# What's next for PMR2

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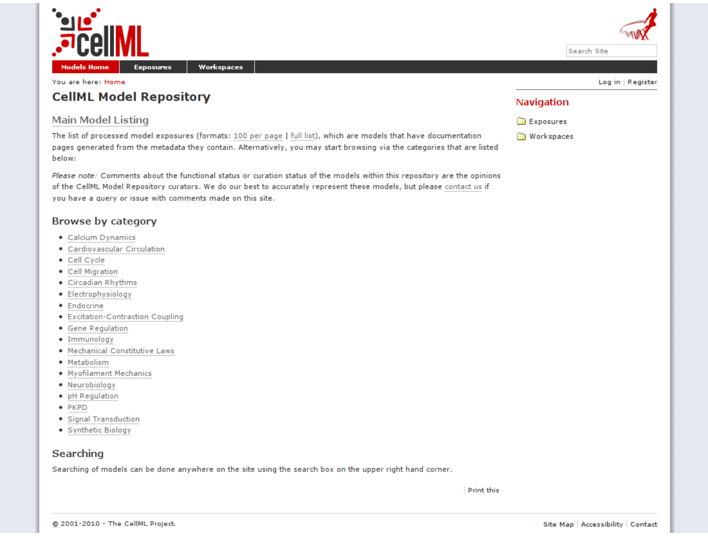
# What does PMR2 have now?

- Integrated Mercurial for storage of models.
  - Embedded workspaces.
- Uses Plone for presentation and content management.
  - Also user access control.
- Provide a presentational interface that is customizable and extensible through plugins through the Zope Component Architecture.

# PMR2 was planned for

- The CellML model repository.
- A repository of other types of models, next up will most likely be FieldML support (cmgui/zinc viewer).
- Ultimately it will fulfill its role as The Physiome Model Repository.



You are here: Home

**CellML Model Repository**

**Main Model Listing**

The list of processed model exposures (formats: 100 per page | full list), which are models that have documentation pages generated from the metadata they contain. Alternatively, you may start browsing via the categories that are listed below:

*Please note:* Comments about the functional status or curation status of the models within this repository are the opinions of the CellML Model Repository curators. We do our best to accurately represent these models, but please contact us if you have a query or issue with comments made on this site.

**Browse by category**

- Calcium Dynamics
- Cardiovascular Circulation
- Cell Cycle
- Cell Migration
- Circadian Rhythms
- Electrophysiology
- Endocrine
- Excitation-Contraction Coupling
- Gene Regulation
- Immunology
- Mechanical Constitutive Laws
- Metabolism
- Myofilament Mechanics
- Neurobiology
- pH Regulation
- PKPD
- Signal Transduction
- Synthetic Biology

**Searching**

Searching of models can be done anywhere on the site using the search box on the upper right hand corner.

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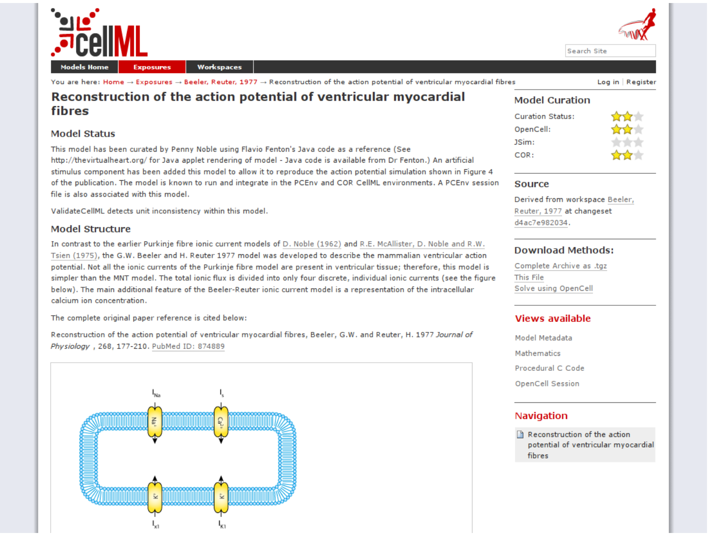


You are here: Home → Exposures → Beeler, Reuter, 1977 → Reconstruction of the action potential of ventricular myocardial fibres

**Reconstruction of the action potential of ventricular myocardial fibres**

**Model Status**

This model has been curated by Penny Noble using Flavio Fenton's Java code as a reference (See http://thevirtualheart.org/ for Java applet rendering of model - Java code is available from Dr Fenton.) An artificial stimulus component has been added this model to allow it to reproduce the action potential simulation shown in Figure 4 of the publication. The model is known to run and integrate in the PCEnv and COR CellML environments. A PCEnv session file is also associated with this model.

ValidateCellML detects unit inconsistency within this model.

**Model Structure**

In contrast to the earlier Purkinje fibre ionic current models of D. Noble (1962) and R.E. McAllister, D. Noble and R.W. Tsien (1975), the G.W. Beeler and H. Reuter 1977 model was developed to describe the mammalian ventricular action potential. Not all the ionic currents of the Purkinje fibre model are present in ventricular tissue; therefore, this model is simpler than the MNT model. The total ionic flux is divided into only four discrete, individual ionic currents (see the figure below). The main additional feature of the Beeler-Reuter ionic current model is a representation of the intracellular calcium ion concentration.

The complete original paper reference is cited below:

Reconstruction of the action potential of ventricular myocardial fibres, Beeler, G.W. and Reuter, H. 1977 *Journal of Physiology* , 268, 177-210. PubMed ID: 874889

**Model Curation**

Curation Status: ★★☆
OpenCell: ★★☆
JSim: ☆☆☆
COR: ★★☆

**Source**

Derived from workspace Beeler, Reuter, 1977 at changeset d4ac7e982034.

**Download Methods:**

Complete Archive as .tgz
This File
Solve using OpenCell

**Views available**

Model Metadata
Mathematics
Procedural C Code
OpenCell Session

**Navigation**

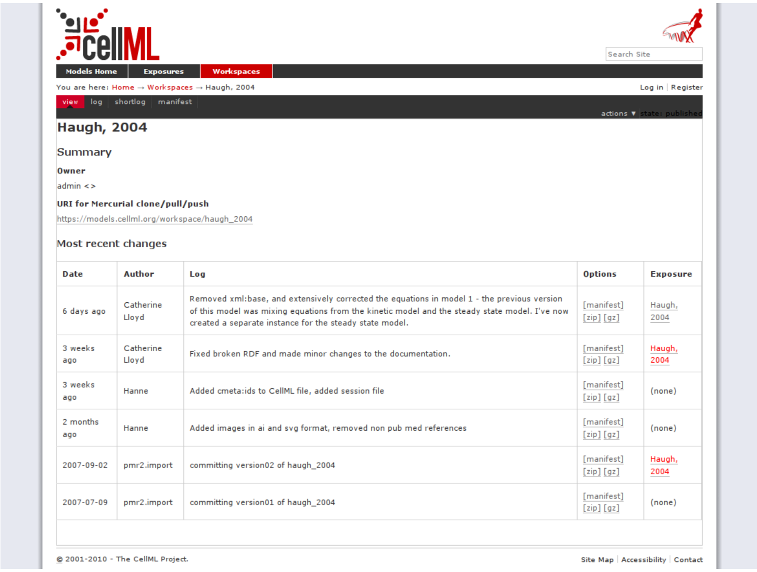
Reconstruction of the action potential of ventricular myocardial fibres

# Recent new features

- User workspaces.
  - This allows user to create their own workspaces of any name.
  - Implemented; will be released in v0.3.
- Exposure File Notes.
  - Implemented as plugins for PMR2, they provide the views and its creation methods for specific file formats.
  - Implemented; released in v0.2.

# User workspaces

- Every users of PMR2 can create workspaces in their user workspace folder.
- This eliminates workspace name clashes.
- Can support forking of models in the future if needed.



Haugh, 2004

Summary

**Owner**

admin < >

**URI for Mercurial clone/pull/push**

https://models.cellml.org/workspace/haugh_2004

Most recent changes

| Date | Author | Log | Options | Exposure |
|---|---|---|---|---|
| 6 days ago | Catherine Lloyd | Removed xml:base, and extensively corrected the equations in model 1 - the previous version of this model was mixing equations from the kinetic model and the steady state model. I've now created a separate instance for the steady state model. | [manifest] [zip] [gz] | Haugh, 2004 |
| 3 weeks ago | Catherine Lloyd | Fixed broken RDF and made minor changes to the documentation. | [manifest] [zip] [gz] | Haugh, 2004 |
| 3 weeks ago | Hanne | Added cmeta:ids to CellML file, added session file | [manifest] [zip] [gz] | (none) |
| 2 months ago | Hanne | Added images in ai and svg format, removed non pub med references | [manifest] [zip] [gz] | (none) |
| 2007-09-02 | pmr2.import | committing version02 of haugh_2004 | [manifest] [zip] [gz] | Haugh, 2004 |
| 2007-07-09 | pmr2.import | committing version01 of haugh_2004 | [manifest] [zip] [gz] | (none) |

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# Exposure presentational plugins

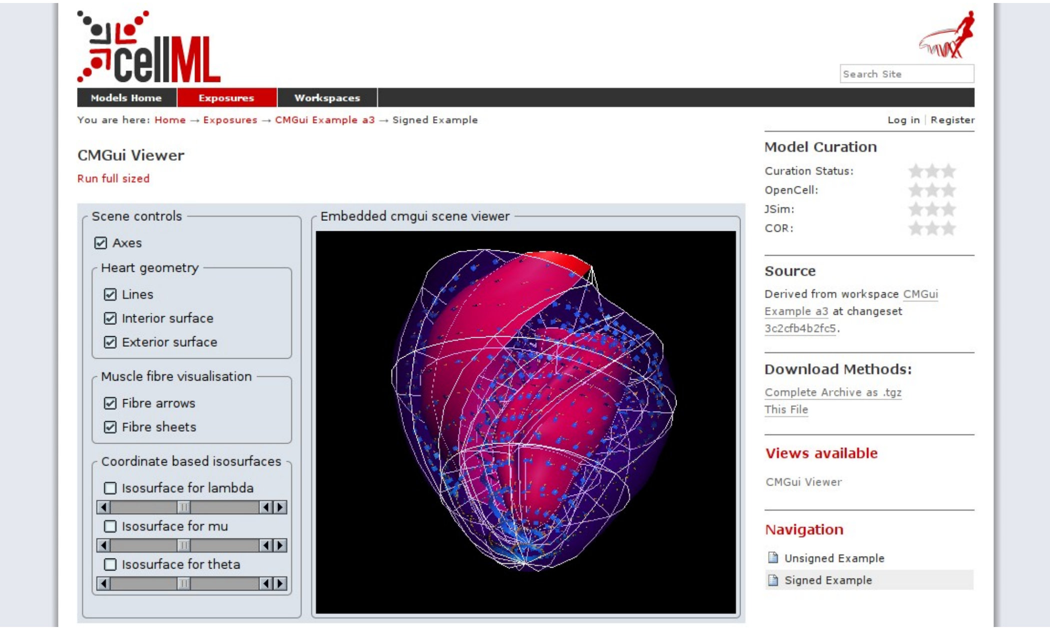
- There may be types of model (files) in the repository.
- Each of these files will then be "built", with notes (Exposure File Notes) attached to them.
- These notes provide storage for the generated data; viewers can be customized to render this data.
- Built on top of Zope's annotation module.
- Utilizes the Zope Component Architecture, which makes heavy use of the adapter pattern.
- This makes it relatively easy to add new plugins to improve the presentation of existing models or other model types.

# Example Zope configuration file.

```
<configure
    xmlns="http://namespaces.zope.org/zope"
    xmlns:browser="http://namespaces.zope.org/browser"
    i18n_domain="fieldml">
  <adapter
      for="pmr2.app.content.interfaces.IExposureFile"
      factory=".CMGuiViewerNoteFactory"
      provides="fieldml.pmr2.interfaces.ICMGuiViewerNote"
      name="cmgui_viewer"
      />
  <utility
      name="cmgui_viewer"
      component=".annotator.CMGuiViewerAnnotatorFactory"
      provides="pmr2.app.annotation.interfaces.IExposureFileAnnotator"
      />
  <browser:page
      for="pmr2.app.content.ExposureFile"
      name="cmgui_viewer"
      class=".browser.CMGuiViewerView"
      permission="zope2.View"
      />
</configure>
```

# Improving presentation of models

- The ZCML file in the previous slide was from the plugin that enabled this Zinc viewer view for exnode model files.
- In the future FieldML will be used instead.



You are here: Home → Exposures → CMGui Example a3 → Signed Example

**CMGui Viewer**

Run full sized

Scene controls
- ☑ Axes

Heart geometry
- ☑ Lines
- ☑ Interior surface
- ☑ Exterior surface

Muscle fibre visualisation
- ☑ Fibre arrows
- ☑ Fibre sheets

Coordinate based isosurfaces
- ☐ Isosurface for lambda
- ☐ Isosurface for mu
- ☐ Isosurface for theta

Embedded cmgui scene viewer

**Model Curation**

Curation Status:
OpenCell:
JSim:
COR:

**Source**

Derived from workspace CMGui Example a3 at changeset 3c2cfb4b2fc5.

**Download Methods:**

Complete Archive as .tgz
This File

**Views available**

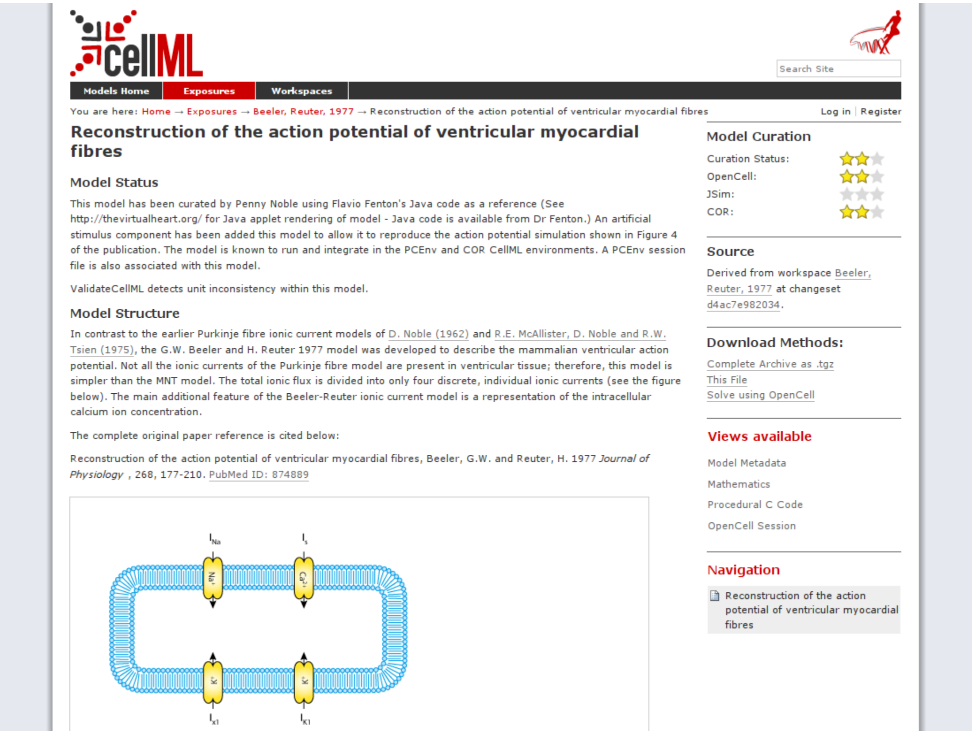
CMGui Viewer

**Navigation**

Unsigned Example
Signed Example

# Improving presentation of models

- Currently, exposures are just a rendering of simple, free formatted text with static images.



You are here: Home → Exposures → Beeler, Reuter, 1977 → Reconstruction of the action potential of ventricular myocardial fibres

## Reconstruction of the action potential of ventricular myocardial fibres

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### Model Curation

| | |
|---|---|
| Curation Status: | ★★☆ |
| OpenCell: | ★★☆ |
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### Source

Derived from workspace Beeler, Reuter, 1977 at changeset d4ac7e982034.

### Download Methods:

Complete Archive as .tgz
This File
Solve using OpenCell

### Views available

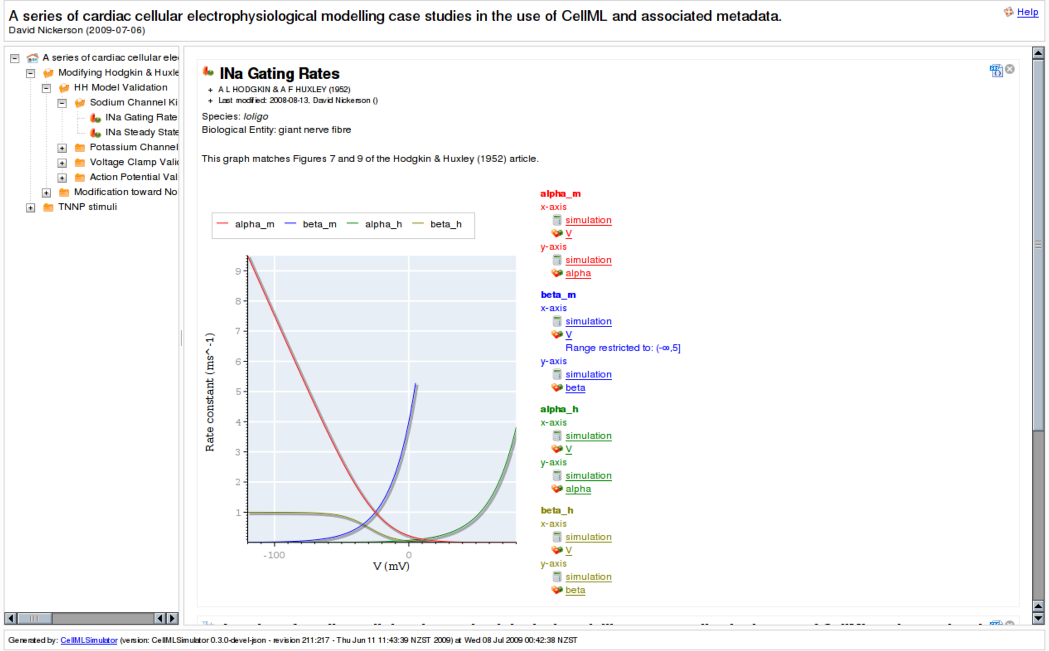
Model Metadata
Mathematics
Procedural C Code
OpenCell Session

### Navigation

Reconstruction of the action potential of ventricular myocardial fibres

# Improving presentation of models

- Through the exposure plugin system, it is possible to implement and integrate an interactive model viewer, such as CellMLSimulator.



A series of cardiac cellular electrophysiological modelling case studies in the use of CellML and associated metadata.
David Nickerson (2009-07-06)

**INa Gating Rates**

+ A L HODGKIN & A F HUXLEY (1952)
+ Last modified: 2008-08-13, David Nickerson ()

Species: *loligo*
Biological Entity: giant nerve fibre

This graph matches Figures 7 and 9 of the Hodgkin & Huxley (1952) article.

**alpha_m**
x-axis
simulation
V
y-axis
simulation
alpha

**beta_m**
x-axis
simulation
V
Range restricted to: (-∞,5]
y-axis
simulation
beta

**alpha_h**
x-axis
simulation
V
y-axis
simulation
alpha

**beta_h**
x-axis
simulation
V
y-axis
simulation
beta

Generated by: CellMLSimulator (version: CellMLSimulator 0.3.0-devel-json - revision 211:217 - Thu Jun 11 11:43:39 NZST 2009) at Wed 08 Jul 2009 00:42:38 NZST

# Searching in PMR2

- Default search engine in Plone limits to text, meaning the RDF metadata within the file is ignored.
- So we will introduce RDF store, and support SPARQL for querying.
- Also provide pre-made search templates so users would not need to construct those SPARQL statements.
- This however depends on a more standardized metadata specification.

# Web service access

- JSON/XMLRPC access to repository to gather information about workspaces/exposures.
- Thus other programs and/or websites can access the data stored in PMR2 through this machine friendly interface.
- Query any saved simulation results.

# Fin

- Thank you for your attention.