

# From stars to flags: how we rate a model

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# Stars



A star system denotes the curation status of a model



Not curated



Maths consistent with the published paper



No typos, units consistent, model complete, not over-constrained, and reproduces the published results;



Model satisfies physical constraints – eg conservation of mass, momentum, charge, etc.

## But... we have problems

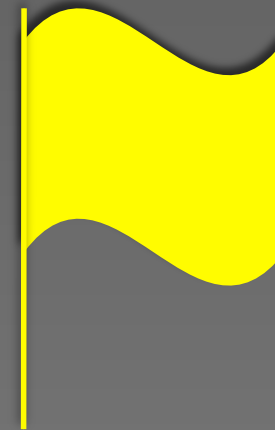


- 1 star and 2 stars are mutually exclusive



- 3 star curation status can only be awarded by a “domain expert”, who is not the model author themselves – which limits the number of 3 star models

# Replacing stars with flags




MIRIAM

Minimum Information Requested In the  
Annotation of Models

# MIRIAM based flags

Application of the MIRIAM Standard as the CellML model curation flags							
	Tyson 1991	Goldbeter 1991	Noble 1998	Sneyd 2004	Cooling 2007	Ostby 2008	Lovell 2004
<b>REFERENCE CORRESPONDENCE</b>							
Is the model encoded in a public, standardized, machine-readable format?	yes	yes	yes	yes	yes	yes	yes
Does the model comply with the standard in which it is encoded?	yes	yes	yes	no	yes	no	yes
Does the model clearly relate to a single reference description. If the model is composed from different parts is there a description of the derived/combined model?	yes	yes	yes	yes	yes	yes	yes
Does the encoded model structure reflect the processes listed in the reference description?	yes	yes	yes	yes	yes	yes	yes
Is the model instantiated in a simulation: if it is are all quantitative attributes defined, including initial conditions?	yes	yes	yes	no	yes	yes	no
When instantiated, does the model reproduce all results given in the reference description within an epsilon (algorithms, round-up errors)?	yes	yes	yes	no	yes	yes	no
<b>ATTRIBUTION ANNOTATION</b>							
Is the model named?	yes	yes	yes	yes	yes	yes	yes
Is there a citation of the reference description associated with the model (complete citation, unique identifier, unambiguous URL)? Note that this citation should allow identification the authors of the model.	yes	yes	yes	yes	yes	yes	yes
Are the name and contact of the model creators joined?	yes	yes	yes	yes	yes	yes	yes
Are the date and time of creation and last modification specified?	yes	yes	yes	yes	yes	yes	yes
Is the model linked to a precise statement about the terms of distribution?	yes	yes	yes	yes	yes	yes	yes
<b>EXTERNAL RESOURCE ANNOTATION</b>							
Are all the model components unambiguously identified (annotated with external resources)	n/a	n/a	n/a	n/a	n/a	n/a	n/a
Is this annotation refined/is there a qualifier?	n/a	n/a	n/a	n/a	n/a	n/a	n/a
Does the annotation use MIRIAM URIs?	n/a	n/a	n/a	n/a	n/a	n/a	n/a
- Is the identifier analysed within the framework of the data type?	n/a	n/a	n/a	n/a	n/a	n/a	n/a
<b>CURRENT CURATION STAR RATING</b>	2	2	2	0	3	2	0




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## Workspaces

The list of model workspaces.

- [A Primer on Modular Mass Action Modelling with CellML](#)
- [A review of cardiac cellular electrophysiology models](#)
- [Activation of spaK](#)
- [Activation of spaR](#)
- [Adrian, Chandler, Hodgkin, 1970](#)
- [Aguda, B, 1999](#)
- [Aguda, Tang, 1999](#)
- [Albrecht, Colegrove, Friel, 2002](#)
- [Albrecht, Colegrove, Hongpaisan, Pivovarova, Andrews, Friel, 2001](#)
- [Aon, Cortassa, 2002](#)
- [Aslanidi 2009](#)
- [Aslanidi Atrial Model 2009](#)
- [Asthagiri, Lauffenburger, 2001](#)



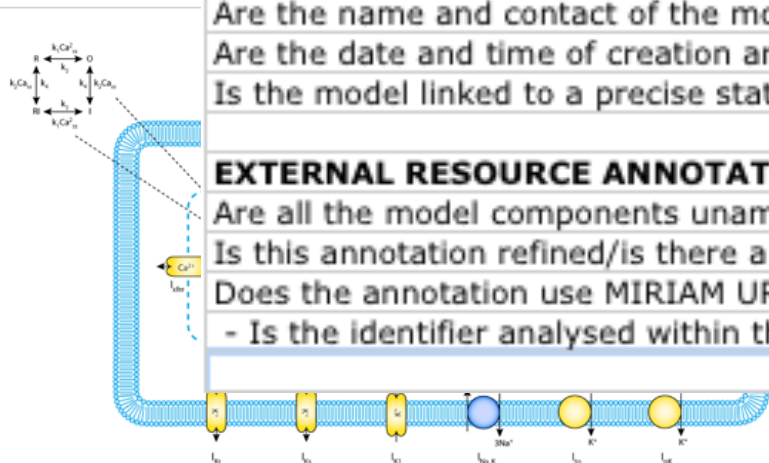
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## Electrophysiology

- [Adrian, Chandler, Hodgkin, 1970](#)  
Voltage clamp experiments in striated muscle fibres
- [Albrecht, Colegrove, Friel, 2002](#)  
Differential Regulation of ER Ca<sup>2+</sup> Uptake and Release Rates Accounts for Multiple Modes of Ca<sup>2+</sup>-induced Ca<sup>2+</sup> Release
- [Albrecht, Colegrove, Hongpaisan, Pivovarova, Andrews, Friel, 2001](#)  
Multiple Modes of Calcium-induced Calcium Release in Sympathetic Neurons I: Attenuation of Endoplasmic Reticulum Ca<sup>2+</sup> Accumulation at Low [Ca<sup>2+</sup>]<sub>i</sub> during Weak Depolarisation
- [Aslanidi, Boyett, Dobrzynski, Li, Zhang, 2009](#)  
Mechanisms of transition from normal to reentrant electrical activity in a model of rabbit atrial tissue: interaction of tissue heterogeneity and anisotropy
- [Aslanidi, Stewart, Boyett, Zhang, 2009](#)  
Optimal velocity and safety of discontinuous conduction through the heterogeneous Purkinje-ventricular junction
- [Beeler, Reuter, 1977](#)  
Reconstruction of the action potential of ventricular myocardial fibres
- [Benson, Aslanidi, Zhang, Holden, 2008](#)  
The canine virtual ventricular wall: a platform for dissecting pharmacological effects on propagation and arrhythmogenesis
- [Benson, Aslanidi, Zhang, Holden, 2008](#)  
The canine virtual ventricular wall: a platform for dissecting pharmacological effects on propagation and arrhythmogenesis
- [Benson, Aslanidi, Zhang, Holden, 2008](#)  
The canine virtual ventricular wall: a platform for dissecting pharmacological effects on propagation and arrhythmogenesis
- [Bernus, Wilders, Zemlin, Verschelde, Panfilov, 2002](#)  
A computationally efficient electrophysiological model of human ventricular cells
- [Bertram, Previte, Sherman, Kinard, Satin, 2000](#)  
The Phantom Burster Model for Pancreatic Beta Cells
- [Bertram, Previte, Sherman, Kinard, Satin, 2000](#)  
The Phantom Burster Model for Pancreatic Beta Cells
- [Bertram, Previte, Sherman, Kinard, Satin, 2000](#)  
The Phantom Burster Model for Pancreatic Beta Cells
- [Bertram, Sherman, 2004](#)  
A Calcium-based Phantom Bursting Model for Pancreatic Islets
- [Bertram, Smolen, Sherman, Mears, Atwater, Martin, Soria, 1995](#)  
A role for calcium release-activated current (CRAC) in cholinergic modulation of electrical activity in pancreatic beta-cells
- [Bondarenko, Szigeti, Bett, Kim, Rasmusson, 2004](#)  
A Computer Model for the Action Potential of Mouse Ventricular Myocytes
- [Boyett, Zhang, Garny, Holden, 2001](#)  
Control of the pacemaker activity of the sinoatrial node by intracellular Ca<sup>2+</sup>. Experiments and modelling





n/a



# Model exchange

Common set of curation flags (MIRIAM)

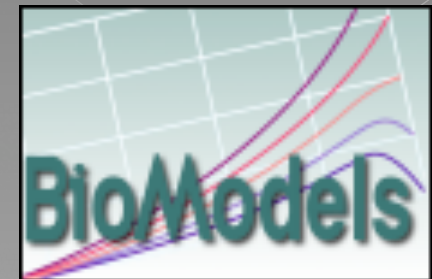
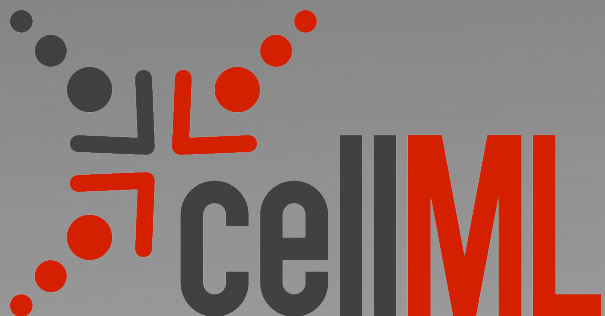
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Model annotation

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Language converters

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# Summary

- ◉ Current star system can be confusing and misinterpreted
- ◉ MIRIAM standard can form the basis of a new set of curation “flags”
- ◉ Together with model annotation and improved language converters this should allow model exchange between databases
- ◉ Combining limited curation resources