The Zebrafish: An Emerging Preclinical Screening Tool for Nanomedicine Development

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A critical bottleneck in nanomedicine development is the transition from experimental systems to *in vivo* applications. *In vitro* experimental models are not able to mimic the physiological complexity of nano-bio-interactions at an organ level and to predict pharmacokinetic properties of nanomedicine therapeutics *in vivo*. The zebrafish emerged as a model in nanomedicine research offering the potential for an *in vivo* screening early in development. Our findings indicate that the zebrafish model is a useful tool for nanomedicines to increase the accuracy of predictions regarding nanomedicine fate and safety in higher animals [1, 2]. Results (*i.e.* systemic circulation, blood clearance by macrophages or targeting capacity) in the zebrafish model were highly predictive for experiments in rodents, thereby allowing an assessment of subtle formulation changes *in vivo* in a time- and cost-effective manner.

In contrast to the predictable pattern of organization, *i.e.* nanoparticle synthesis, *in vitro* cell culture screening, and *in vivo* rodent studies, the zebrafish model can be used as a screening platform to optimize nanomedicines *in vivo* and to select promising formulations for subsequent rodent studies. This approach facilitates the translation of the classical nanomedicine development process from an empirical approach to an optimization-by-design concept thereby addressing an unmet need in the field of nanomedicine drug discovery.

[1] S Sieber (2017) J. Control. Release. **264**, 180-191; [2] K Park (2017) J. Control. Release. **264**, 342

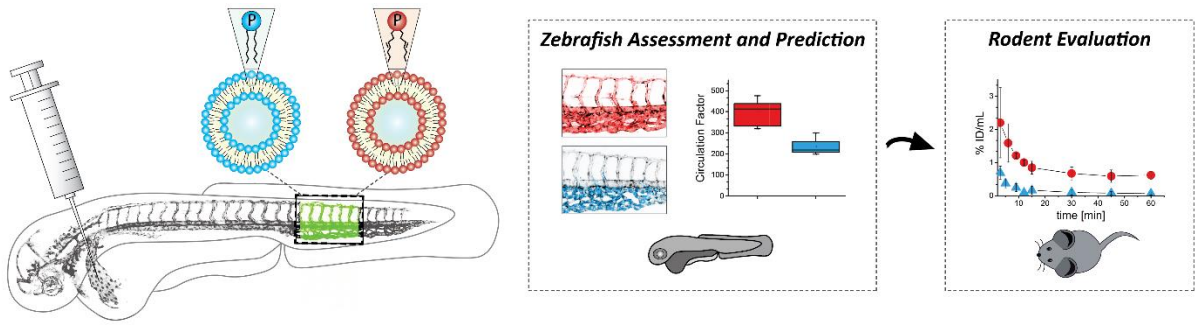

Figure 1: The zebrafish model is a useful vertebrate screening tool for nanomedicines to predict their pharmacokinetics in rodents.