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# Swiss Science Concentrates

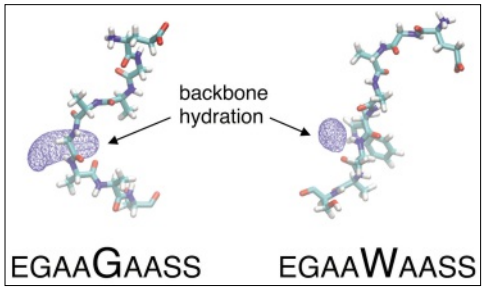
## A CHIMIA Column

Short Abstracts of Interesting Recent Publications of Swiss Origin

### Backbone Hydration Determines the Folding Signature of Amino Acid Residues

O. Bignucolo, H. T. A. Leung, S. Grzesiek, and S. Bernèche*, *J. Am. Chem. Soc.* **2015**, *137*, 4300. University of Basel

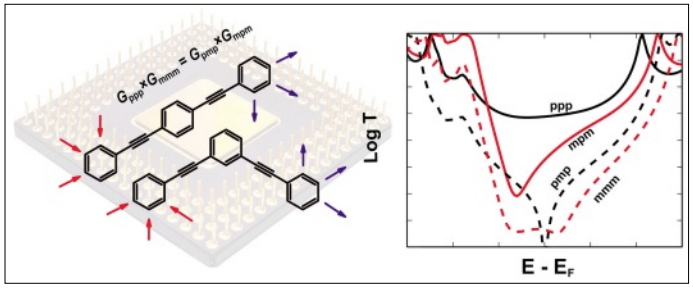
The relation between the sequence of a protein and its three-dimensional structure remains largely unknown. A lasting dream is to elucidate the side-chain dependent driving forces that govern the folding process. To better understand the underlying mechanism, the authors studied peptides of the sequence EGAAXAASS (X = Gly, Ile, Tyr, Trp) through comparison of molecular dynamics (MD) trajectories and NMR residual dipolar coupling (RDC) measurements. The RDC data for aromatic substitutions provide evidence for a kink in the peptide backbone. The simulations further reveal that the driving force leading to such helical-turn conformations arises from the lack of hydration of the peptide chain on either side of the bulky aromatic side chain, which can potentially act as a nucleation point initiating the folding process.




### A Quantum Circuit Rule for Interference Effects in Single-Molecule Electrical Junctions

D. Zsolt Manrique, C. Huang, M. Baghernejad, X. Zhao, O. A. Al-Owaedi, H. Sadeghi, V. Kaliginedi, W. Hong*, M. Gulcur, T. Wandlowski, M. R. Bryce*, and C. J. Lambert*, *Nat. Commun.* **2015**, *6*, 6389. University of Bern

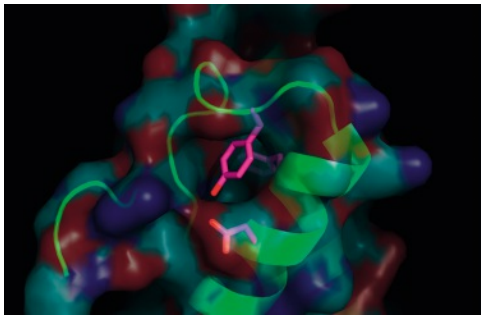
Detailed knowledge on the electrical conductance of single molecules is essential for the development of molecular-scale devices. The authors investigated the conductive properties of oligo(phenyleneethynylene)-type molecules possessing three aromatic rings of the type X-Y-X (X = pyridyl and Y = phenyl) with *para*-, *meta*- or *ortho*-connectivities by break junction techniques, DFT-based theory and analytic Green's functions. They find that the molecular conductances are related by a simple product rule and are particularly sensitive to quantum interference in the central ring (Y).




### Evolutionary Conserved Tyr169 Stabilizes the β2-α2 Loop of the Prion Protein

D. Huang* and A. Caflisch*, *J. Am. Chem. Soc.* **2015**, *137*, 2948. University of Zürich

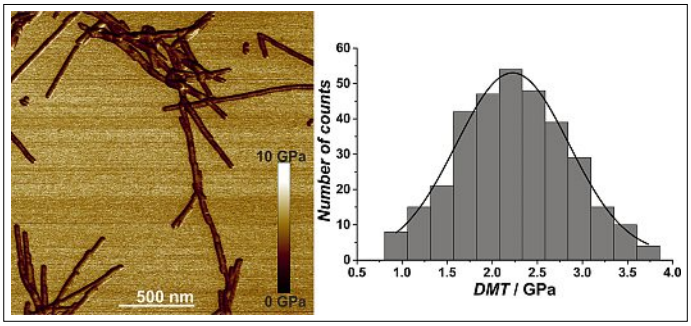
The function of the prion protein (PrP) in mammalians is not known. Experimental evidence indicates that the primary structure of the β2-α2 loop region influences the conversion from the cellular species (PrPC) to the β-sheet-rich aggregate. The authors have carried out MD simulations to investigate the local conformational polymorphism of the β2-α2 loop in the wild type prion protein and six single-point mutants. The simulations indicate that the strictly conserved Y169 in mammalian prion proteins stabilizes the $3_{10}$-helical turn in the β2-α2 loop, thus hindering the conversion to an aggregation-prone conformation.



### Influence of the β-Sheet Content on the Mechanical Properties of Aggregates during Amyloid Fibrillization

F. S. Ruggeri, J. Adamcik, J. S. Jeong, H. A. Lashuel, R. Mezzenga*, and G. Dietler*, *Angew. Chem. Int. Ed.* **2015**, *54*, 2462. EPF Lausanne and ETH Zürich

Amyloid fibrils are highly ordered insoluble protein aggregates related to human neurodegenerative diseases, such as *Parkinson's* and *Alzheimer's*. Mezzenga, Dietler and coworkers investigated the evolution of mechanical and structural properties of amyloidogenic structures formed during the fibrillization process using AFM and spectroscopic techniques. Their results reveal that the difference in the mechanical properties of oligomers and mature fibrils is due to an internal structural change from a random coil to a structure with increased β-sheet content. The findings are central to elucidate the stability, toxicity, and clearance of amyloid fibrils so that new therapeutic strategies could be developed to combat the onset of neurodegenerative disorders.




Prepared by Caroline D. Bösch, Markus Probst, Yuliia Vyborna, Mykhailo Vybornyi, Simon M. Langenegger and Robert Häner*

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