

PRESIDENT'S SELECTION

The Newsletter from the ETH Zurich President

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THERAPY ROBOTS

High tech with a sensitive touch



Photo: Tom Kawara

Paralysed in an accident: the Lokomat teaches patients to walk in a virtual environment.

The therapy robots developed at ETH Zurich are built on groundbreaking knowledge. With virtual realities and sensitive sensors, the sophisticated machines are becoming increasingly better at meeting patient needs.

Preparing doctors ahead of difficult births, teaching paralysed humans how to walk and use their hands again and reactivating the sense of orientation of older people with dementia, therapy robots developed at the ETH's Sensory-Motor Systems Lab are designed for diseased and injured people – from birth through to old age.

However, for Professor Robert Riener, Head of the Lab, the machines are not simply metal and wire installations. "Thanks to an intelligent communication technology between man and machine, the complex assistants have the skill to recognise not only the physical but also the psychological condition of the patient and can react accordingly." ETH Zurich has succeeded in achieving this worldwide technological edge in collaboration with the Balgrist University Hospital.

Besides therapists, Riener's family of robots also incorporates simulators which optimise movement sequences in sport (e.g. in rowing) and special robotic systems that can be applied in MRI scanners for diagnostic purposes. Two robots are already being intensively tested in daily practice:

with Lokomat, patients practise exercising their limbs again. By measuring pulse, breathing rate and skin conductance, the latest version of the device (image left) can determine whether the patient is stressed or bored – and automatically adjust the programme and the entire virtual environment to the patient accordingly.

Armed for daily life

And with the help of the arm therapy robot ARMin, patients who have suffered from a stroke learn

to use their arms again, using a virtual training programme to practise everyday skills such as cooking. In clinical studies, ARMin has produced excellent results and is set to enter the market very soon. A more recent project has started researching a robot for people suffering from Alzheimer's disease: the Cognimat enables memory and cognitive functions to be trained in a fun and efficient way. It is being developed in close cooperation with hospital experts.



Senility: the Cognimat helps treat memory loss.

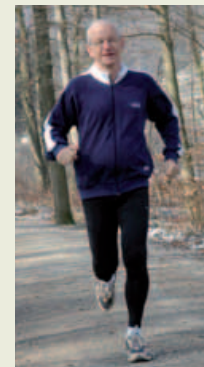
Growing need for effective therapy

Paraplegia is a severe affliction that requires intensive therapy. In Switzerland, around 300 people a year meet this fate, with extreme sports such as carving and paragliding increasing the risk of paralysis after an accident. However, the largest and fastest growing group of paralytics are people who have suffered a stroke. Of the 16,000 victims a year, around half find themselves disabled (including forms of paralysis); in order to help as many as possible to cope with daily life again, effective therapies are called for.

EDITORIAL

Good health!

Dear Reader,



Mens sana in corpore sano – this ancient Roman quotation applies to us today more than ever. With our health being important to all of us, ETH also places a

particular focus on this valuable commodity.

The new Health Sciences and Technology (HEST) Department has been set up in order to pool and interconnect our wide range of competencies. This applies not only to nutrition, movement science and neuroscience, but also to medical technology. Maintaining health and quality of life poses a number of challenges to our aging society. With a new study programme and interdisciplinary research, ETH Zurich can contribute pioneering solutions to this problem.

I hope you enjoy reading this issue and above all I wish you: good health!

R. Eichler

Prof. Dr. Ralph Eichler
President ETH Zurich

"QUOTE ... UNQUOTE"

"With enough exercise, it doesn't matter what you eat as long as you don't go overboard with amounts."

Paolo Colombani, ETH faculty member and President of the European Food Information Resource EuroFIR and author of the bestseller "Fette Irrtümer" (Fat Lies).

EXERCISE PHYSIOLOGY



Photo: ETH Zurich
Synthetic exercise maximises endurance and strength.

Fit to the max

A training programme that combines endurance and strength has revealed astonishing results in an experiment conducted by ETH and the University of Zurich. This could bring future benefits not only to top athletes but to patients recovering from surgery and sufferers of muscle diseases.

Up till now, joggers and weight-lifters went their different ways: to the forest running tracks or to the gym. However, the team of exercise physiologists at ETH and the University of Zurich, led by Dr. Marco Toigo, has combined the two kinds of exercise into a single training method and have announced impressive findings.

“Synthetic exercise” basically means lifting weights with a vibrating plate under the candidate’s feet. In addition, blood pressure cuffs are wrapped round the upper thigh to interrupt the blood flow.

After five weeks of three training sessions a week, each lasting three minutes, giving a total of three quarters of an hour, the test candidates displayed 60 percent points more stamina on their training bikes. In addition, they showed a remarkable increase of 80 percent points greater strength.

Higher levels of strength and endurance are also reflected in distinctly larger muscle fibres and increased numbers of blood capillaries in tissue samples. Further research aims to investigate and exploit this phenomenon more intensively.

NANOMEDICINE

Zooming into cells

The reasons why nanomedicine holds promise for exciting innovations are explained below by Viola Vogel, ETH Professor of Biologically Oriented Materials.

Ms Vogel, does medicine always need to advance into smaller dimensions to achieve new findings?

Despite considerable progress, we still know very little about the causes of many diseases. Unraveling mechanisms, such as environmental factors that promote the growth of cancer, are yet to be understood in detail. With nanoanalytical instrumentation, however, we can zoom into the machinery of cells and observe how they function.



Viola Vogel.

Can you tell us in which direction your research ideas are heading?

With new technologies, scientists can not only make atoms and molecules visible but also manipulate them. Added to this, innovative materials can be developed, inspired by materials

found in the natural world. For example, I am investigating how cells interact and respond to their surroundings and react to external stimuli. In this process, we are interested in seeing how mechanical forces are transformed into biochemical signals simply by stretching proteins.

What exactly is it in the tiny world that fascinates you?

We are gaining a better understanding of how biological nanosystems work, and how mechanical forces in concert with biochemical stimuli can heal tissue. A good example of how little is known about how to actually stimulate regeneration is evident once a patient suffers a heart attack. Building upon interdisciplinary basic research we aim to discover new pathways on how to exploit the huge potential of nanotechnology to improve medical diagnostics and therapy.

IN SHORT

HEST: coming soon

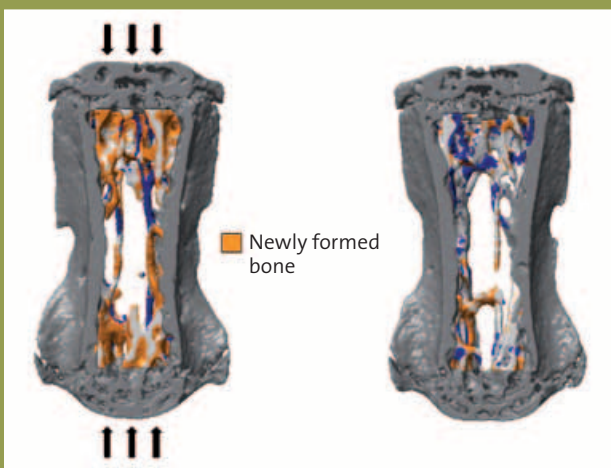
The new Department of Health Sciences and Technology (HEST) has been established to create basic principles for maintaining and enhancing people’s quality of life through to old age. The D-HEST will accelerate the transfer of knowledge and technology into practice and, from autumn 2011, educate a new generation of students in nutrition, movement science and neuroscience, as well as medical technology.



Fast track expansion

By giving donations to the ETH Zurich Foundation, private partners show their support of the university’s key strategic areas. With its Medical Technology of the Future initiative, ETH Zurich plans to become a leading centre in this field with six new professorships and added infrastructure. Last year, donors such as Philips and FIFA enabled significant advances in this direction to be made. For the arm therapy robot ARMin (image above), start-up financing was provided by resources from the Strategic Fund (including from the Walter Haefner Foundation).

ETH RESEARCH IN FOCUS: A HEALTHY SHAKE



Vibrations stimulate bone growth. This has recently been demonstrated by ETH Professor Ralph Müller from the Institute for Biomechanics. Mice were given a good shake five minutes a day, three days a week, for one month. And the result: substantially more new bone material had formed in their spines than in the normal mice (image left).

Research planned for the next few years will tell whether this method of improving health by shaking will function in humans as well. Patients with complex bone fractures or looming osteoporosis are therefore obliged to indeed be patient.

FINAL WORD

Prosthetic humans

With the steady advancement of medical technology, increasingly more artificial parts are being implanted in human bodies – in other words, the prosthetic world is booming. According to Michael Hampe, Professor of Philosophy at ETH Zurich, we will only avoid worrying about the growing technologisation of our bodies when we have overcome the idea that nature and technology stand in opposition. In research, this cultural evolution has already been dialectically achieved. Bio-degradable implants from ETH laboratories such as those for coronary vessels are soon to be in use. Natural technology or technological nature? Who’s worried as long as it works?