



Advanced Cell Biology. Lecture 22

Alexey Shipunov

Minot State University

March 20, 2013

Outline

Questions and answers

Expression

Post-transcriptional controls



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Expression

Post-transcriptional controls



Previous final question: the answer

How many signals control the *Lac* operon?



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How many signals control the *Lac* operon?

▶ 2



Expression

Post-transcriptional controls



Riboswitches

- ▶ mRNAs may control its own synthesis through riboswitches
- ▶ Riboswitch is a short sequence which change conformation of mRNA and block/unblock RNA polymerase
- ▶ Riboswitches may have small molecules to bind with them



Riboswitch

GUANINE IS SCARCE

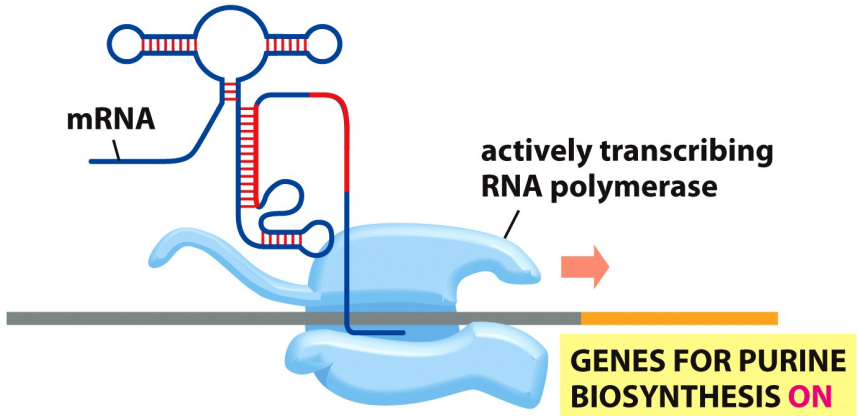


Figure 8-24a Essential Cell Biology 3/e (© Garland Science 2010)



Regulation of translation initiation

Many different kinds of repressors and activators may bind to ribosome-binding site (upstream to AUG codon) and block/unblock translation

- ▶ “Thermosensors” change conformation of mRNA and may unblock translation
- ▶ Riboswitches may also block/unblock translation
- ▶ Antisense complementary RNAs could block translation



mRNA-binding proteins as translation regulators

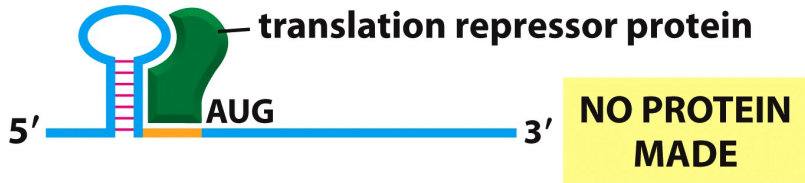
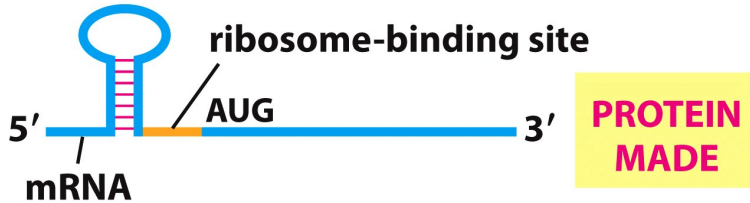


Figure 8-25a Essential Cell Biology 3/e (© Garland Science 2010)



Natural thermosensor RNA as translation regulator

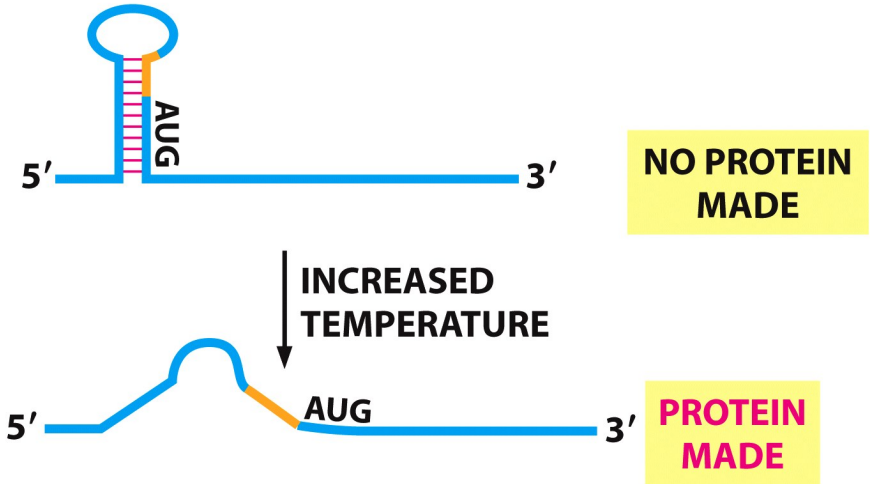


Figure 8-25b Essential Cell Biology 3/e (© Garland Science 2010)



Riboswitches as translation regulators

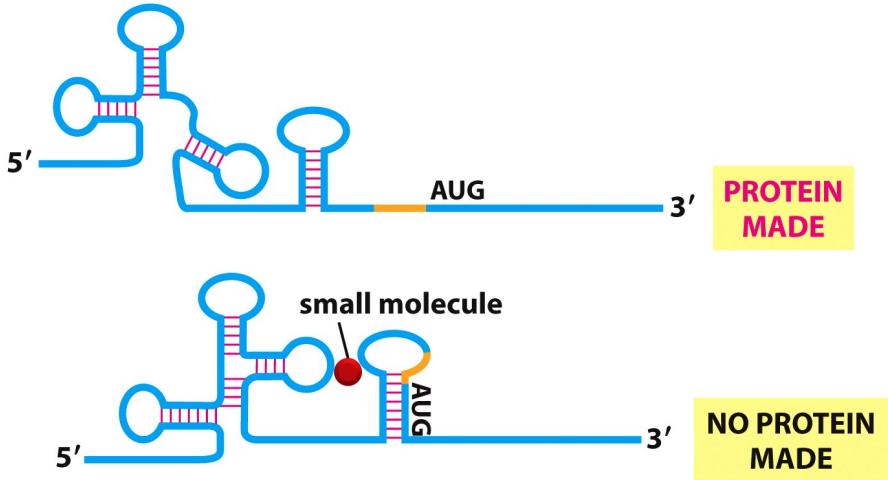


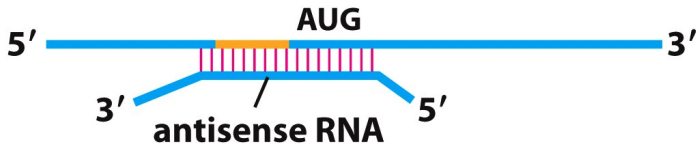
Figure 8-25c Essential Cell Biology 3/e (© Garland Science 2010)



Antisense RNAs as translation regulators



**PROTEIN
MADE**



**NO PROTEIN
MADE**

Figure 8-25d Essential Cell Biology 3/e (© Garland Science 2010)



miRNA control

- ▶ microRNAs (miRNAs) form a RNA-induced silencing complexes with proteins (RISCs)
- ▶ If a RISC finds a complementary mRNA, it blocks translation and destroy this mRNA



miRNA at work

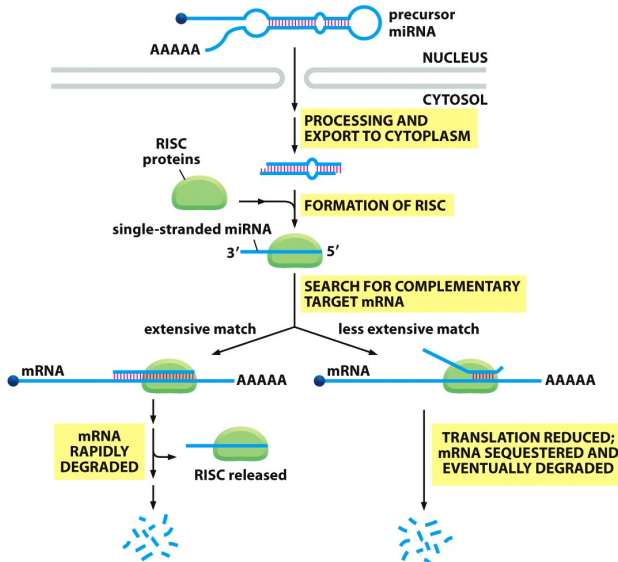


Figure 8-26 Essential Cell Biology 3/e (© Garland Science 2010)

RNA interference

- ▶ Dicer nuclease chop dsRNA of virus into fragments
- ▶ These fragments (small interfering RNAs, siRNAs) incorporate into RISCs
- ▶ Then RISCs become able to “know” invader RNAs
- ▶ Prokaryotes have somewhat similar, wonderful CRISPR-CAS system (will be explained later)



siRNAs

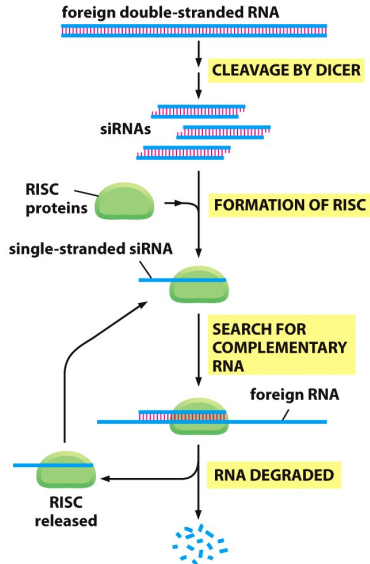


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Final question (3 points)

Are riboswitches capable of epigenetic inheritance?



Summary

- ▶ Riboswitches, proteins and miRNA can regulate post-transcriptional gene expression
- ▶ miRNAs/RISCs are capable to “memorize” invader RNA



For Further Reading



A. Shipunov.

Advanced Cell Biology [Electronic resource].

2011—onwards.

Mode of access:

http://ashipunov.info/shipunov/school/biol_250



B. Alberts et al.

Essential Cell Biology. 3rd edition.

Garland Science, 2009.

Chapter 8.

