# Training material for model curation:
## Introductory reading and work-flow

Files and supporting materials are available at:
http://www.ebi.ac.uk/biomodels/training/

Vijayalakshmi Chelliah
BioModels Team
EMBL-EBI
Wellcome Trust Genome Campus
Hinxton, Cambridge CB10 1SD

Contact: viji@ebi.ac.uk

# I. Initial Reading and Exercise:

## A. Books and links to learn basic biology and modelling

- Read relevant books on Mathematical modelling and its application in biology
- Essential Cell Biology, Dynamic Models in Biology
- Basic Biology

  http://en.wikipedia.org/wiki/Cell_%28biology%29
  http://en.wikipedia.org/wiki/Cell_nucleus
  http://en.wikipedia.org/wiki/Plasma_membrane
  http://en.wikipedia.org/wiki/Protein
  http://en.wikipedia.org/wiki/Nucleic_acid
  http://en.wikipedia.org/wiki/Lipid
  http://en.wikipedia.org/wiki/Carbohydrate
  http://en.wikipedia.org/wiki/Central_dogma
  http://en.wikipedia.org/wiki/Metabolism
  http://en.wikipedia.org/wiki/Cell_signaling
  http://en.wikipedia.org/wiki/Gene

- Basic modelling

  http://en.wikipedia.org/wiki/Chemical_kinetics
  http://en.wikipedia.org/wiki/Mass_action_law
  http://en.wikipedia.org/wiki/Enzyme_kinetics

- Modelling biological systems

  http://en.wikipedia.org/wiki/Modelling_biological_systems

## B. BioModels (http://www.ebi.ac.uk/biomodels) – Publications and other details

- Primary citations:
  Nucleic Acids Res. 2006 Jan 1; 34(Database issue):D689-91. [PMID: 16381960]
  BMC Syst Biol. 2010 Jun 29; 4:92. [PMID: 20587024]
  BMC Syst Biol. 2013 Nov 1; 7:116. [PMID: 24180668]

- Other citations :
  http://www.ebi.ac.uk/biomodels-main/citation
  http://scholar.google.co.uk/citations?hl=en&user=sxPul0AAAAAJ

- Frequently Asked Question :
  http://www.ebi.ac.uk/biomodels-main/faq

## C. Standards for model encoding – SBML (Systems Biology Mark-up Language)

- Go through http://sbml.org/ website. Look mainly at the basic introduction, documentation-specifications, publications, etc.

## D. Software tools to encode and simulate model

- COPASI – encoding and simulation tool
- SBMLeditor – to encode model in SBML

- For more details look in the http://sbml.org/SBML_Software_Guide. - This gives the tools that support SBML.
- J R Soc Interface. 2009 Aug 6; 6 Suppl 4:S405-17. [PMID: 19364720]

**E. Exercise – Model building and simulation**

- Follow exercise_modelbuilding&simulation.pdf from
  http://www.ebi.ac.uk/biomodels/training/build_simulate/
  All required files needed for the exercise can be downloaded from the above URL.

**F. Exercise – Identifying and correcting errors in the model**

- Follow exercise_modelbreak.pdf from
  http://www.ebi.ac.uk/biomodels/training/error_identify/
- A list of models is given with their reference publications. All these models have few errors in it. Fix the models, simulate it and reproduce the figures that are published in the corresponding reference publications.

**G. More models**

- Go through the models that has been selected for “Model of the Month” entry
  http://www.ebi.ac.uk/biomodels-main/modelmonth

## II. Actual Project – Encoding models from literature through publication in BioModels:

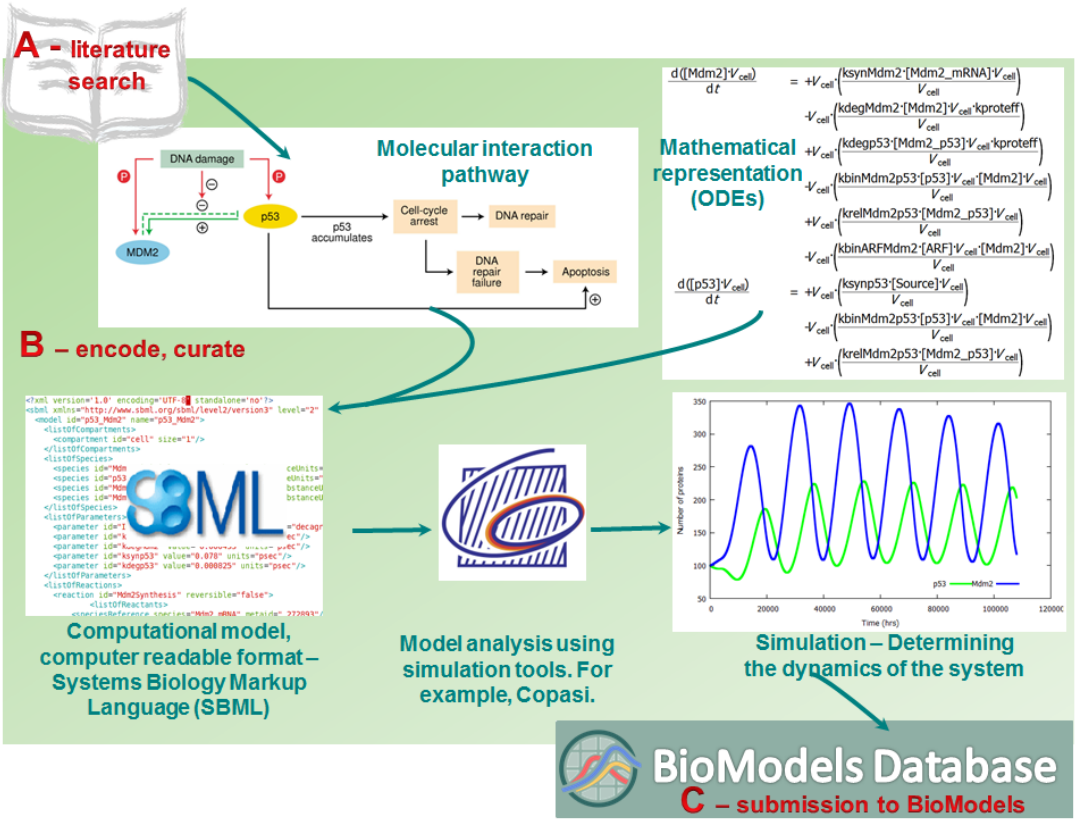


Figure1: Model curation work-flow.

### A. Collecting Models from literature (Figure 1 – A)

- Do an intensive search on the literature and collect all available mathematical models that correspond to the topic assigned to you.
- Maintain your references in a bibliographic tool.

### B. Encoding and curating models (Figure 1 – B, Figure 2):

- Read the model curation tips at http://www.ebi.ac.uk/biomodels-main/curationtips
- Extract the relevant information, such as physical entities, parameters, reactions or rate laws from the paper.
- Encode the extracted information in SBML (refer to the exercise in the previous section).
- Simulate the model and see if it can reproduce figures in the paper (refer to the exercise in the previous section).
- Reproduce at least one figure from the reference publication.

### C. Submission to the BioModels Database (Figure 1 – C, Figure 2):

- Submit the model to the BioModels Database. Follow the steps at http://www.ebi.ac.uk/biomodels-main/submit
- Do the consistency checks (SBML syntax is checked in this step).
- Submit the curation figure.
- Move the model to the cura_anno.

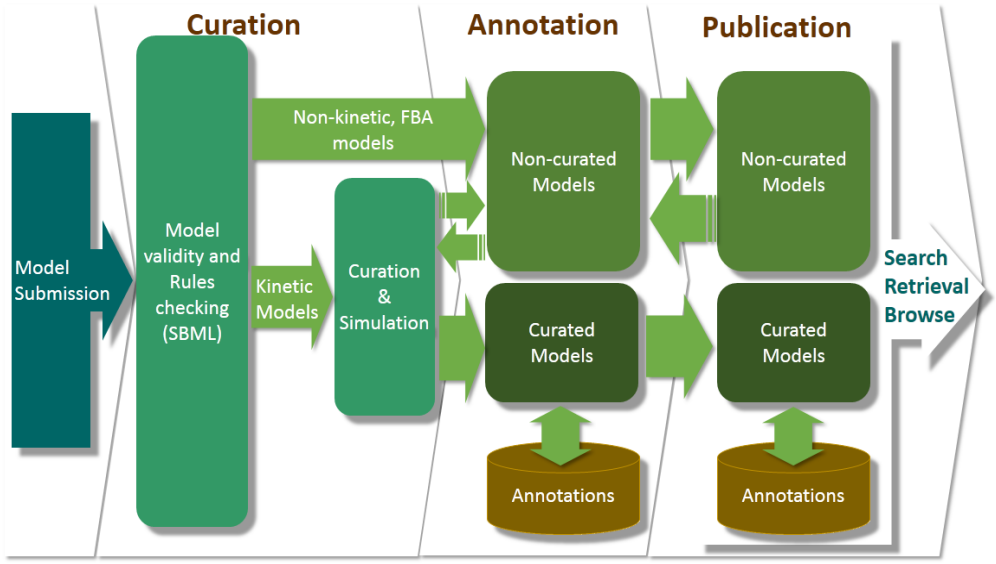


Figure 2: BioModels Database – Model submission to publication

## D. Model Annotation (Figure 2)

- Annotate the model elements with external resources. Read the information on how to annotate models in the following links
    - http://www.ebi.ac.uk/biomodels-main/annoation
    - http://www.ebi.ac.uk/biomodels-main/annotationtips

## E. Review article

- At the end of the project, we aim to write a review article on the assigned topic.
- So, keep track of the models you have collected.
- Maintain a report on each of the model you have analysed, right from the start of the project.
- For previous similar work from the team, refer to CPT Pharamcometrics Syst Pharmacol. 2013 Jul 10; 2:e54. [PMID:23842097].