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UNIVERSITY OF CHEMISTRY  
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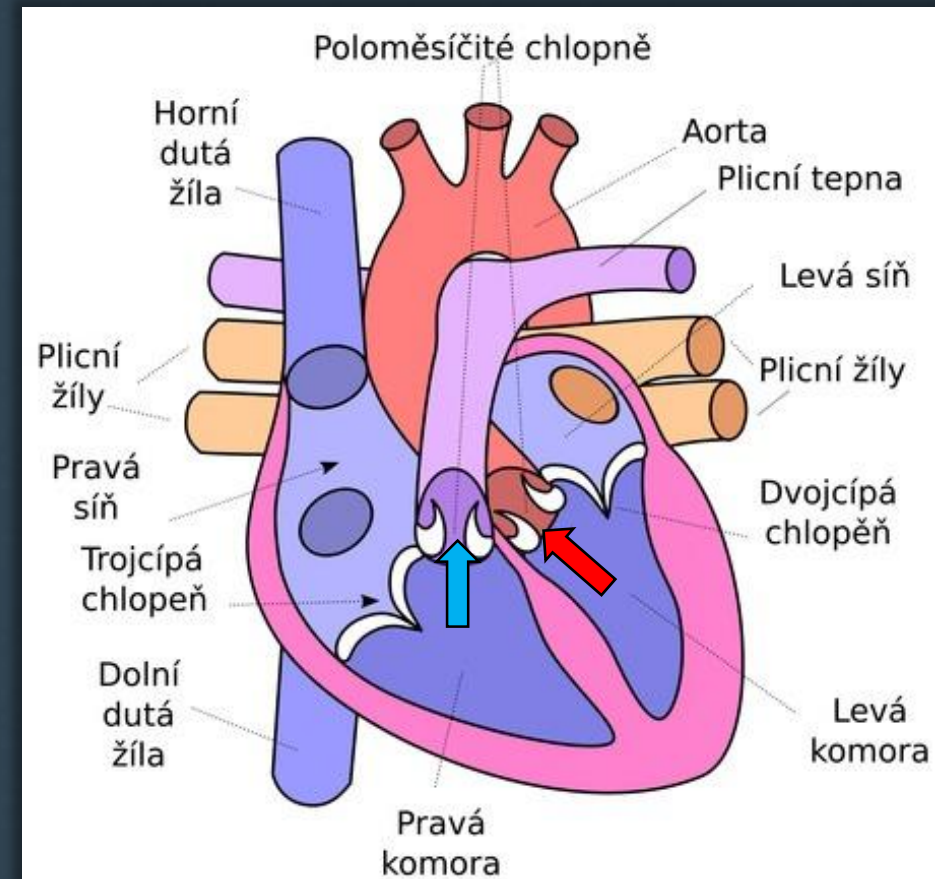
# Modeling of Nanoparticle Motion in a Simple Heart Model

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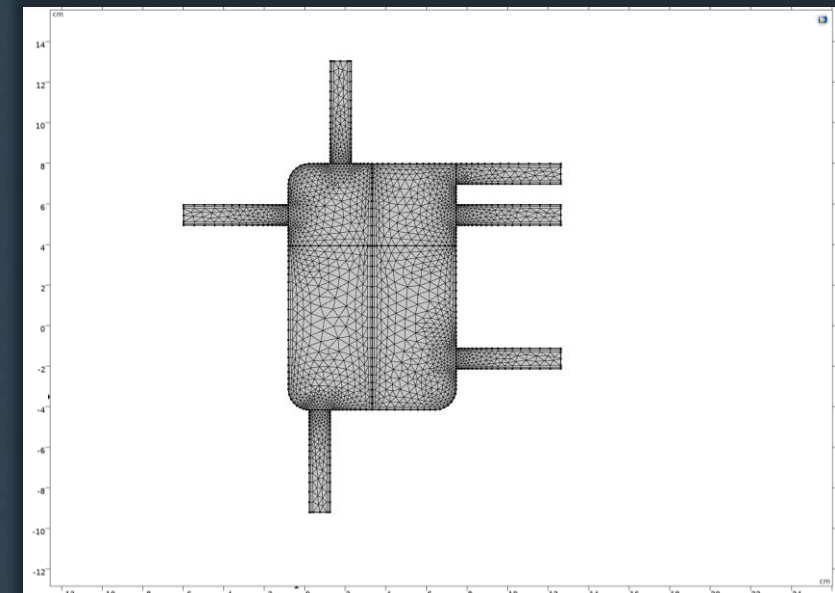
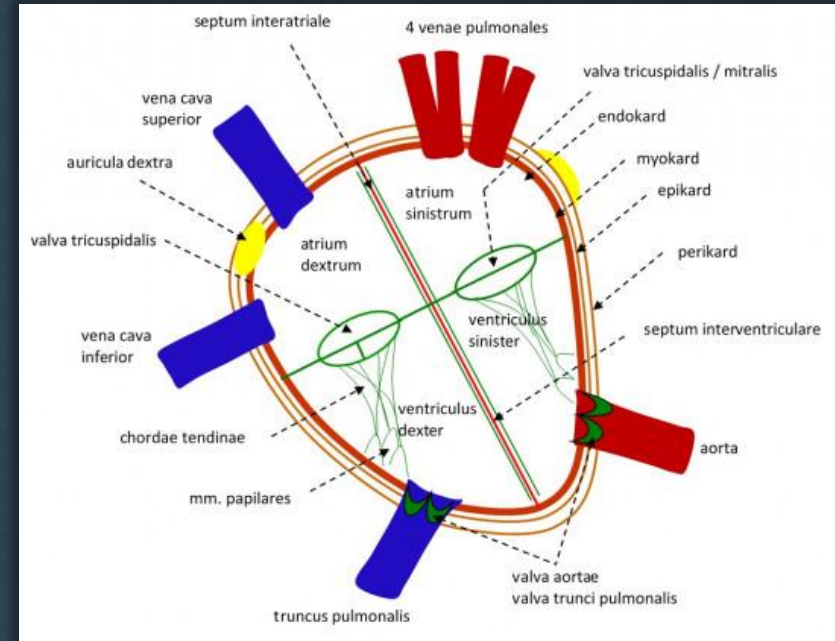
# Introduction

- Cardiovascular disease - Drug delivery system
- Medicinal nanoparticles – carriers (hydrogels, liposomes, etc.)
  - Ability to bind to active sites
  - Site-specific, target-oriented delivery and controlled drug release



# COMSOL Multiphysics

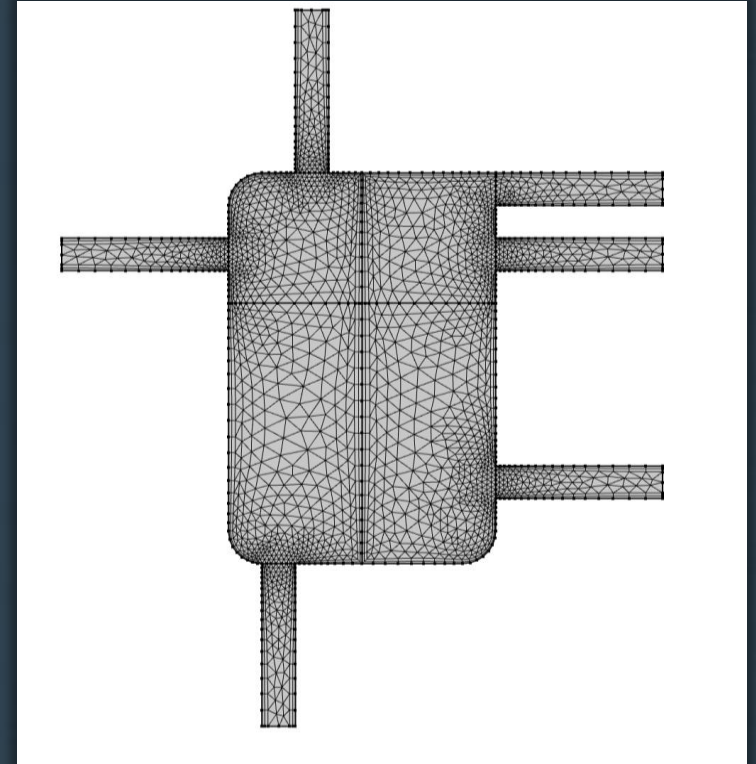
- Using geometry to build a 2D model (cm)
- Material – blood (according to the COMSOL material library)
- Physics:
  - *Transport of Diluted Species, Laminar Flow* – flow detection
  - *Particle Tracing for Fluid Flow* – particle movement



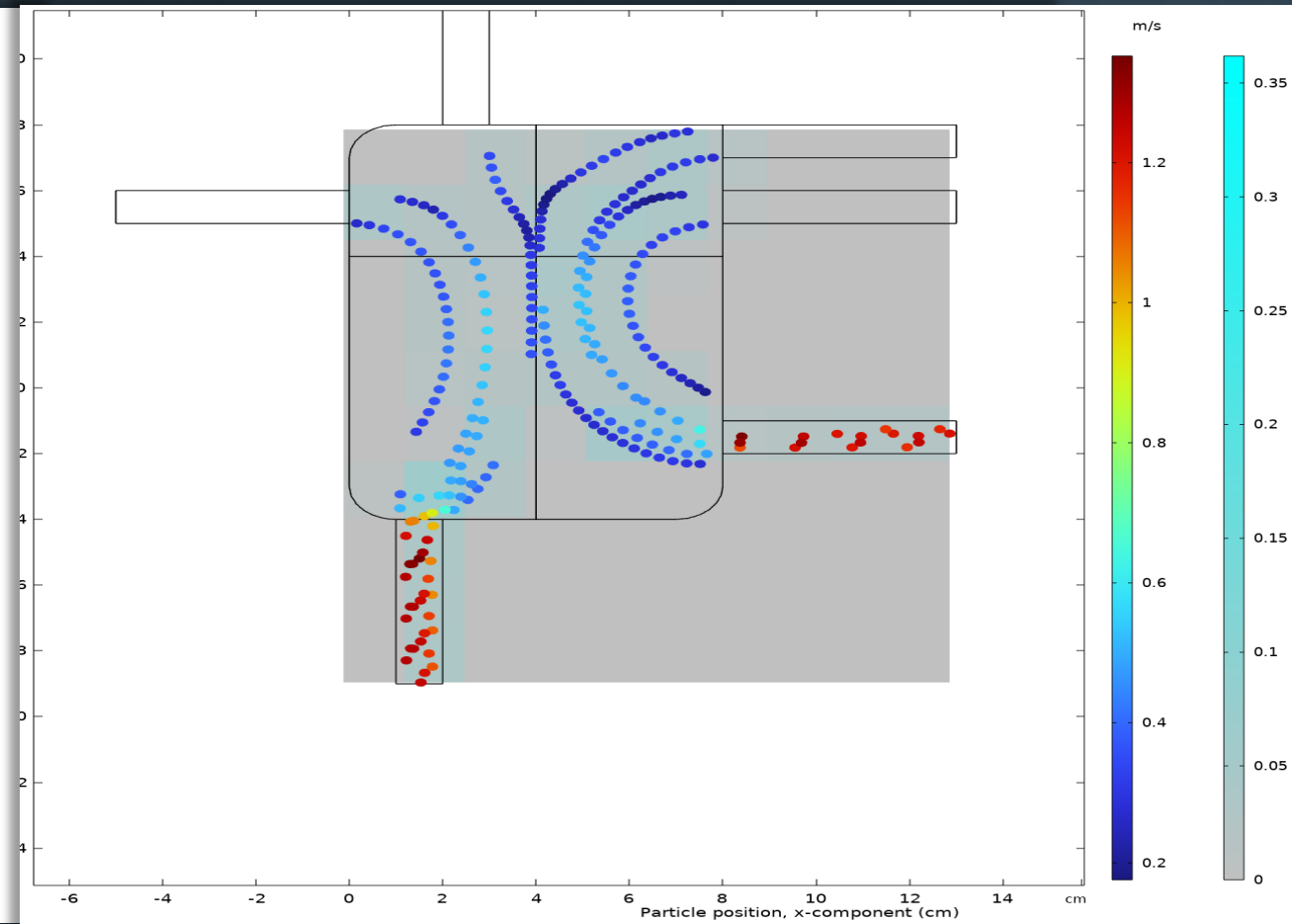
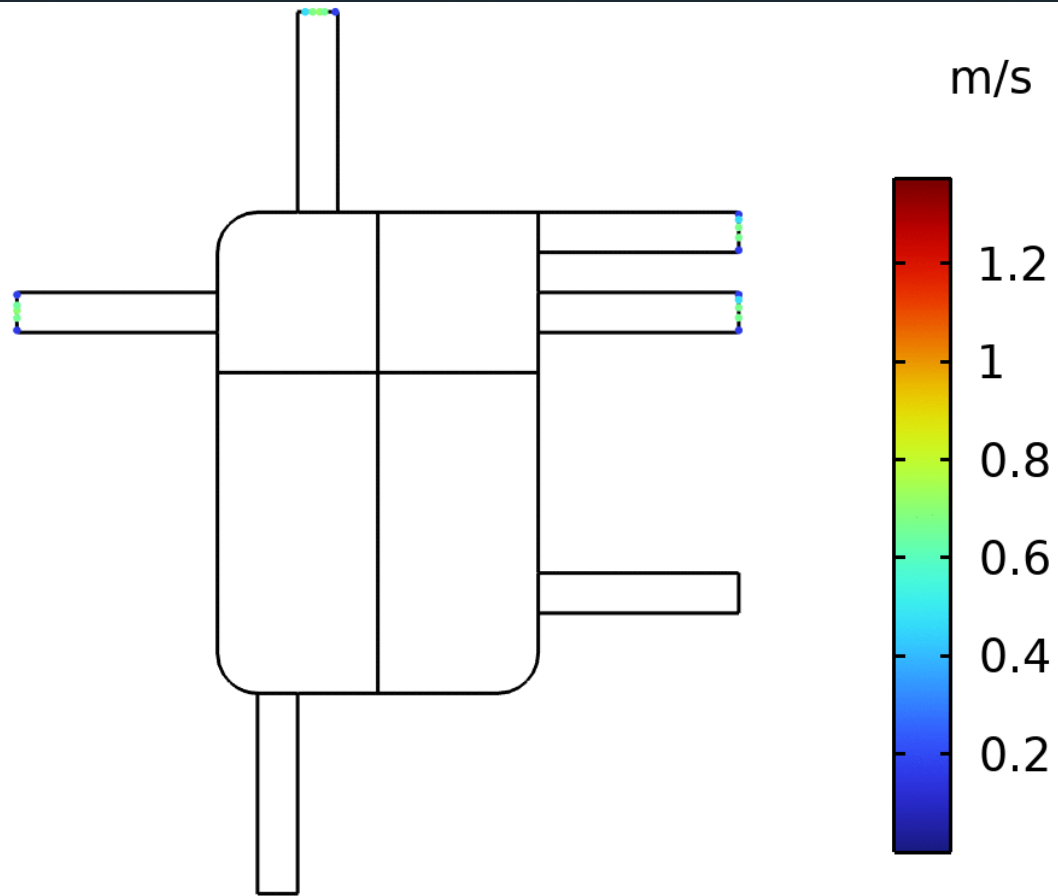
# COMSOL Multiphysics

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- As part of the settings
  - Temperature – 309.55 K
  - Flow rate – 0.5 m/s
  - Diffusion coefficient –  $1 \cdot 10^{-3} \text{ m}^2/\text{s}$
- Use of *Interior Wall* – necessity of other physics (e.g. *Heat Transfer*)



# Simulation



# Conclusion

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- Advantage – possibility of adjusting the model according to needs
- Disadvantage – time-consuming to model an individual living system (details)
  
- 3D heart model with active sites
  - Modeling of the affected site
  - Possibility of attaching different nanoparticles depending on the type of disorder and affinity
  - Tracking of flow deformation depending on heart motion
  - Dependence of flow on heart activity

Thank you for your attention

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