Biographical Sketch of Ueli Aebi

Ueli Aebi holds master degrees in physics and molecular biology. He earned his Ph.D. in biophysics in 1977 from the University of Basel. In 1977/78, he worked as a senior research associate in protein crystallography at the University of California in Los Angeles. In 1979 he joined the faculty at the Johns Hopkins University School of Medicine in Baltimore, holding appointments in the Departments of Cell Biology and Anatomy, and in Dermatology. In 1986 he moved to the Biozentrum, University of Basel, Switzerland, and has since built a world-class structural biology department that integrates X-ray crystallography, NMR spectroscopy, and light, electron and scanning probe microscopies. Currently, he is Professor and Director of the M.E. Müller Institute for Structural Biology at the Biozentrum. He is also a member of the *National Center of Competence in Research (NCCR)* "Nanoscale Science" where he co-directs the project module "Nanobiology".

His lab has a long-standing interest in a structure-based understanding of molecular machines, and more generally, supramolecular assemblies by a hybrid methods experimental approach that include light, electron and scanning probe microscopies, X-ray crystallography, molecular cell biology and protein design. Being problem-driven, he focuses on (1) cytoskeletal filament structure, assembly and turnover; (2) the nuclear pore complex and its involvement in nucleocytoplasmic transport; and (3) fibrillogenesis of amyloid forming peptides and how this relates to disease progression. Also, his group is working on novel optical and mechanical nano-sensors and -actuators for local diagnostics and therapy by minimally invasive interventions.

He has co-authored well over 200 original research articles, reviews and book chapters in prestigious journals such as Nature, Science, Cell, the Journal of Cell Biology, the Journal of Molecular Biology and others. Among the numerous honors and awards, he is an elected member of the *European Molecular Biology Organization* (*EMBO*) and of the *Academia Europaea*, and in 2002 he was awarded the *G.J. Mendel Medal* by the Czech Academy of Sciences. In 2004 he was elected president of the *European Microscopy Society* (EMS), in 2005 he co-founded the *American Academy of Nanomedicine* (AANM) of which he is an Executive Board Member, and in 2006 he was elected an Executive Board Member of the *International Fedration of Societies of Microscopy* (IFSM).

In addition, Ueli Aebi has almost 25 years of business experience. In 1981 he co-founded *Protek, Inc.* to develop, manufacture, and sell hip and knee prostheses in North America. Between 1986 and 1991 he also served on the Technical Board of *Protek AG*. Since 1996 he has been chairing the board of *Gehring Cut* that develops and manufactures surgical instruments and other precision mechanical components. In 2003 he co-founded *Therapeomic, Inc.* that focuses on novel protein drug formulations and growth factor enhanced tissue repair. In 2005 he joined the board of *Alpha-O Peptides*, a biotech start-up company that develops novel repetitive antigen display, diagnostic imaging and drug targeting/delivery platforms by employing rationally designed polyhedral peptide nanoparticles. In 2004 he became

president of the *Basel Tumor Bank Foundation*, which administers and annotates one of the largest breast tumor registries, and conducts and sponsors work on biomolecular expression profiling of breast tumors aimed at individualized diagnosis, risk assessment, therapy and follow-up.

10 Recent Peer-reviewed Publications:

Steinmetz, M.O., Stoffler, D., Müller, S.A., Jahn, W., Wolpensinger, B., Goldie, K.N., Engel, A., Faulstich, H. and Aebi, U. (1998). Evaluating Atomic Models of F-Actin with an Undecagold-Tagged Phalloidin Derivative. *J. Mol. Biol.* **276**, 1-6.

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Stoffler, D., Feja, B., Fahrenkrog, B., Walz, J., Typke, D., Baumeister, W. and Aebi, U. (2003). Cryo-Electron Tomography Reveals Novel Insights into Nuclear Pore Architecture - Implications for Nucleocytoplasmic Transport. *J. Mol. Biol.* 328, 119-130.

Stolz, M., Raiteri, R., Daniels, A.U., Baschong, W. and Aebi, U. (2004). Dynamic Elastic Modulus of Articular Cartilage Determined at Two Different Levels of Tissue Organization by Indentation-Type Atomic Force Microscopy. *Biophys. J.* **86**, 3269-3283.

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Baer, H., Muecke, N., Kostareva, A., Sjöberg, g., Aebi, U. and Herrmann, H. (2005). Myopathic Desmin Mutations Impair Filament Formation at Distinct Stages of the Assembly Process. *Proc. Natl. Acad. Sci. USA* **102**, 15099-15104.

Kreplak, L., Bär, H., Leterrier, J.F., Herrmann, H. and Aebi, U. (2005). Exploring the Mechanical Behavior of Single Intermediate Filaments. *J. Mol. Biol.* **354**, 569-577.

Lim, R.Y.H., Huang, N.-P., Koeser, J., Schwarz-Herion, K., Deng, J., Lau, K.H.A., Fahrenkrog, B. and Aebi, U. (2006). Flexible FG-Nucleoporins as Entropic Barriers to Nucleocytoplasmic Transport. *Proc. Natl. Acad. Sci. USA* **103**, 9512-9517.

Raman, S., Machaidze, G., Lustig, A., Aebi, U. and Burkhard, P. (2006). Structure-based Design of Peptides that Self-assemble into Regular Polyhedral Nanoparticles. *Nanomedicine* **2**, 95-102.

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10 Most Important Publications:

Aebi, U., Smith, P.R., Isenberg, G. and Pollard, T.D. (1980). Structure of Crystalline Actin Sheets. *Nature* (Lond.) **288**, 296-298.

Aebi, U., Cohn, J., Buhle, E.L. and Gerace, L. (1986). The Nuclear Lamina is a Meshwork of Intermediate-type Filaments. *Nature* (Lond.) **323**, 560-564.

Panté, N., Bastos, R., McMorrow, I., Burke, B. and Aebi, U. (1994). Interactions and 3-D Localization of a Group of Nuclear Pore Complex Proteins. *J. Cell Biol.* **126**, 603-617.

Bremer, A., Henn, C., Goldie, K.N., Engel, A., Smith, P.R. and Aebi, U. (1994). Towards Atomic Interpretation of 3-D Reconstructions of F-Actin Filaments. *J. Mol. Biol.* **242**, 683-700.

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The use of microscopes: from the bench to the patient

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Visualizing the structure and dynamics of proteins, molecular assemblies and cellular components is key to our understanding of biological function. Here, we discuss the major approaches in imaging, measuring, and manipulating biological matter ranging from the millimeter to the nanometer scale. A variety of experimental methods have been developed to provide three-dimensional (3-D) structural insight at various resolutions. Data acquisition is achieved by multiple imaging modalities including light, electron and scanning force microscopy (LM, EM and SFM). To visualize 3-D data sets, and to animate their dynamic properties in real-time, powerful graphics computers are employed. The focus will be on the SFM - a member of the family of scanning probe microscopes (SPMs) - as this instrument has opened completely new vistas for analyzing the surface topography of biological matter in its physiological buffer environment at a resolution comparable to that achieved by EM. Most exciting, while providing us with the 'eyesâ€™ for imaging biological matter from the mm to the Î¼m and, ultimately, the nm scale, the SFM also gives us the 'fingers' to measure and manipulate biological matter at the level of single molecules, organelles and cells. Evidently, the prospects of this unique nano-sensor and -actuator in fundamental research and for practical applications in biology and medicine are only limited by our imagination. The biomedical potential of such nano-sensors and -actuators will be illustrated by examples that include a molecular transport machine, cytoskeletal filament and single cell biomechanics, and an arthroscopic SFM.