Generic-specific relationships representation in SBGN PD

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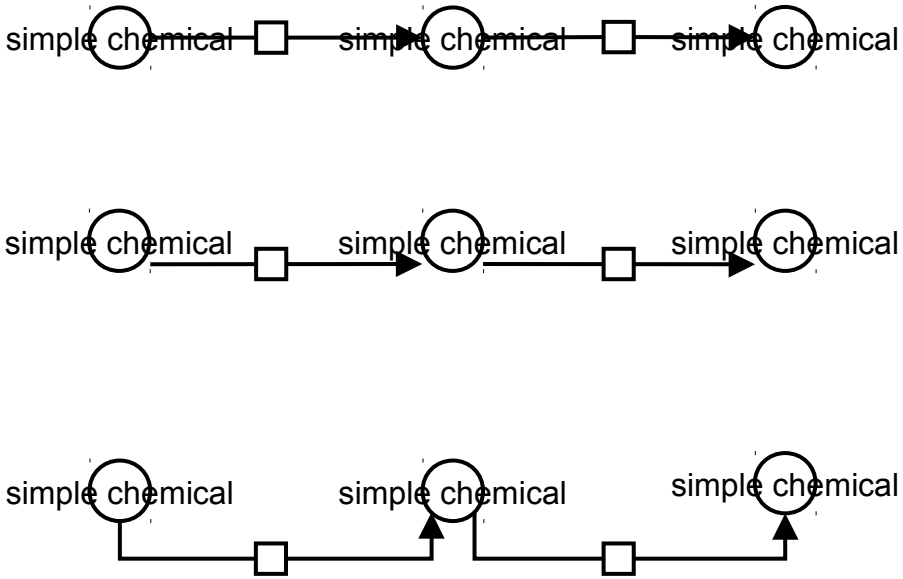
COMBINE 2011

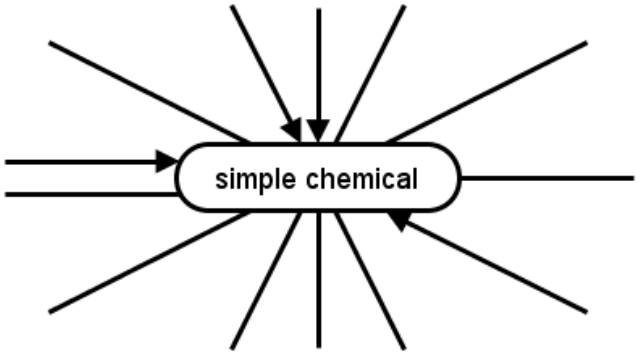
Heidelberg, Germany

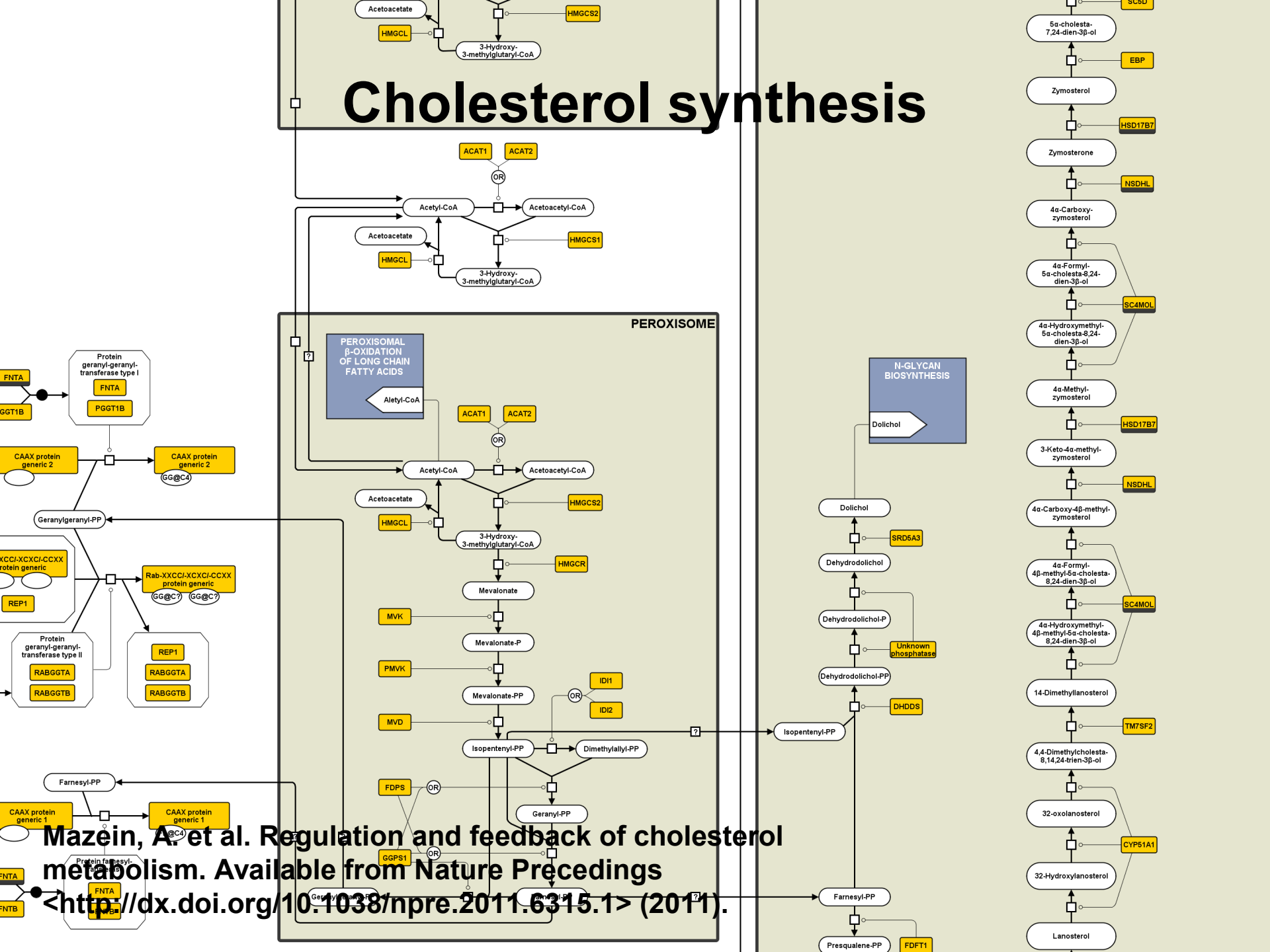
Proposed new shape for simple chemical

Currently used shape for simple chemical



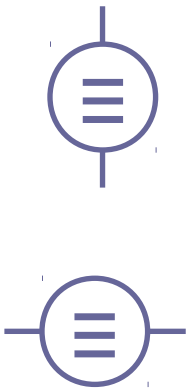
Proposed shape





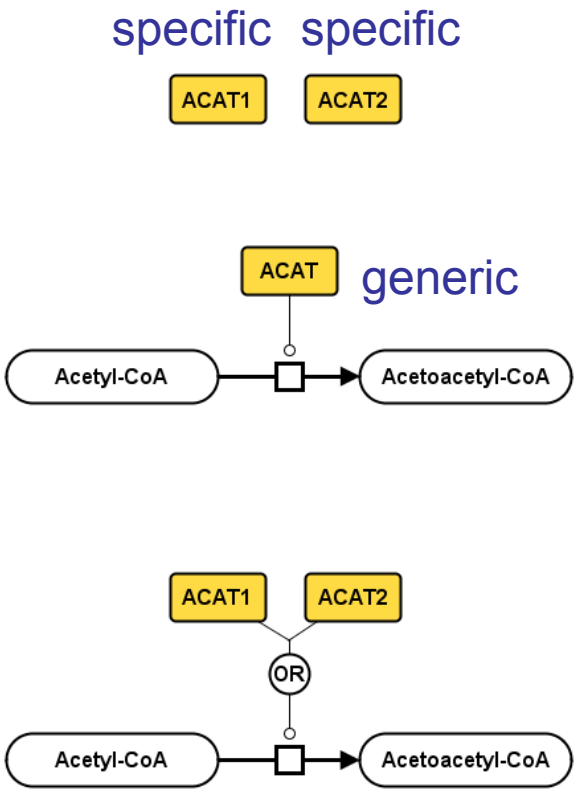
Mazein, A. et al. Regulation and feedback of cholesterol metabolism. Available from Nature Precedings <http://dx.doi.org/10.1038/npre.2011.6315.1> (2011).

Identity operator

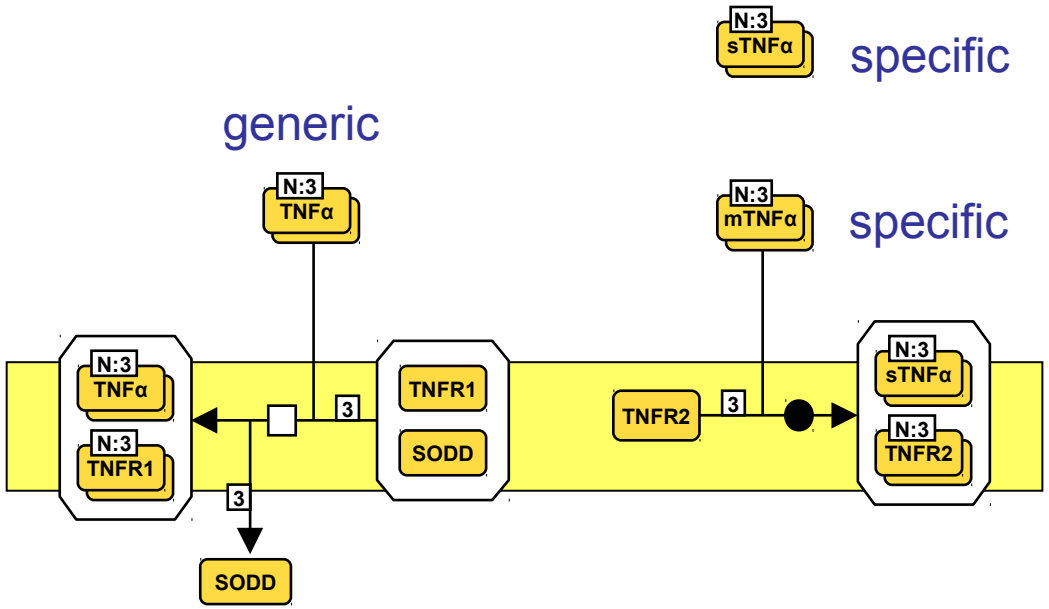


- Why?
- Examples
- Rules

Why is it important?

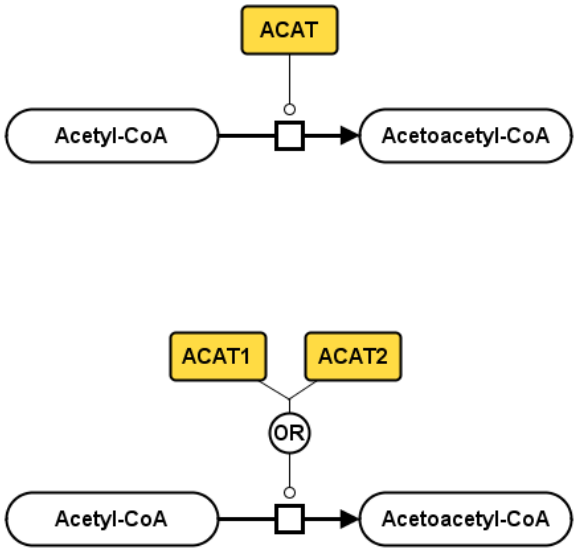


Isoenzymes and OR gate

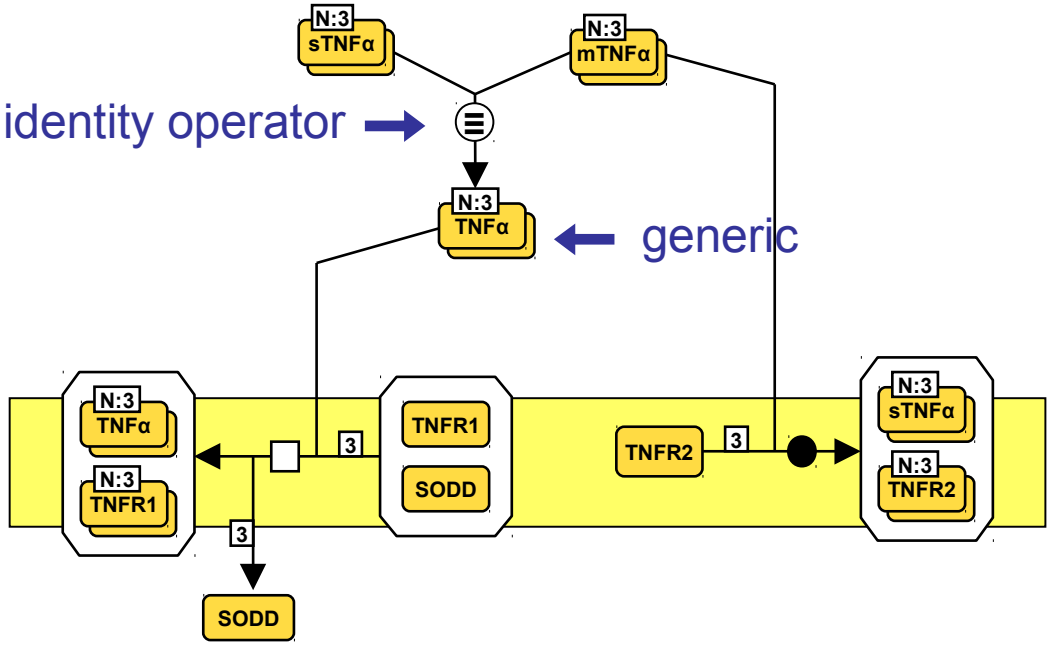


Generic is consumed in the next step
(it has to be presented on the map)

Why is it important?

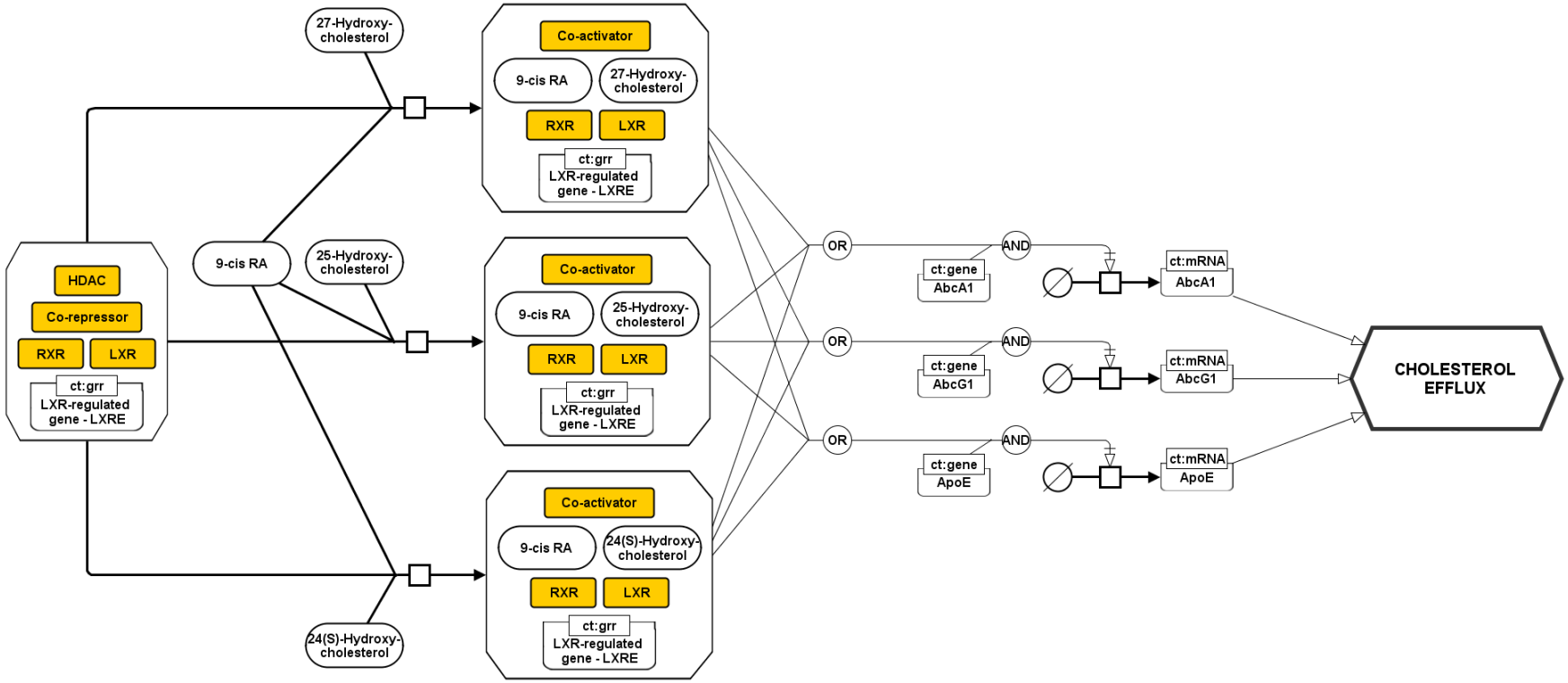


Isoenzymes and OR gate

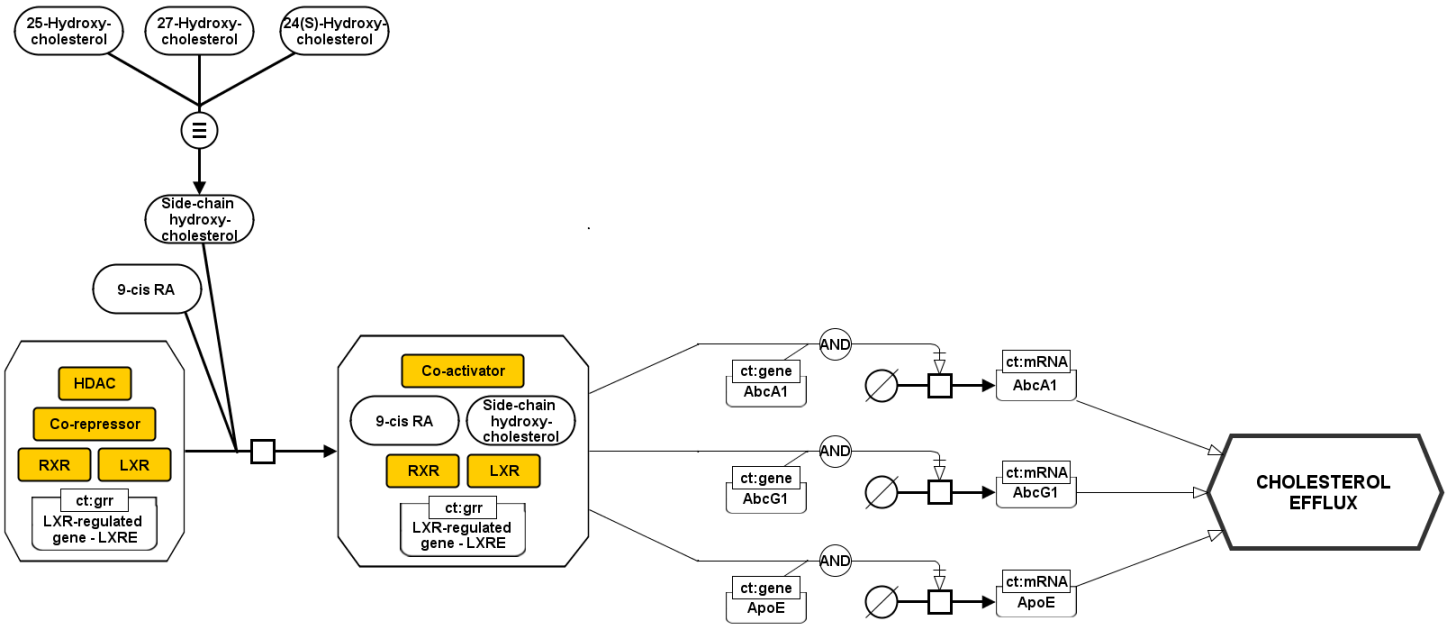


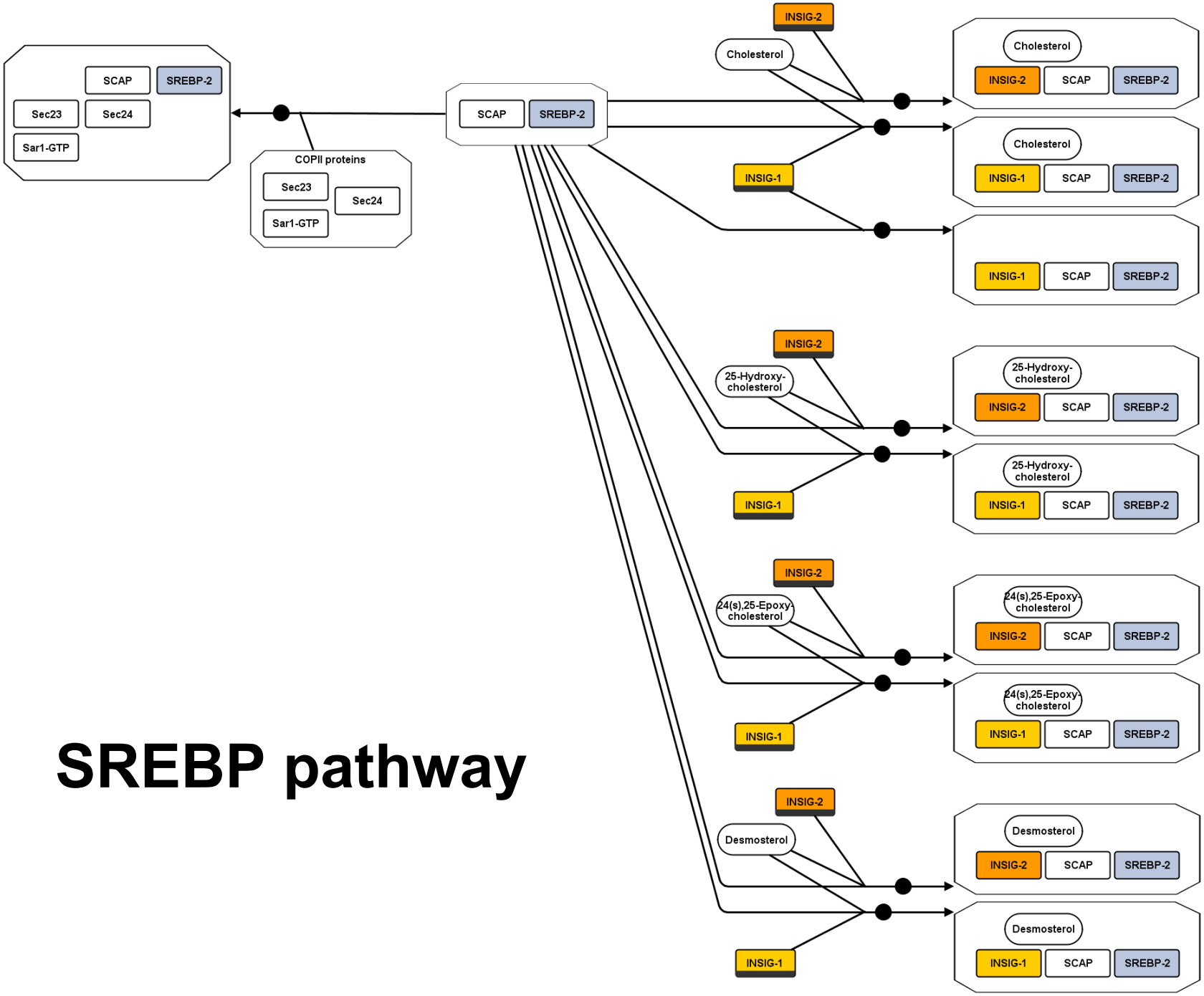
Generic is consumed in the next step
(it has to be shown as a separate entity)

LXR pathway


27-Hydroxy-cholesterol
9-cis RA
25-Hydroxy-cholesterol
24(S)-Hydroxy-cholesterol
HDAC
Co-repressor
RXR
LXR
ct:grr
LXR-regulated gene - LXRE
Co-activator
9-cis RA
27-Hydroxy-cholesterol
RXR
LXR
ct:grr
LXR-regulated gene - LXRE
Co-activator
9-cis RA
25-Hydroxy-cholesterol
RXR
LXR
ct:grr
LXR-regulated gene - LXRE
Co-activator
9-cis RA
24(S)-Hydroxy-cholesterol
RXR
LXR
ct:grr
LXR-regulated gene - LXRE
OR
OR
OR
AND
AND
AND
ct:gene
AbcA1
ct:gene
AbcG1
ct:gene
ApoE
ct:mRNA
AbcA1
ct:mRNA
AbcG1
ct:mRNA
ApoE
CHOLESTEROL EFFLUX

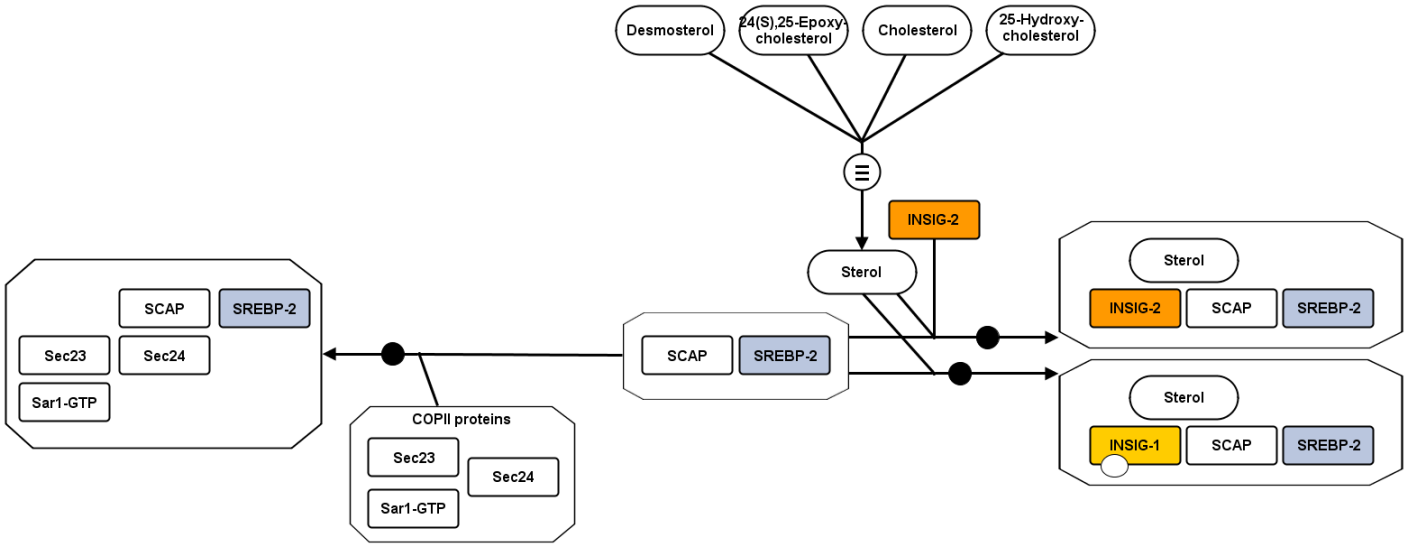
LXR pathway: identity operator



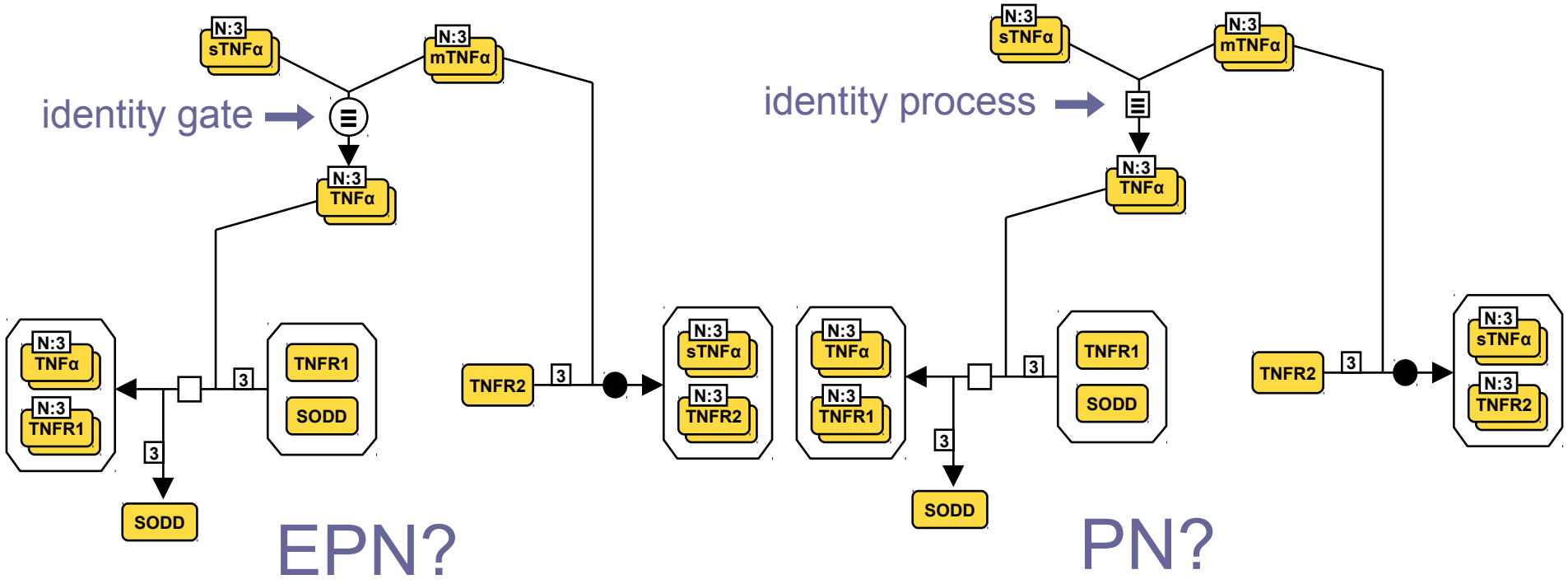


SREBP pathway

SREBP pathway: identity operator

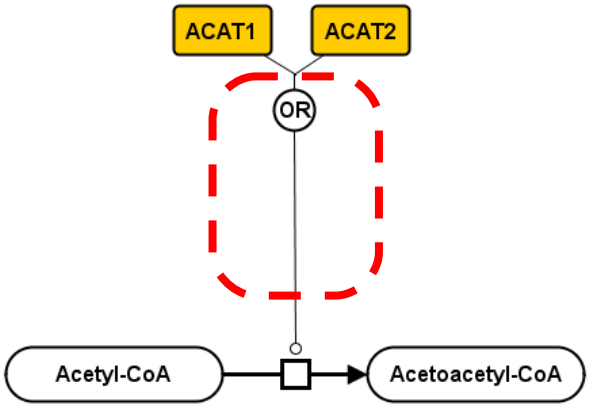


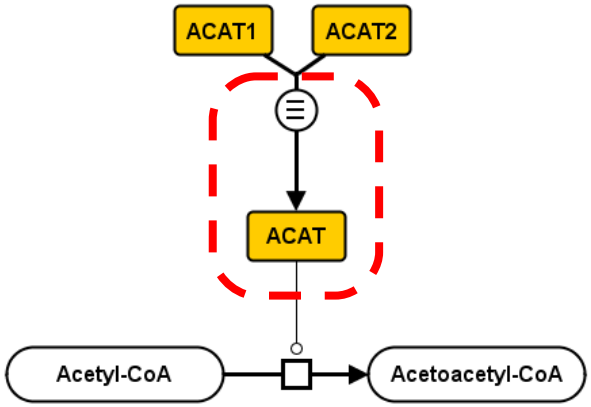
Identity gate or identity process?



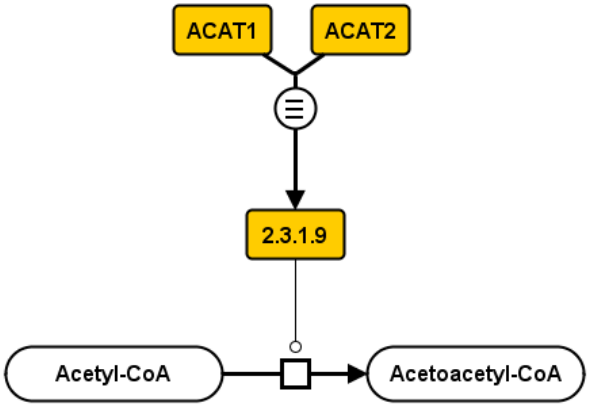
The identity operator is used in conjunction with consumption and production: that makes it a PN.

OR gate and identity operator

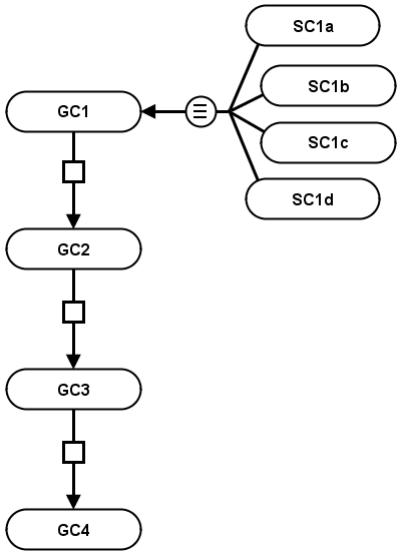




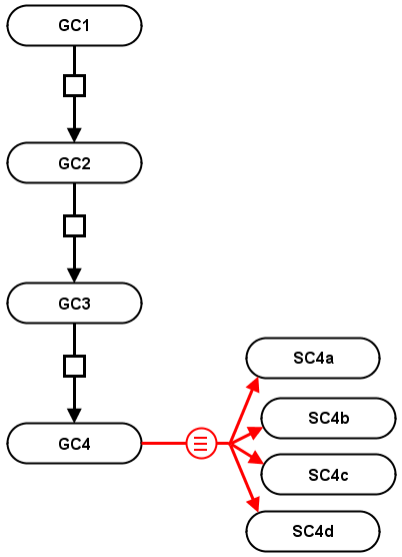
OR gate can be replaced by a combination of identity operator and corresponding generic



Identity operator input-output

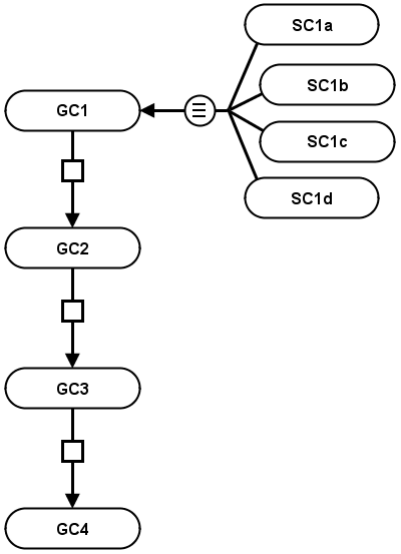


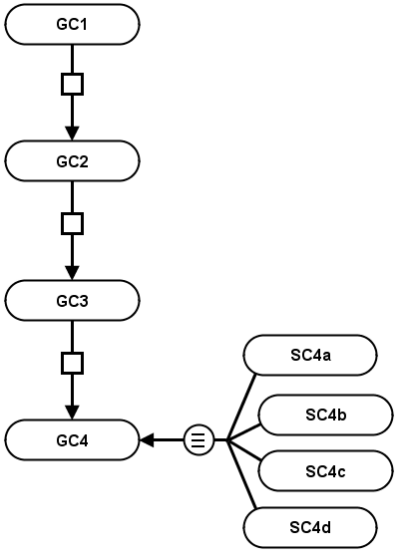
Generic is consumed



Generic is produced

Identity operator input-output



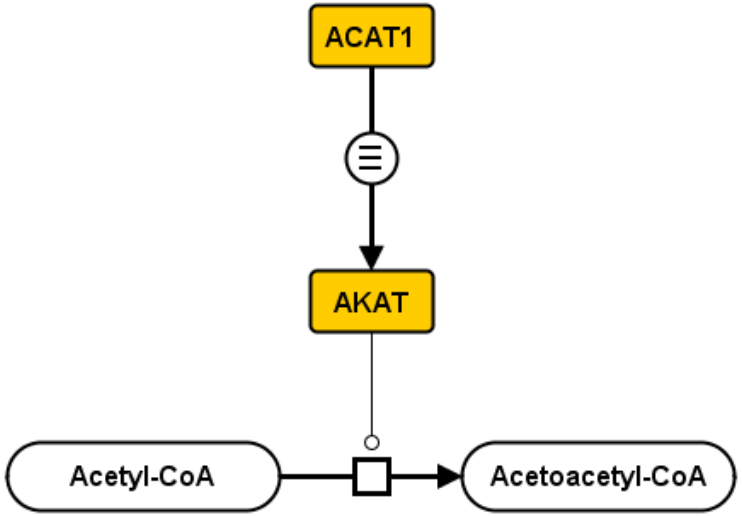


Generic is consumed

Generic is produced

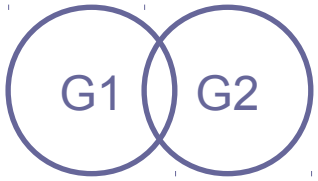
From specifics to generic only

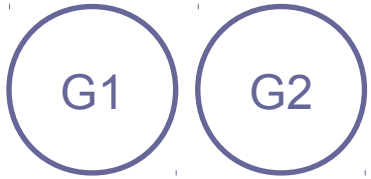
One generic - one specific connection

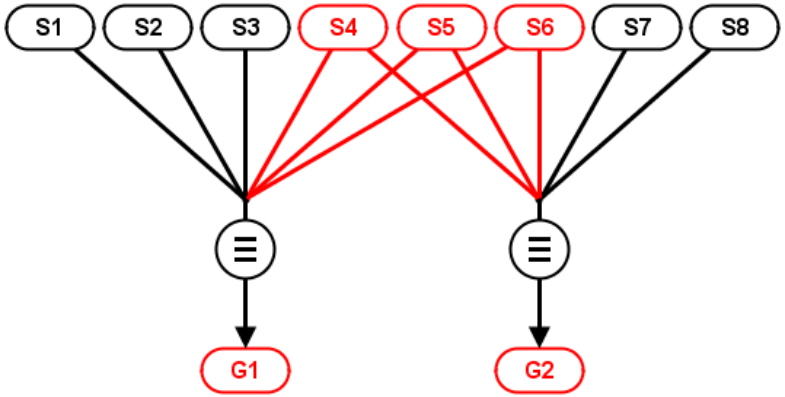


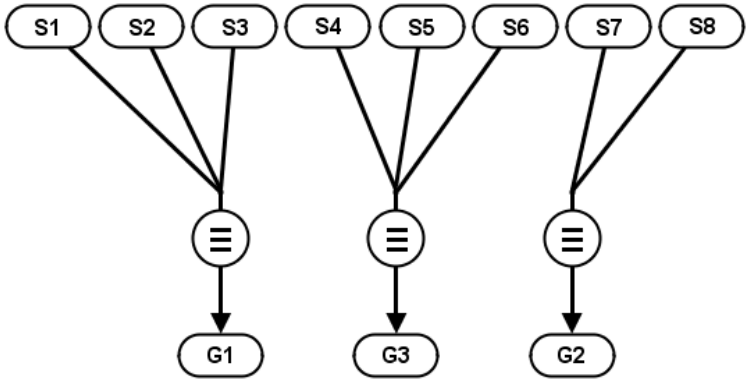
Identity operator between ONE specific and its generic is allowed

Rule 1. Overlapping pools are not allowed

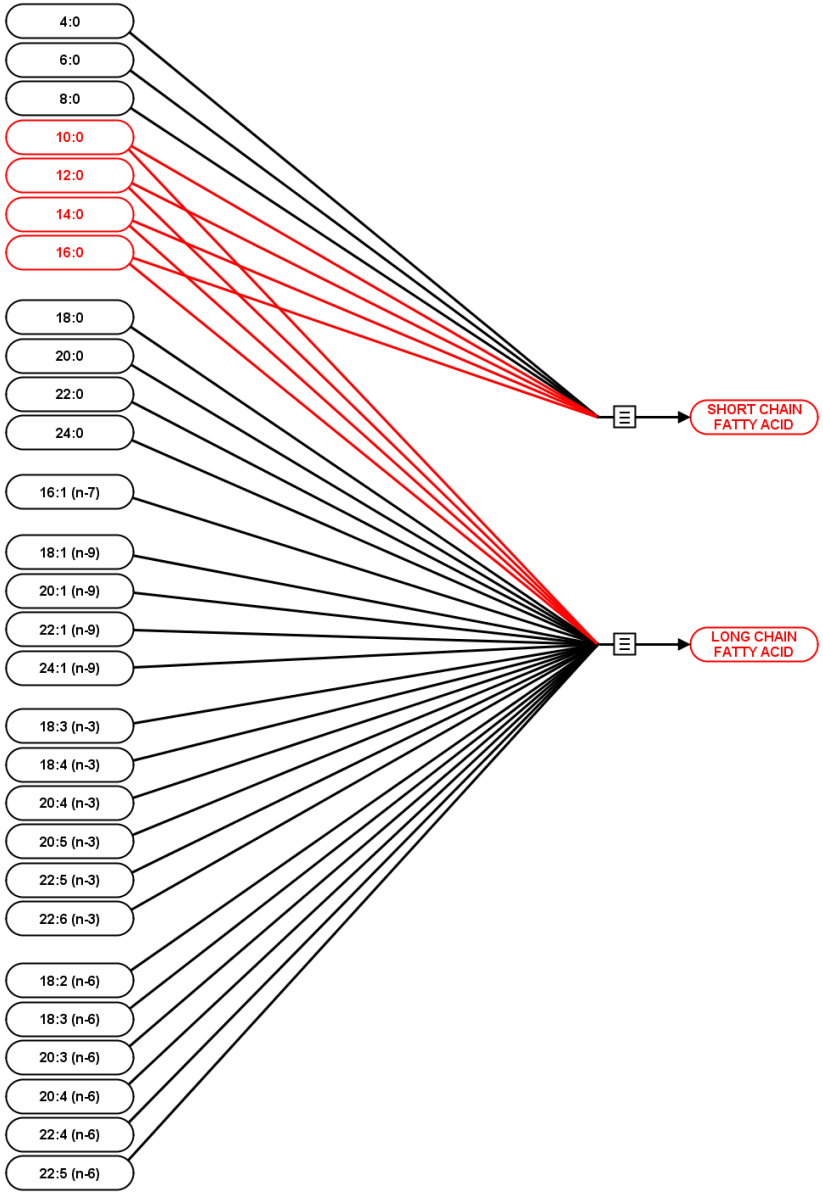




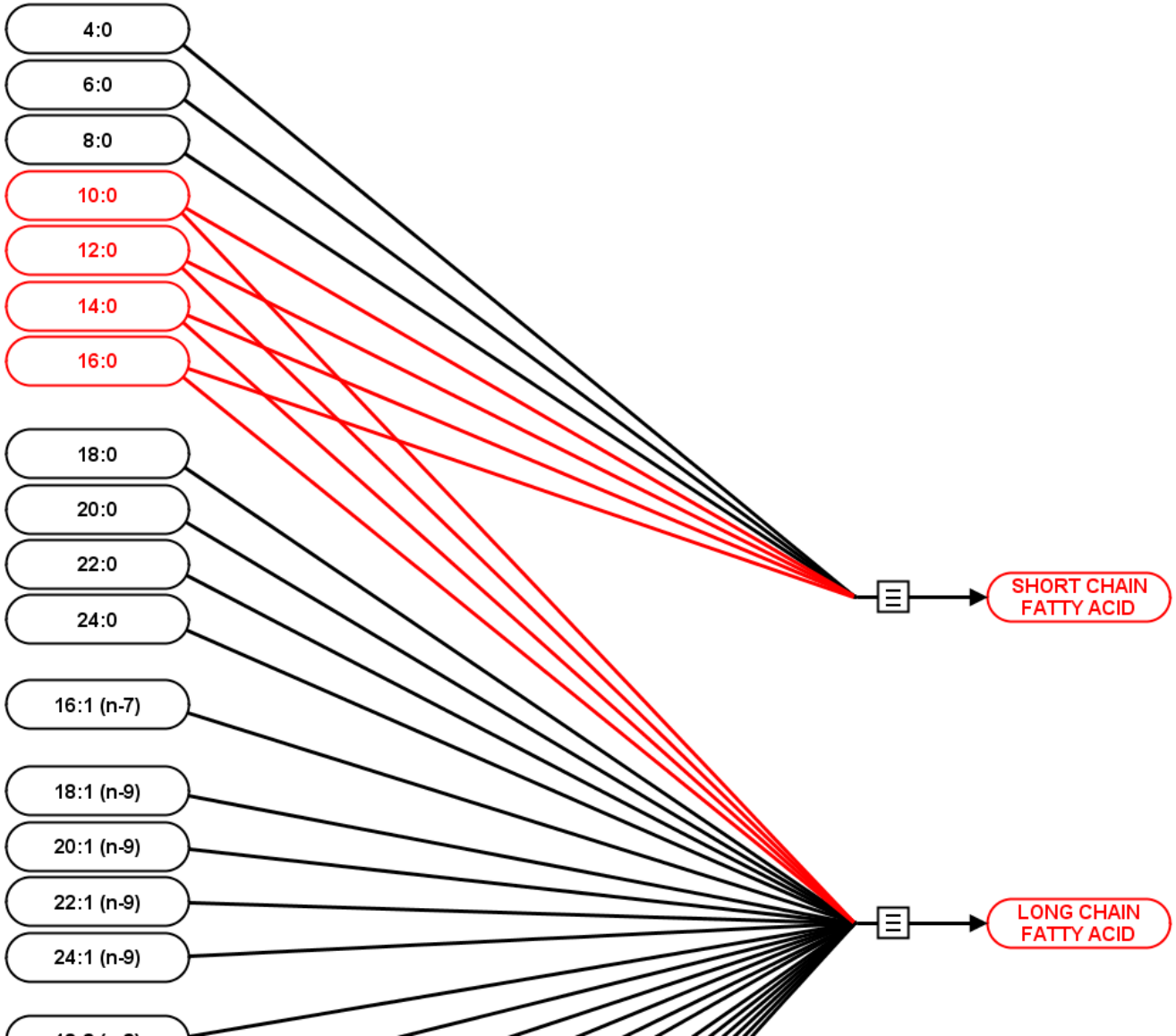




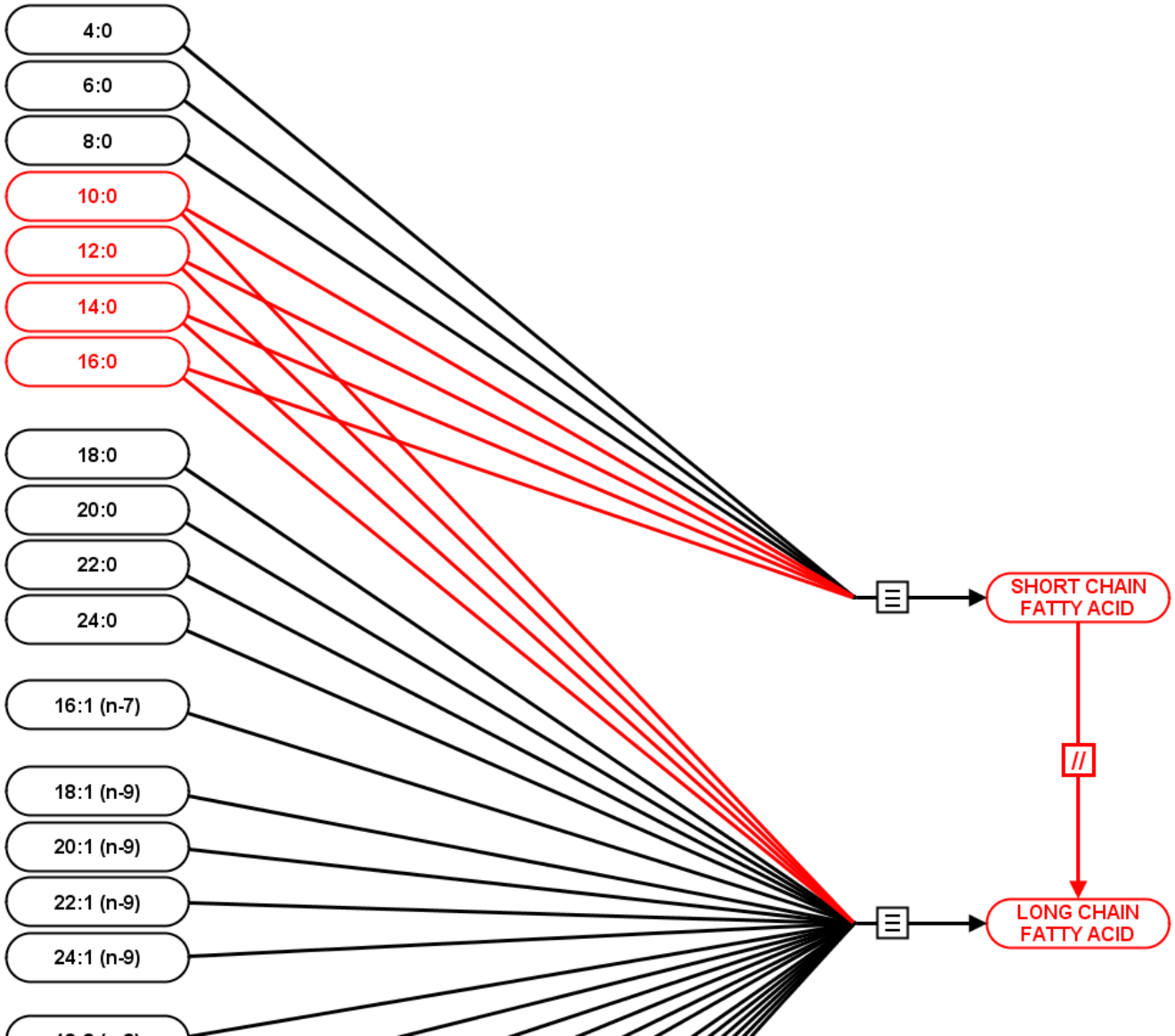
Example. Overlapping pools



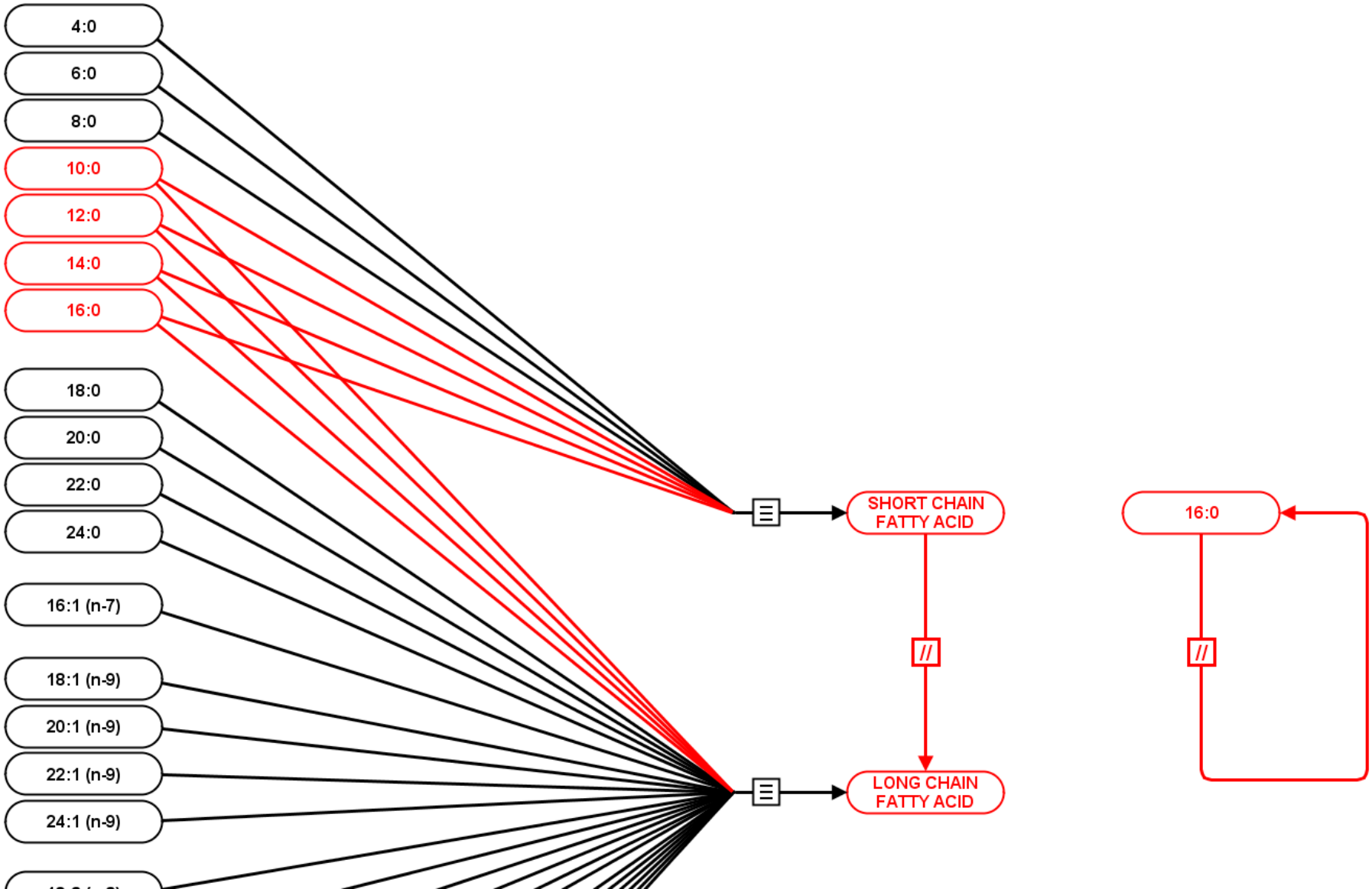
Example. Overlapping pools



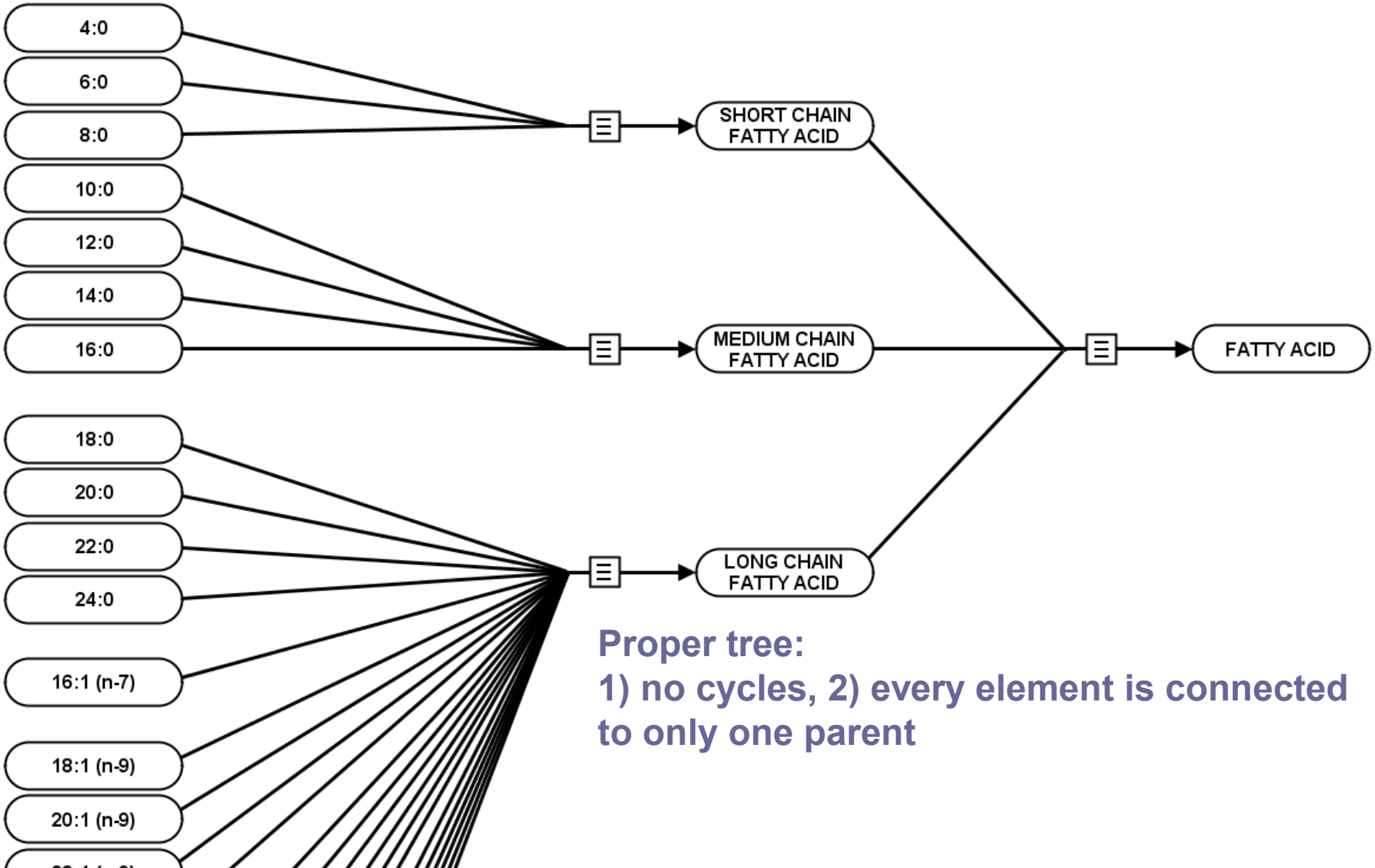
Example. Overlapping pools



Example. Overlapping pools

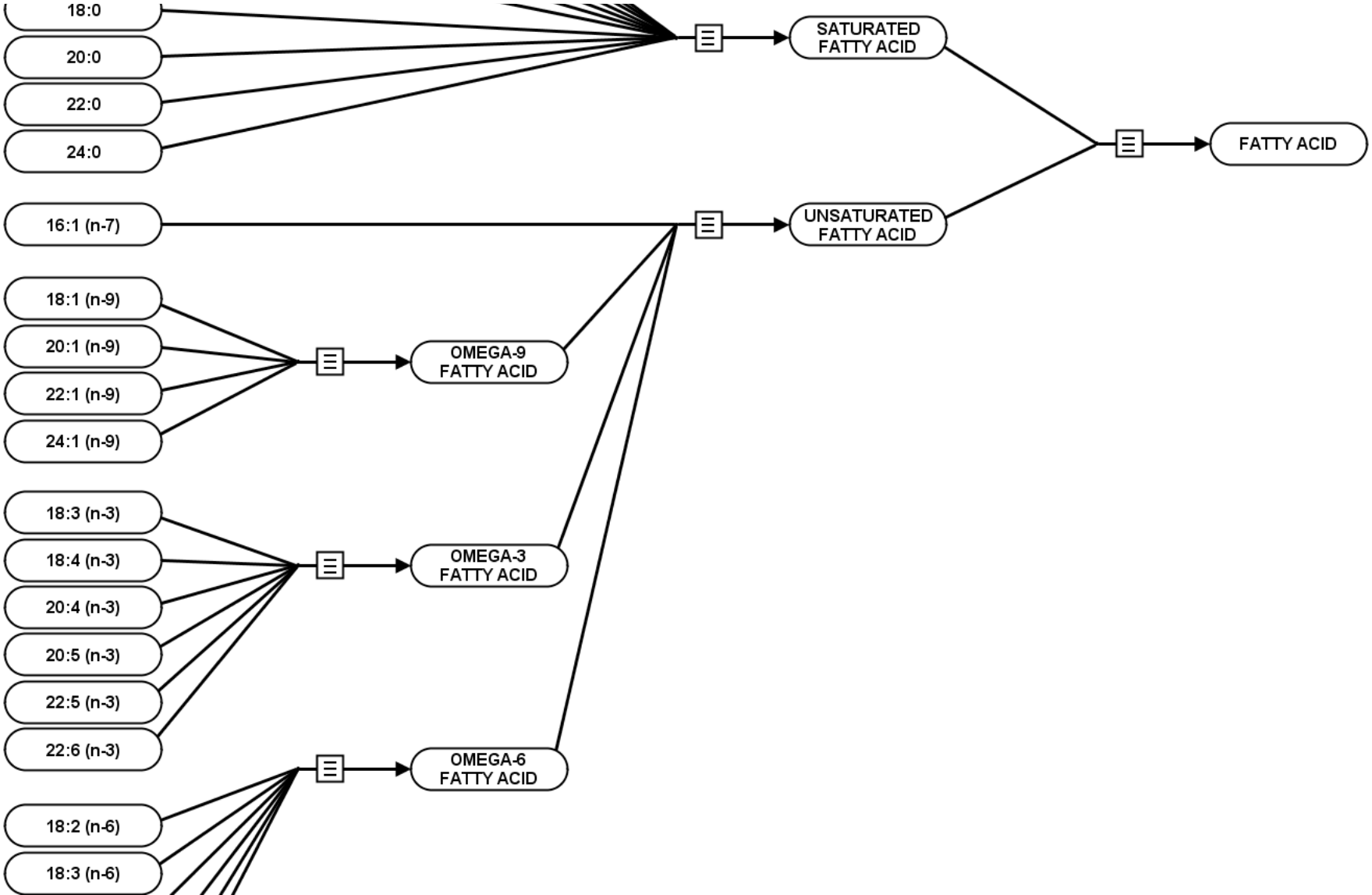


Fatty acid generic chart: short, medium and long chain fatty acids

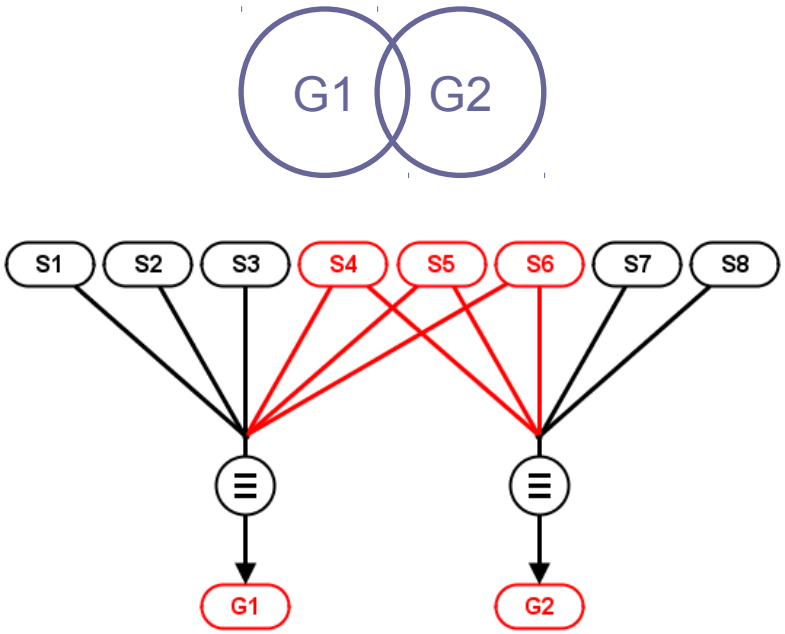


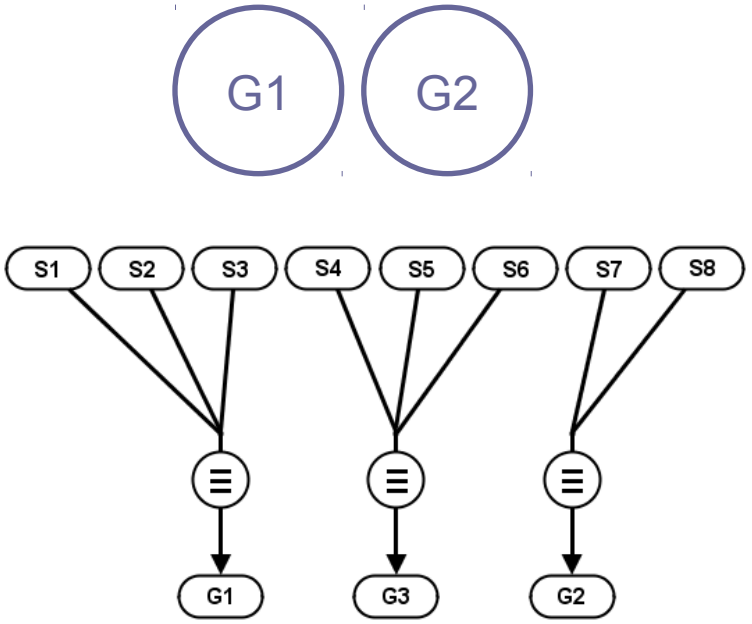
Proper tree:
1) no cycles, 2) every element is connected to only one parent

Fatty acid generic chart: saturated and unsaturated fatty acids

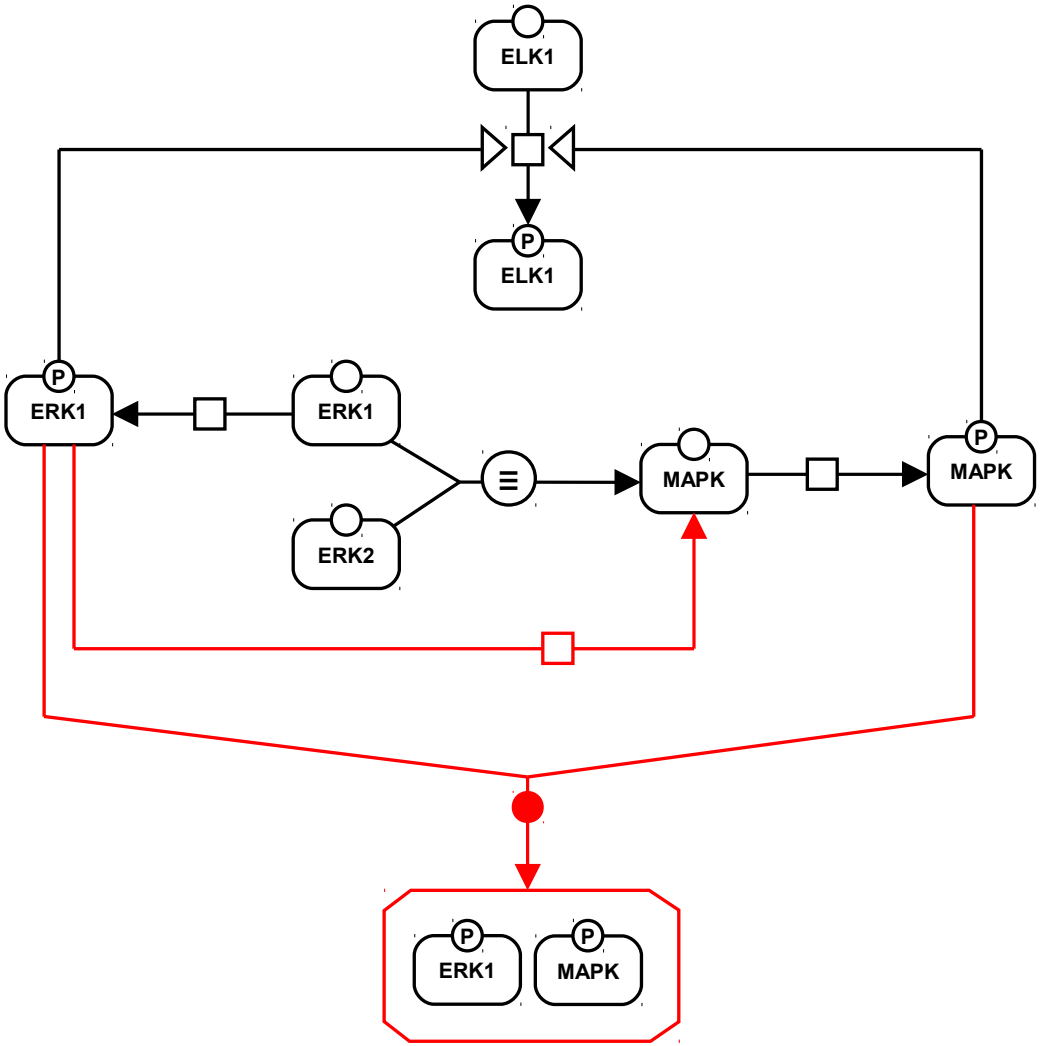


Rule 1. Overlapping pools are not allowed





Rule 2. A process should not affects EPNs belonging or deriving from both sides of an identity process (Nicolas Le Novère)



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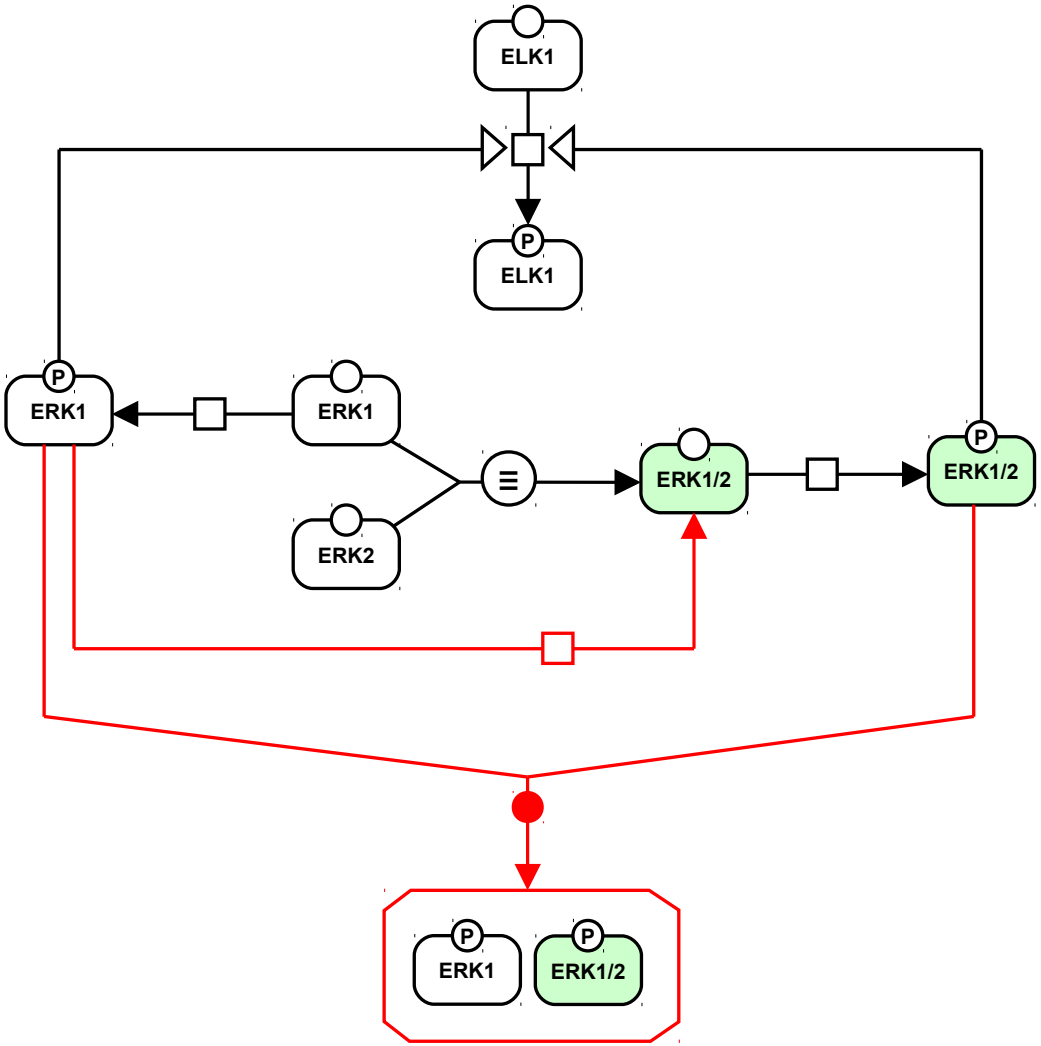

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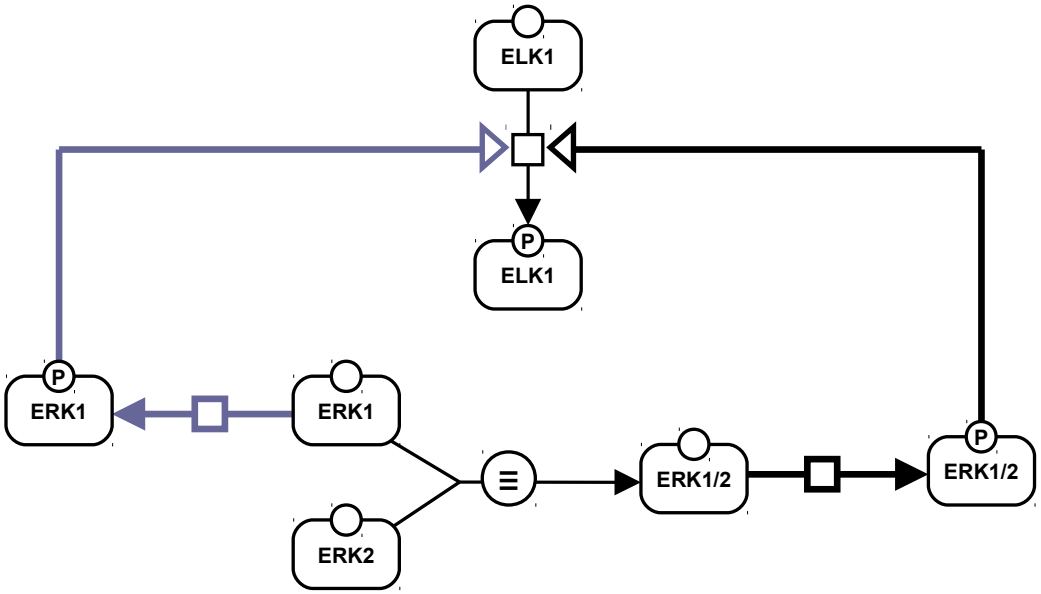

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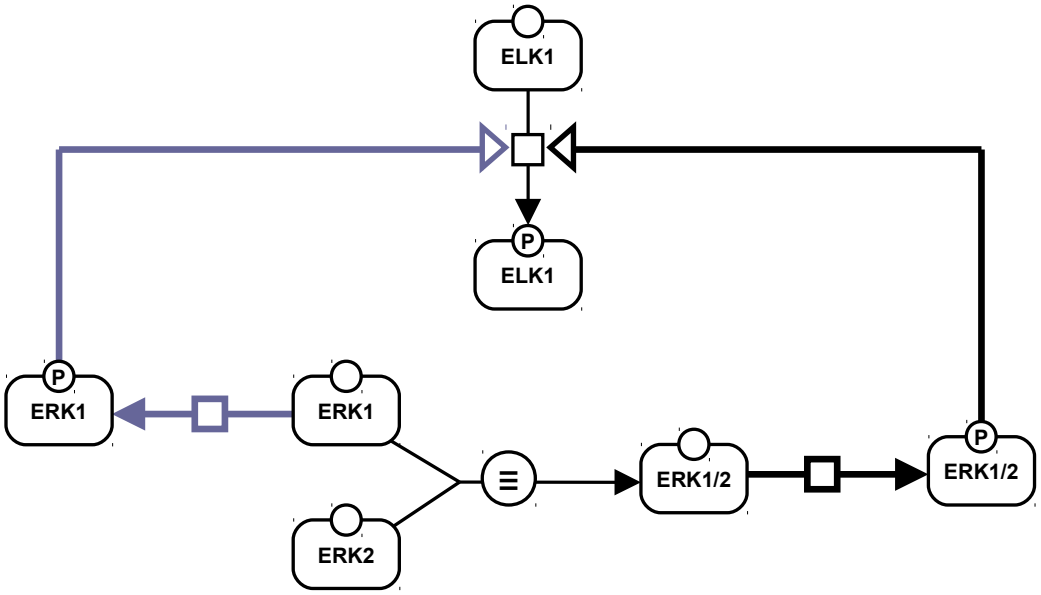
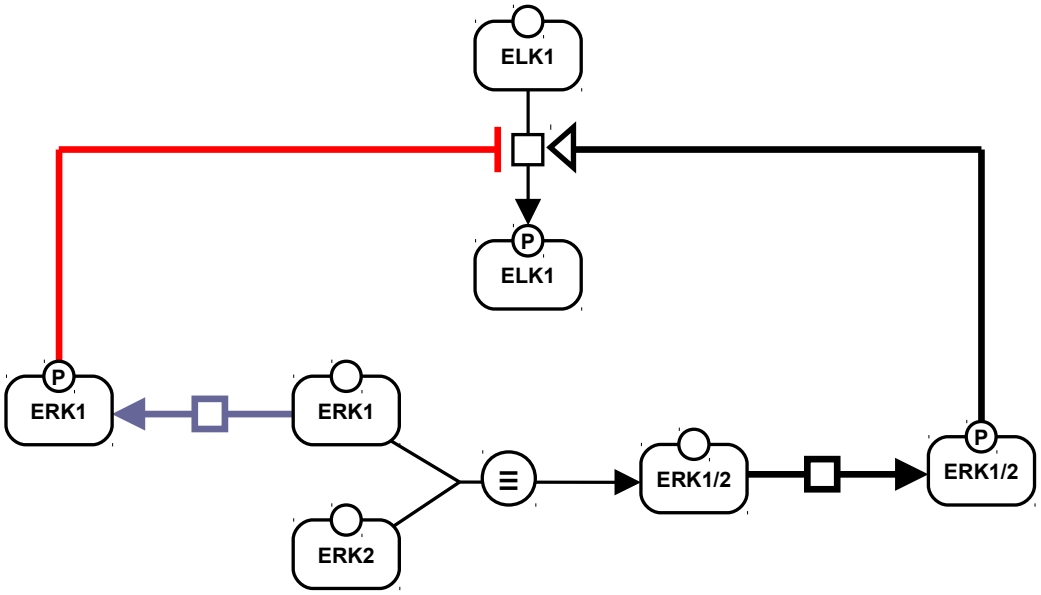


“Included” processes are allowed

“Included” regulatory links are allowed

Rule 2. A process should not affects EPNs belonging or deriving from both sides of an identity process (Nicolas Le Novère)



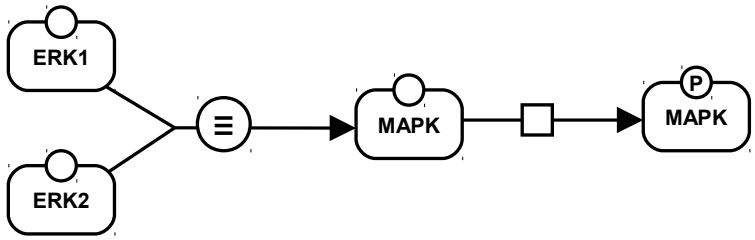
“Included” processes are allowed

“Included” regulatory links are allowed

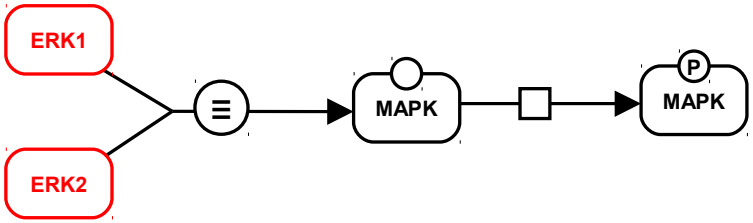
Contradicting regulatory links are NOT allowed

State variable

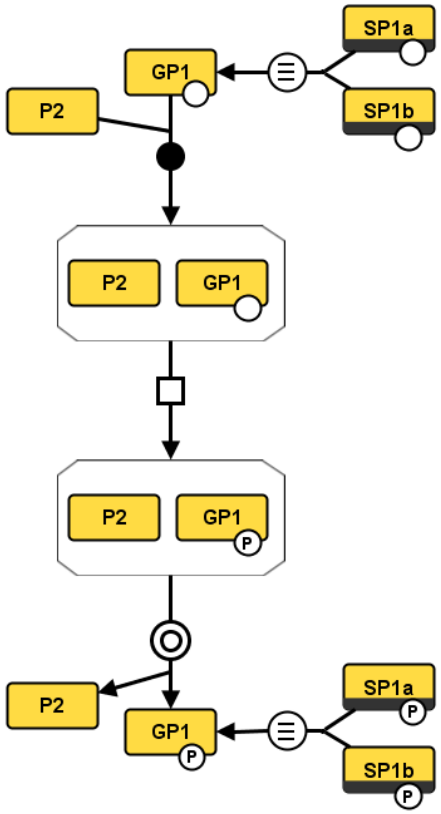
correct



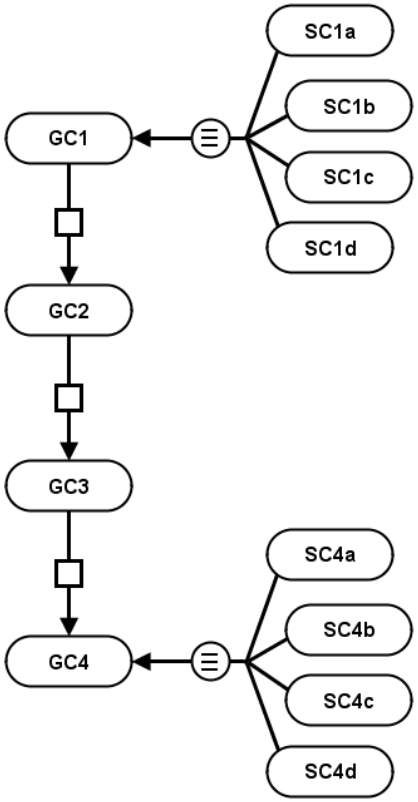
wrong



Rule 3. For simple chemicals (stateless EPN) it is NOT allowed to show specifics both as input and as output of the pathway



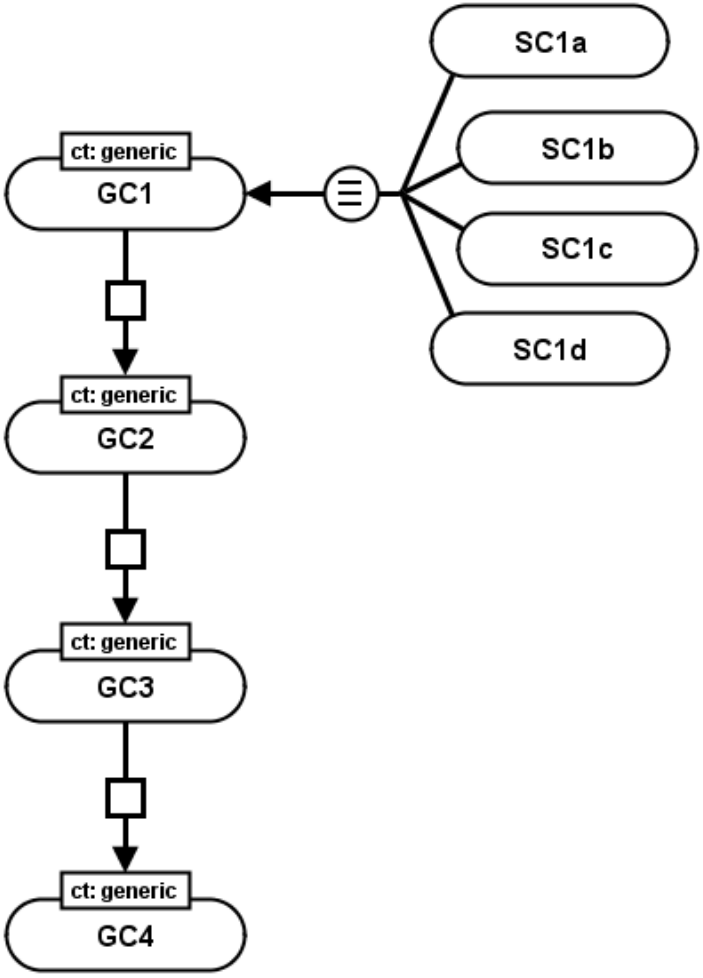
The names remain the same



SC1a -> SC4a
SC1b -> SC4b
SC1c -> SC4c
SC1d -> SC4d

The names are different

Unit of information can be used to mark generics



Summary

- Identity gate rather than identity process 
- Always directed from specifics to generic
- One-specific-to-one-generic identity operator is allowed
- **Rule 1.** Overlapping pools are not allowed
  - "Included" processes are allowed
  - "Included" regulatory links are allowed
  - Contradicting regulatory links are not allowed
- **Rule 2.** A process should not affects EPNs belonging or deriving from both sides of an identity process
- **Rule 3.** For simple chemicals (stateless EPN) it is NOT allowed to show specifics both as input and as output of the pathway.

Acknowledgments

Anatoly Sorokin
Stuart Moodie
Nicolas Le Novère

SBGN-ED developers team

Thank you

Division of PATHWAY MEDICINE

CSBE
CENTRE FOR SYSTEMS BIOLOGY AT EDINBURGH

School of informatics