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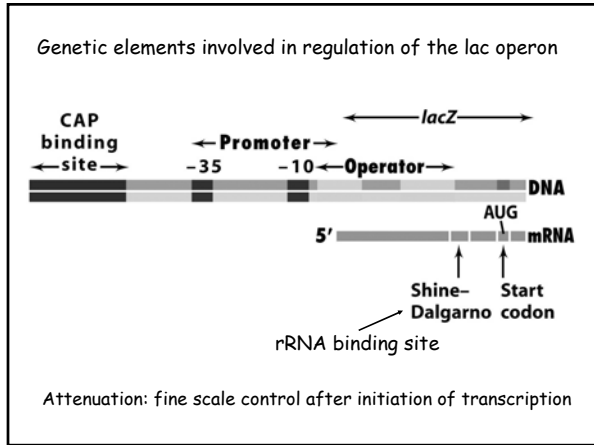
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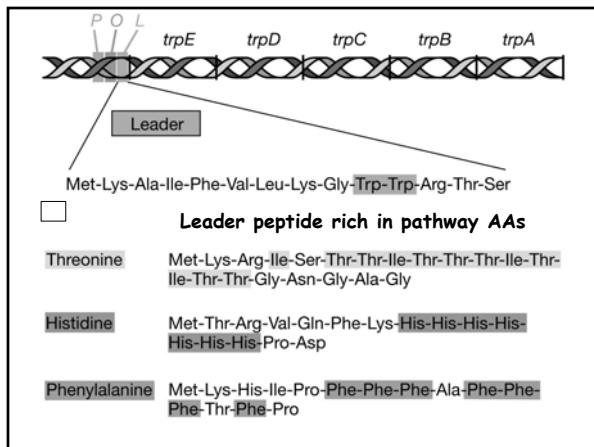
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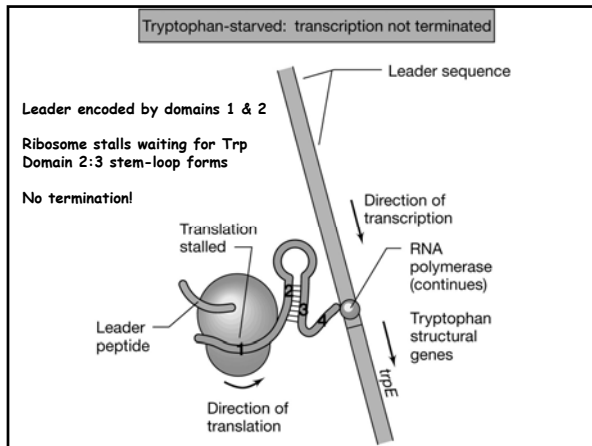
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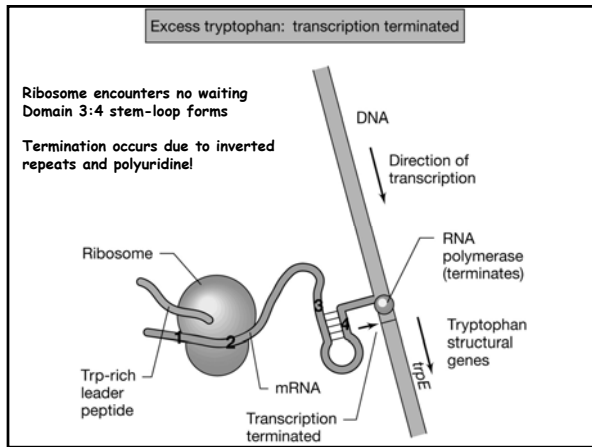
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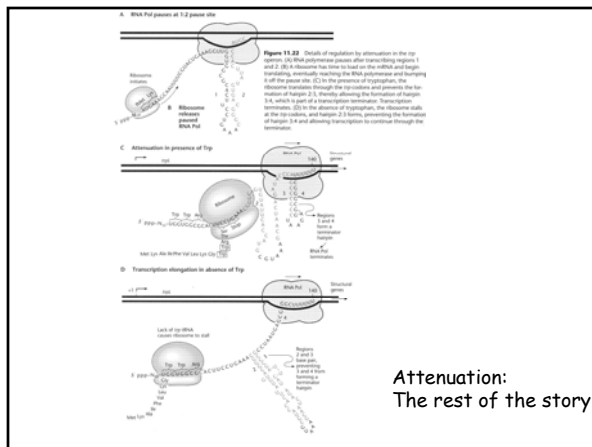
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## Global Control Systems

**Table 8.1** Examples of global control systems known in *Escherichia coli*<sup>a</sup>

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

<sup>a</sup> 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.)

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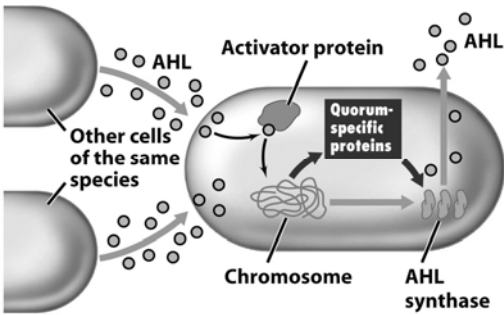
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## Quorum Sensing



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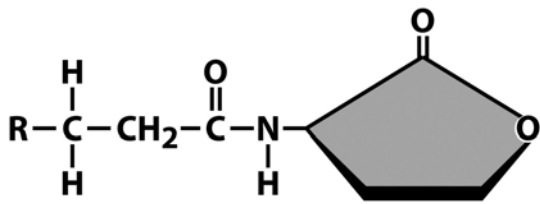
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**Acyl homoserine lactone (AHL)**

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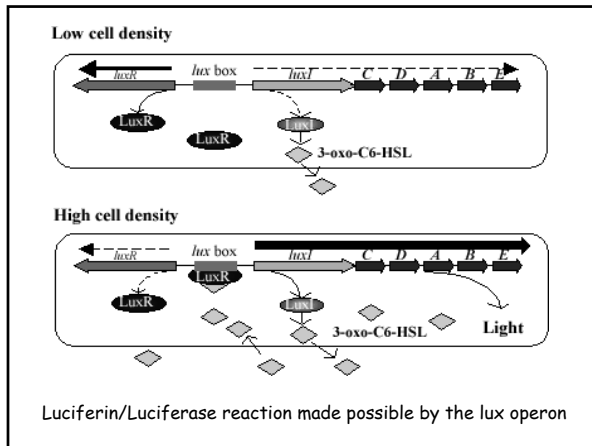
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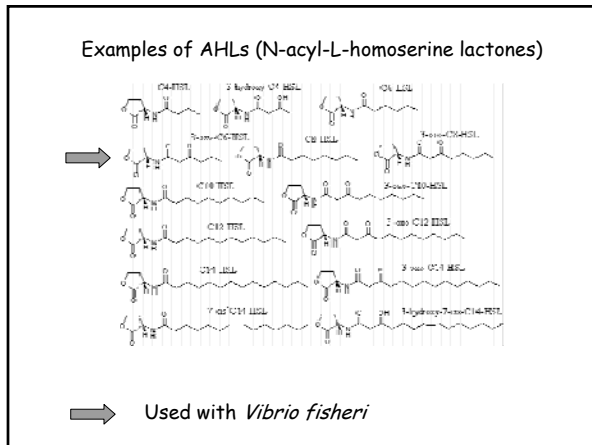
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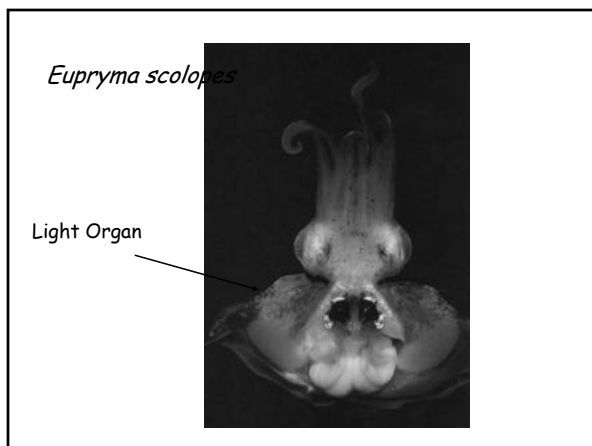
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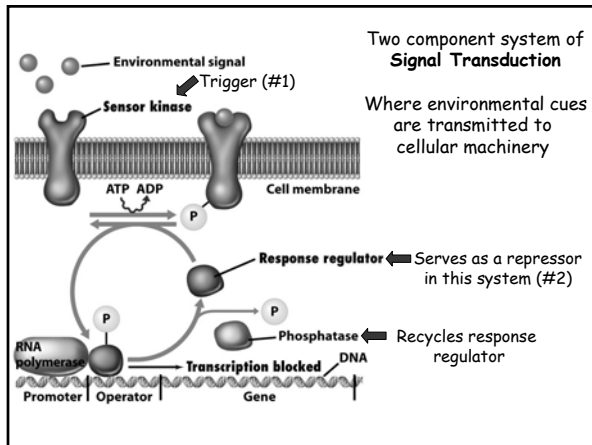
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### Two-Component Regulatory Systems

**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 <sup>a</sup>
Air system	O <sub>2</sub>	AerB	ArcA	Repressor/Activator
Nitrate and nitrite anaerobic regulation (Nar)	Nitrate and nitrite	NarX and NarX	NarL, NarP	Activator/Repressor
Nitrogen utilization (Ntr)	NH <sub>4</sub> <sup>+</sup>	NtrB, the product of <i>glnE</i>	NtrC, the product of <i>glnG</i>	Activates RNA polymerase at promoters requiring $\sigma^{54}$
Ple regulon	Inorganic phosphate	PhoR	PhoB	Activator
Protein regulation	Osmotic pressure	EnvZ	OmpR	Activator/Repressor

<sup>a</sup> 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.

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