. One of these was that you travel a bit more than usual for a PhD student. We attended these so called Investigator Working Group (IWG) meetings for the IML-1 mission. In these multi day meetings the status of the mission was presented and discussed, from the agencies point of view, from the launcher / orbiter points of view and especially from the science from the full mission. It was from these IWG meetings that I started to develop some knowledge regarding gravity related physical phenomena and the experiments performed in that field. During lunch and dinner discussions the various physical researchers happily explained their experiments in laymen's terms to a simple cell biologist in spe. The same the happened the other way around. These IWG were quite common for Shuttle Spacelab [3] missions. We also had them for our IML-2 and later Shuttle to Mir Missions with Spacehab.

In the current ISS era we do not have these IWGs anymore. With that we also have far less opportunities to be exposed to (micro-) gravity related research from other disciplines. Maybe a cell biologist might run into an animal or human researcher but seldom into e.g. a fluid physicist.

Also, at the time of Spacelab the science teams themselves informed and instructed the crew about the background and in-flight procedures of their experiments. Accept for maybe human physiological studies, this contact between science groups and crew is also far less, if at all present, for current spaceflight studies. This makes the present involvement in spaceflight studies a bit less exciting (says the old man!). With current flights you are more and more becoming only a small part of a much larger system. I also have the feeling and see evidence that the focus and role of the science in current spaceflight activities is far less than it was at the time I started to work in this field. There is no facility scientist with a pivotal role in the preparation and execution of the experiments anymore. I think this will decrease even more with the increasing liberalization of space flight. This is for sure a good evolvement of our research area but is does take away some of the grandeur of spaceflight research.

The science we performed in our first studies was from a kind of explorative nature. It was known from Salyut [5], Skylab [6] and Mir [7] missions that cosmonauts and astronauts loose bone while in space. Such findings were confirmed by animal studies. However, since spaceflight also is a highly stressful activity, it could be that these reduced bone structures were related to higher levels of cortisol. In our in vitro study [8] we could show that indeed bone tissue itself, so without systemic factors, can adapt to a lower (gravity) mechanical load environment. On top of that we were one of the first who showed that not only bone forming cells (osteoblasts) are reduced in spaceflight but that also the activity of bone resorbing cells (osteoclasts) is increased.

The initial experiments were performed in the very successful ESA Biorack facility. Other biological 'pilot studies' were performed in these IML missions such as systematic studies on plant gravitropism, bacterial and Drosophila growth that formed the basis for nowadays studies.

The Biorack was one of the first facilities that systematically applied to use of an on-board centrifuge. This provided a 1g control and was later also used for part-time 1g exposures for even partial g studies.

Paul Veldhuijzen (left) and Jack van loon awaiting for their bone samples return after Shuttle STS-42 / IML-1 had retuned on Kennedy Space Center in Florida, USA, 30 Jan. 1992

The use of centrifuges dominated the rest of my career in space and gravity related research. I built ny own very small centrifuge for in vitro bone studies. Later we developed the MidiCAR and the ESA Large Diameter Centrifuge (LDC). I hope we are also to make the next step toward chronic hypergravity for humans using the Human Hypergravity Habitat, H3. I am pleased to see that the role and importance of centrifuges and hypergravity has increased over the last couple of decades.

Dr. Jack van Loon, VU Amsterdam

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