The Future of Mechanics

A Workshop on the Future of Mechanics
was held at the IUTAM Business Meeting at
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The following presentation was given by
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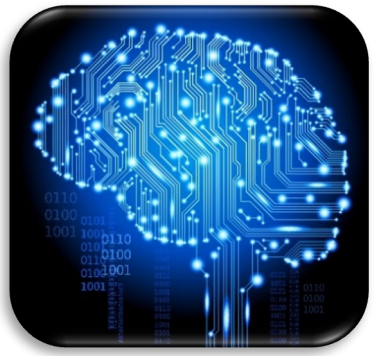
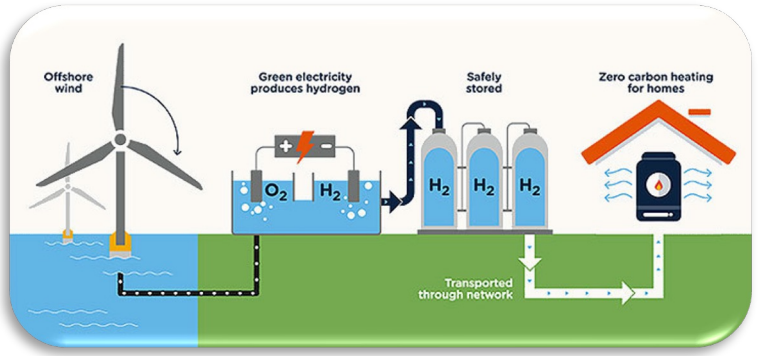
The Future of Mechanics - Opportunities

What are the main opportunities in the field of mechanics?
Many exciting "new" science and technologies - Examples

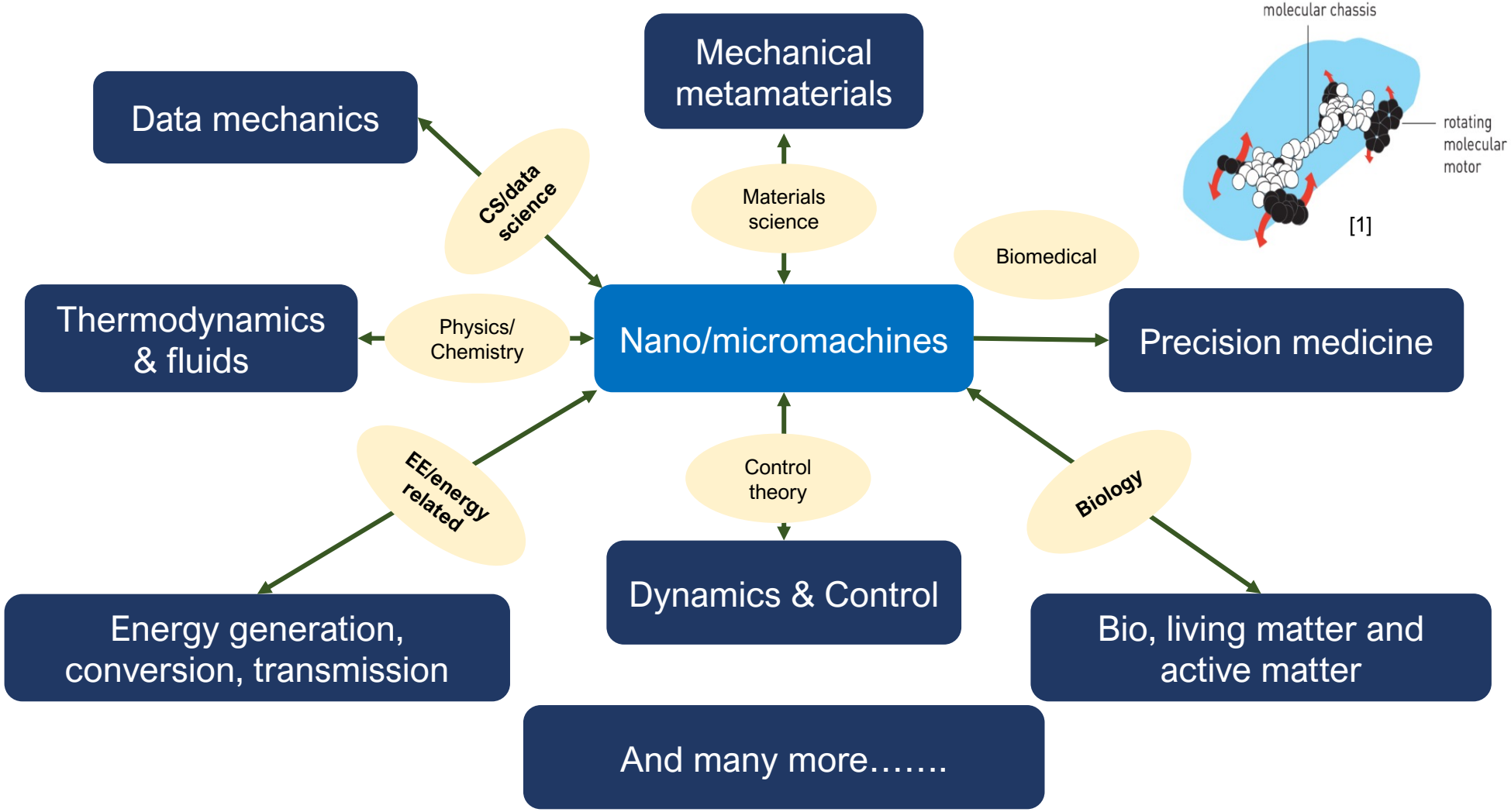
- **Energy and Environment Mechanics**
  - *Clean energy transition*
  - *Resilience/Disaster management due to climate change*
- **Data Mechanics**
  - *Data-driven (machine learning, embedded sensing) without/with physics-informed modelling*
  - *Automated physics discovery from data; modern solvers combined with modern computing architectures*
- **Bio, living matter and active matter**
  - *Mechanics of biological cells/tissues for new medical treatments & disease prevention*
  - *Evolution of the material structures of bodies/tissues (growth, fracture, healing, defects)*
- **Additive manufacturing and other topics**
  - *Microscopic composition & macroscopic properties of materials*
  - *Complex fluids/ soft solids*





New Science/Technology Example: Nano/micromachines-nano/micromotors and interconnected opportunities

The Nobel Prize in Chemistry 2016 was awarded jointly to Jean-Pierre Sauvage, Sir J. Fraser Stoddart and Bernard L. Feringa "for the design and synthesis of molecular machines“. Like heat engines/electric motors, nano/micromotors are self-propelled and self-contained machines controlling key mechanical elements (directional motion, force, energy conversion).



The Future of Mechanics – Challenges

What are the main challenges for the field of mechanics?

- New talent
- Diversity, equity & inclusion
- Increased simulation power/machine learning without losing mechanics fundamentals
- Complex systems
  - Non-linearity; randomness; high-dimensionality; complex individual/collective dynamics; interdisciplinarity
- Uncertainties
  - Quantitative estimation (system/model-inherent)
  - Consideration in experiments, numerical simulations, models