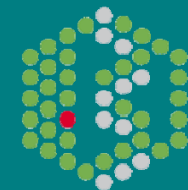


# Reactome

## Export of BioPax and SBML from Reactome

David Croft

EMBL-EBI



# Rationale – Journal information

Nature 407(6805):770-6. The Biochemistry of Apoptosis.

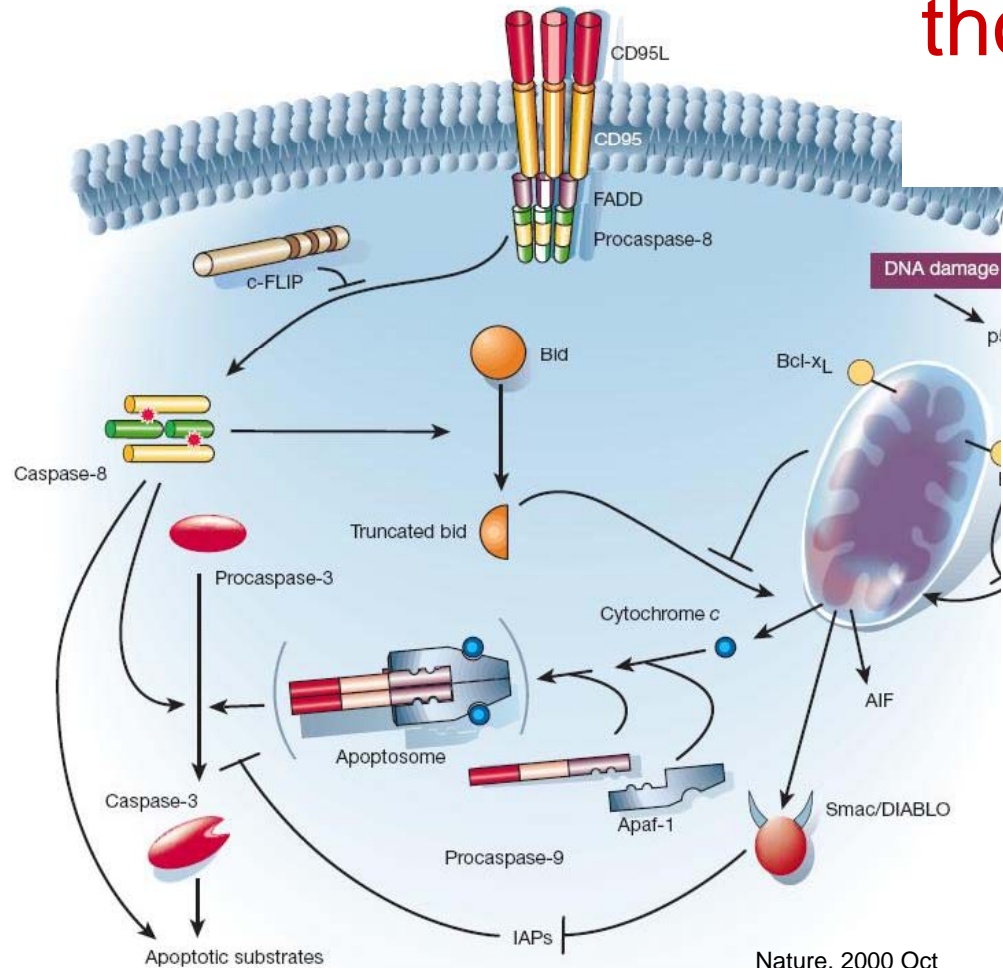
“**Caspase-8** is the key **initiator** caspase in the **death-receptor pathway**. Upon **ligand binding**, death receptors such as **CD95** (Apo-1/Fas) **aggregate** and form **membrane-bound** signalling **complexes** (Box 3). These complexes then recruit, through **adapter proteins**, several molecules of **procaspase-8**, resulting in a high local concentration of zymogen. The induced proximity model posits that under these crowded conditions, the low intrinsic protease activity of procaspase-8 (ref. 20) is sufficient to allow the various proenzyme molecules to mutually cleave and activate each other (Box 2). A similar mechanism of action has been proposed to mediate the activation of several other caspases, including **caspase-2** and the nematode caspase **CED-3** (ref. 21).”

How can I access the pathway described here and reuse it?



# Rationale - Figures

A picture paints a thousand words...



...but:

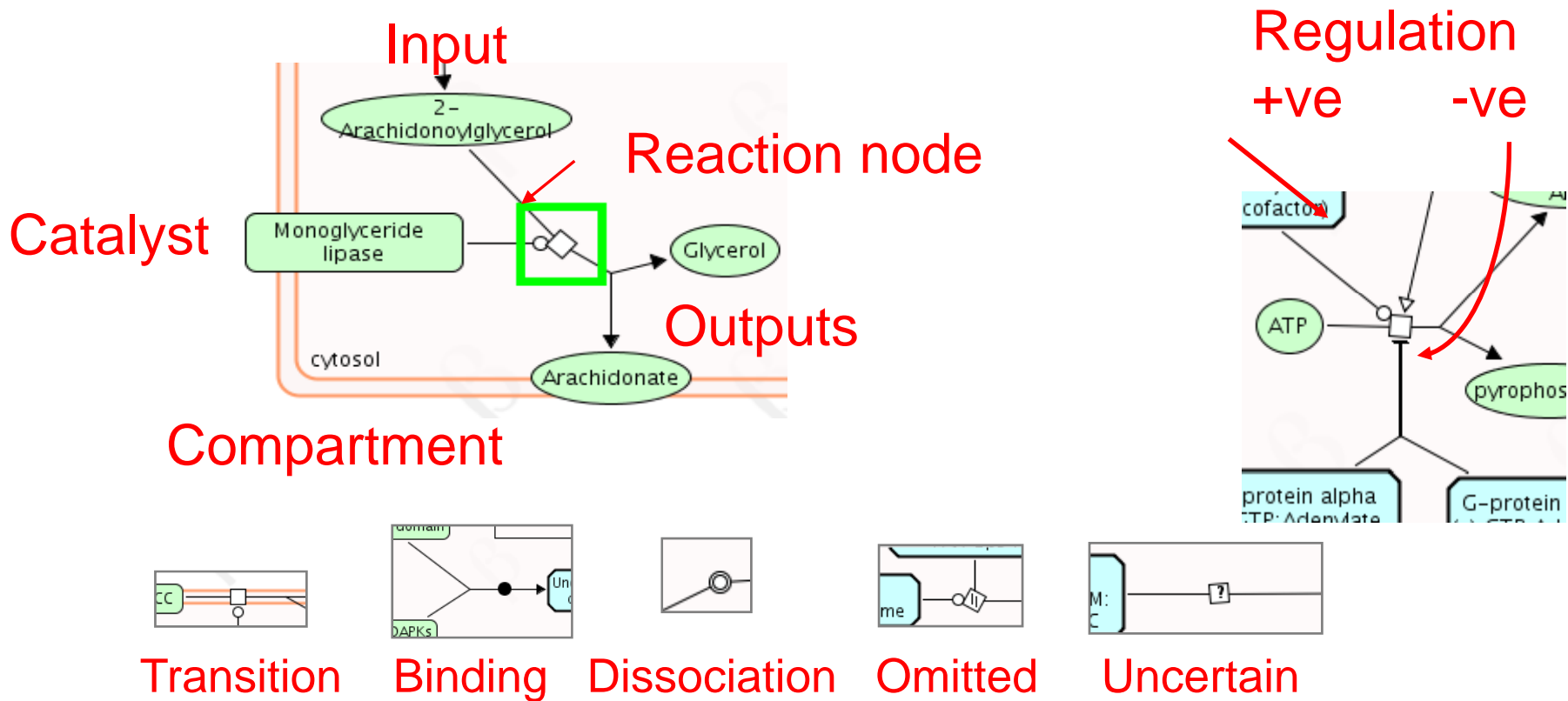
- Just pixels
- Omits key details
- Assumes
- Fact or Hypothesis?



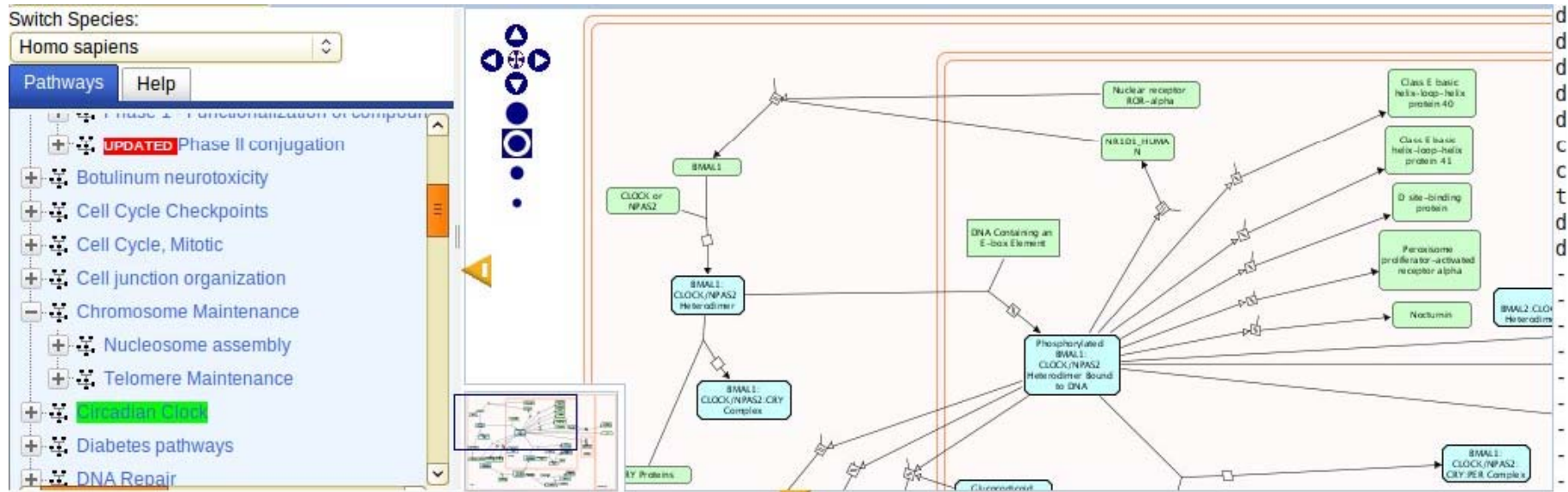
Nature. 2000 Oct 12;407(6805):770-6.  
The biochemistry of apoptosis.

# Events – reactions and regulations

Boxes are proteins, protein sets, mixed sets or complexes.  
 Ovals are small molecules (or sets of)  
 Green boxes are proteins or sets, blue are complexes.



# Events - pathways

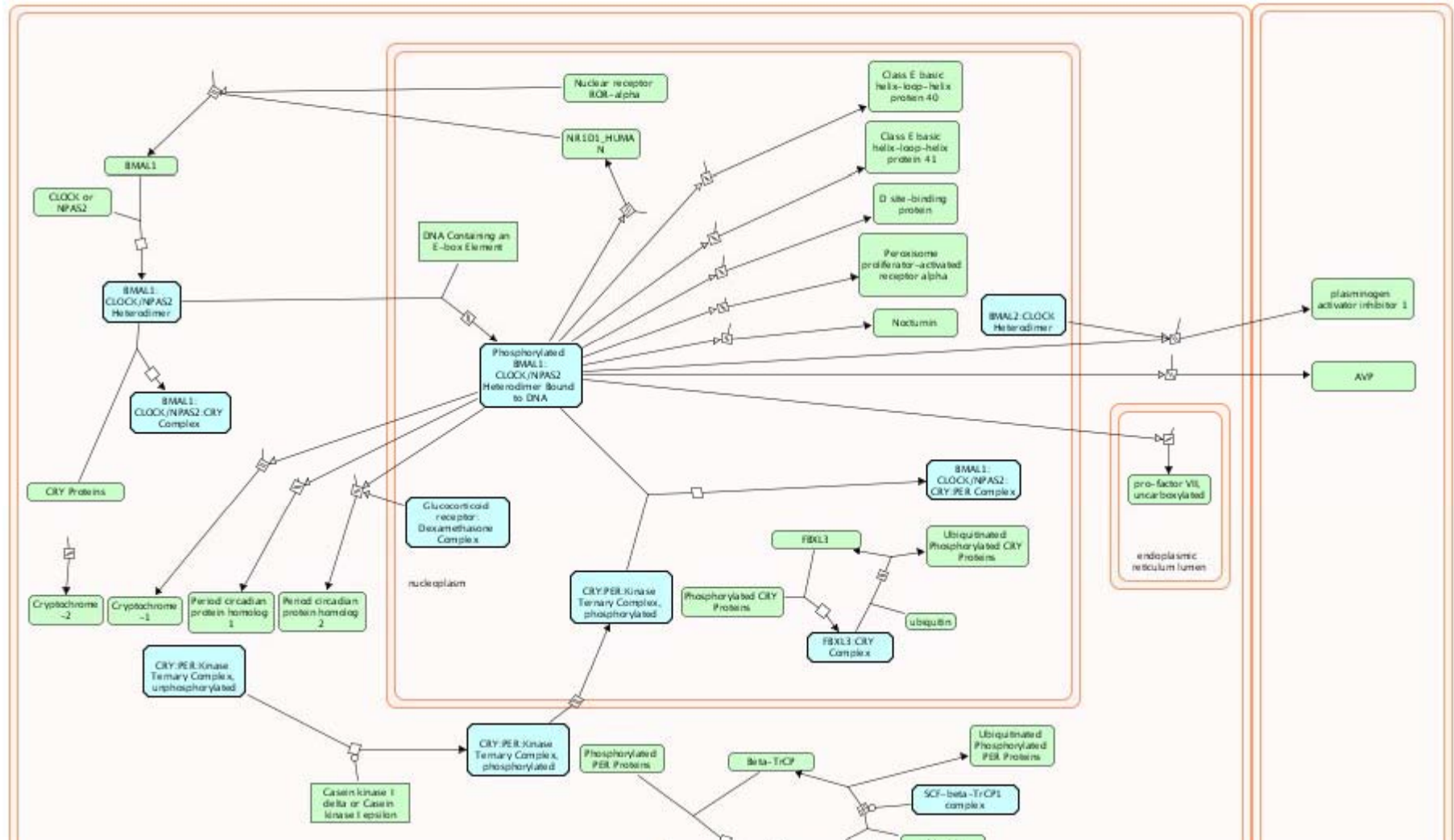


## Circadian Clock

<b>DOI</b>	10.3180/REACT_24941.1
<b>Stable identifier</b>	REACT_24941.1
<b>Authored</b>	May, B, 2009-05-17
<b>Reviewed</b>	D'Eustachio, P, 2009-05-26 Albrecht, U, 2010-06-23 Kay, SA, 2010-06-23 Hirota, T, 2010-06-23 Delaunay, F, 2010-06-23

At the center of the mammalian circadian clock is a negative transcription/translation-based feedback loop: The BMAL1:CLOCK/NPAS2 heterodimer transactivates CRY and PER genes by binding E-box elements in their promoters; the CRY and PER proteins then inhibit transactivation by BMAL1:CLOCK/NPAS2. BMAL1:CLOCK/NPAS2 activates transcription of CRY, PER, and several other genes in the morning. Levels of PER and CRY proteins rise during the day and inhibit expression of CRY, PER, and other BMAL1:CLOCK/NPAS2-activated genes in the afternoon and evening. During the night CRY and PER proteins are targeted for degradation by phosphorylation and polyubiquitination, allowing the cycle to commence

# Manually laid-out pathway diagram



# Coverage

- Apoptosis
- Cell cycle
- DNA repair
- Transcription, mRNA processing, translation, post-translational modification
- Signaling pathways (insulin, NOTCH, opioid, NGF, EGFR, FGFR, Rho GTPases II, Opioid, Wnt)
- Hemostasis
- Metabolism (energy, amino acid, lipid, nucleotide, xenobiotic)
- Synaptic transmission
- Lipoproteins – HDL and VLDL

# BioPax Output

- BioPax level 2 and level 3 provided.
- Available for single pathways or for the whole database.
- OWL format dump files.
- Under level 3, the following are exported:
  - bp:Pathway (pathway name)
  - bp:pathwayComponent (reactions)
  - bp:comment (text description)
  - bp:xref (Pubmed references)
  - bp:cellularLocation
  - bp:entityReference (Protein UniProt ID)
  - bp:UnificationXref (GO terms)



# New SBML Output

- SBML level 2.3.
- Available for single pathways or for the whole database.
- Uses MIRIAM-compliant URIs for references to UniProt etc.
- The following are included in the SBML:
  - Coordinates for reactions, using layout extension.
  - listOfSpecies
  - ListOfCompartments
  - ListOfReactions
  - UniProt IDs, ChEBI IDs, GO Ids, PubMed IDs
  - Curated text summaries for reactions & pathways

# Future Plans

- RESTful API to allow custom query of Reactome, results returned as BioPax or SBML.
- Import reaction dynamics from other databases.
- Optional collapse of reactions.
- Interactive construction of SBML or BioPax based on user data.
- CellDesigner SBML
- Integration with systems biology packages, e.g. SBW??

# Interactive export of SBML or BioPax I

<a href="#">Home</a>	<a href="#">About</a>	<a href="#">Content</a>	<a href="#">Documentation</a>	<a href="#">Tools</a>	<a href="#">Download</a>	<a href="#">Contact Us</a>	<a href="#">Outreach</a>
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## Generate SBML from a list of Identifiers

Takes a list of Reactome reaction DB\_IDs and generates the corresponding SBML. [More....](#)

Paste or upload your data: [Example](#)

[Browse...](#) [Clear](#)

[Generate SBML](#)

# Interactive export of SBML or BioPax II

## Optional parameter settings and filters

### Choose SBML level and version numbers

Level:  Version:

### Pathway inclusion filter

### Compartment inclusion filter

### Organism inclusion filter

### Choose layout

LayoutExtension  SBGN  CellDesigner

### Pathway exclusion filter

### Compartment exclusion filter

### Organism exclusion filter

# Interactive export of SBML or BioPax III

Select format to download this table:

Pathway name ▼▲	Species ▼▲	Total number of proteins ▼▲	Matching proteins in data ▼▲	% in data ▼▲	Click button to view pathway
ABC-family proteins mediated transport	Homo sapiens	15	0	<input type="text" value="0%"/>	<input type="button" value="View"/>
Adaptive Immunity Signaling	Homo sapiens	0	0	<input type="text" value="0%"/>	<input type="button" value="View"/>
Advanced glycosylation endproduct receptor signaling	Homo sapiens	13	1	<input type="text" value="7%"/>	<input type="button" value="View"/>
Amyloids	Homo sapiens	28	3	<input type="text" value="10%"/>	<input type="button" value="View"/>
APC/C-mediated degradation of cell cycle proteins	Homo sapiens	79	39	<input type="text" value="49%"/>	<input type="button" value="View"/>
Apoptosis	Homo sapiens	0	0	<input type="text" value="0%"/>	<input type="button" value="View"/>
Apoptotic execution phase	Homo sapiens	48	3	<input type="text" value="6%"/>	<input type="button" value="View"/>
Aquaporin-mediated transport	Homo sapiens	30	0	<input type="text" value="0%"/>	<input type="button" value="View"/>
Asparagine N-linked glycosylation	Homo sapiens	85	1	<input type="text" value="1%"/>	<input type="button" value="View"/>
Axon guidance	Homo sapiens	0	0	<input type="text" value="0%"/>	<input type="button" value="View"/>
Base Excision Repair	Homo sapiens	19	18	<input type="text" value="94%"/>	<input type="button" value="View"/>
Bile acid and bile salt metabolism	Homo sapiens	27	1	<input type="text" value="3%"/>	<input type="button" value="View"/>

...er...should I try a live demo?

[www.reactome.org/ReactomeGWT/entrypoint.html#SBMLRetrievalPage](http://www.reactome.org/ReactomeGWT/entrypoint.html#SBMLRetrievalPage)