BioSoft
Biophysics and Soft Matter

BIO Interfaces
International Graduate School
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HELMHOLTZ
Information & Data Science
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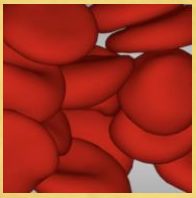
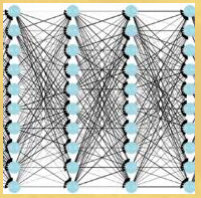
Digital Twins in the Life Sciences

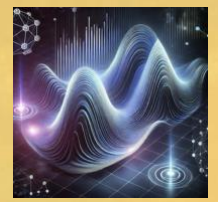
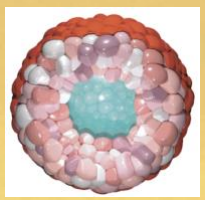
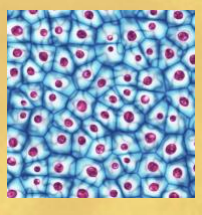
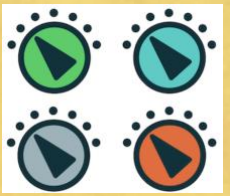
Lecture Series on Turning Raw Data into Dynamic Models

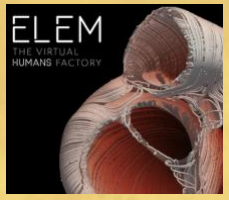
Digital twins are digital representations of physical objects, systems, or processes connected to their physical counterparts. This technology enables the creation of an accurate virtual model by integrating data and models, which can be monitored, optimized, and used to make predictions. The concept of digital twins has been initially used in engineering and manufacturing but has spread into other disciplines. Whereas a classical view of a digital twin requires bidirectional coupling to the physical twin, a somewhat looser definition is often found in life sciences. For example, the idea of virtual cohorts has been put forward, e.g., to generate biologically realistic data for a target population with a specific condition rather than for an individual. Various disciplines and research fields play central roles in digital twin technology, including artificial intelligence (AI), mechanistic physics-based modeling, the Internet of Things (IoT), big data, numerical simulation, and data analysis. A thorough engagement with the topic combines theoretical foundations with practical applications, fostering an interdisciplinary understanding.

Participants in the lecture series will get a structured introduction covering **data acquisition and processing**, **mechanistic approaches**, **data-driven approaches**, **study design,** and **legal and ethical aspects**, and learn about specific **challenges**, such as uncertainty handling, data leakage, and generalization of the models. Examples of **applications** from the viewpoints of informatics, biology, health, material research, chemistry, and physics will complete the series.





24.04. L. Geris (VPH Institute), Digital Twins in the Life Sciences
08.05. N. Jung (KIT), Acquisition, Processing, and Provision of Data
15.05. D. Fedosov (FZJ), Mechanistic Models
22.05. S. Rulands (LMU Munich), Data-driven Models
05.06. C. Niklas (Heidelberg University Hospital), Building Trust in Medical Digital Twins
26.06. V. Fortuin (Helmholtz AI), Uncertainty Quantification in Machine Learning
10.07. D. Iber (ETH Zürich), Building Digital Twins of Development and Disease
17.07. F. J. Theis (Helmholtz AI), Towards a Virtual Cell (The lecture starts at 1:30 pm.)
24.07. P. Friederich (KIT), Bayesian Optimization for Digital Twins
31.07. S. Speidel (TU Dresden), Next-Generation Surgery
07.08. J. Aguado-Sierra (ELEM Biotech), The Virtual Humans Factory

The lectures usually take place on Thursdays from 2:00 pm to 3:30 pm CEST!
Further details and up-to-date information in case of changes: https://events.hifis.net/e/dt2025

Registration is mandatory. Please register using the short link below. You will receive a registration confirmation that contains a personalized Zoom link, which will be valid for all meetings of the lecture series—save the meeting link!

https://events.hifis.net/e/dt2025

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