

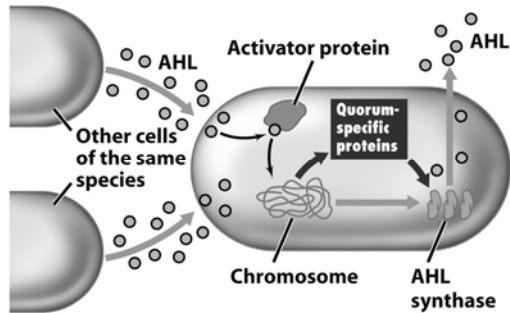
Global Control Systems

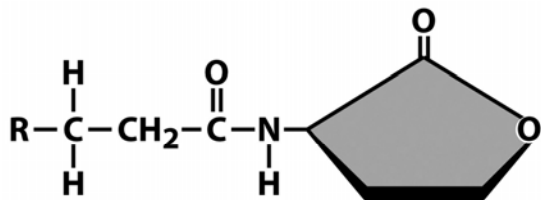
Table 8.1 Examples of global control systems known in *Escherichia coli*^a

System	Signal	Primary activity of regulatory protein	Number of genes regulated
Aerobic respiration	Presence of O ₂	Repressor (ArcA)	50+
Anaerobic respiration	Lack of O ₂	Activator (FNR)	70+
Catabolite repression	Cyclic AMP concentration	Activator (CAP)	300+
Heat shock	Temperature	Alternative sigma (σ^{32})	36
Nitrogen utilization	NH ₄ limitation	Activator (NtrA)/alternative sigma (σ^{54})	12+
Oxidative stress	Oxidizing agent	Activator (OxyR)	30+
SOS response	Damaged DNA	Repressor (LexA)	20+

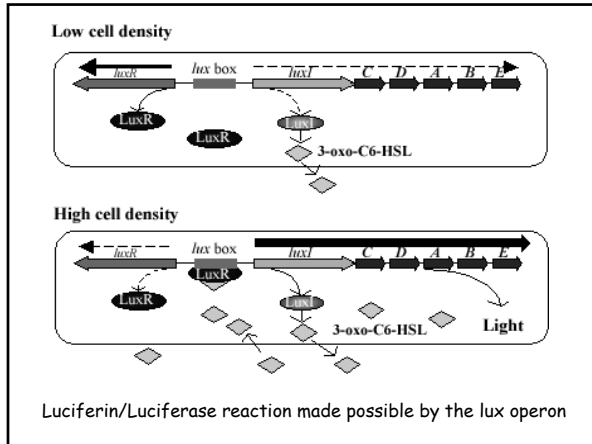
^a For many of the global control systems, regulation is complex. A single regulatory protein can play more than one role. For instance, the regulatory protein for aerobic respiration is a repressor for many promoters but an activator for others, whereas the regulatory protein for anaerobic respiration is an activator protein for many promoters but a repressor for others. Regulation can also be indirect or require more than one regulatory protein. Some of the regulatory proteins involved are members of two-component systems (see Section 8.12). Many genes are regulated by more than one global system. (For a discussion of the SOS response, see Section 10.4.)

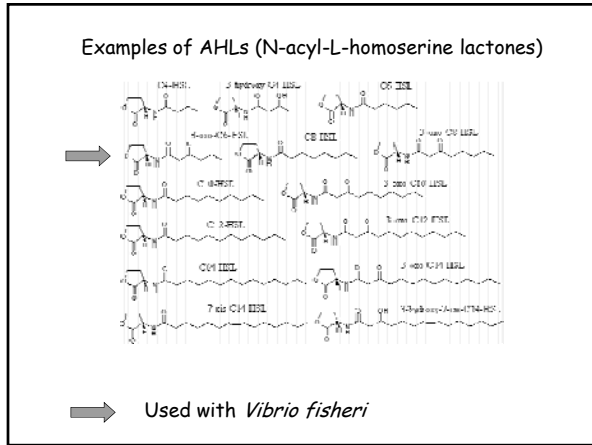
Quorum Sensing

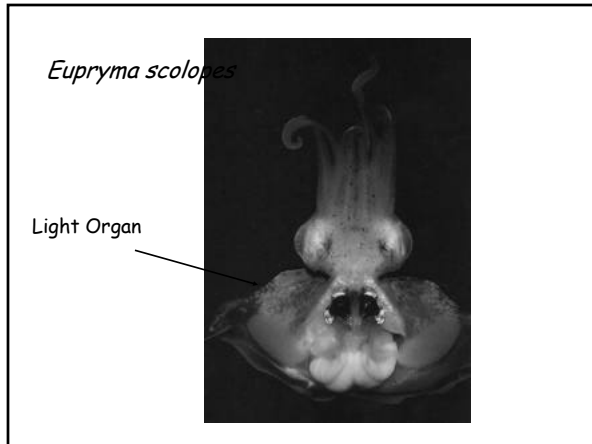




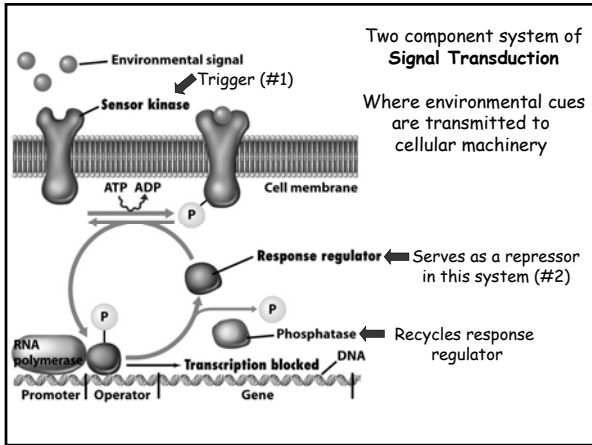
Acyl homoserine lactone (AHL)











Two-Component Regulatory Systems

Table 9.3 Examples of two-component regulatory systems that regulate transcription in *Escherichia coli*

System	Environmental signal	Sensor kinase	Response regulator	Activity of response regulator ^a
Air system	O ₂	AerB	ArcA	Repressor/Activator
Nitrate and nitrite anaerobic regulation (Nar)	Nitrate and nitrite	NarX and NarX	NarL, NarP	Activator/Repressor
Nitrogen utilization (Ntr)	NH ₄ ⁺	NtrB, the product of <i>glnE</i>	NtrG, the product of <i>glnG</i>	Activates RNA polymerase at promoters requiring σ^{54}
Pho regulon	Inorganic phosphate	PhoR	PhoB	Activator
Porin regulation	Osmotic pressure	EnvZ	OmpR	Activator/Repressor

^a Note that several of the response regulator proteins act as both activators and repressors depending on the genes being regulated. Although ArcA can function as either an activator or a repressor, it functions as a repressor on most operons that it regulates.
