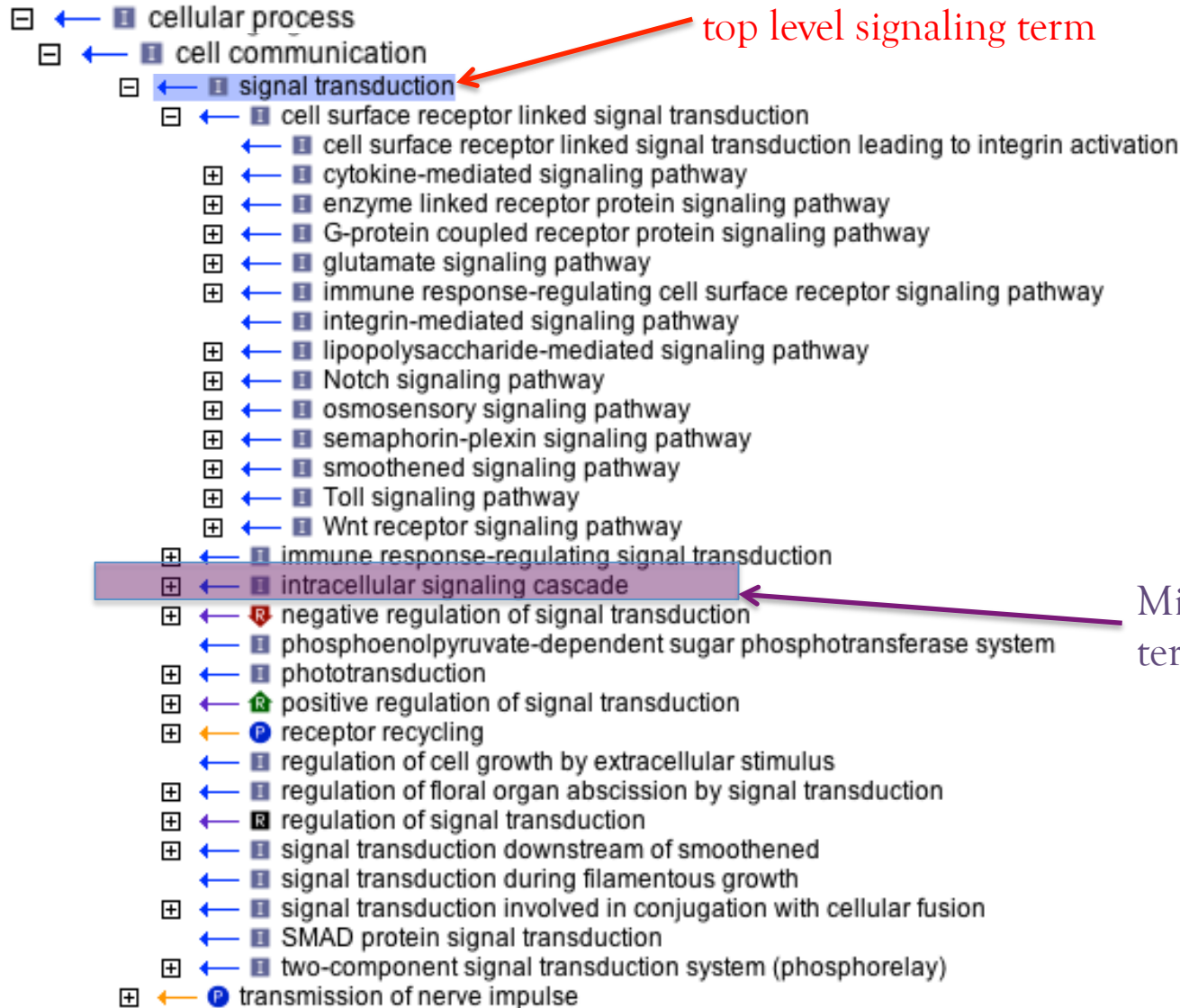

A BRIEF HISTORY OF
SIGNALING IN GO
(June 2011)

How it looked before the signaling overhaul

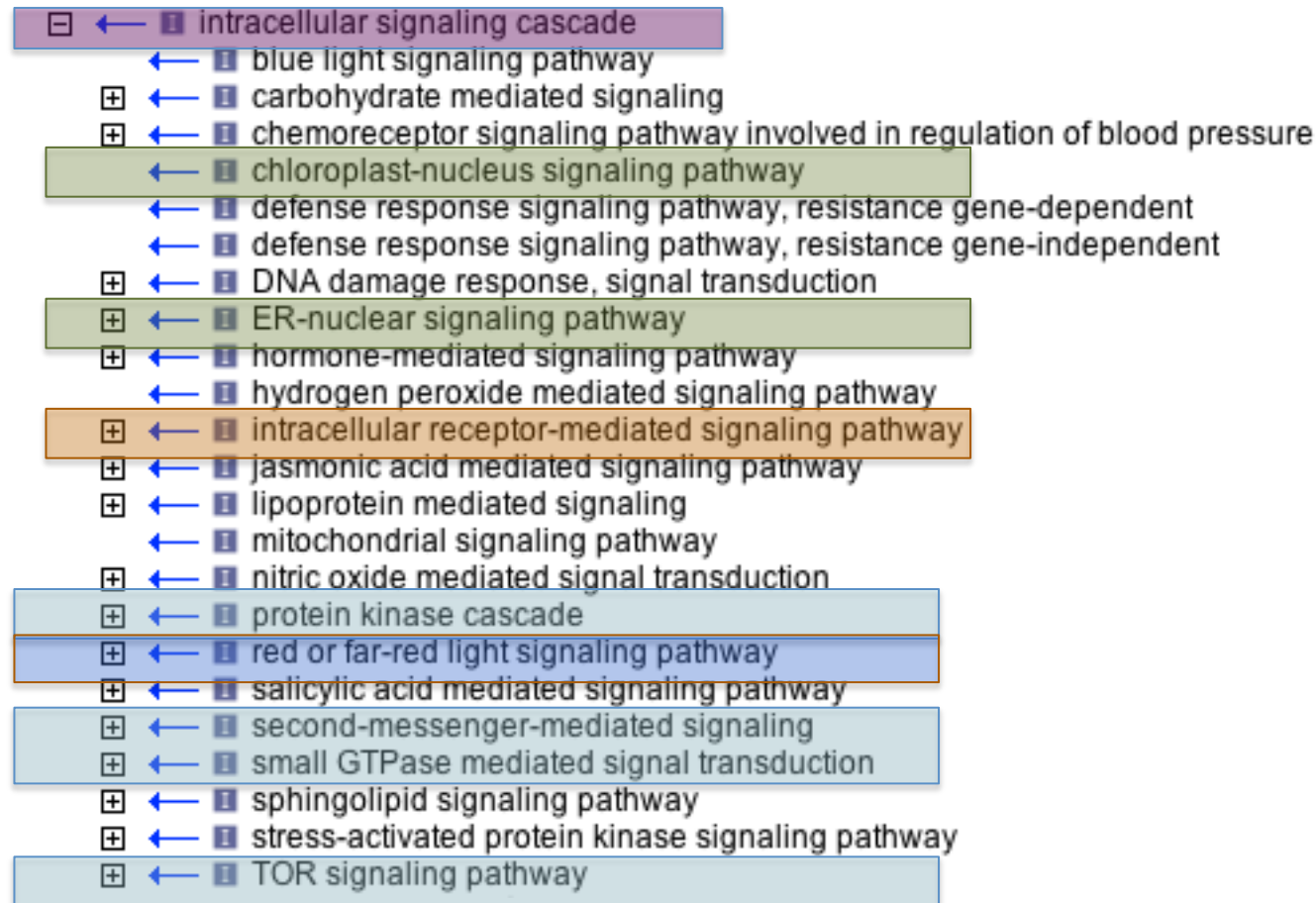
(pre-January 2010 when Jen committed the large changes)



Signaling pathways began with an activated receptor, and did not include the ligand

Mixed bag of child terms

Intracellular signaling.. a mixed bag



PHASE I: SPLIT INTO PROCESS AND PATHWAYS

In Phase I of the signaling overhaul, a generic ‘signaling ; GO:0023052’ term was created and the node was split into:

- ❖ **signaling pathways:** *the series of GPs that transduce a signal*
- ❖ **signaling processes:** *the individual steps of signaling*

[These changes were committed at the start of 2010, just before Jen left for maternity leave]

- ⊖ ← **signaling**
 - ⊕ ← **behavioral signaling**
 - ⊕ ← **cell-cell signaling**
 - ⊕ ← **extracellular matrix-cell signaling**
 - ⊕ ← **motogenic signaling initiating cell movement in cerebral cortex**
 - ← **motogenic signaling involved in interneuron migration from the subpallium to the cortex**
 - ← **motogenic signaling involved in postnatal olfactory bulb interneuron migration**

- ⊖ ← **signaling pathway**
 - ⊕ ← **carbohydrate mediated signaling**
 - ⊕ ← **cell surface receptor linked signaling pathway**
 - ⊕ ← **chemoreceptor signaling pathway involved in regulation of blood pressure**
 - ← **defense response signaling pathway, resistance gene-dependent**
 - ← **defense response signaling pathway, resistance gene-independent**
 - ⊕ ← **hormone-mediated signaling pathway**
 - ← **hydrogen peroxide mediated signaling pathway**
 - ⊕ ← **immune response-regulating signaling pathway**
 - ⊕ ← **intracellular signaling pathway**
 - ⊕ ← **jasmonic acid mediated signaling pathway**
 - ⊕ ← **lipoprotein mediated signaling**
 - ⊕ ← **negative regulation of signaling pathway**
 - ⊕ ← **nitric oxide mediated signal transduction**
 - ⊕ ← **osmosensory signaling pathway**
 - ⊕ ← **positive regulation of signaling pathway**
 - ⊕ ← **red or far-red light signaling pathway**
 - ⊕ ← **regulation of signaling pathway**
 - ⊕ ← **salicylic acid mediated signaling pathway**
 - ⊕ ← **sphingolipid signaling pathway**

'signaling pathway' & 'signaling process' are siblings

- ⊖ ← **signaling process**
 - ⊕ ← **consequence of signal transmission**
 - ⊖ ← **generation of a signal involved in cell-cell signaling**
 - ⊕ ← **creation of an inductive signal**
 - ⊕ ← **signal release**
 - ⊕ ← **initiation of signal transduction**
 - ⊕ ← **receptor recycling**
 - ⊕ ← **regulation of signaling process**
 - ⊕ ← **signal release**
- ⊖ ← **signal transmission**
 - ⊕ ← **signal release**
 - ⊕ ← **signal transduction**
 - ← **signal transmission via air**
 - ← **signal transmission via conformational transition**
 - ⊕ ← **signal transmission via diffusible molecule**
 - ⊕ ← **signal transmission via phosphorylation event**
 - ← **signal transmission via transcytosis**
 - ⊕ ← **signal transmission via vascular system**
 - ⊕ ← **transmission of nerve impulse**
 - ⊕ ← **two-component signal transduction system (phosphorelay)**
 - ⊕ ← **termination of signal transduction**

'signaling pathway' and 'signal transduction' aren't connected

PROCESS/PATHWAY SPLIT

At the September 2010 GOC meeting (Bar Harbor), Becky gave a presentation on the signaling overhaul. It became clear that splitting the signaling node into pathways and processes was problematic for a number of reasons:

1. Annotators had to make a high-level decision about whether to annotate to a pathway or a process term, as they were unconnected in the arrangement.
2. All pathways are processes (the term is under biological_process).
3. Pathways are an ‘artificial’ set of gene products that act together.

AUTUMN 2010

After the September 2010 GOC meeting (Bar Harbor), it was decided to remove the pathway/process split in signaling. The major edits were:

1. All pathways were moved back under 'signal transduction'.
2. Pathways were agreed to begin with a ligand activating a receptor. Therefore, the ligand is part of the signaling pathway (and can be annotated to 'signal transduction').
3. There is no generic 'signaling pathway' term (this is essentially: signal transduction').
4. The signaling node was split into:
 - cell-cell signaling ; GO:0007267
 - multicellular organismal signaling ; GO:0035637
 - multi-organism signaling ; GO:0035636

January 2011

Split into multi-organism, multicellular organism, and cellular signaling (to match split in GO process).

- [-] ← [I] signaling
 - [+] ← [I] cell-cell signaling
 - [+] ← [I] extracellular matrix-cell signaling
 - [+] ← [I] mitogenic signaling initiating cell movement in cerebral cortex
 - ← [I] mitogenic signaling involved in interneuron migration from the subpallium to the cortex
 - ← [I] mitogenic signaling involved in postnatal olfactory bulb interneuron migration
 - ← [I] multi-organism signaling
 - [+] ← [I] multicellular organismal signaling
 - [+] ← [R] negative regulation of signaling
 - [+] ← [R] positive regulation of signaling
 - [+] ← [R] regulation of signaling
 - [+] ← [P] signal maturation
 - [-] ← [P] signal transduction
 - [+] ← [I] carbohydrate mediated signaling
 - [+] ← [I] cell surface receptor linked signaling pathway
 - [+] ← [I] chemoreceptor signaling pathway involved in regulation of blood pressure
 - ← [I] chloroplast-nucleus signaling pathway
 - ← [I] defense response signaling pathway, resistance gene-dependent
 - ← [I] defense response signaling pathway, resistance gene-independent
 - [+] ← [I] DNA replication checkpoint
 - [+] ← [I] ER-nucleus signaling pathway

signaling pathways under
signal transduction.

...simplified to aid more consistent
annotation

