Gastrointestinal Physiology

This project focuses on the mathematical modeling of various aspects of the physiology of the gastrointestinal tract.

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1. Quantitative cellular description of gastric slow wave activity

Alberto Corrias & Martin L. Buist. Quantitative cellular description of gastric slow wave activity. *Am J Physiol Gastrointest Liver Physiol*, 294(4):G989–G995, Apr 2008.

This article presents a quantitative model of the cellular processes that lead to the generation of slow wave activity in the stomach. We provide further data here in support of the above publication, primarily based on a CellML encoding of the model written by Alberto Corrias.

The following annotated CellML encodings of this model were used with the CellMLSimulator software to generate the graphical outputs from the model shown below. These models reproduce the numerical experiments presented in Figure 5 of the Corrias & Buist (2008) article.

- **control**: the base ICC model with no modifications (also available in **C** format [C & header] and **Matlab** format [init & compute] as generated by COR);
- **no IP3 release**: base ICC model modified to simulate the presence of Xestospongin C;
- **high IP3**: base ICC model modified to simulate the presence of #1-adrenoreceptors stimulation with consequent increase in IP3 level by 70 nM.

The control ICC model from Figure 5(A) of the Corrias & Buist (2008) article *[CellML code]*.

The no IP3 release simulation from Figure 5(B) of the Corrias & Buist (2008) article *[CellML code]*.

The high IP3 concentration simulation from Figure 5(C) of the Corrias & Buist (2008) article *[CellML code]*.

2. A quantitative model of gastric smooth muscle cellular activation

Alberto Corrias & Martin L. Buist. A quantitative model of gastric smooth muscle cellular activation. *Ann Biomed Eng*, 35(9):1595–1607, September 2007.

This mathematical model defines a physiologically realistic quantitative description of smooth muscle cellular electrophysiology. We provide further data here in support of the

above publication, primarily based on a CellML encoding of the model written by Alberto Corrias.

Encodings of this model are available in the following formats:

- **CellML**: including simulation and graphing metadata;
- **C**: generated from the CellML version using the CellML API `CellML2C` program;
- **Matlab [init & compute]**: generated from the CellML version using COR.

The above annotated CellML encoding of this model was used with the CellMLSimulator software to generate the graphical outputs from the model shown below. These results match those given in the paper and provide a useful validation check for the CellML encoding of the model.

CellML encoded

Intracellular calcium transient.	Delayed rectifier current.
Membrane calcium currents.	Sodium current.
A-type potassium current.	Calcium activated potassium current.