N E W S L E T T E R

ZEM

Universität Zürich[UZH]

Zentrum für Evolutionäre Medizin / Centre for Evolutionary Medicine

Anatomisches Institut, Universität Zürich / Institute for Anatomy, University of Zürich

A Semiannual Newsletter N° 2 - Spring 2011

News from the Centre

Greetings from the Head, Frank Rühli

Since the official opening of the ZEM last October, which formally marked the starting phase of the still on-going academic and infrastructural organisation of the centre, one of our focal points was investing into the infrastructure itself.

Major investments

In fact, together with the Functional Genomics Centre, the ZEM has acquired an Electrospray Mass Spectometer. Ralph Schlapbach, Head of the FGC, explains on page 4 of this newsletter in which ways this expensive piece of equipment is important in protemoics research and the analysis of proteins in biological samples.

These important investments have been a major point in this beginning phase of the ZEM. Not only to facilitate the working conditions and work of our different groups, but also broaden our scope towards the research in proteomics as a whole. In this same respect, a lot of effort has been put into building our international collaborations to which the first meeting in October was a very successful starting point.

Postgraduate courses

Since then, the ZEM has been able to write a complete course in Evolutionary Medicine together with Macej Henneberg at the University of Adelaide which will be held this semester (Please refer to our website for the complete syllabus) – and we are aiming for the same here in Zürich where we hope to establish post-graduate courses as soon as possible.

Apart from this very important teaching aspect, the first results of our research are being published and the feedback has been excellent so far.

For the next couple of months our main goal is to find ways to deal with the constant shortage of rooms and working space available. The constructions for the new offices for the ZEM are projected to be finished by the end of the summer and new labs on the Irchel Campus will hopefully also be available by this date. And it will be just in time, because we do hope to finish the various appointment sessions for junior and senior positions with the ZEM by that time as well.

Mumien

Mensch - Medizin - Magie

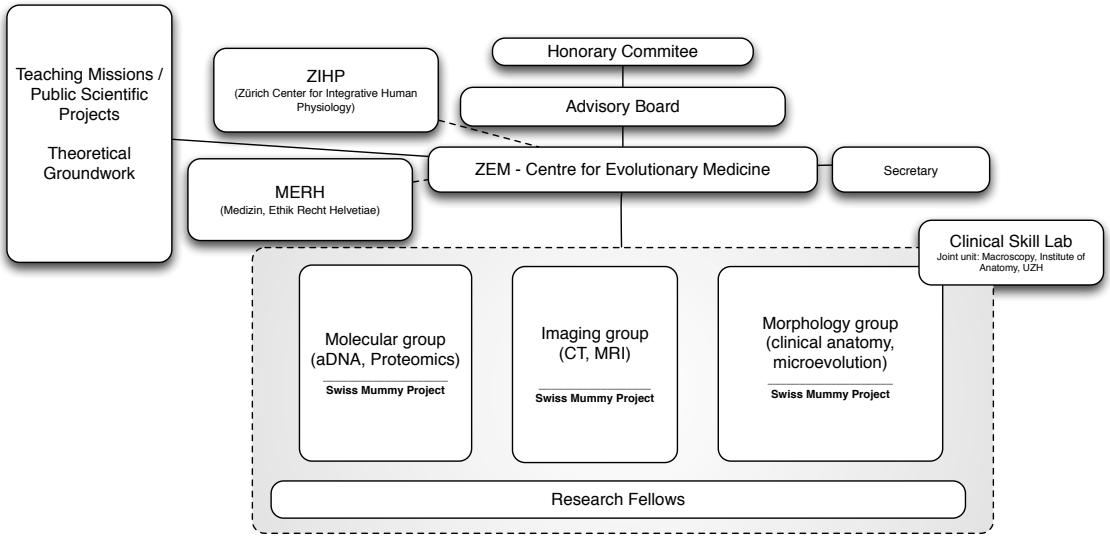
Public exhibit organised by the ZEM with the UZH at the University of Zürich, Irchel Campus.

22th of September 2011 - 8th of January 2012

The exhibit will cover various aspects of the new field of Evolutionary Medicine, such as Epidemology, aDNA research and the Egyptian dimension of mummy research.

Several mummies from various Swiss museums and institutions will also figure in the exhibit.

We thank the Mäxi Foundation for their continuous, most generous support.



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International Collaborators

Prof. B. Blümich	**Rheinisch-Westfälische Technische Hochschule, Aachen**
PD M. Bock	**Deutsches Krebsforschungszentrum, Heidelberg**
Prof. B. Bogin	**Loughborough University**
Prof. M. Henneberg	**Anatomical Sciences, University of Adelaide**
Prof. I. Hershkovitz	**Anatomy and Anthropology, Faculty of Medicine, Tel Aviv Univ.**
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Prof. W. Schiefenhövel	**Human Ethology Group, Max-Planck-Institute, Andechs**
Prof. B. Solomon	**Department of Orthopaedics, Royal Adelaide Hospital**
Prof. N. Tuross	**Department of Human Evolutionary Biology, Harvard University**
PD A. Zink	**Institute for Mummies and the Iceman, Bozen**

Local Collaborators

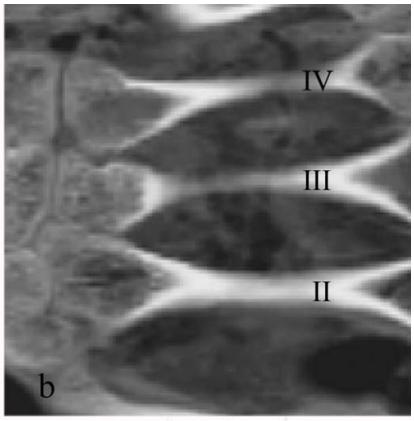
Prof. J. Hodler	**Institut für Diagnostische Radiologie, USZ**
Prof. Ch. Pfirrmann	**Radiologie, Uniklinik Balgrist, UZH**
PD D. Schaer	**Klink und Poliklinik für Innere Medizin, USZ**
Prof. R. Schlapbach	**Functional Genomics Center, UZH, ETH Zürich**
Divisionär A. Stettbacher	**Oberfeldarzt, Schweizer Armee, Bern**
Prof. G. Székeley	**Institut für Bildverarbeitung, ETH Zürich**
Prof. U. Woitek	**Institut für Empirische Wirtschaftsforschung, UZH**

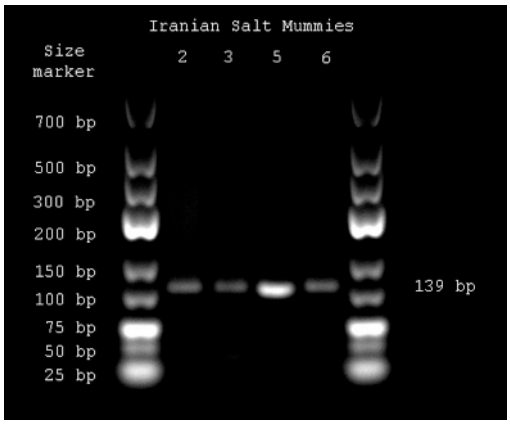
Visiting Scholar Ina Kaufmann (Dr. des. oec. publ.) on her time with the ZEM

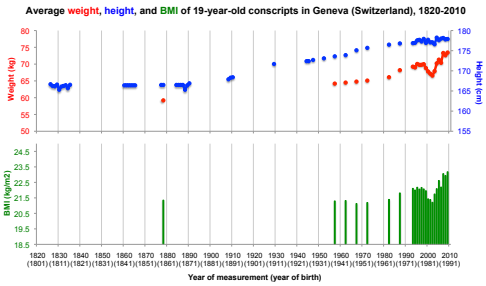
I am a visiting scholar with a rather unfamiliar background for medical science. Coming from economics, ethics and philosophy I have just finished my PhD thesis in neuroeconomics and philosophy of science. The project at the ZEM now provides me the opportunity to continue to work in the field of interdisciplinary research and to combine philosophical thinking with other branches of science. Ethical issues are of forefront importance in bio-medical science, but have just started to be considered for ancient mummy research.

The project I'm involved in at the ZEM takes up this challenge by starting to reflect on ethical issues. These are for example about questions of bodily integrity, data sampling, cultural contexts, or problems of proper communication of research results. Motivated by the newness and the relevance of this topic, we attempt to push the ethical discourse forward and I'm happy that I have the chance to be part of this project.

This all started with our last years' publication titled 'Without informed Consent? Ethics and ancient Mummy Research' (Kaufmann/Rühli 2010, Journal of Medical Ethics) where we delineated possible stakeholders affected by ancient mummy research and the resulting possible ethical dilemma. The latter might occur due to the missing consent of the subject and a possible invasive form of the chosen method of investigation. The positive reactions and responses encouraged us to continue our ethical reflection on mummy research. In our latest project we try to develop guidance of proper ethical conduct for scientists' involved in evidence-based research with human remains. In the end we hope to come up with a first draft of an ethical framework. By this we hope to promote the so far limited held discussion of ethical issues in mummy research and pave the way for a future oriented branch of interdisciplinary science.







The Imaging Group

Lena Öhrström, med. pract.
Dr. Dr. Roger Seiler
Johann Wanek, MSc Med Phys

Spotlight on a current project of the group:

Terahertz Imaging

The initial aim of the project was to prove the feasibility of terahertz imaging in ancient mummies. This study was realised in cooperation with the Department of Molecular and Optical Physics from the Albert-Ludwigs University in Freiburg im Breisgau, Germany.

Terahertz radiation lies in the electromagnetic spectrum between microwaves and the infrared spectrum. It is a very low energetic radiation, which doesn't have any destroying effect on the DNA. The ancient DNA in mummies is already highly fragmented and very difficult to amplify, so it is desirable to use an absolutely non-invasive investigation method.
We demonstrated that Terahertz radiation could penetrate through ancient mummified samples, such as an Egyptian hand and an ancient Egyptian mummified fish. Tissue and bone differentiation was possible. In the following, the results were compared to corresponding CT images.

At present the imaging quality of Terahertz imaging is not comparable to the one of Computed Tomography. The spatial resolution in CT is much higher. Another problem is the limited penetration depth. Currently we try to improve the imaging quality and the penetration depth by using different frequencies and different set-ups. At present we work together with the Department of Molecular and optical physics in Freiburg im Breisgau, Germany as well as with the ISL (Institut Franco-Allemand de Recherches), in St. Louis, France.

The Molecular Group

Dr. Natallia Shved
Dr. Christina Warinner

Spotlight on a current project of the group:

Creative science: adapting methods from cancer research to the study of ancient DNA

DNA damage poses a significant challenge to ancient DNA research. DNA fragmentation and miscoding lesions complicate genetic analysis and can dramatically increase the time and cost involved in ancient DNA research.
Many factors are known to contribute to the degree of DNA damage present in an ancient sample, including temperature, soil pH, seasonal cycles of hydration and dessication, and chemical and bacterial exposure. Many attempts have been made to develop predictive models for estimating DNA damage using these factors, but there is a great deal of stochastic variation that is not accounted for by these models. Currently, the only way to accurately quantify DNA damage in a sample is by using expensive next generation sequencing approaches.

A rapid and low cost method for accurately estimating DNA damage using ordinary lab equipment would be highly beneficial for pre-screening ancient samples before further research. Samples with low DNA quantity and quality could be excluded from further analysis, thus saving time and money, and samples with good DNA preservation could be prioritized for additional analysis. The ZEM Molecular Group is currently conducting experiments using a method adapted from cancer research to quantify DNA damage in forensic and archaeological samples. Being located in a medical school has opened our eyes to many new synergistic possibilities in ancient DNA research. Scientists engaged in determining the effectiveness of chemotherapy drugs face some of the same challenges as ancient DNA researchers, just from a different angle. We plan to present our first results at the 7th International World Mummy Congress in San Diego this June.

The Morphology Group

Olia Bolshakova, med. dent.
Dr. Dr. Karl Link
Dr. Kaspar Staub

Spotlight on a current project of the group:

Evolution of body height, weight and shape in Switzerland since the 19th century

The aim of the project is to follow the evolution of body height, weight, BMI and body shape in Switzerland since the 19th century. Therefore, the most reliable data source are individual conscript measurements, taken during universal conscription, representing 80-100% of the 19-year-old men alive. The trends of height, weight and BMI in the canton of Geneva shows the general Swiss pattern: The positive secular height trend begun in the 1890s (birth years 1870s) and slowed down a hundred years later in the 1990s (birth years 1970s). Contrary, the trend in body weight did not slow down in the recent decades, average weight continued to rise. Consequently, average BMI, which did not change between 1879 and the 1950s, shows a marked two-step increase at the end of the 1980s and again since 2002. In spring 2011 first publications on conscript data in general as well as on the above described trend of height and BMI of the conscripts have been submitted to national and international journals.

The current main research areas point in different directions: In the second half of 2011, we not only explore evolution of body shape of the conscripts additionally including arm and chest circumference, but also intend to reconstruct BMI and thus nutritional status for past periods when weight is missing, examine modern German and Austrian conscript data, study the relationship between height, weight and BMI on a large data sample, pursuer the relationship between vitamin D status or metabolic syndrome gained from metabolic data during the recent conscription years, or demonstrate regional or socioeconomic differences in height and BMI of Swiss conscripts today and in the late 19th century.

Publications

The ZEM in the press / Publications by ZEM collaborators

Popular press coverage:

Neue Zürcher Zeitung, 27/10/2010

Radio DRS "Echo der Zeit", 27/10/2010

Nature Medicine, 12/2010

NewScientist, 15/1/2011

DiscoveryNews, 31/1/2011

Sonntagsblick, 31/10/2010.

Neue Zürcher Zeitung, 1/2/2011

Nature.com, 3/2/2010

Tagesanzeiger, 5/2/2011

Cahiers de science et de la vie, 2/2011

Tagesanzeiger, 26/2/2011

Arte Fernsehsendung, 12/2/2011

DiscoveryNews, 3/3/2011

NewScientist, 4/3/2011

Handelszeitung, 3/2011

ScienceNOW, 4/2011

Harris lines revisited: Prevalence, comorbidities, and possible etiologies.
Papageorgopoulou C, Suter SK, Rühli FJ, Siegmund F.
Am J Hum Biol. 2011 May;23(3):381-91.

Paleobot.org: establishing open-access online reference collections for archaeobotanical research
Warinner Ch., d'Alpoim Guedes J, Goode D.
Vegetation History and Archaeobotany 20:3 (2011), 24.

Extracellular Hemoglobin Polarizes the Macrophage Proteome toward Hb-Clearance, Enhanced Antioxidant Capacity and Suppressed HLA Class 2 Expression
Kaempfer Th., Duerst E., Gehrig P., Roschitzki B., Rutishauser D., Grossmann J., Schoedon G., Vallelian F., Schaer D.J.
Journal of Proteome Research, in press.

History of Paleopathology in Switzerland.
Gruber Ph., Böni Th., Rühli FJ, in: *The History of Paleopathology: Pioneers and Prospects*, Oxford University Press, in press.

Imaging: the history of radiography, current issues and future trends.
Rühli FJ, in: *The History of Paleopathology: Pioneers and Prospects*, Oxford University Press, in press.

Fundamentals of Paleoimaging techniques.
Wanek J, Papageorgopoulou C, Rühli FJ, in: *A companion to Paleopathology*, Cambridge University Press, in press.

Mummies for Medicine

Most med students dissect cadavers, not mummies. Now Swiss researchers plan to use ancient DNA to attack some of the modern world's most pressing medical problems. They're part of a small but growing movement to unravel the mysteries of disease from a surprising new angle: evolution.

Officially launched in late October, the University of Zurich's new Centre for Evolutionary Medicine will investigate both how diseases evolve and how humans become vulnerable to them. Some of their biggest questions involve changes in human anatomy, says the center's director, Frank Rühli, such as whether an increasingly sedentary lifestyle may have weakened spinal columns, causing back pain. They'll also take DNA from ancient remains, such as Egyptian mummies (see photo), to compare genomes of ancient pathogens with those of modern ones—a valuable tool for detecting how fast diseases evolve and how environmental changes can affect them. Knowing how maladies flourish, says Rühli, will give scientists a much better idea of how to combat them.

With 11 researchers in Zurich and some 20 local and international collaborators, Rühli says the center will be larger than any other institute in the burgeoning field. He hopes its clinical—rather than theoretical—approach will help convince skeptics that an evolutionary perspective could have practical value. "We all think that biological evolution has stopped," he says. But when anatomy can change in just a few decades, "that's not true."

Science, 330 Nov. 2010

Cover story on ZEM research, ***NewScientist***, March 2011

Open Positions at the ZEM:

Head of Morphology Group

Head of ancient DNA lab/proteomics

Head of Imaging Group

Post-Doc Positions

Post-Graduate Courses

First course in Evolutionary Medicine at the University of Adelaide with collaboration from the ZEM, Zürich.

In Zürich, new similar courses are being prepared at present.

For more details and further information, please refer to http://www.anatom.uzh.ch/zem

Current News

Prof. Dr. Ralph Schlapbach, Head Functional Genomics Centre

Together with the Functional Genomics Center Zurich, the Centre for Evolutionary Medicine acquired a latest generation high accuracy mass spectrometer for proteomics research. The LTQ Orbitrap Velos system, also called a "Hybrid Linear Ion Trap - Orbitrap Electrospray Mass Spectrometer" can be considered todays most versatile instrument for the investigation of proteins in complex biological samples. Having this technology available at ZEM and FGCZ not only allows the researchers to investigate highly complex biological samples and to investigate individual peptides and proteins, but also to evaluate the overall composition of the proteome, i.e. the collective identity of all measurable proteins in cells and tissues. Together with the option to identify and characterize post-translational modifications of peptides and proteins, the technology enables the researchers to gather comprehensive overviews of the protein or even proteome status of the organism under investigation. Taking advantage of the system capabilities, large numbers of proteins can not only be identified but also quantified at high accuracy using algorithmic and chemical methods in combination.
Technically, the overall LC-MS/MS system consists of an ultra-high performance liquid chromatography system for the separation of complex protein and peptide mixtures present in biological tissue or cell culture samples, an electrospray ionization unit is used to softly ionize biomolecules (bring charges to the molecules in a fine aerosol so they can enter the mass spectrometer), and a combination of two mass analyzers: the LTQ Velos- linear ion trap part is perfectly suited for very sensitive and fast mass analysis while the second mass analyzer, the Orbitrap, is used for the determination of accurate masses with high resolution. With this powerful analytical system at hand. the researchers of the ZEM are well equipped for all proteomics research projects of today and the future years.

Upcoming dates with ZEM participation:

April 2011	**Annual Meeting of the American Association of Anatomists, Washington DC. Annual Meeting of the American Association of Physical Anthropologists Minneapolis**
June 2011	**World Mummy Congress, San Diego**
Sept 2011	**Gesellschaft für Anthropologie, Deutschland, Jahreskongress**
Okt 2011	**Bolzano Mummy Congress**

Address

Zentrum für Evolutionäre Medizin
Anatomisches Institut
Winterthurerstrasse 190, CH-8057 Zürich, Switzerland

zem.uzh@gmail.com
http://www.anatom.uzh.ch/zem

Administrative Services ZEM:

PD Dr. PhD Frank Rühli, Head
Dr. Thomas Böni, Co-Head

Bettina M. Kreissl Lonfat, Admin. Assistant +41 44 635 5605
Christoph Fellner, IT Support