

## Polyelectrolytes and Biological Systems: A Charged Relationship

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If charges are appended to linear or crosslinked polymers, a polyelectrolyte results. Polyelectrolyte are ubiquitous and play a major role in biophysics. Important natural polyelectrolytes as e.g. DNA or Heparin are central in biology and a thorough understanding of these systems and of charge-charge interaction is one of the main tasks of biophysics.<sup>1</sup>

In my lecture I will discuss our recent research done on

- Interaction of linear polyelectrolytes with proteins.<sup>2,3</sup> This problem is also relevant for the formation of biocondensates by the interaction of cationic and anionic proteins.
- Charged polymer networks and their interaction with proteins<sup>4</sup>
- Role of polyelectrolytes in virus infection<sup>5,6</sup>

In all cases a quantitative understanding of the systems in terms of analytical models can be achieved which may pave the way for future pharmaceutical applications.

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<sup>1</sup> Achazi, K. *et al.* Understanding the Interaction of Polyelectrolyte Architectures with Proteins and Biosystems. *Angew Chem Int Ed Engl* **60**, 3882-3904 (2021). <https://doi.org:10.1002/anie.202006457>

<sup>2</sup> Walkowiak, J. J. & Ballauff, M. Interaction of Polyelectrolytes with Proteins: Quantifying the Role of Water. *Adv Sci* **8**, 2100661 (2021). <https://doi.org:ARTN 2100661 10.1002/adv.202100661>

<sup>3</sup> Malicka, W., Haag, R. & Ballauff, M. Interaction of Heparin with Proteins: Hydration Effects. *J Phys Chem B* **126**, 6250-6260 (2022).

<sup>4</sup> Freudenberg, U., Atallah, P., Sommer, J. U., Werner, C. & Ballauff, M. Analysis of the Binding of Cytokines to Highly Charged Polymer Networks. *Macromolecular Bioscience* **23** (2023). <https://doi.org:10.1002/mabi.202200561>

<sup>5</sup> Nie, C. A. X. *et al.* Polysulfates Block SARS-CoV-2 Uptake through Electrostatic Interactions\*\*. *Angew Chem Int Edit* **60**, 15870-15878 (2021).

<sup>6</sup> Nie, C., Sahoo, A. K., Netz, R. R., Herrmann, A., Ballauff, M. & Haag, R. Charge Matters: Mutations in Omicron Variant Favor Binding to Cells. *ChemBiochem* **23**, e202100681 (2022). <https://doi.org:10.1002/cbic.202100681>