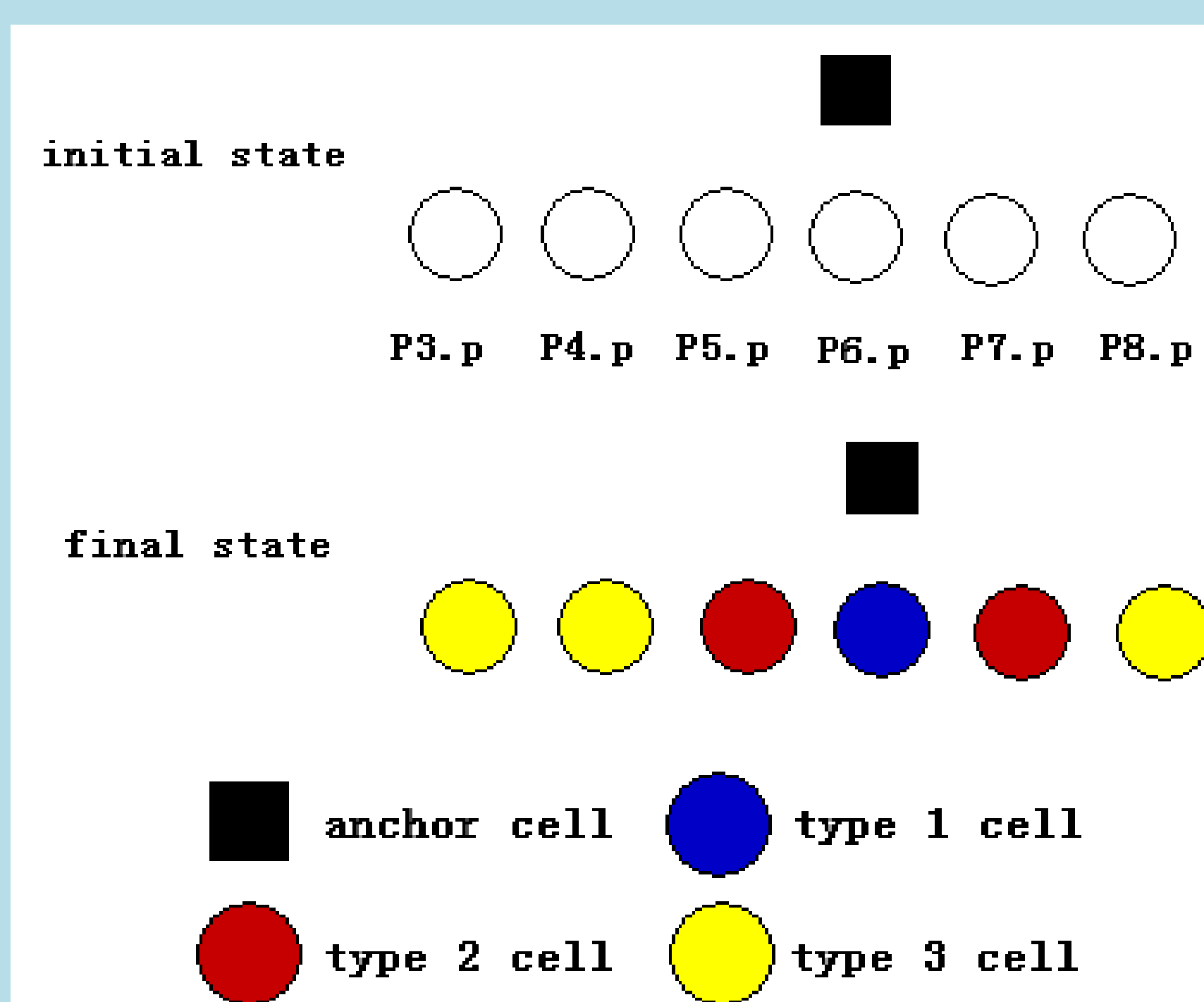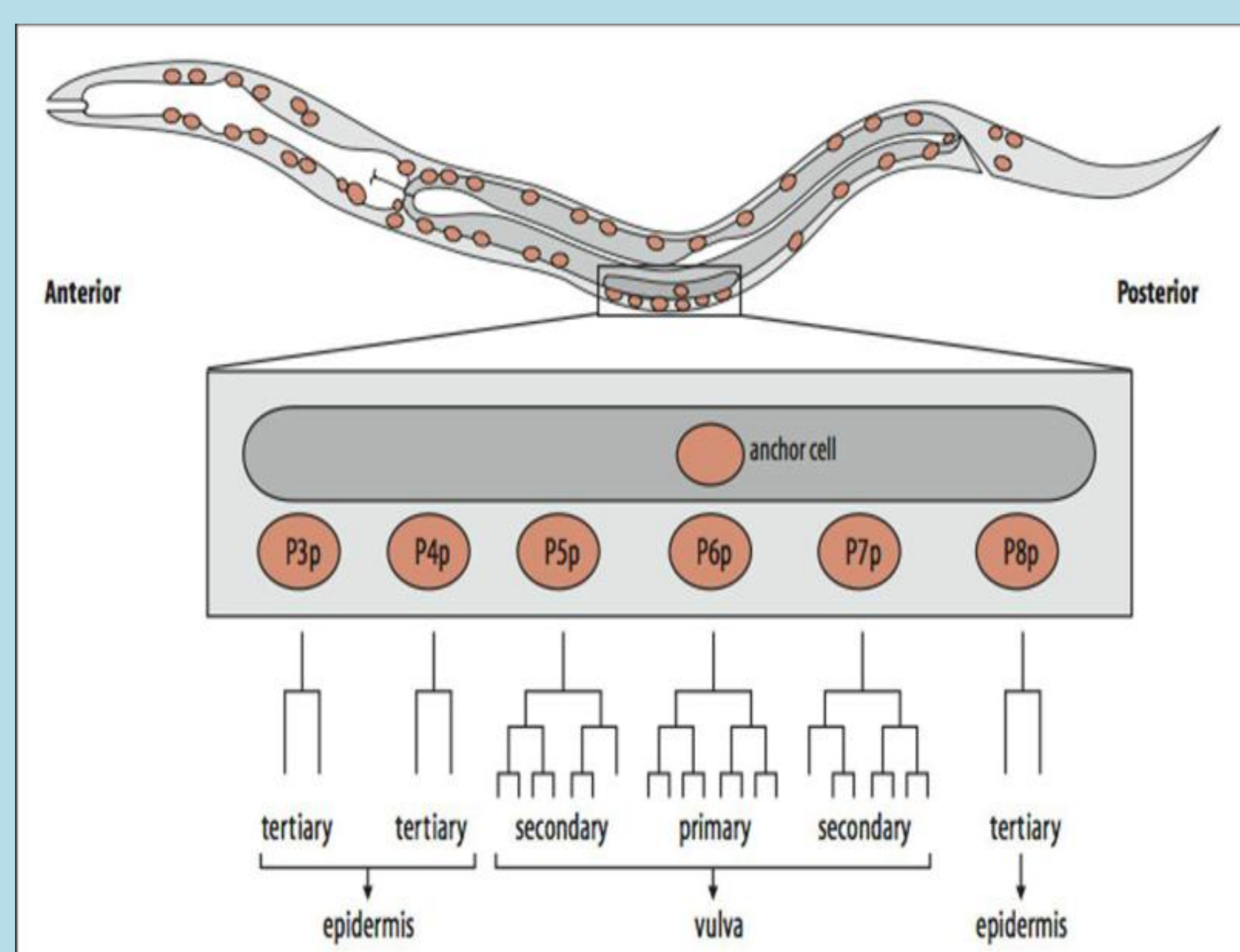# Cell fate patterning in *C.elegans* VPCs
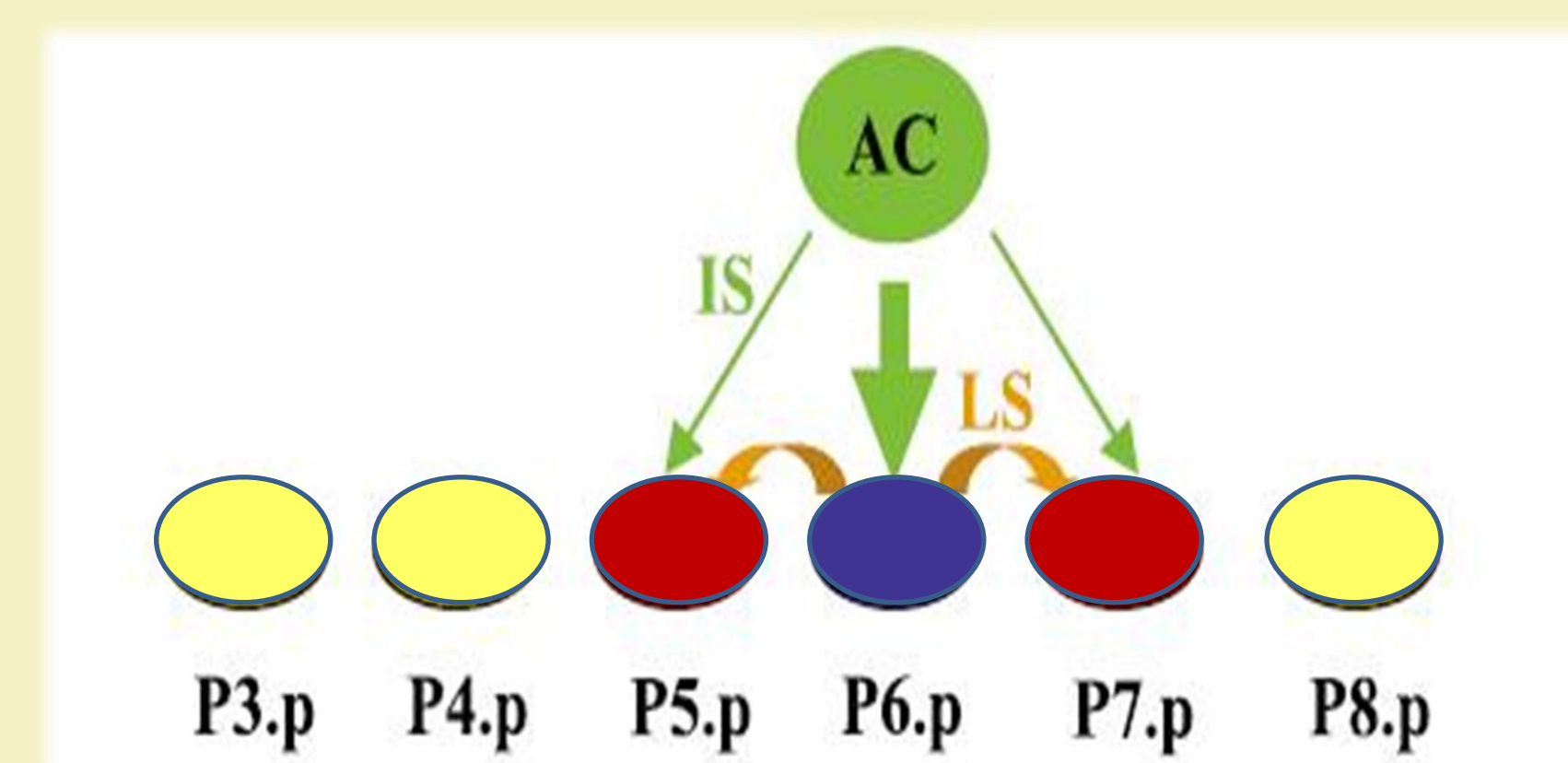
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➤ Introduction

C.elegans VPC differentiation

Anterior / Posterior
anchor cell
P3p P4p P5p P6p P7p P8p
tertiary tertiary secondary primary secondary tertiary
epidermis vulva epidermis

initial state
P3.p P4.p P5.p P6.p P7.p P8.p
final state

- anchor cell
- type 1 cell
- type 2 cell
- type 3 cell

Signaling pathway

AC IS LS
P3.p P4.p P5.p P6.p P7.p P8.p

crosstalk

		Signal Pathway	Receptor	Ligand	Transmission Way
Inductive signal（IS）		EGF pathway	EGFR(LET-23)	EGF(LIN-3)	diffusible
Lateral signal（LS）		Notch pathway	Notch(LIN-12)	DSL-1	diffusible
				LAG-2, APX-1	membrane-bound

Signal transductions induce *C.elegans* VPCs patterning

➤ Model
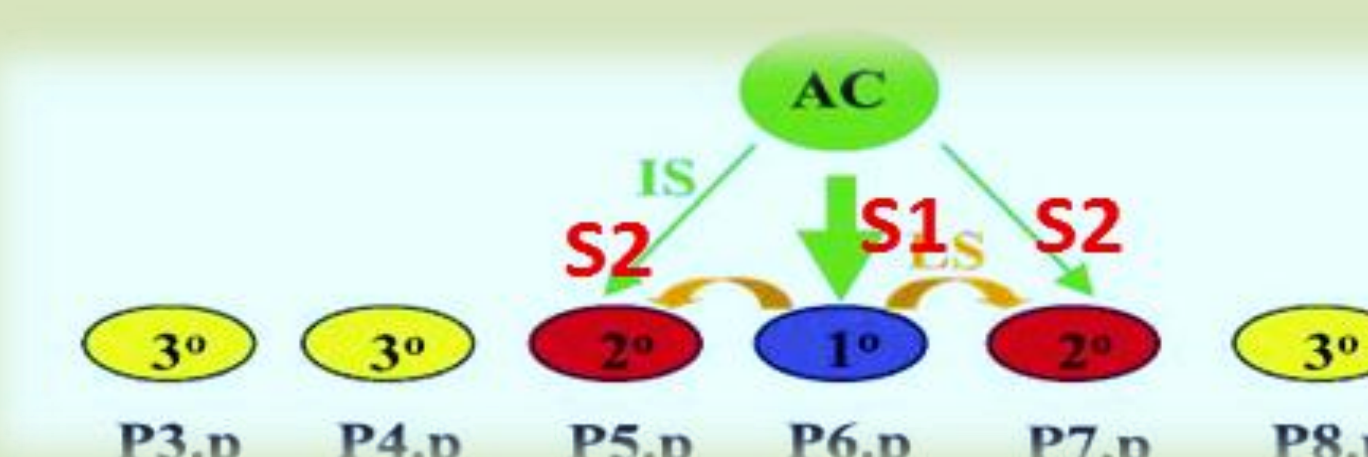
topology — follow — function

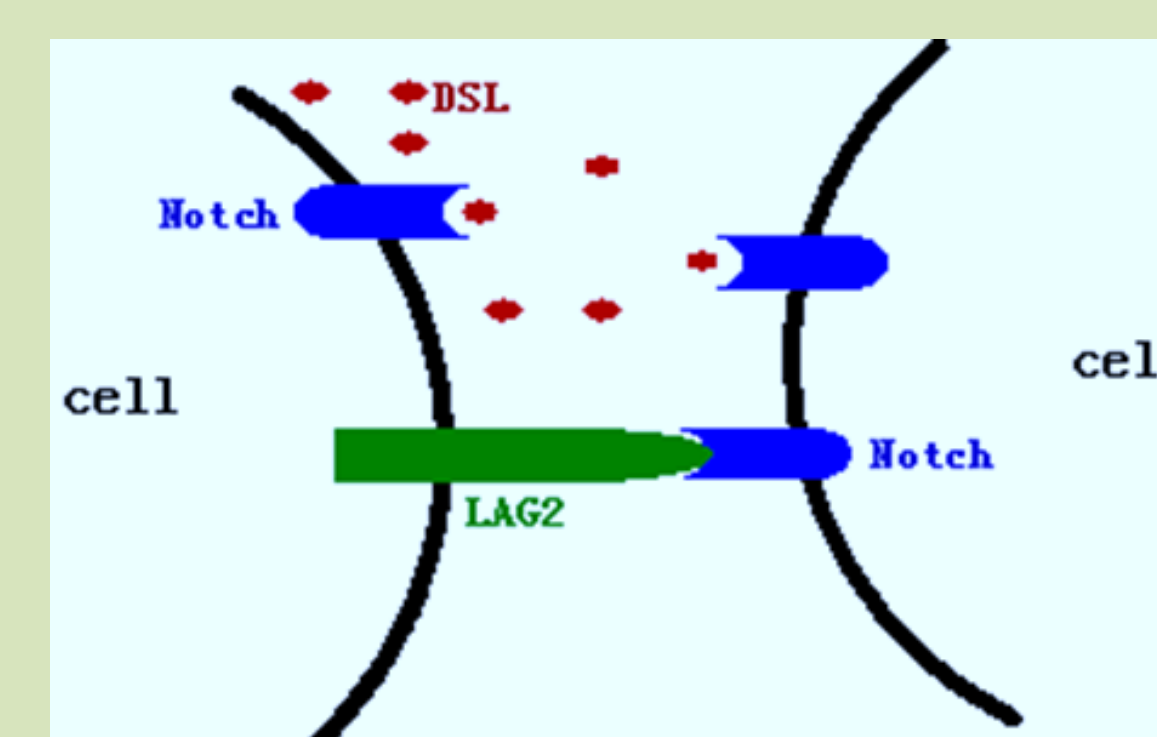$$\frac{dB}{dt} = V\frac{A^n}{A^n + k^n} - \frac{B}{\tau}$$

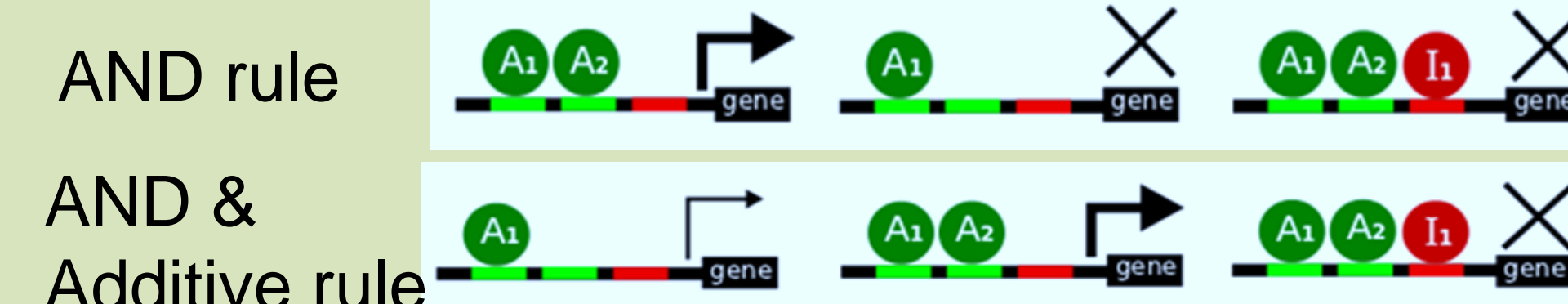$$\frac{dB}{dt} = V\frac{k^x}{A^x + k^x} - \frac{B}{\tau}$$

AC S2 S2
initial
P3.p P4.p P5.p P6.p P7.p P8.p
target

coarse graining

AC
1° 2° 3°

simplify

1° 2° AC

conditions

(1)S1=1, S2=0-0.5

AC IS S2 S1 S2
3° 3° 2° 1° 2° 3°
P3.p P4.p P5.p P6.p P7.p P8.p

(2) Different DSL/LAG2

DSL
Notch
cell
LAG2
Notch
cell

(3)Two logic rules

AND rule
AND & Additive rule

➤ Result

(1)Robustness constrain

Number of topologies vs Q value
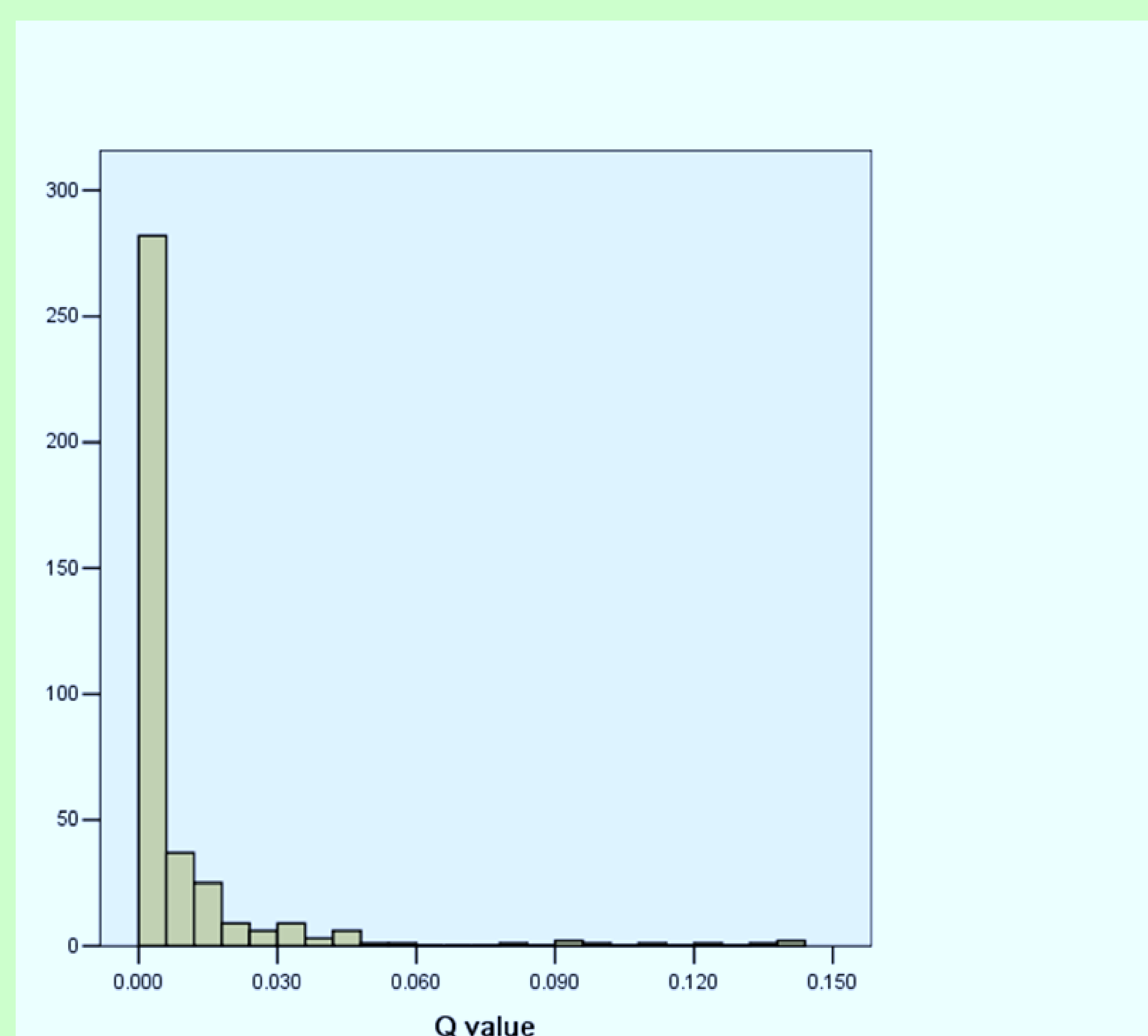
The distribution of Q for S2=0.1，AND rule，only DSL

(2) Prefer smaller S2 and more LAG2(membrane-bound)

AND rule

- onlyDSL
- DSL×2LAG2
- DSL×LAG2
- DSL×0.5LAG2
- onlyLAG2

Qmax vs S2
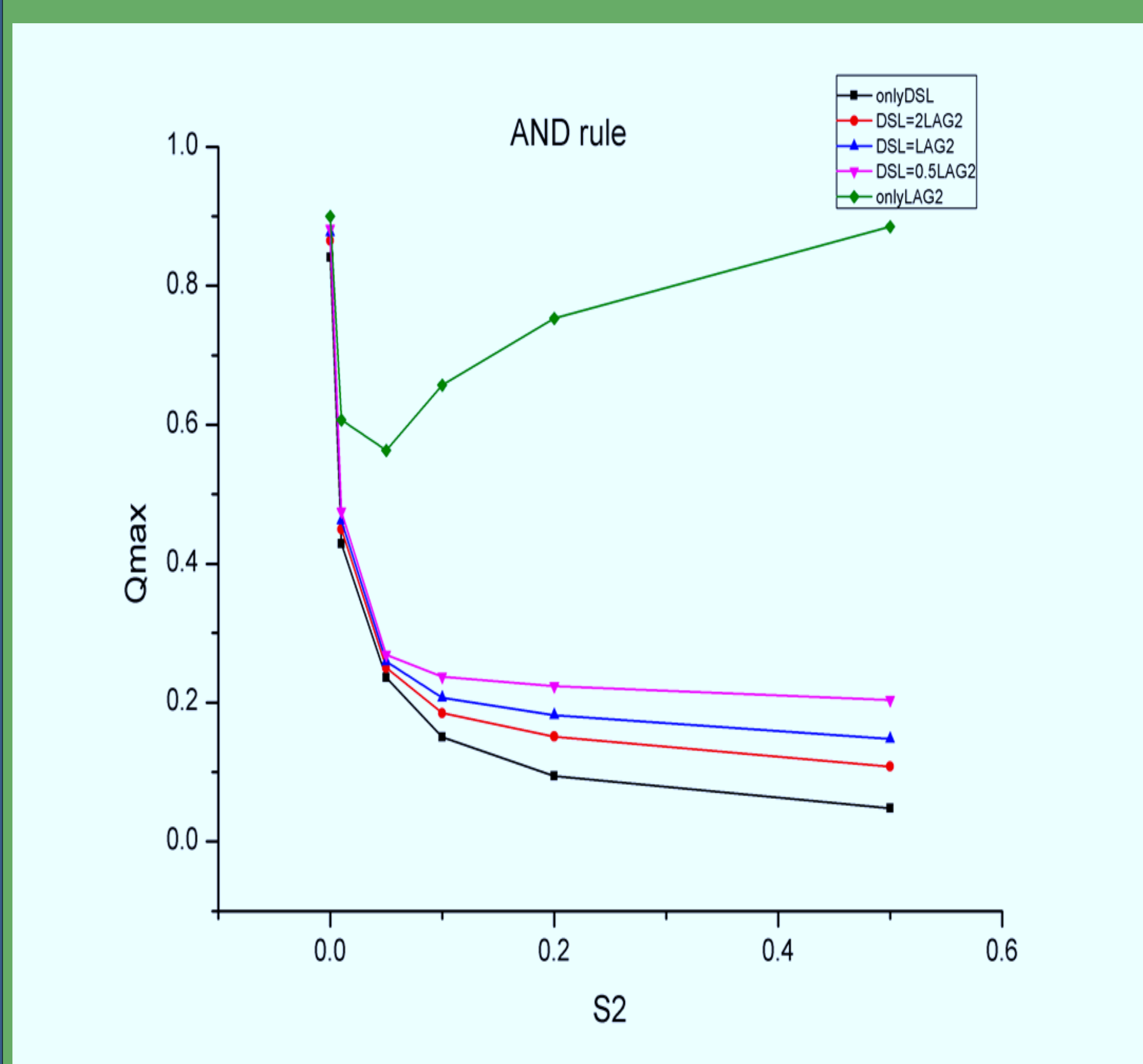
(3) Two types of topologies that can achieve the pattern

Type A

core topology 1
core topology 2

Type B

core topology 3