

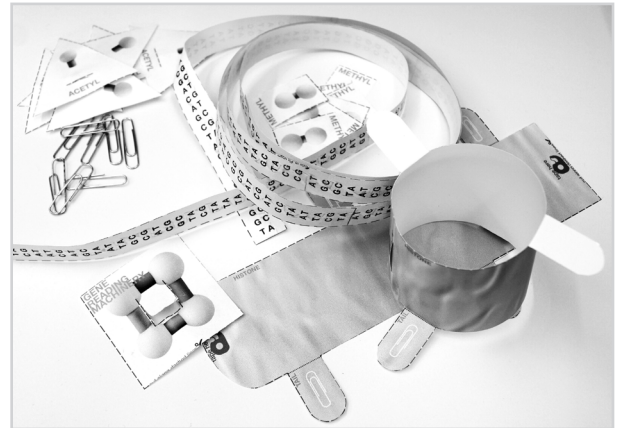


# DNA and Histone Model

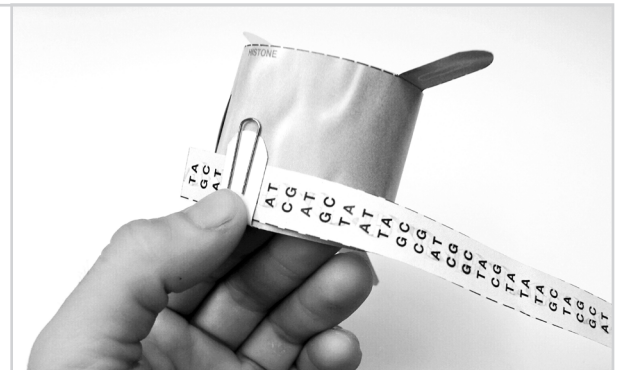
How do molecules control gene expression?

## MAKING DNA **INACCESSIBLE**

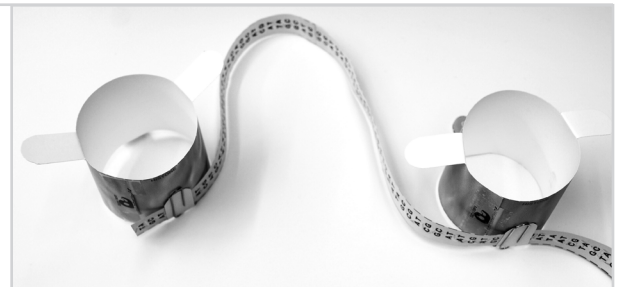
Cut out all of the molecules on pages 5-8, assemble the DNA ribbon and histone spools. Gather 8 paperclips.



In the cell, DNA is wound around spool-like molecules called histones. Attach one end of the DNA ribbon to a histone. Fold one of the histone tails over the DNA ribbon to help hold it in place. Secure it with a paperclip.



Attach the remaining histones along the DNA ribbon at a distance of 2 strips of DNA apart (roughly 16 cm).



Hold the first histone upright in one hand. Wind the DNA ribbon clockwise around it roughly two times or until you bump in to the next histone. Fold all of the histone tails over the DNA ribbon to help hold it in place and secure with a paperclip.

In a real cell, a length of DNA wraps around a histone roughly 1.7 times and histone tails wrap around the wound DNA similarly.



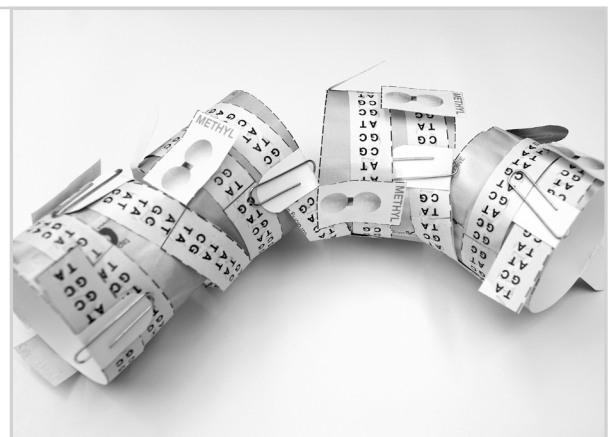


# DNA and Histone Model MAKING DNA INACCESSIBLE cont.

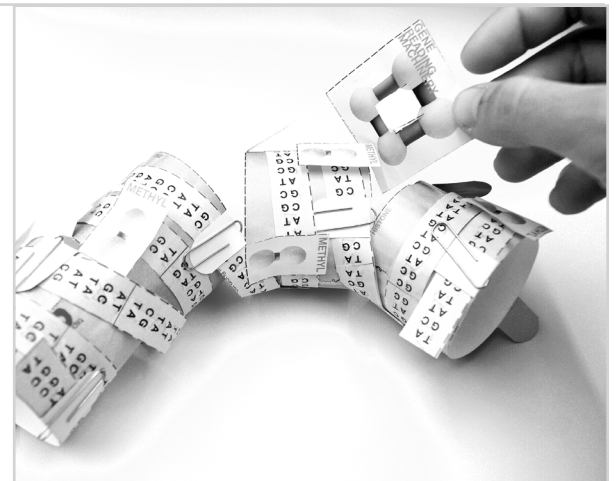
Trying not to fold or bend the DNA ribbon, wind it around the next histone. Again, fold the histone tails around the DNA ribbon and secure with a paperclip. Repeat until all of the DNA ribbon has been wound. The histones should begin to stack on top of one another as you wind.



When DNA is wound tightly around histones, there tends to be a lot of methyl molecules bound to it. The methyl molecules cover the DNA, making it unreadable to gene reading machinery. Use tape to attach the methyl molecule cut outs to exposed areas of your DNA ribbon.



Genes become active when gene reading molecules attach and move down a length of accessible DNA, "reading" the DNA code as they go along. Try to attach and move the Gene Reading Machinery cut-out to any length of the DNA ribbon that is not spooled around a histone or covered by methyl. Can the machinery read any significant stretch of DNA? Would this be an active, or inactive gene?



Remove the methyl molecules and de-construct your model if moving to the next step: **MAKING DNA ACCESSIBLE**

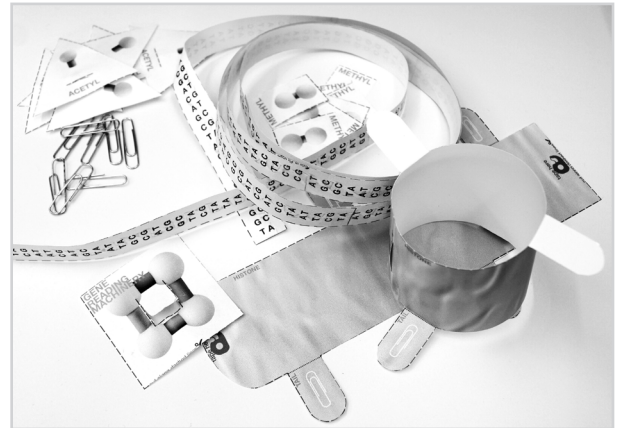


# DNA and Histone Model

How do molecules control gene expression?

## MAKING DNA **ACCESSIBLE**

Cut out all of the molecules on pages 5-8, assemble the DNA ribbon and histone spools. Gather 8 paperclips.



DNA is wound around spool-like molecules called histones. At times, acetyl molecules bind to histone tails. Attach two acetyl molecules to each histone at different locations. To attach the molecules, pull a histone tail through the cut in the center of the acetyl molecules. Now your histones are “acetylated”.



Attach an acetylated histone to one end of your DNA ribbon, secure it with a paperclip.

Attach the remaining acetylated histones along the length of the DNA ribbon at distances of 2 DNA strips apart (roughly 16 cm).



Hold the first histone upright in one hand. Wind the DNA ribbon clockwise around it two times or until the first histone touches the next one.





# DNA and Histone Model MAKING DNA ACCESSIBLE cont.

In a real cell, the addition of acetyl molecules cause the histones to distance themselves from one another. Be sure that no part of the neighboring histones, including the acetyl molecules are touching. If they are, unwind the DNA ribbon a little bit to put some space between the histones. Secure the DNA ribbon with a paperclip.



Wind the DNA ribbon clockwise around the next histone. Again, be sure that no part of neighboring histones are touching then secure the DNA ribbon with a paperclip. Repeat until the DNA ribbon has been wound around all the histones. The histones and DNA should be spooled loosely, with some space between histones.



Genes become active when gene reading molecules attach and move down a length of accesible DNA, "reading" the DNA code as they go along. Try to attach and move the Gene Reading Machinery cut-out to any length of the DNA ribbon that is not spooled around a histone. Can the machinery read any significant stretch of DNA? Would this be an active, or inactive gene?

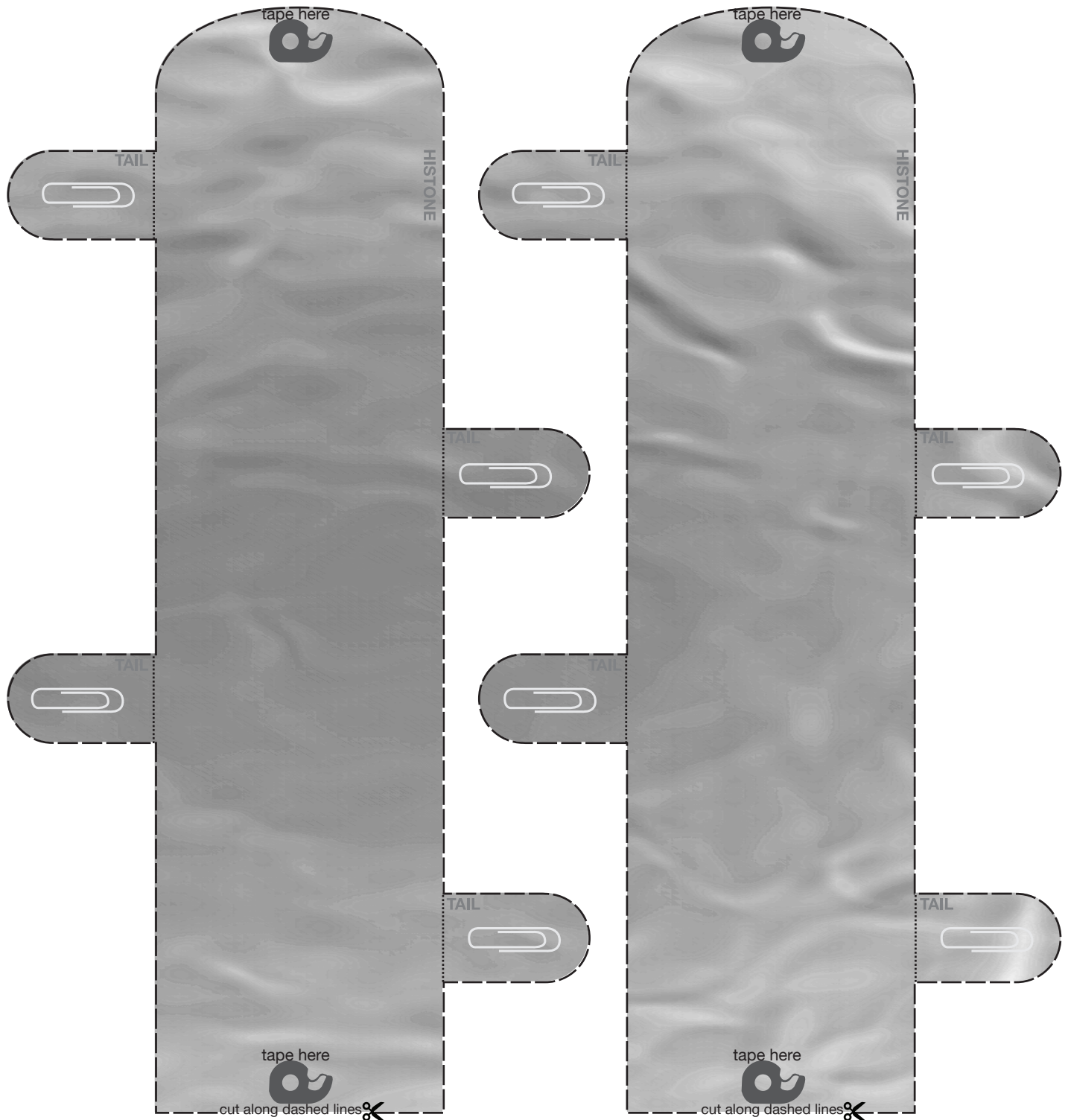






# HISTONE SPOOLS - Set 1

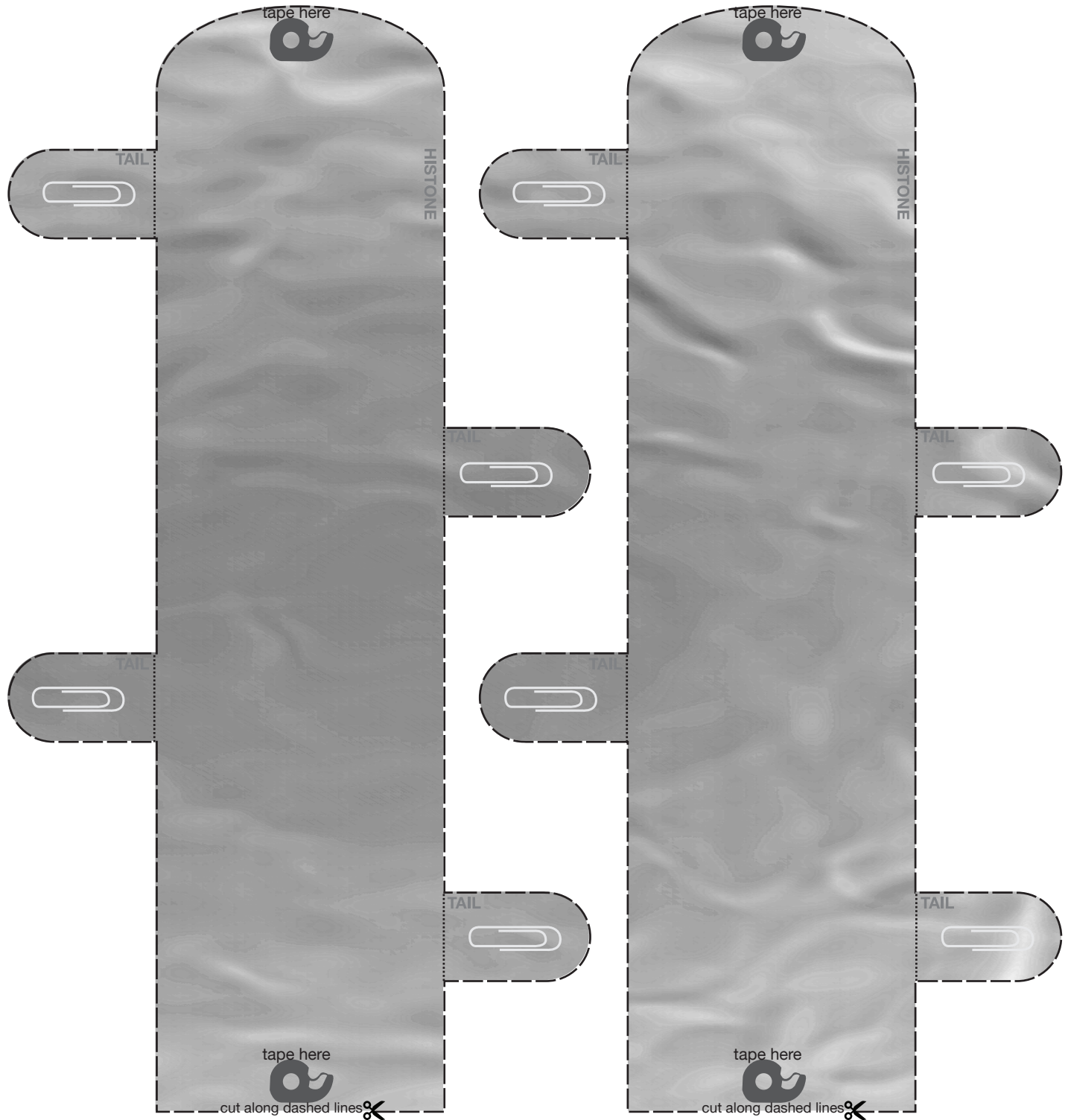
Tape the ends of each histone together to form spools.





# HISTONE SPOOLS - Set 2

Tape the ends of each histone together to form spools.





# DNA Strips

Tape the short ends of the DNA strips together to form one long DNA ribbon.

TA	TA	CG	GC	CG	CG	TA	GC
GC	GC	AT	TA	AT	TA	AT	TA
GC	AT	GC	GC	GC	GC	AT	CG
AT	TA	TA	GC	GC	TA	CG	AT
GC	CG	AT	CG	TA	GC	GC	TA
AT	AT	CG	AT	AT	TA	AT	AT
CG	AT	GC	GC	CG	AT	GC	CG
AT	CG	CG	GC	GC	GC	CG	TA
TA	AT	AT	AT	AT	AT	AT	GC
TA	GC	AT	TA	GC	TA	GC	TA
GC	TA	CG	TA	CG	TA	CG	GC
AT	AT	GC	AT	AT	AT	TA	CG
TA	TA	AT	TA	CG	TA	GC	GC
CG	GC	CG	AT	CG	AT	TA	CG
CG	CG	AT	TA	GC	TA	CG	GC
GC	AT	TA	AT	AT	GC	GC	TA
TA	CG	AT	CG	TA	TA	AT	AT
CG	GC	TA	GC	TA	CG	TA	TA
TA	TA	TA	AT	AT	GC	TA	CG
TA	CG	CG	CG	TA	AT	AT	GC
GC	TA	TA	TA	AT	CG	GC	CG
TA	TA	TA	GC	TA	AT	CG	TA
AT	TA	TA	TA	AT	GC	TA	TA
TA	GC	GC	CG	TA	CG	AT	AT
GC	TA	CG	GC	CG	TA	CG	TA
CG	CG	AT	CG	TA	AT	GC	AT
AT	GC	GC	AT	GC	CG	TA	AT
CG	AT	GC	CG	TA	GC	AT	GC
GC	CG	AT	AT	GC	AT	TA	CG
AT	AT	GC	GC	GC	GC	AT	AT
AT	TA	TA	TA	CG	CG	TA	GC
CG	GC	GC	AT	TA	AT	GC	CG
AT	GC	TA	TA	GC	GC	TA	GC
GC	AT	GC	CG	TA	GC	CG	AT
TA	GC	TA	TA	CG	TA	CG	TA

cut along lines



# Methyl, Acetyl and Gene Reading Machinery

Cut out and slit along interior dashed lines.

