



# AUCKLAND BIOENGINEERING INSTITUTE

THE UNIVERSITY OF AUCKLAND  
NEW ZEALAND

Te Whare Wananga o Tamaki Makaurau

By Randall Britten

ABI Software Laboratory  
Project:  
Course:  
Date:  
Author:



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Te Whare Wānanga o Tāmaki Makaurau

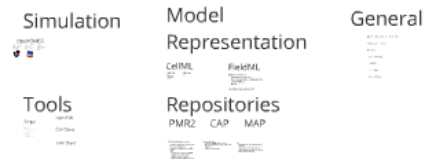
By Randall Britten

ABI Software Laboratory

Projects  
Recent progress  
Future roadmap

# ABI Software Laboratory

## Projects



## Recent progress

## Future roadmap

# Projects

## Simulation



## Model Representation

CellML

CellML API  
CellML Spec

FieldML

FieldML v1.0 Enclosed  
- External data, text, HTML  
- Multi-element shapes and interpolation  
- Support for library  
- Support

Uncertainty representation draft

## General

- BATS - Build and Test Server
- Physiome Tracker
- GitHub
- OpenCMISS
- PMR2
- FieldML
- OpenCOR

## Tools



- OpenCOR
- CAP Client
- MAP Client

## Repositories

PMR2 CAP MAP

Mykamu Model Repository collection  
- Software and/or model or both used for testing or validation  
- Can only be used for CellML models  
- API  
- Model format supporting CellML, SBML, and/or other model formats  
- Model version management  
- Metadata (e.g. license, author, etc.)

Recent developments  
- Support for FieldML generation format  
- Doi-based content for FieldML for models  
- Metadata  
- Business requirements

Tool  
- Support for data visualization and data flow  
- Support for business logic and data flow  
- Support for data flow and data flow

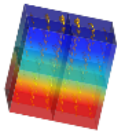
# Simulation

## OpenCMISS

- Multi-scale, multi-physics simulation.
- Spatial-temporal simulation of regions (right, left, ventricle, atrium, pericardium, interconnects).
- Targeted at any large HPC architectures, shared and distributed memory architectures, accelerator systems.

- Currently supports for the following problem types:
  - Laplace, Poisson, linear elasticity, heat conduction, advection-diffusion, fluid dynamics (Navier-Stokes, Stokes flow, Darcy flow), electrophysiology.
- Both static and dynamic, linear and nonlinear.

- Recent work:
  - Python interface
  - Contact mechanics
  - Interfacing
  - Further electro-physiology progress
  - CFD: 1D branching Navier-Stokes, Resizable flow, collision with analytical solutions.
  - FEM/ML/CA support
  - Gethub
  - Maintenance

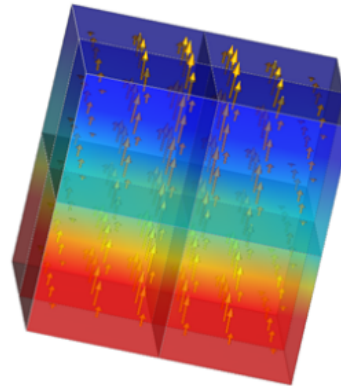
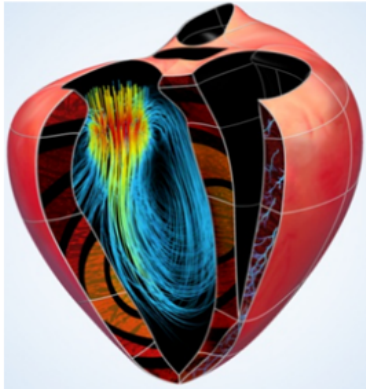



# OpenCMISS

- Multi-scale, multi-physics simulation.
- Spatio-temporal simulation of organs (rigid; soft tissue; fluids, porous tissue, interactions)
- Targeted at multiple HPC architectures, shared and distributed memory architectures, accelerated systems.

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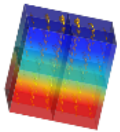
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- Recent work:
  - Python interface
  - Contact mechanics
  - Interfacing
  - Further electro-physiology progress
  - CFD: 1D branching Navier-Stokes, Pressure flow, collision with a rigid wall.
  - FEM/MLA support
  - Gmsh
  - Miscellaneous



# CellML API

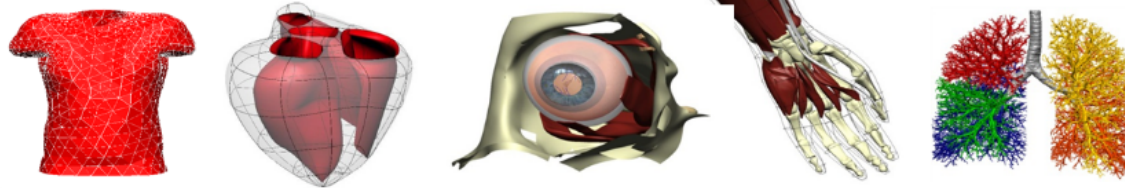
Recent progress:

- Release of version 1.9 and version 1.10
- First binary release
- Some SED-ML support ... Simulation Service
- Text input service
- Other incremental improvements
- Draft randomness/uncertainty in models (VPH-Share project)
- Draft of CellML 1.2

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# Cmgui



Recent progress:

- Cmgui 2.8 released
- Cmgui API
- APIs for regions, fields, materials, time
- Fitting and optimisation
- Groups/Regions refactoring
- CAD
- Tetrahedral meshing
- FieldML 0.4 support
- Zinc on other browsers
- Buildbot usage
- Much maintenance and refactoring

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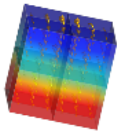
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# Projects

## Simulation



## Model Representation

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- Multi-element shapes and interpolation  
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Uncertainty representation draft

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## Tools



- OpenCOR
- CAP Client
- MAP Client

## Repositories

PMR2 CAP MAP

Mykamu Model Repository collection  
- Software and/or data for use in the repository  
- Can only be used for the CellML model  
- API  
- Model format supporting, HTML, XML, JSON, and/or CSV (or other)  
- Model version management  
- Metadata (e.g. license, author, etc.)

Recent developments  
- Support for the CellML generation format  
- The latest version of the CellML API  
- Metadata

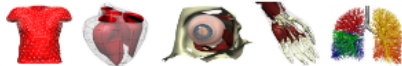
Tool  
- Support for the generation of the CellML API  
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# Tools

OpenCOR

Cmgui



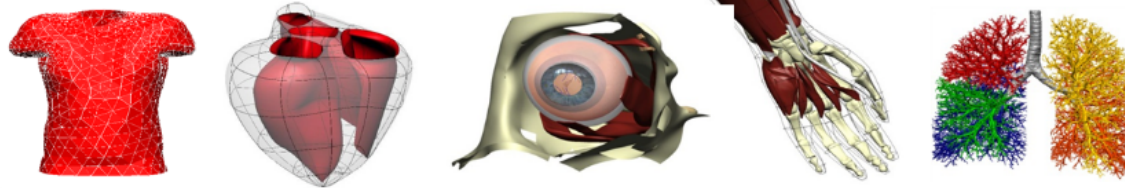
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## Simulation



## Model Representation

### CellML

CellML API  
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### FieldML

FieldML v0.4 Enclosed  
- External data, text, HTML  
- Multi-element shapes and interpolation  
- objects in library  
- Import

Uncertainty representation draft

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## Repositories

- PMR2
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Mykamu Model Repository collection  
- Software and/or model or both, some for testing or development  
- Can only be used locally for CellML models  
- API  
- Model format supporting: CellML, SBML, SBML-qual, SBML-qual (CellML), SBML-qual (CellML), SBML-qual (CellML), SBML-qual (CellML)  
- Metadata (name, version, date, etc.)  
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Recent developments  
- Support for FieldML generation format  
- Doi viewer (linked to doi page for model)  
- Metadata  
- Metadata

Tool  
- Support for data visualization and  
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Nonlinear  
- Model of a cell (2011-12-15)  
- CellML API  
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CellML Spec

- CellML 1.0 API  
- CellML 1.0 API

## FieldML

FieldML v0.4 released

- External data, text, HDF5
- More element shapes and interpolation options in library
- Import

Uncertainty representation draft

Repositories

# CellML

## CellML API

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- CellML 1.0  
- CellML 1.1

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Repositories



# Repositories

PMR2

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## Physiome Model Repository software

- Software to be deployed on web server for running a model repository
- Currently: Historically focused on CellML models
- Aims:
  - Broader format support (e.g. FieldML, SBML, Image data (DICOM) etc.)
  - Reliable version management
  - Metadata aware searching and model discovery

## Recent developments

- Support for FieldML precursor format
- Zinc Viewer embedded in web page for model.
- Maintenance
- Rudimentary webservices

## Next

- Better Meta-data annotation indexing and searching
- Support for broader range of data and artifacts related to models, e.g. image data, demonstration multi-media.

PMR2



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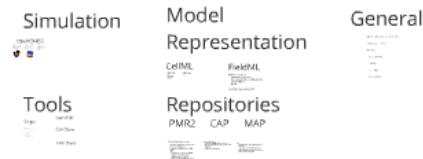
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