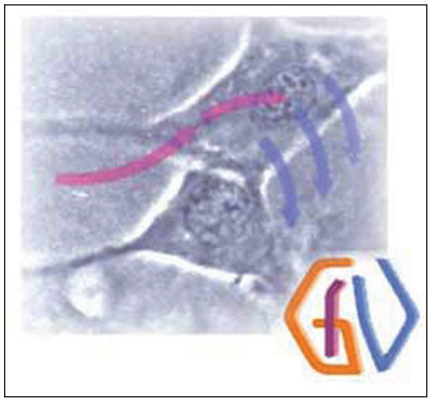
# The viruses' guide to the cell – from the cell surface to the nucleus and back again

## Meeting Report on the 7th Workshop ‚Cell Biology of Viral Infections' of the German Society of Virology (GfV) in Deidesheim, October 6th–8th.

By Kay Grünewald[1] and Mario Schelhaas[2].



Since the dawn of molecular and cellular biology, insights into the mechanistic wonders of the cell have been helped as well as sometimes pioneered by following the invasion strategies of viruses and other pathogens. Viruses as obligatory cellular parasites make use of a large variety of basic cellular processes such as endocytosis, nuclear import, transcription, replication, and exocytosis. Early studies made use of viruses as they provided a simple, limited component system that could be easily followed by the molecular biological, biochemical, and morphological techniques available. With the technological advances made over the decades, cell biologists expanded their model systems, and pathogens ceased to be a major tool to study cellular biology. However, this field at the crossroad between cell biology and infection biology has re-emerged with new vigour particularly with regards to membrane trafficking events [1-3], for overviews refer to [4-7].

To foster exchange and research at the crossroads of cell biology and virology, the German Society of Virology established the study group ‚Cell Biology of Viral Infections'. The main purpose of this study group is to bring together researchers of the allegedly divided fields by means of informal workshops. Held again on the estates of the famous winery Bassermann-Jordan (Deidesheim) in the palatinate region, this year's 7th annual workshop was again generously co-sponsored by the German Society of Cell Biology. Four cell biological keynote speakers gave exciting insights into their particular research efforts.

*Carien Niessen* from the University of Cologne re-visited the proliferation characteristics of skin stem cells and the nature of the various cell-cell adhesion structures in complex epithelia. She described the function of E cadherin - an initiator of cell-junction polarity - with the help of conditional knockout mice. Surprisingly, the absence of E-cadherin lead to a loss of the inside-out barrier but not the outside-in barrier. This phenotype was mediated by a loss of atypical PKC zeta phosphorylation and points to a decisive role of the PI3 kinase/Rac/PKC signalling pathway. Among the loss of tight junction barrier functionality, E-cadherin absence resulted in the upregulation of desmosome structures that may partially counteract the loss of E-cadherin junctions.

*Roland Wedlich-Soeldner* (MPI for Biochemistry, Martinsried) talked about his recently developed actin probe LIVEACT [8] that is extensively used in his lab to follow cortical actin dynamics. Exemplary for his research, he described the shrinkage/growth dynamics of actin cables in yeast that also exhibit split and bundling behaviour. Astonishingly, he could also visualize a similar fission and fusion behaviour of what he called actin worms: a special arrangement of cortical actin present in mammalian cells. These structures have been so far elusive to live cell analysis.

*Ineke Braakman* from the University of Utrecht reported on research that spanned almost her entire career: the oxidative protein folding within the ER lumen. Ineke has used among other proteins the influenza virus haemagglutinin as a model substrate and explained how the order of disulfide bond formation can affect folding, multimerization, and secretion of proteins.

Finally, *Ari Helenius* from the ETH Zurich highlighted the various strategies that viruses use to highjack cellular mechanisms for cell entry. First, he explained how viruses can use active transport of cell receptors along filopodial structures that is powered by actin retrograde flow to enhance their infectious potential by targeting plasma membrane areas on the cell body and thus the cellular endocytic machin-

[1] Max-Planck-Institute of Biochemistry, Dept. Molecular Structural Biology, Emmy Noether Group 'Structural cell biology of virus infection', Am Klopferspitz 18, D-82152 Martinsried, Germany.

[2] ETH Zurich, Institute of Biochemistry, Schafmattstrasse 18, CH-8093 Zurich, Switzerland.
Future address: University of Münster, Centre for the Molecular Biology of Inflammation, Emmy Noether Group 'Endocytosis of Human Papillomavirus Type 16', Von Esmarch Str. 56, D-48149 Münster, Germany. Email: mario.schelhaas@bc.biol.ethz.ch

ery [9]. As a second example, he emphasized how vaccinia virus poses as an apoptotic body to trigger macropinocytic internalization of the particle [10]. Lastly, he explained how some viruses may indeed be able to induce their own endocytic uptake by deforming membranes and thus triggering tubular invaginations of the plasma membrane. With this, he presented first clues indicating that there are further strategies in cell entry beyond the currently known pathways.

Besides the invited speakers, the participants displayed in a number of talks and posters the wide variety of cell biological features of viral infections. Topics ranged from transport of Hepatitis C viruses through low and high affinity interactions in the bloodstream to hepatocytes, macropinocytic entry of human cytomegalovirus, analysis of Influenza A virus induced and modulated signalling, to systems biology approaches to study endocytosis, and secretion of Hepatitis C viruses, - just to name a few. The talks also showed a wide expertise in techniques covering a range from specialized life cell imaging at cutting edge speed and sensitivity, small molecule techniques, RNAi screens, to high resolution cryo electron microscopy.

Possibly with the help of the excellent Riesling served during the compulsory wine tasting, the meeting proved again to be a platform that stimulated interdisciplinary discussions, provided valuable feedback and served as a nucleation point for a number of new collaborations. We hope that next year's 8th workshop will be similarly successful – and in order to make it happen, we would like to emphasize and explicitly extend our invitation to all researchers in the fields of cell biology as well as pathogen modulated host cell behaviour to join us in autumn 2009, again in Deidesheim. The committed participation in the discussions by the cell biological keynote speakers was a clear sign that the covered aspects are by far not just of interest to virologists. We are sure that this series of workshops will continue to stimulate interactions between researchers, both, with cell biological and virological interest.

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*Dr. Mario Schelhaas*
*ETH Zurich*
*Institute of Biochemistry*
*Schafmattstr. 18, HPM E 10.2*
*CH-8093 Zurich*
*E-mail: mario.schelhaas@bc.biol.ethz.ch*