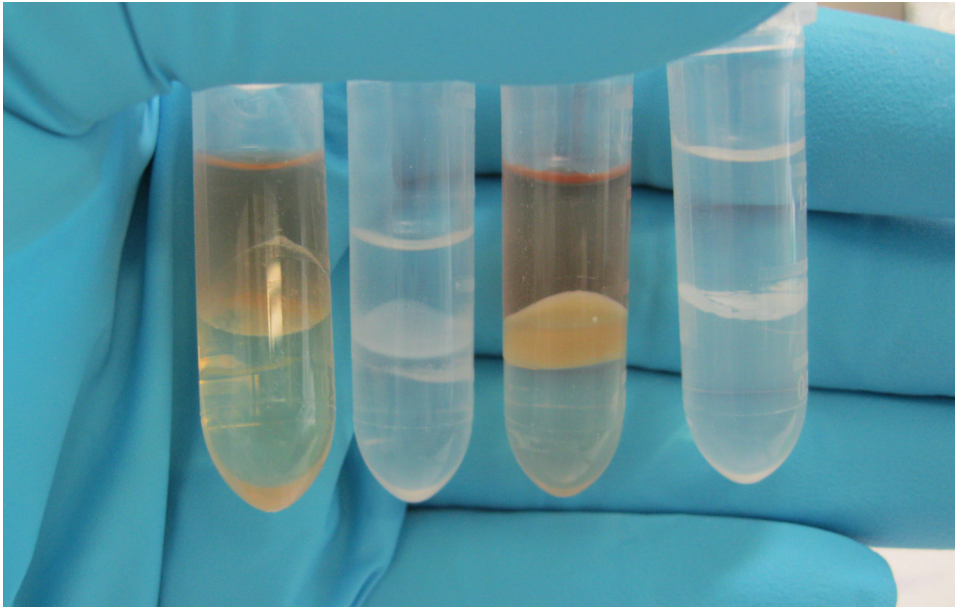




ZEMNews



Ancient samples undergoing DNA-extraction
(Photo: Dr. A. Bouwman)

Spotlight on the ongoing ZEM research:

Examining the change in CCR5 Δ 32 frequency in central Europe over time: Small pox, HIV resistance and the past. (Dr. Abigail Bouwman)

The CCR5 protein allows transport across T-cell walls, both useful and dangerous things use this entry. The 32bp deletion found in some copies of the CCR5 gene stops the protein from working and so can limit infection from certain pathogenic organisms.

This mutation is found only in western-Eurasian populations, and has a higher frequency in northern Europe, especially Scandinavia. This mutated allele became widely known and studied in the recent past because, when both copies of the gene are affected, it confers resistance to HIV infection. This gives the mutation a large positive selection bias and will increase frequency

in the population, as those without the mutation are more likely to die. The frequency in Europe is too high to have been caused by HIV, as this is a relatively new disease. Historians, epidemiologists and geneticists have been intrigued by the CCR5 Δ 32 and the cause of the original selective pressure. Early dating of the mutation indicated that it first occurred during the Black Death and so it was linked to Yersinia pestis epidemics. However, more recent data indicates that the allele is much older. In addition, it appears that having two copies of the allele do not prevent the onset of plague. Another likely cause of the selective pressure in Smallpox, which attacks T-cells in a similar way to HIV.

In order to better understand the dating it is important to know the strength of the selective pressure, as we can not measure this directly, an alternative is to see how the frequency has changed over time.

Ancient DNA has been used to show that the CCR5 Δ 32 allele was present in similar frequency before and after plague epidemics, and was also present much earlier. However, the sample sizes in this study were low.

We are currently looking at archaeological central European populations in an effort to calculate the change in frequency of the allele over time, and to help to narrow down the dating of the allele. By this we will also better understand how quickly humans can adapt to diseases which is important in this post-antibiotic age. This project is funded by Novartis.

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Part of the ZEM-team during the retreat days in Castasegna (Grisons, CH) in October 2012

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Ancient samples undergoing DNA-extraction (photo: Dr. A. Bouwman)

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<http://evolutionäremedizin.ch/>

Foreword

Dear Ladies and Gentlemen



It is a real pleasure for me to present to you the newest ZEM Newsletter. It covers roughly the time span since Spring 2012. In the meantime many notable developments have happened:

First, we were able to further establish the ZEM within and outside the University of Zurich. More collaborations and research projects were launched, e.g. in the molecular field. Also, with the Mummy exhibition "Mumien: Mensch, Medizin, Magie" in 2011 we were able to present very successfully our research and other mummy researchers work to a wider audience. This exhibition was possible thanks to the tremendous support of the University of Zurich, the Mäxi foundation and other foundations such as the Mercator foundation.

With the assistance of my wonderful team of employees, we were able to acquire further grant money, e.g. at the Swiss National Science foundation (to get a state-of-the-art Micro-CT scanner) or at the Novartis Stiftung. Also a

constant flow of publications under the umbrella of the ZEM is appearing and shows the academic impact of this still unique endeavour. Furthermore, various national and international media reports show the growing public interest in the ZEM. Finally, we expanded the ZEM by officially adding a fourth research group covering basic research issues such as paleopathology.

The new year will bring further adjustments of organizational structures, the launch of larger third-party funded projects and some final moving to larger room facilities, all together another important step in the path to keep the ZEM fully rolling.

In the name of all my employees, I thank you for your interest, the support by the various members of the honorary committee, advisory board as well as local and international collaborators and foremost the Mäxi Foundation for their continuous support who makes all of this possible. If you have any comments or further specific interest please let us know anytime!

Sincerely,

A handwritten signature in cursive script, reading "F. Rühli".

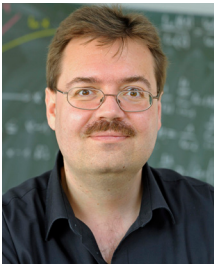
Frank Rühli (Head)



Dr. A. Bouwman extracting an ancient DNA sample out of an Egyptian canopic jar in Munich, December 2012 (Photo: M. Habicht)

«Building bridges and breaking borders»

The Director of the Institute of Anatomy at the University of Zurich about the ZEM and the significance of its research within anatomy in general and the Institute in particular.



Prof. Dr. Dr. Oliver Ullrich
(Director, Institute of Anatomy, University of Zurich)

One of the first things, which an anatomist learns, is respect for history. It took many centuries and countless researchers to understand the structure and function of the human body. Until today, anatomy is one of the cornerstones of a doctor's medical education.

The concept of evolutionary medicine builds bridges – not only between the past, the present and the future, but also between scientific disciplines. Evolutionary medicine links history, archaeology, pathology, anatomy, modern imaging and molecular biology to the questions of medicine and to the need for understanding evolutionary aspects of disease aetiology and disease patterns.

For evolutionary medicine, research conditions in Switzerland are excellent: Historic and recent data of

Swiss Army conscripts represents a worldwide unique and unsurpassed precious source to study secular trends of body mass, stature and structure and to understand correlations between socio-economic development and anthropometric and metabolic changes. Very recently, ZEM members went to the Vatican to extend their studies to the Pontifical Swiss Guard of Holy See, founded in the 16th century and the only Swiss Guard that still exists.

To learn from history is a chance to form and shape our future. Thanks to the inimitable collections of historic data and specimens, there is a unique and powerful research potential in Switzerland, which is continuously advanced and developed by the ZEM. In this context, also the recently restored and catalogued Galler pathological bone collection represents an excellent historic database.

Modern anatomy today is no longer limited by methodological borders and is no longer confined into the classical research areas. Modern anatomy is free to ask entirely new questions and to understand the human body from entirely new aspects. Modern anatomy makes use of state of the art cellular, molecular and functional investigations, but

maintains and develops its strong morphological competence.

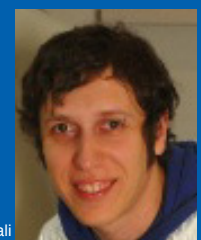
Today we are in an enormously privileged situation. We cannot only rely on the overall and easily available results of centuries of research, but we can also use modern sophisticated experimental methods and innovative concepts. Our colleagues from the Center for Evolutionary Medicine developed their research fields with passion and with dedication, build bridges between disciplines and ask questions, which are important for our society.

I wish to congratulate my colleagues from the ZEM for their pioneering work and wish them every possible success in 2013.

New International Collaborations



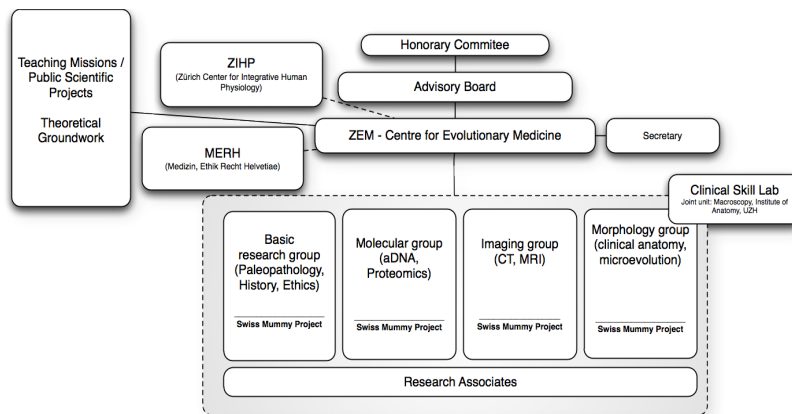
Prof. J. Tutkuvienė



Dr. D. Piombino-Mascalì

In 2012, the ZEM has been particularly active in reaching out to other researchers in adjacent fields and securing strong international collaborations. Thus, we are proud to welcome Prof. Janina Tutkuvienė from the Faculty of Medicine, Vilnius University, and Dr. Dario Piombino-Mascalì from the Department of Cultural Heritage and Sicilian Identity from Palermo.

ZEM Organigramm



The current composition of the ZEM committees and collaborators.

Honorary Committee:

Dr. M. Dell Ambrogio
Staatssekretär für Bildung und Forschung

Dr. T. Heiniger
Regierungsrat Kanton ZH

Prof. F. Gutzwiller
Ständerat ZH

Prof. D. Wyler
Prorektor Medizin und Naturwissenschaften UZH

M. Coninx
Geschäftsführer "Finanz und Wirtschaft"
Tamedia AG

M. Prenosil
VR Präsident Sprüngli AG, Präsident City
Vereinigung

Dr. Th. Wellauer
COO Swiss Re
Zürich

Advisory Board:

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Dekan Medizinische Fakultät, UZH

Prof. M. Hengartner
Dekan Mathem.-Naturwiss. Fakultät UZH

Prof. M. Thali
Direktor Institut für Rechtsmedizin UZH

Prof. M. Gassmann
Direktor Institut für Veterinärphysiologie,
Zürich Center for Integrative Human Physiology, UZH

Prof. S. Gay
Rheumaklinik, Institut für Physikalische
Medizin USZ

Prof. Ch. Gerber
Chefarzt Orthopädie Balgrist Zurich

Prof. B. von Rechenberg
Direktorin Center for Applied Biotechnology
and Molecular Medicine UZH, Vetsuisse

Prof. M. Rudin
Institute for Biomedical Engineering ETH

Prof. C. van Schaik
Direktor Anthropologisches Institut UZH

Prof. B. Tag
Rechtswissenschaftliches Institut UZH, Vor-
sitzende Kompetenzzentrum Medizin - Ethik
- Recht Helvetiae

Prof. O. Ullrich
Direktor Anatomisches Institut UZH

Local Collaborators:

Prof. J. Hodler
Institut für Diagnostische Radiologie, USZ

Prof. Ch. Pfirrmann
Radiologie, Uniklinik Balgrist UZH

PD D. Schaer
Klinik und Poliklinik für Innere Medizin, USZ

Prof. R. Schlapbach
Functional Genomics Center, UZH, ETH

Divisionär A. Stettbacher
Oberfeldarzt, Schweizer Armee, Bern

Prof. G. Székely
Institut für Bildverarbeitung, ETH

Prof. U. Woitek
Institut für Empirische Wirtschaftsforschung,
UZH

International Collaborators:

Prof. B. Blümich
Rheinisch-Westfälische Technische Hoch-
schule, Aachen

Prof. M. Bock
Radiologisches Department Universitätskli-
nik Freiburg im Breisgau

Prof. B. Bogin
Loughborough University

Dr. Enrico Cappellini
Centre for GeoGenetics, Natural History
Museum & University of Copenhagen

Prof. T. Gilbert
Centre for GeoGenetics, Natural History
Museum & University of Copenhagen

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Anatomical Sciences, University of Adelaide

Prof. I. HersHKovitz
Anatomy and Anthropology, Faculty of
Medicine, Tel Aviv Univ.

Prof. S. Ikram
Department of Egyptology, American Uni-
versity Cairo

Prof. R. Jankauskas
Department of Anatomy, Histology and
Anthropology, Faculty of Medicine, Vilnius
University

Prof. em. J. Komlos
Volkswirtschaftliches Institut, LMU Mün-
chen

Dr. D. Piombino-Mascali
Department of Cultural Heritage and Sicili-
an Identity, Palermo

Dr. Ch. Scheffler
Institut für Biochemie und Biologie, Univer-
sität Potsdam

Prof. W. Schiefenhövel
Human Ethology Group, Max-Planck-Insti-
tute, Andechs

Prof. B. Solomon
Department of Orthopaedics, Royal Ade-
laide Hospital

Prof. N. Tuross
Department of Human Evolutionary Biolo-
gy, Harvard University

Prof. J. Tutkuviene
Department of Anatomy, Histology and
Anthropology, Faculty of Medicine, Vilnius
University

PD A. Zink
Institute for Mummies and the Iceman,
Bozen

The ZEM-Research

Words from the research groups

Dr. Michael Campana

Our new group member of the Molecular Group about his future work at the ZEM



I am an archaeogeneticist by training, having completed my PhD thesis at the Glyn Daniel Archaeogenetics Laboratory (McDonald Institute, University of Cambridge) examining evolution of horse populations using ancient DNA. My thesis

research found that ancient DNA approaches based on a single or a few candidate genes were often insufficient for detecting small-scale population evolution, thus necessitating methodologies that analysed greater proportions of the genome (e.g. whole genome sequencing or SNP arrays). I then conducted post-doctoral research in the Biogeochemistry Laboratory (Department of Human Evolutionary Biology, Harvard University) under the guidance of Professor Noreen Tuross examining disease in New World archaeological populations using high-throughput sequencing techniques. Currently, many of the diseases that decimated the Native American populations during the European colonial population have been definitively identified. I am continuing that research this year at the ZEM in a collaborative project between Harvard and the ZEM.

Further I am examining Peruvian mummies to determine whether we can detect traces of the microbiome preserved in archaeological soft tissues. One of the major issues in ancient DNA-based analysis of historic pathogens is differentiating between host-related DNAs and post-mortem soil-derived contaminating molecules. I am developing methodologies using novel high-throughput sequencing technologies (e.g. Third Generation Sequencing) in order to identify verifiable host-associated microbial DNA sequences. Since microorganisms also colonise different tissues in the body, I am also attempting to determine whether there is a different microbiome signal between soft tissues and hard tissues.

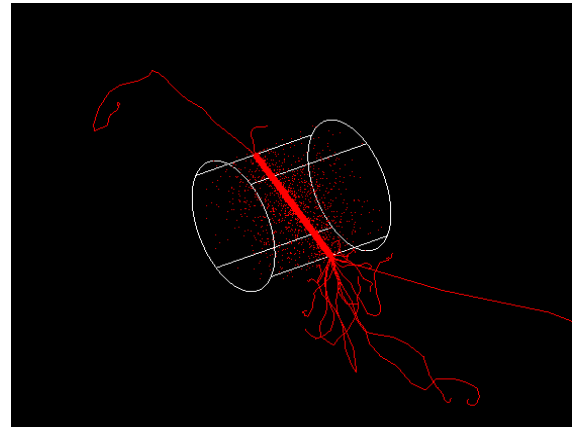
The Imaging Group

Dr. Dr. Roger Seiler

Dr. Lena Öhrström

Johann Wanek, MSc Med Phys

Michael Habicht, M.A.



- **Dental pathologies in ancient mummies**
 - Detailed analyses of mummies in Swiss collections, in the Capuchin Catacombs (Palermo, Italy) and of the Iceman (Bozen, Italy)
- **Diagnostic imaging of ancient mummies**
 - X-ray and CT as the current gold-standard
 - Evaluation/further development of other emerging imaging techniques such as MR and Terahertz specifically for ancient mummified tissues
- **A Monte Carlo simulation based study on the impact of radiation on ancient dry cells**

Groups & Projects

The Molecular Group

Dr. Abigail Bouwman
Dr. Michael Campana
Gülfirde Akgül



- **Ascertaining the microbiome preservation from naturally preserved archaeological soft tissues from the Peruvian Andes** (Joint with Harvard University)
- **Using high-throughput sequencing to investigate the cause of a colonial native Mexican (Mixtec) epidemic** (Joint with Harvard University)
- **Ancient DNA investigation of lactase persistence in Medieval Central Europe** (Joint with Pre- and Protohistory UZH)
- **Ancient DNA investigation of the change of frequency and evolutionary pressure of the CCR5Δ32 allele in Central Europe**
- **Clarifying the migration patterns of native South African peoples using DNA markers from modern and ancient individuals** (Joint with University of Pretoria)
- **Analyzing genomic and proteomic data from dental calculus**

The Morphology Group

Dr. Martin Häusler
Dr. Dr. Karl Link
Dr. Kaspar Staub
Sabrina Meyer, MSc
Sandra Mathews, MSc
Dr. Dagmar Dohr



- **Histological analyses of ancient mummified tissues** (Iranian Salt mummies, mammoth baby Lyuba)
- **Historic Galler collection: Bone pathology reference series: Analysis/compilation of selected diseases**
- **Secular trend (evolution), regional and socio-economic differences in height, BMI and body shape in Swiss conscripts 1875-2013**
- **Secular trend, regional and socio-economic differences in height, BMI and body shape in German conscripts 1956-2010**
- **Evolution of bipedal locomotion and in particular its relationship to functional morphology and pathologies**
- **Evolutionary background of pathologies of the human shoulder girdle, knee and spine**

The **Basic Research Group** of the Centre for Evolutionary Medicine (ZEM) is interested in various underlying principles of current research and projects at the ZEM, ranging as far as the **egyptological perspectives of human mummification**.

ZEM-Publications

(selected publications since last newsletter 3/2012)

Aali A, Stöllner T, Abar A, Rühli F. The Salt Men of Iran: The Salt Mine of Douzlakh, Chehrabad. *Archäol Korrespondenzblatt* 2012, 42: 61- 81.

Hermanussen M, Scheffler C, Bogin B, Rühli F, Staub K, Woitek U et. al. Diversity in auxology: between theory and practice. *Proceedings of the 18th Aschauer Soiree, 13th November 2010. Anthropol Anz* 2012, 69(2): 159-174.

Hermanussen M, Staub K, Assmann C, van Buuren S. Dilemmas in choosing and using growth charts. *Pediatr Endocrinol Rev* 2012, Mar 9(3): 650-656.

Papageorgopoulou C, Staub K, Rühli F. Hypothyroidism in Switzerland from an anthropological, clinical and historic perspective. In: Harbeck M, Heyking v. K, Schwarzberg H (eds.) *Sickness, Hunger, War and Religion. Rachel Carson Center Perspectives* 2012, 3: 75-91.

Haeusler M, Schiess R, Boeni T. Modern or distinct axial bauplan in early hominins? A reply to Williams (2012). *J Hum Evol* 2012, 63: 557-559.

Henneberg M, Saniotis A. How can evolutionary medicine inform future personalized medicine? *Personalized Medicine* 2012, 9(2): 171-173

Warinner C, Robles Garcia N, Tuross N. Maize, beans and the floral isotopic diversity of highland Oaxaca, Mexico. *Journal of Archaeological Science* 2012: in press (available online August 2012).

Wanek J, Papgeorgopoulou, Rühli F. Fundamentals of Paleoimaging Techniques: Bridging the Gap between Physics and Paleopathologists. In: Grauer AL (ed). *A companion to Paleopathology. Blackwell*, 2012: 324-339.

Gruber P, Böni T, Rühli F. History of Paleopathology in Switzerland. In: Buikstra JE, Roberts CA (eds). *The Global History of Paleopathology. Oxford*, 2012: 559-568.

Guedes J, Carrasco D, Flad R, Fosse E, Herzfeld M, Lamberg-Karlovsky K, Lewis C, Liebmann M, Meadow R, Patterson N, Price M, Reiches M, Richardson S, Shattuck-Heidorn H, Ur J, Urton G, Warinner C. Is poverty in our genes? A reply to Ashraf and Galor. *Current Anthropology* 2012: in press.

Warinner C, Robles García N, Spores R, Tuross N. Disease, demography, and diet in early colonial New Spain: Investigation of a 16th century Mixtec epidemic cemetery at Teposcolula Yucundaa. *Latin American Antiquity* 2012, Dec: in press.

Öhrström L, von Waldburg H, Speier P, Bock M, Suri R, Rühli F. MR Imaging versus CT of Peruvian and ancient Egyptian mummified tissues. *Radiographics* 2013: in press.

Aali A, Abar A, Boenke N, Pollard M, Rühli F, Stöllner T. Ancient salt mining and salt men: the interdisciplinary Chehrabad Douzlakh project in north-western Iran. *Antiquity* 2012, 86 (333).

New MSc and PhD students

The ZEM is happy to welcome the following new students (supervision and co-supervision):

- Molebogeng Bodiba (MSc-Project, University of Pretoria, South Africa)
- Sabina Landis (MSc-Project, Zürich)
- Claudio Bigger (MMed-Project, Zürich)
- Michael Strässle (MMed-Project, Zürich)
- Sarah Robertson (PhD-Project, ANU Canberra, Australia)
- Aaron Hermann (PhD-Project, University of Adelaide, Australia)
- Cecilia Collins (PhD-Project, Reading University, UK)
- Sandra Matthews (PhD-Project, Zürich)
- Sabrina Meyer (PhD-Project, Zürich)

Upcoming Dates with ZEM participation

31 Jan - 2 Feb: Conference on the Bioarchaeology of Ancient Egypt, Cairo, Egypt

2 - 3 Apr: 22nd Annual Meeting Paleoanthropology Society, Honolulu, USA

9 - 10 Apr: 40th Annual Meeting of the Paleopathology Association PPA, Knoxville, USA

9 - 13 Apr: 82nd American Association of Physical Anthropologists Annual Meeting AAPA, Knoxville, USA

6 - 9 Aug: 8th World Congress on Mummy Studies, Rio de Janeiro, Brasil

Selected ZEM media and press reports

Print/Online:

- Berner Zeitung, 13.01.2012
- Greenpeace Magazin, 3/2012
- Bild der Wissenschaft, 3/2012
- Beobachter, 27.04.2012
- CNN, 20.05.2012
- Fox News, 31.05.2012
- Wired UK, 6/2012
- Observer (Guardian, UK), 29.07.2012
- Archaeology Magazine, 30.07.2012
- Der Freitag (Berlin), 16.08.2012
- National Geographic, 10/2012
- Blick, 26.10.2012
- Tagesanzeiger, 26.10.2012
- Neue Zürcher Zeitung, 26.10.2012
- NZZ am Sonntag, 04.11.2012

Television:

- SRF (Swiss TV), PULS, 09.01.2012
- SRF (Swiss TV), Aktuell, 25.10.2012
- SRF (Swiss TV), Tagesschau, 25.10.2012
- SRF (Swiss TV), Einstein, 25.10.2012

Radio:

- SRF (Swiss Radio), Regionaljournal, 25.10.2012
- RSI LA 1, 25.10.2012