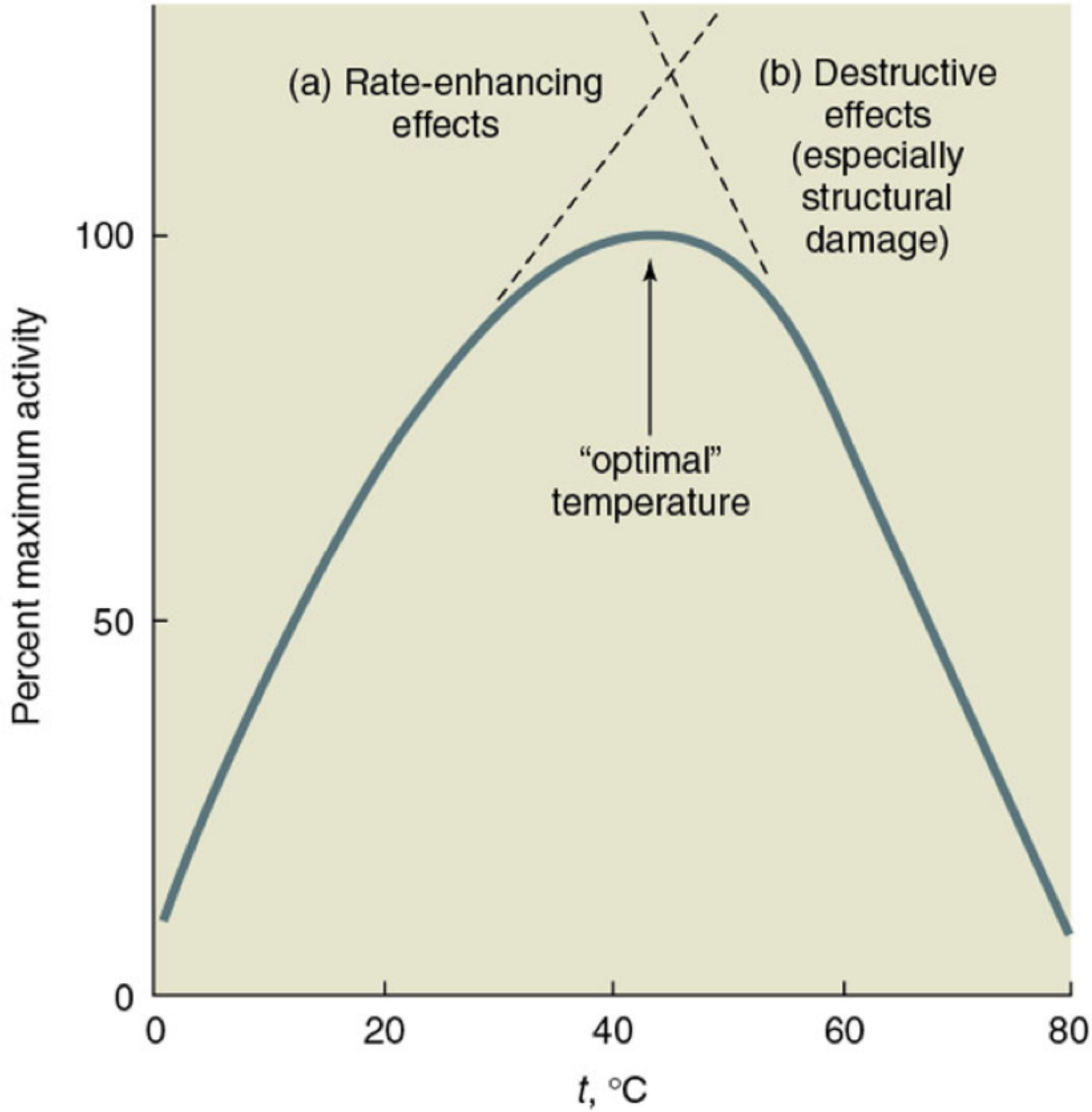
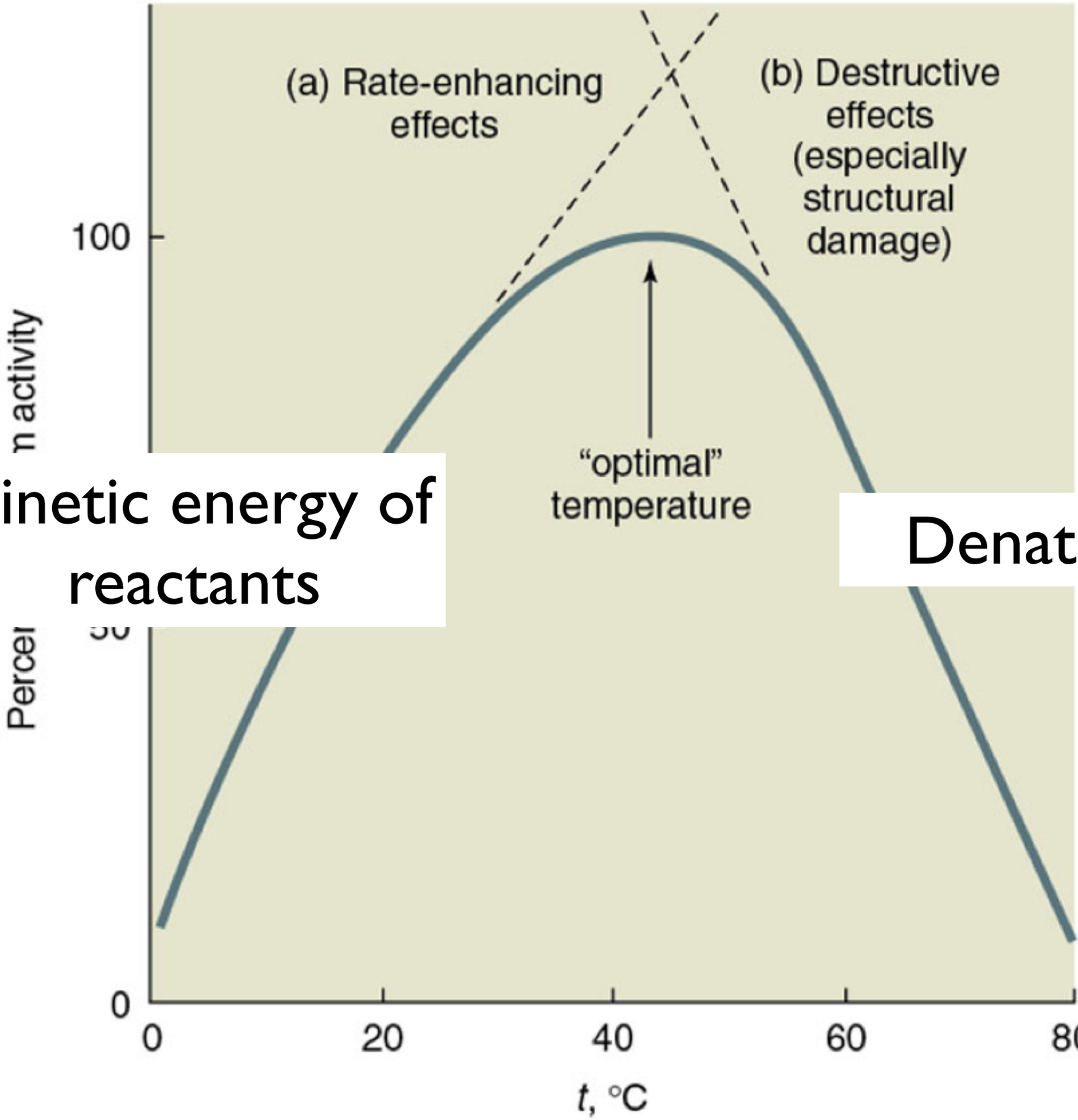
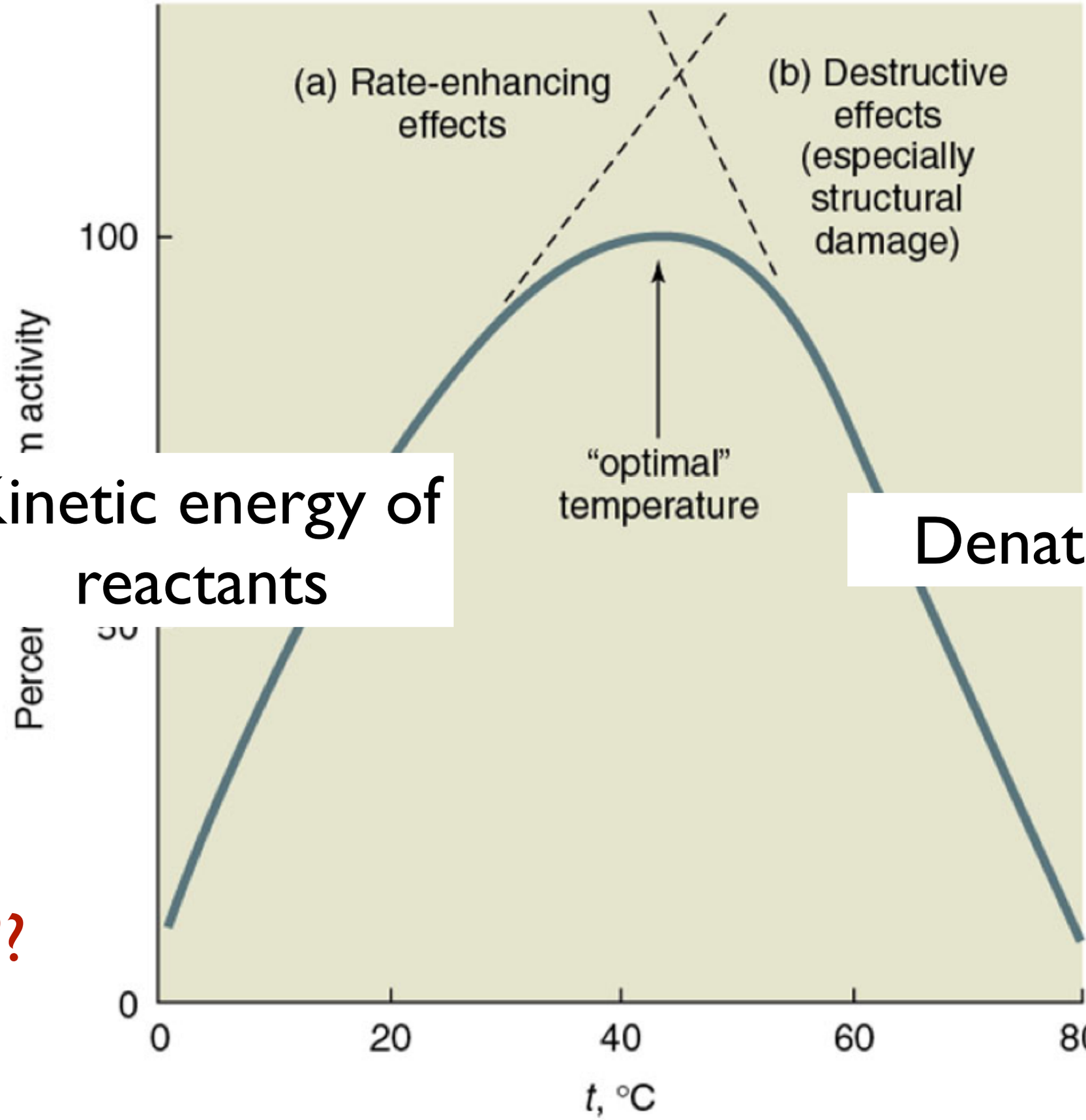
Temperature is important


(a) Rate-enhancing effects
(b) Destructive effects (especially structural damage)
"optimal" temperature
Percent maximum activity
100
50
0
0
20
40
60
80
t, °C



Kinetic energy of reactants

Denaturation

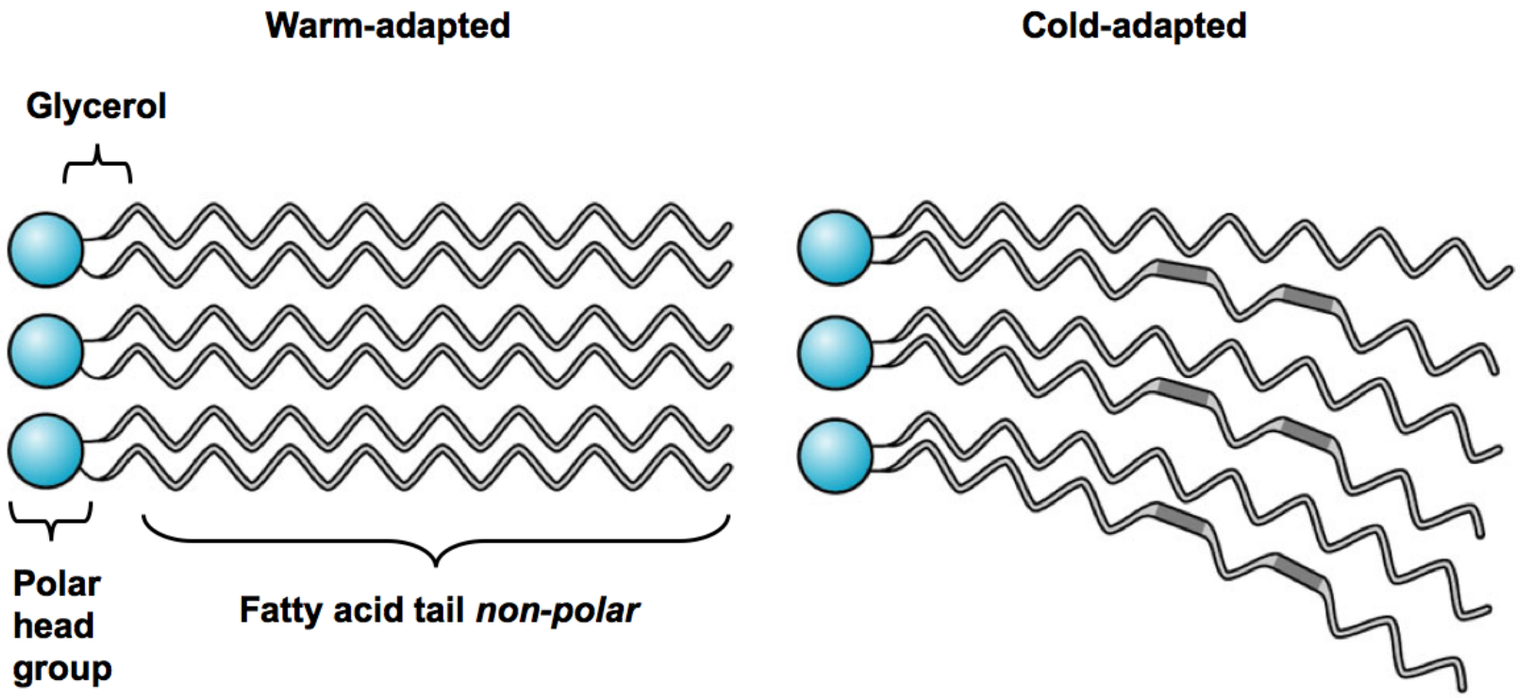


Kinetic energy of reactants

Denaturation

???????

Membranes



cholesterol

how does this change?

Rainbow trout - ratio *sat:unsats*

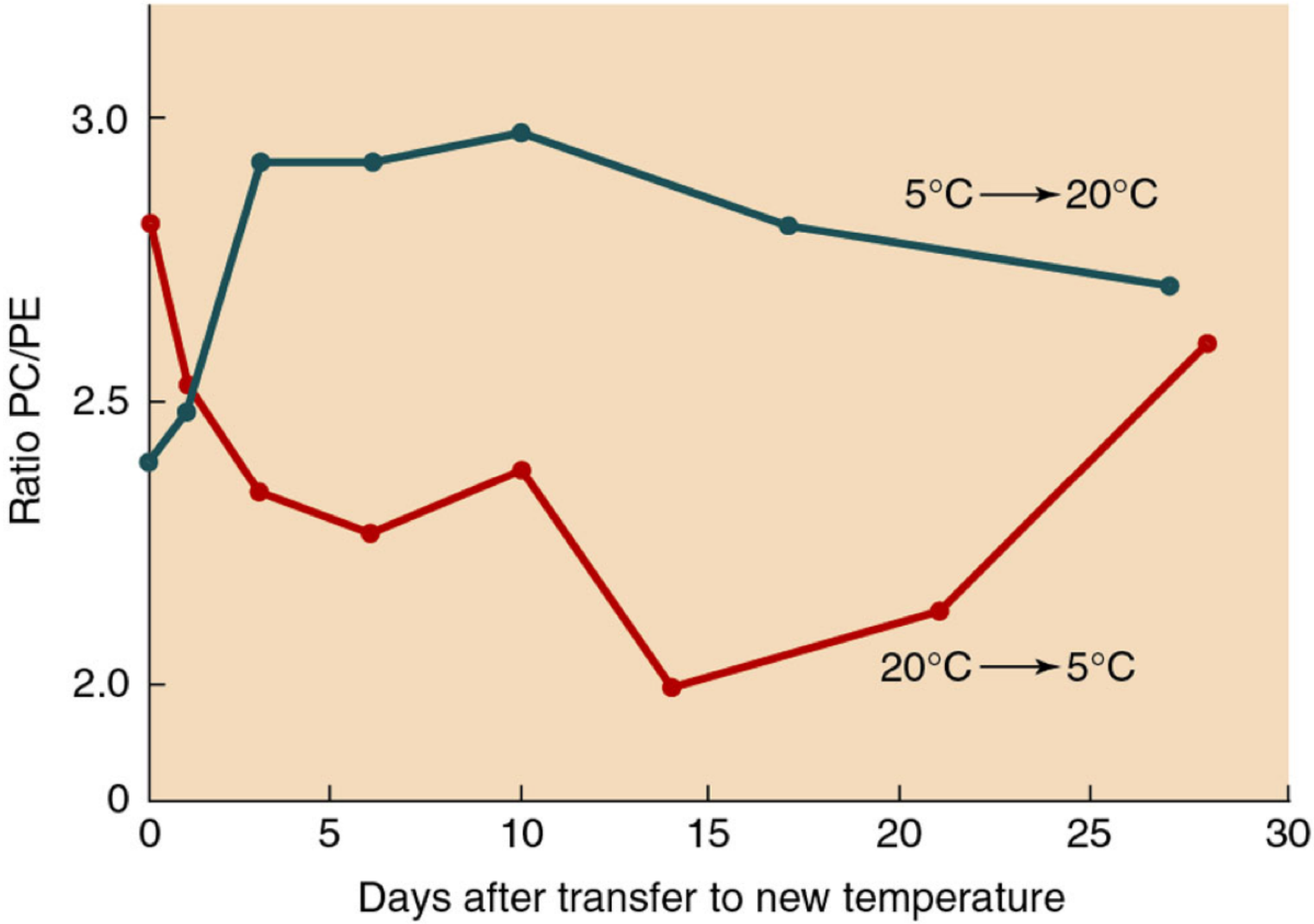


Fig. 15-8c, p.684

Ectotherms

Ectotherms

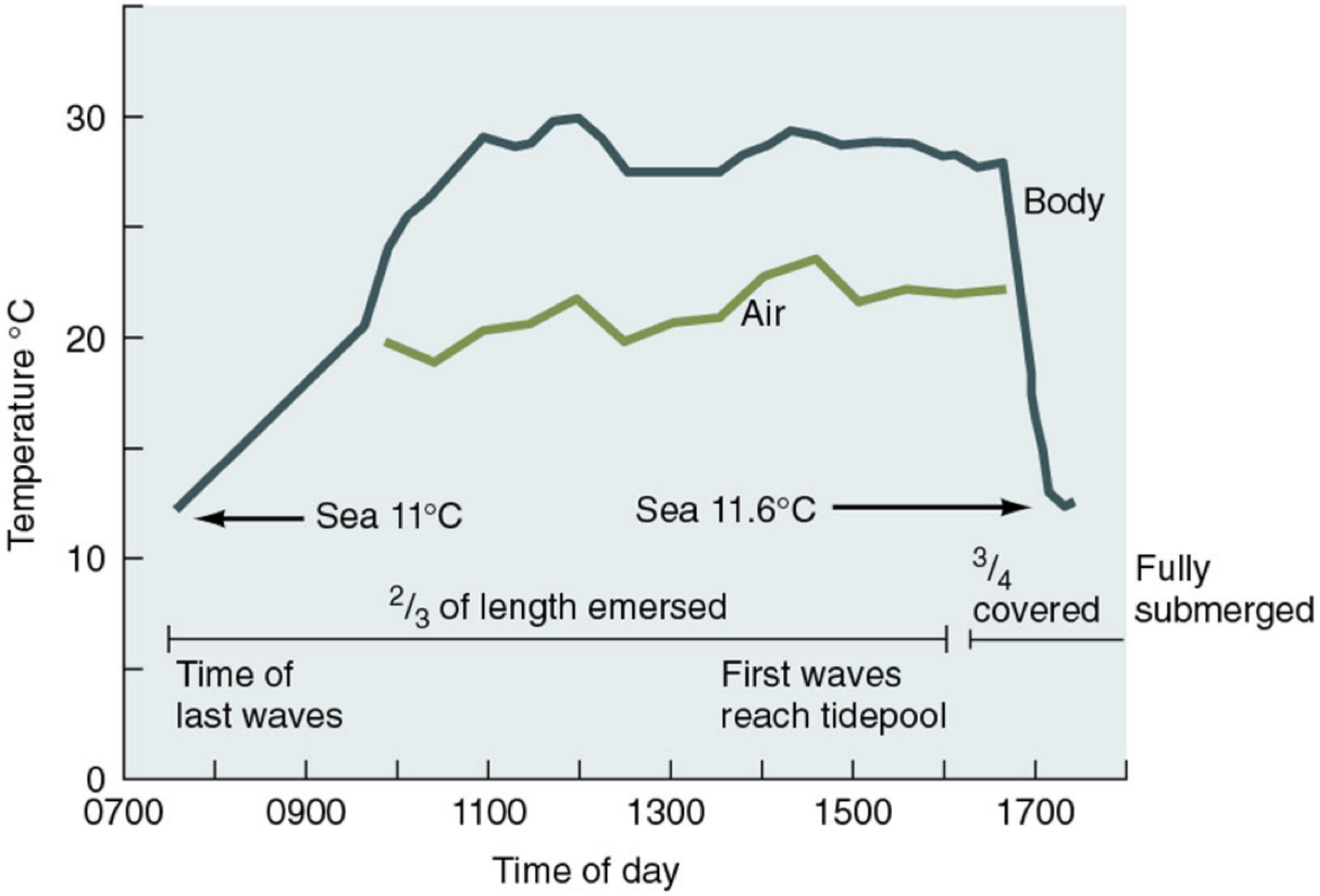


Fig. 15-13, p.689

Ectothermic regulators

Cole - Thomson

Limits to regulation

Acclimatization

Ectotherms can *metabolically compensate*

addition to Membranes -

ROTIENS also can change with temperature

Acclimatization

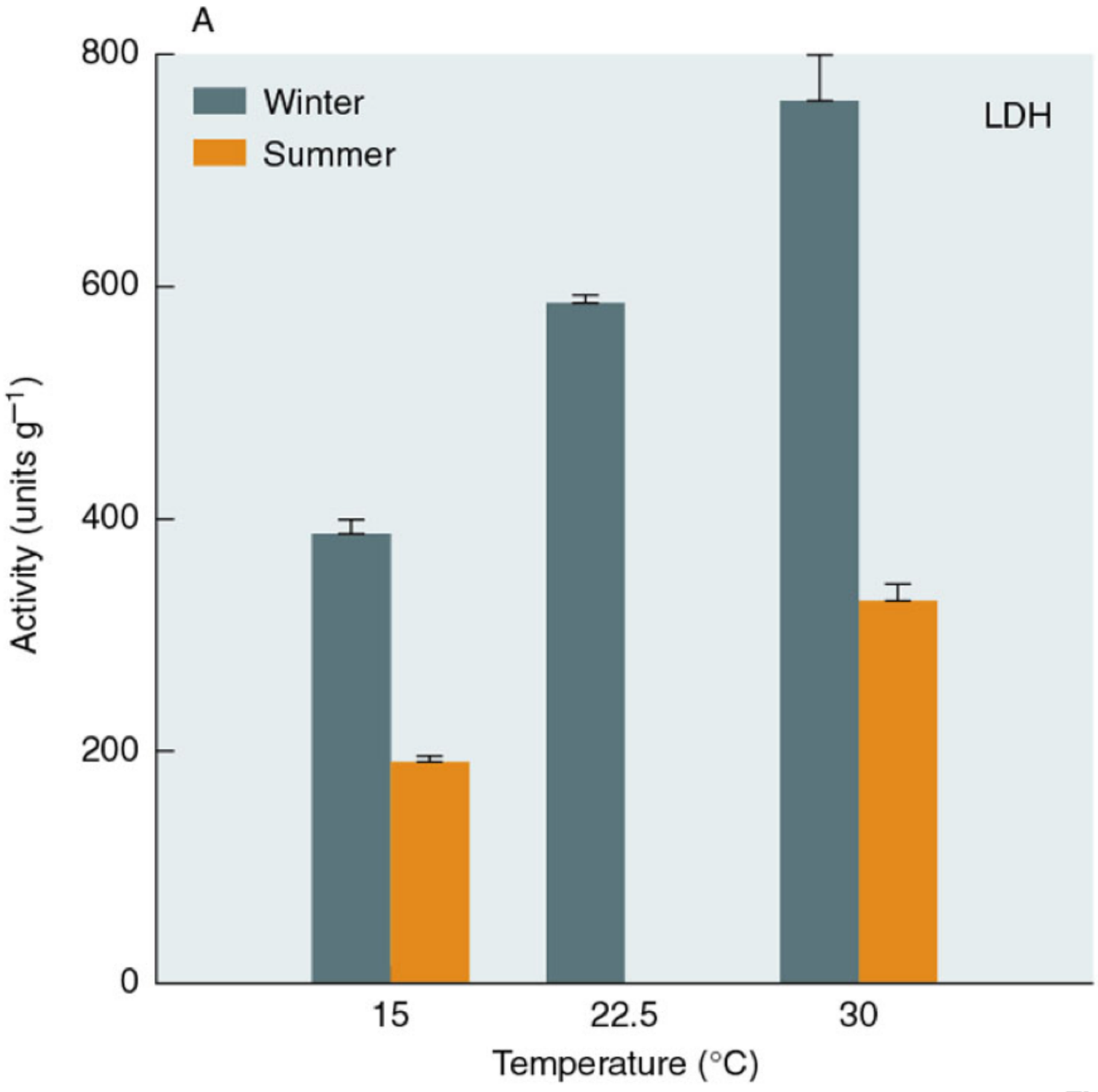


Fig. 15-15, p.690

How is metabolic compensation achieved?

- Membrane adaptation
- pH (amino acid Histidine)
- Enzyme concentration
- Isoform regulation

Tradeoffs

Ectotherms - extreme cold

Ectotherms - extreme cold

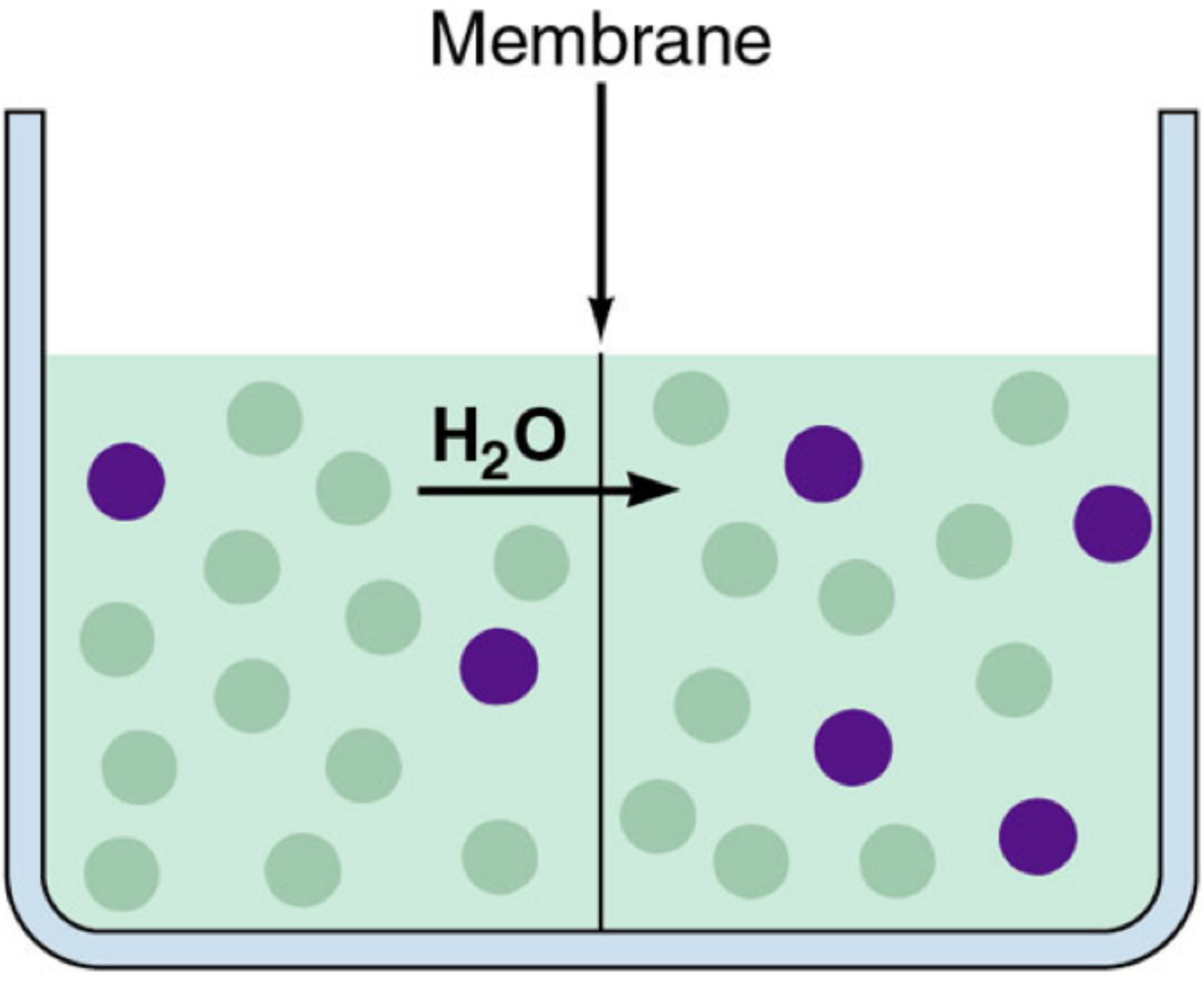
DORMANCY

Freeze Tolerance

Freeze Avoidance

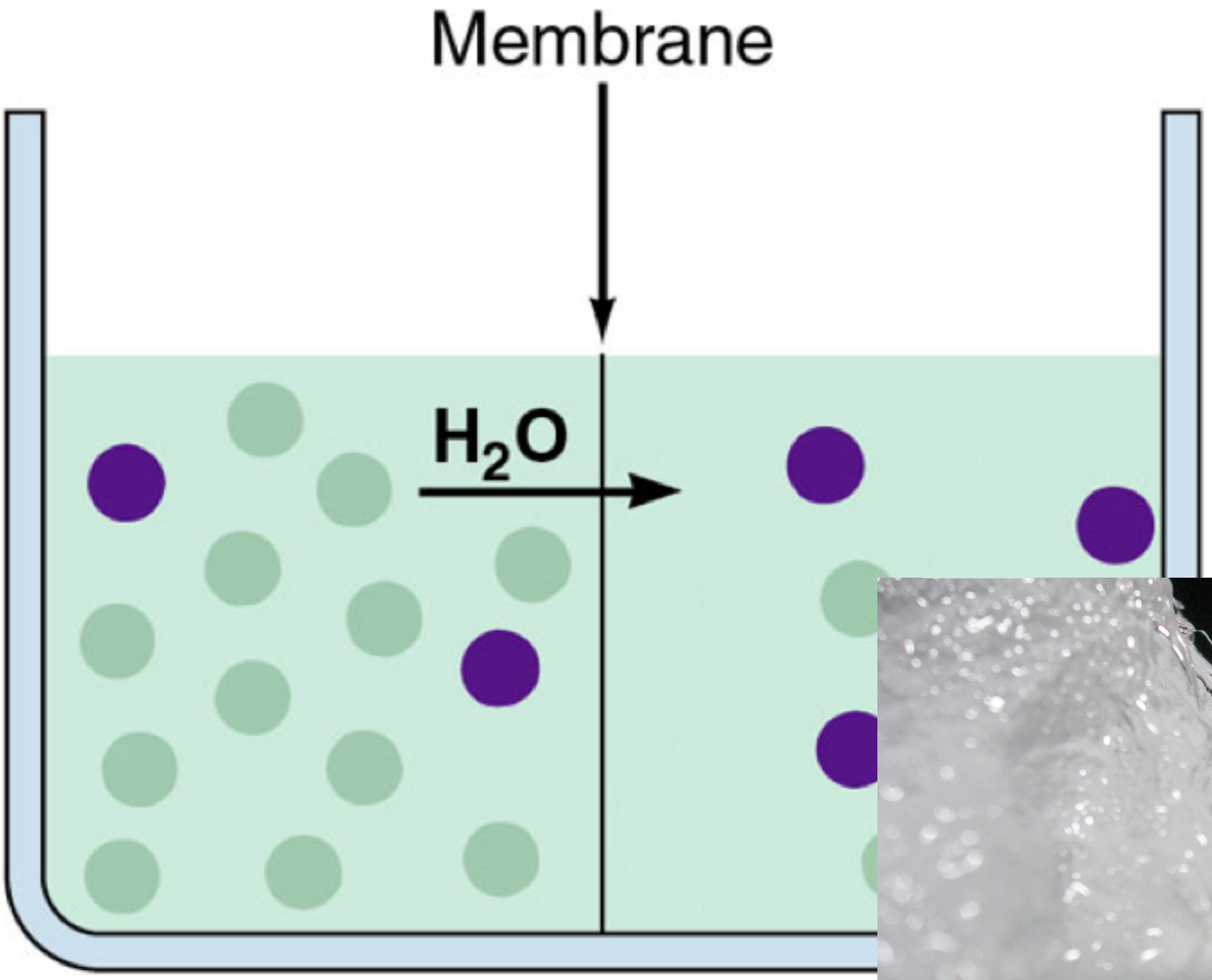
Tolerance

freeze



Tolerance

freeze



Tolerance

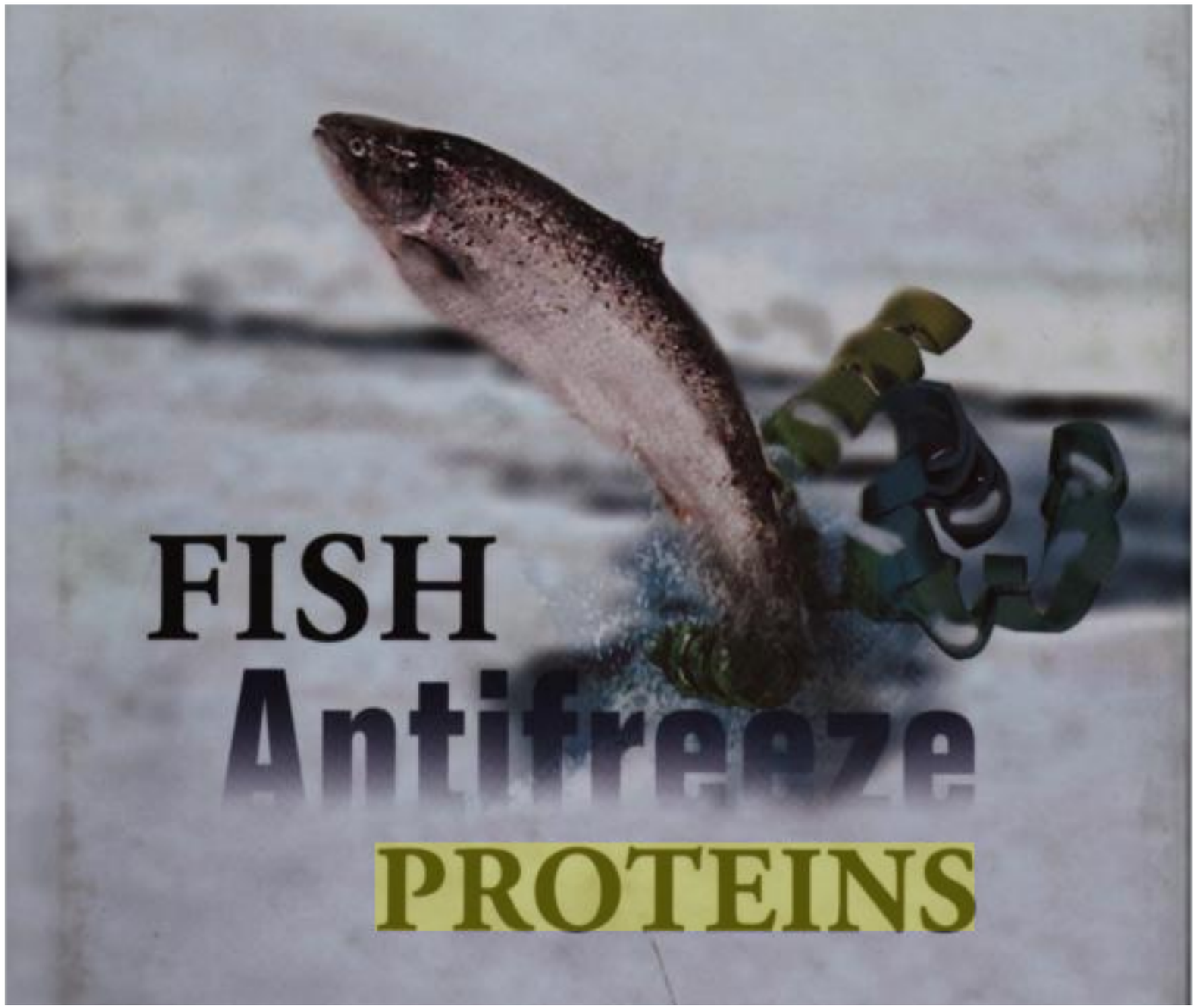
Tolerance

increase glucose

Tolerance

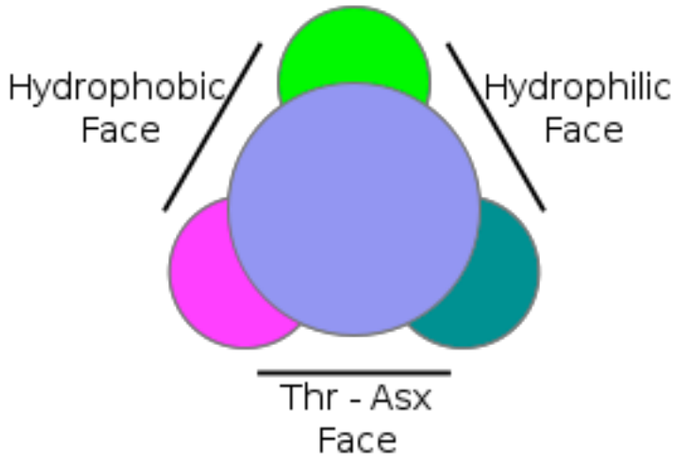
Avoidance

Avoidance



Avoidance

J. Duman and A.L. DeVries. (1976). Isolation, characterization and physical properties of protein antifreezes from the Winter Flounder *Pseudopleunectus Americanus*. Comp. Biochem. Physiol. B54, 375–380.



Elevated temperature

Elevated temperature

acute

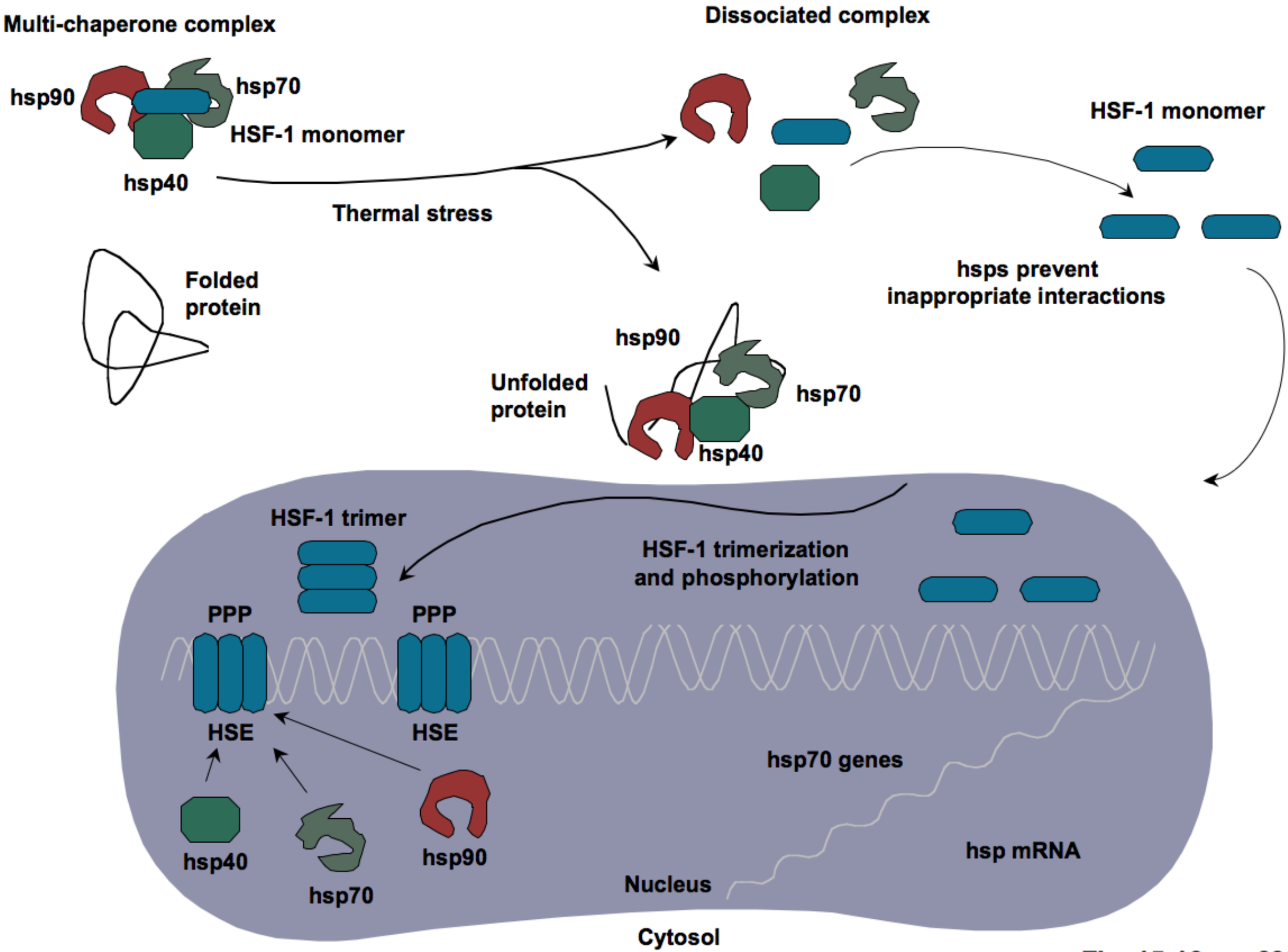
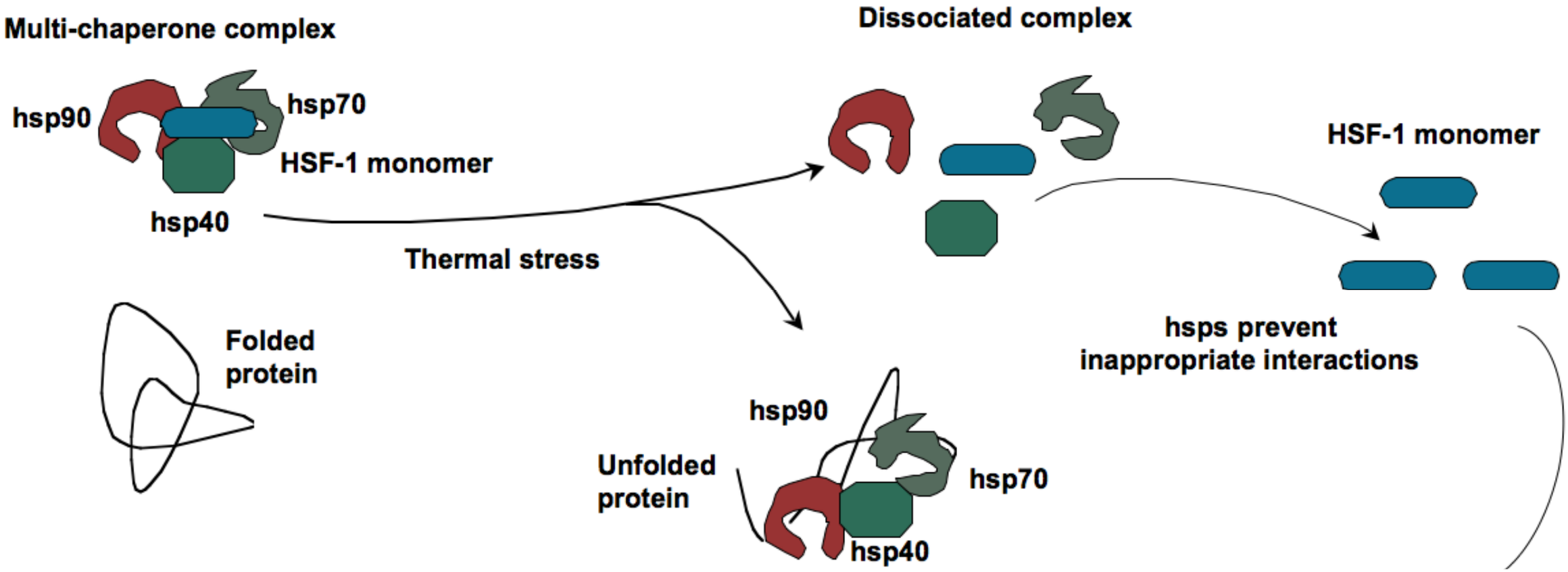


Fig. 15-16a, p.693

Heat Shock


Multi-chaperone complex
hsp90
hsp70
HSF-1 monomer
hsp40
Thermal stress
Dissociated complex
HSF-1 monomer
hsps prevent
inappropriate interactions
Folded
protein
Unfolded
protein
hsp90
hsp70
hsp40

Heat Shock

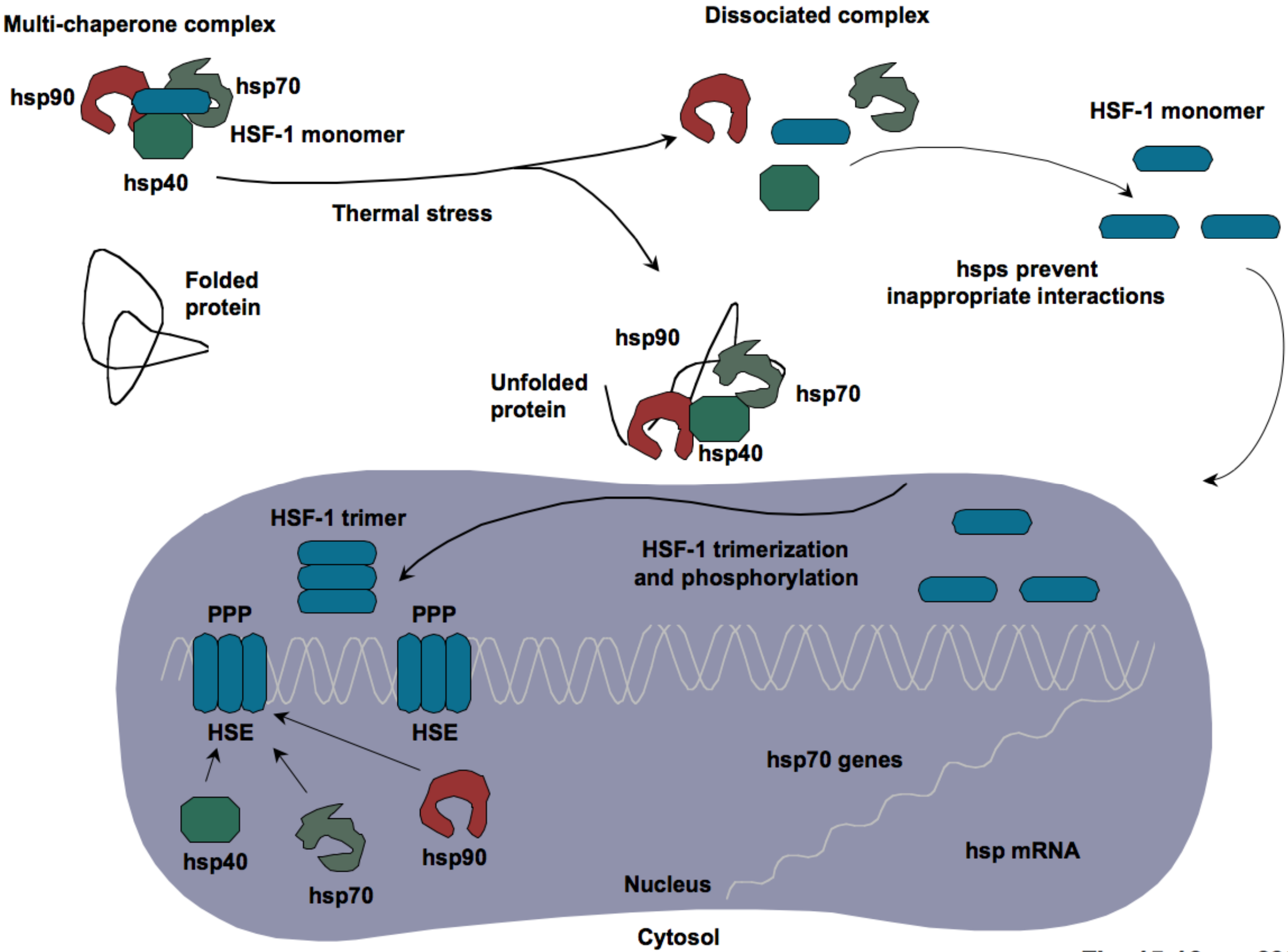


Fig. 15-16a, p.693

Transcription

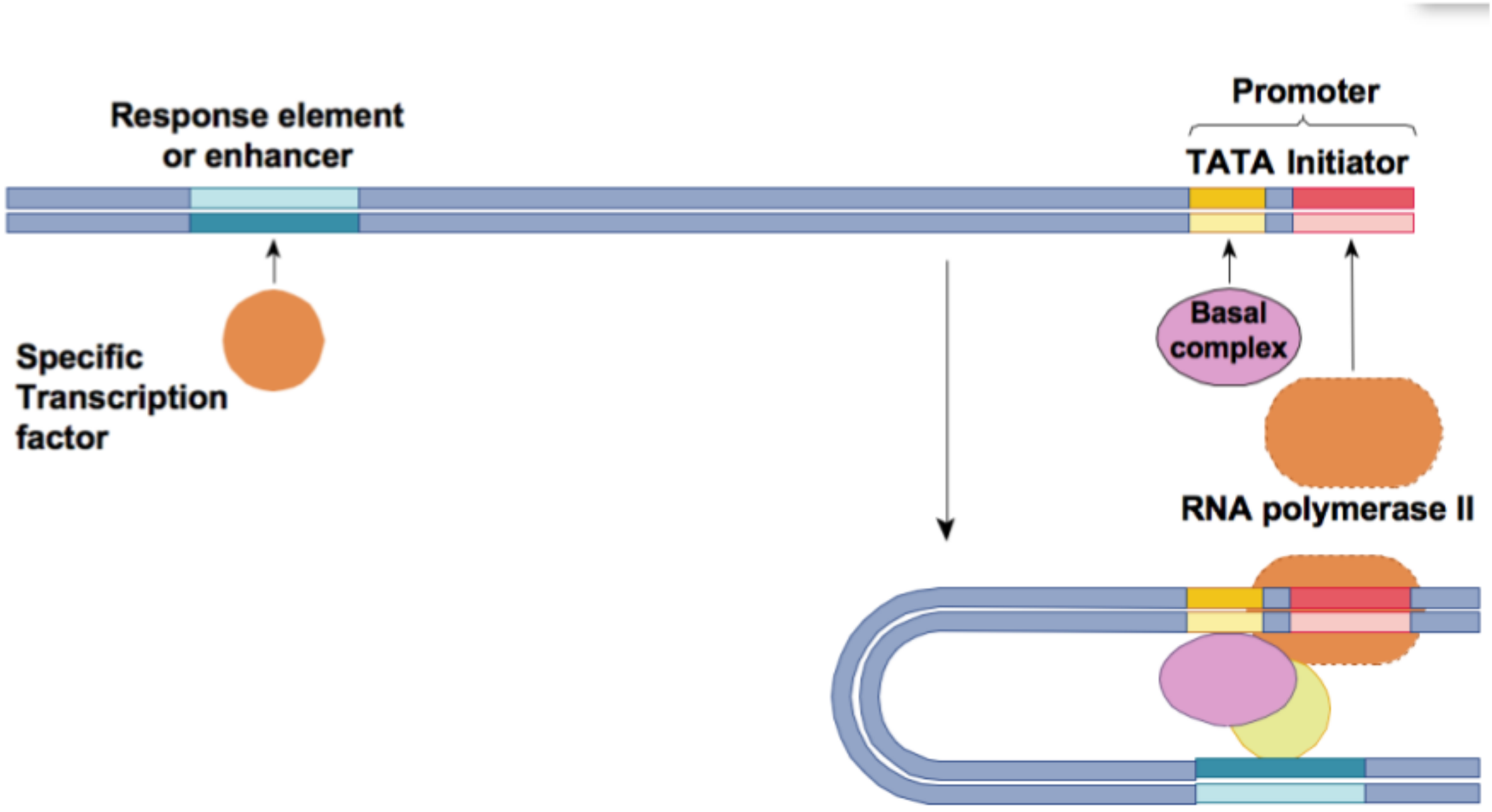


Fig. 2-4b, p.30

Transcription

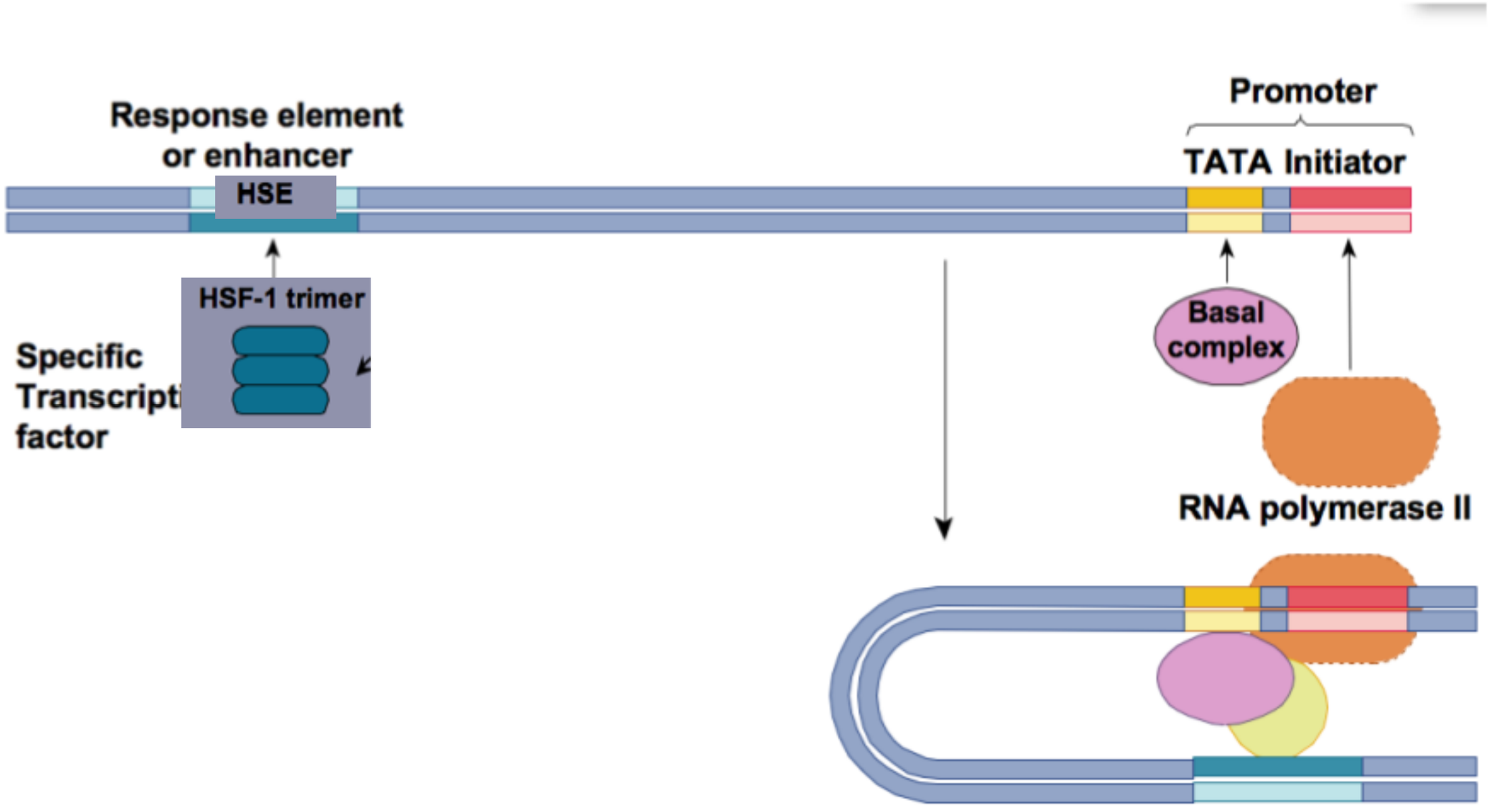


Fig. 2-4b, p.30

Heat Shock

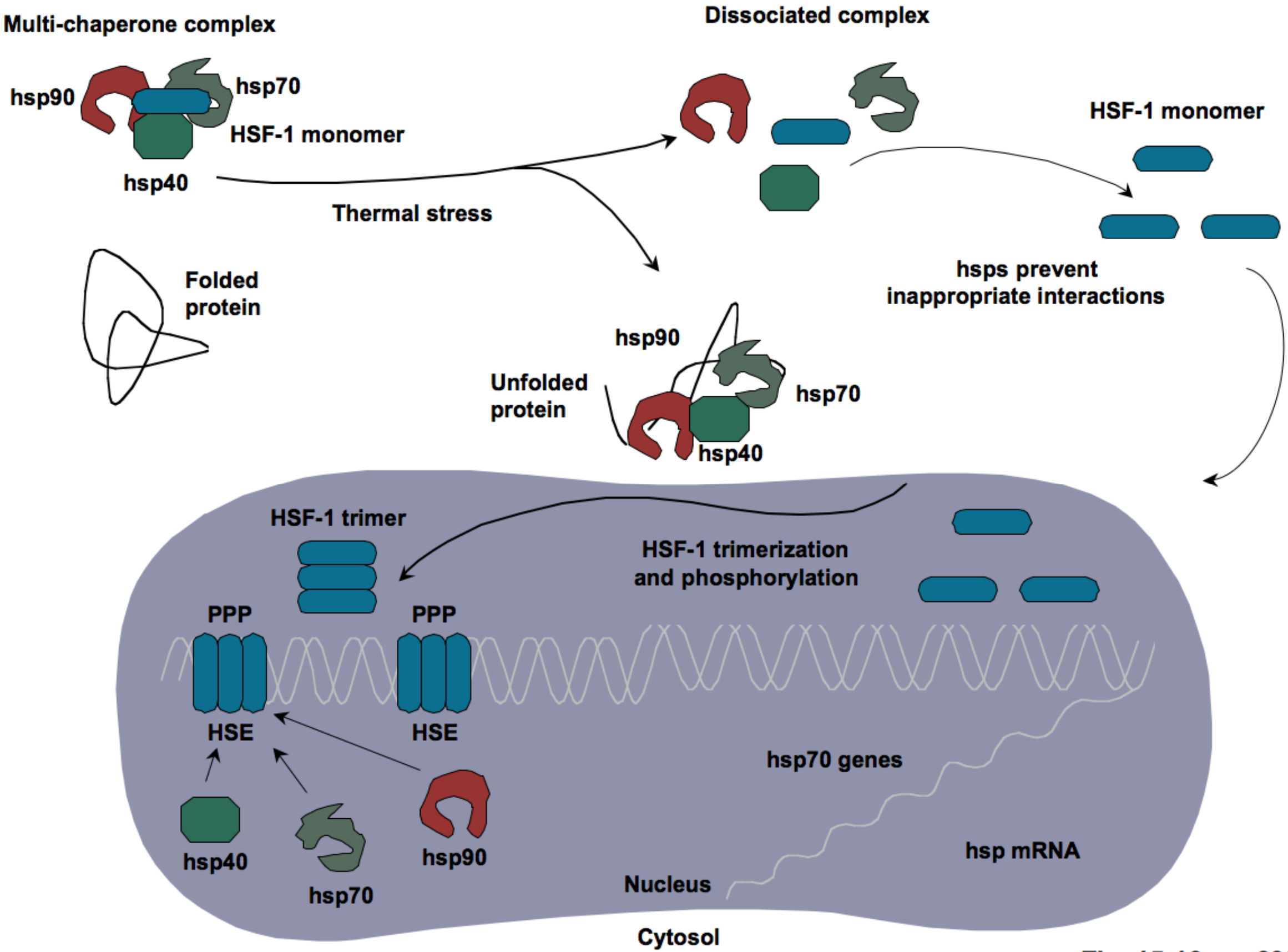
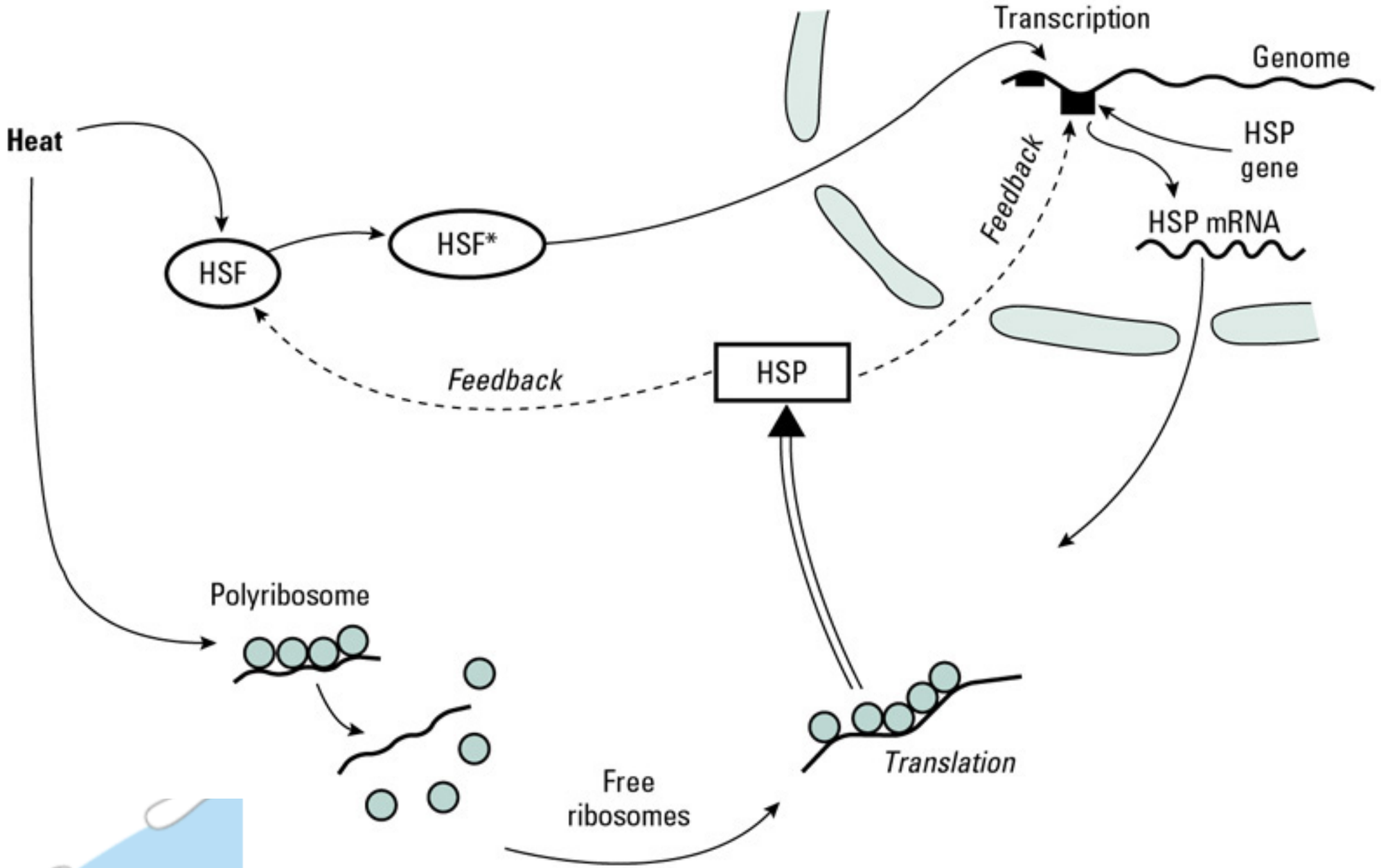


Fig. 15-16a, p.693

Heat Shock


Transcription
Genome
Heat
HSP
gene
Feedback
HSP mRNA
HSF
HSF*
Feedback
HSP
Polyribosome
Free
ribosomes
Translation

Heat shock proteins

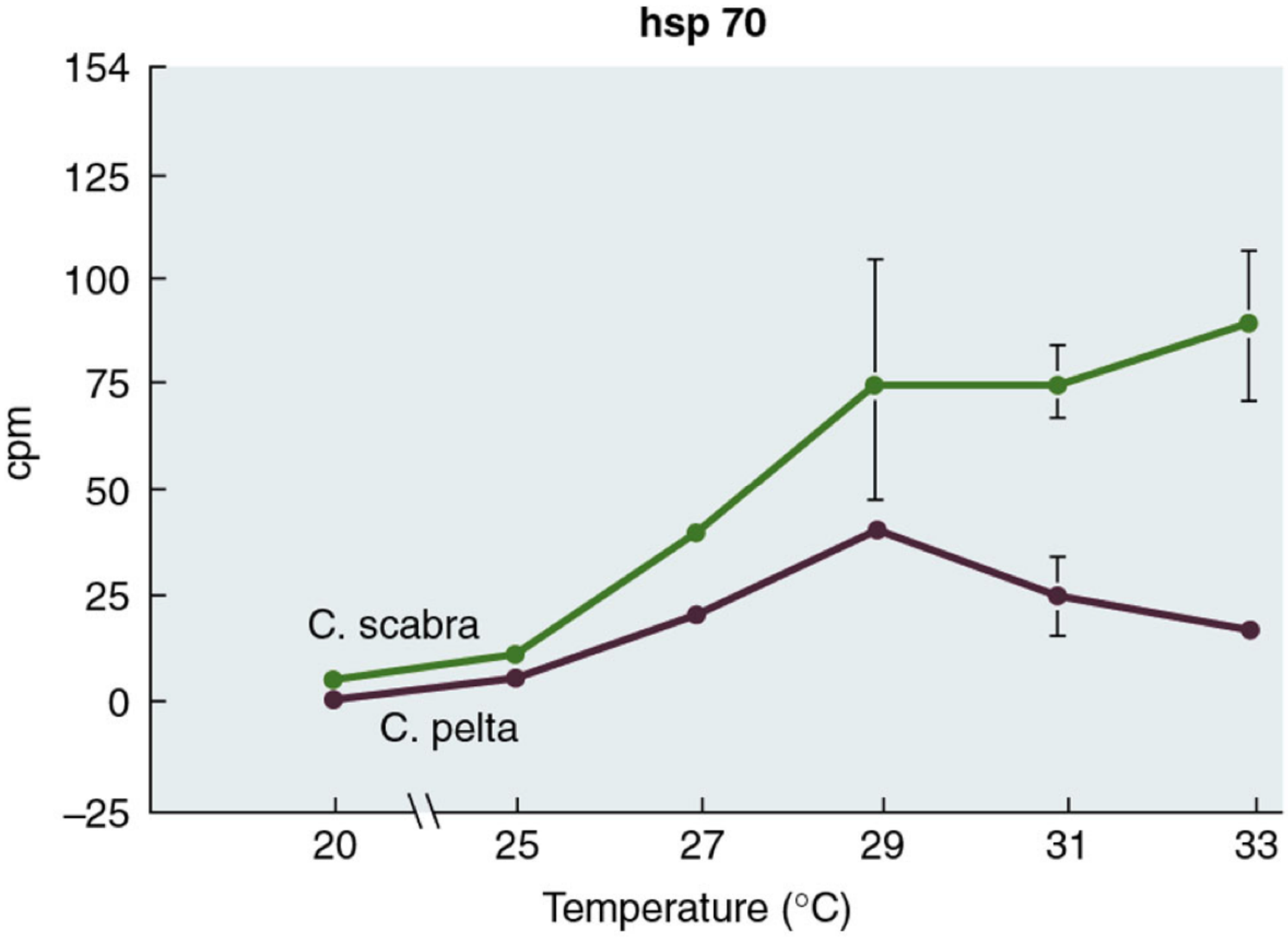
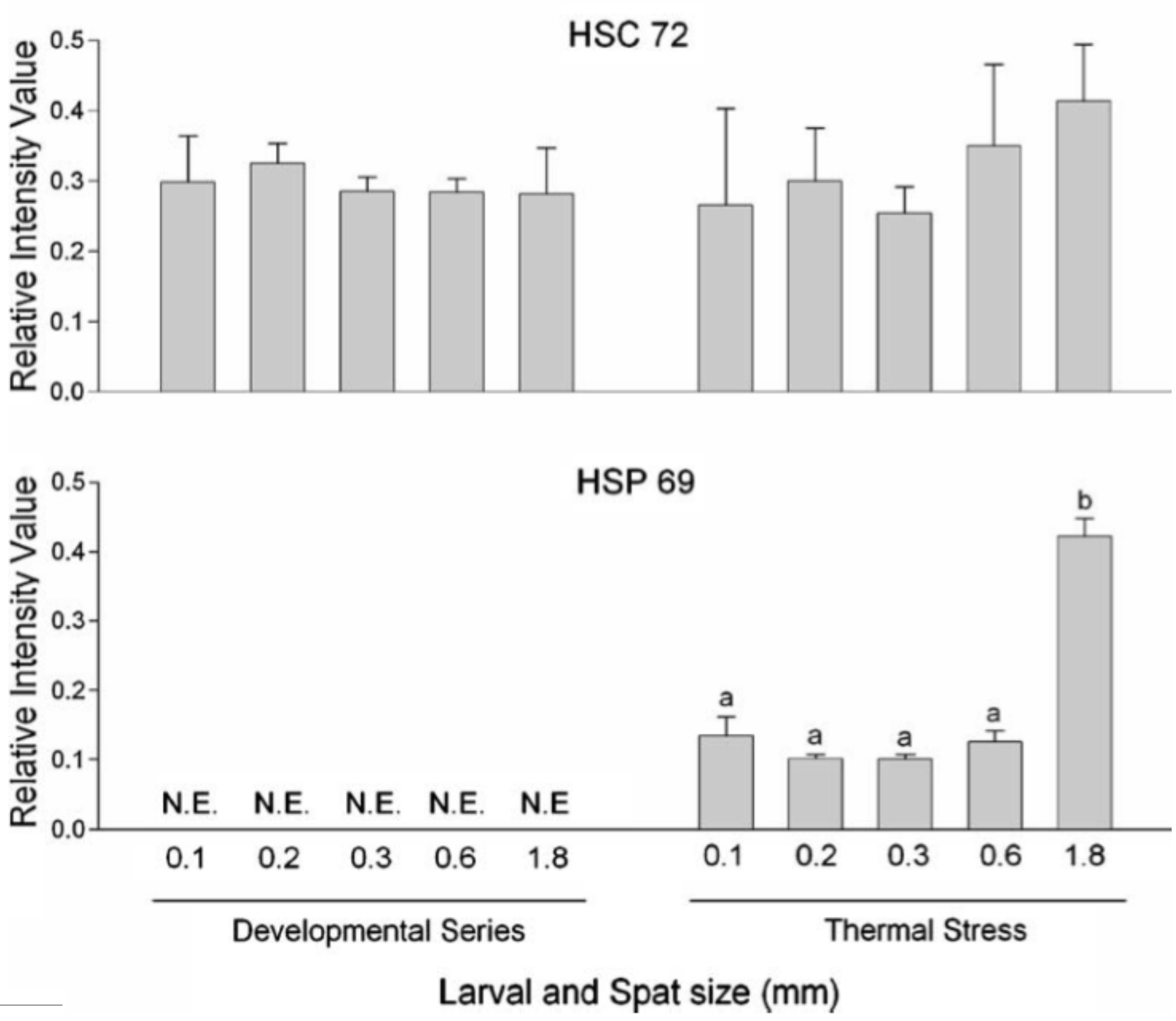


Fig. 15-16b, p.693



Cell Stress and Chaperones
DOI 10.1007/s12192-008-0096-3

SHORT COMMUNICATION

Differences in heat shock protein 70 expression during larval and early spat development in the Eastern oyster, *Crassostrea virginica* (Gmelin, 1791)

Nobuo Ueda · Anne Boettcher

REVIEW