



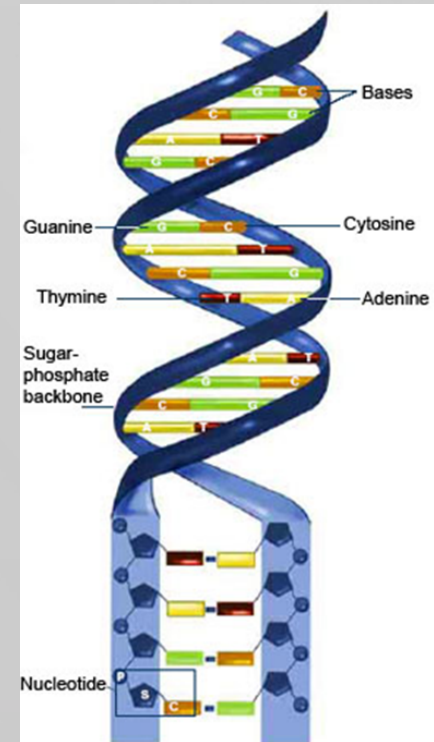
MMTV and HMTV
La-Sigma RET 2014



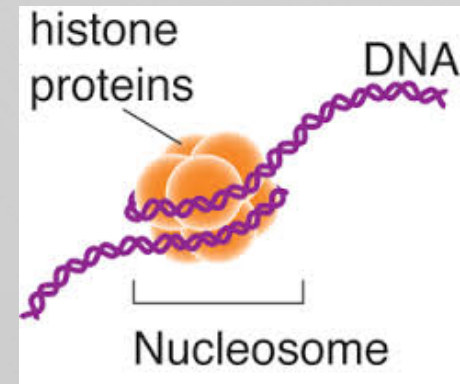


Length of DNA

- DNA has 3 billion base pairs or 3×10^9 bp
- The length of each base pair is roughly
 $\frac{1}{3}$ of a nanometer or $\frac{1}{3} \times 10^{-9}$ m/bp
- Combine the two and you have:
 $(3 \times 10^9) (\frac{1}{3} \times 10^{-9}) \approx 1$ meter in length of 1 copy of DNA
 ≈ 2 meters in length of entire DNA because you have 2 copies
- 2 meters is way bigger than the cell nucleosome so the DNA has to be folded and packaged. Proteins called histones do this by wrapping 147bp of DNA at a time into a giant molecular complex of proteins and DNA called nucleosomes.

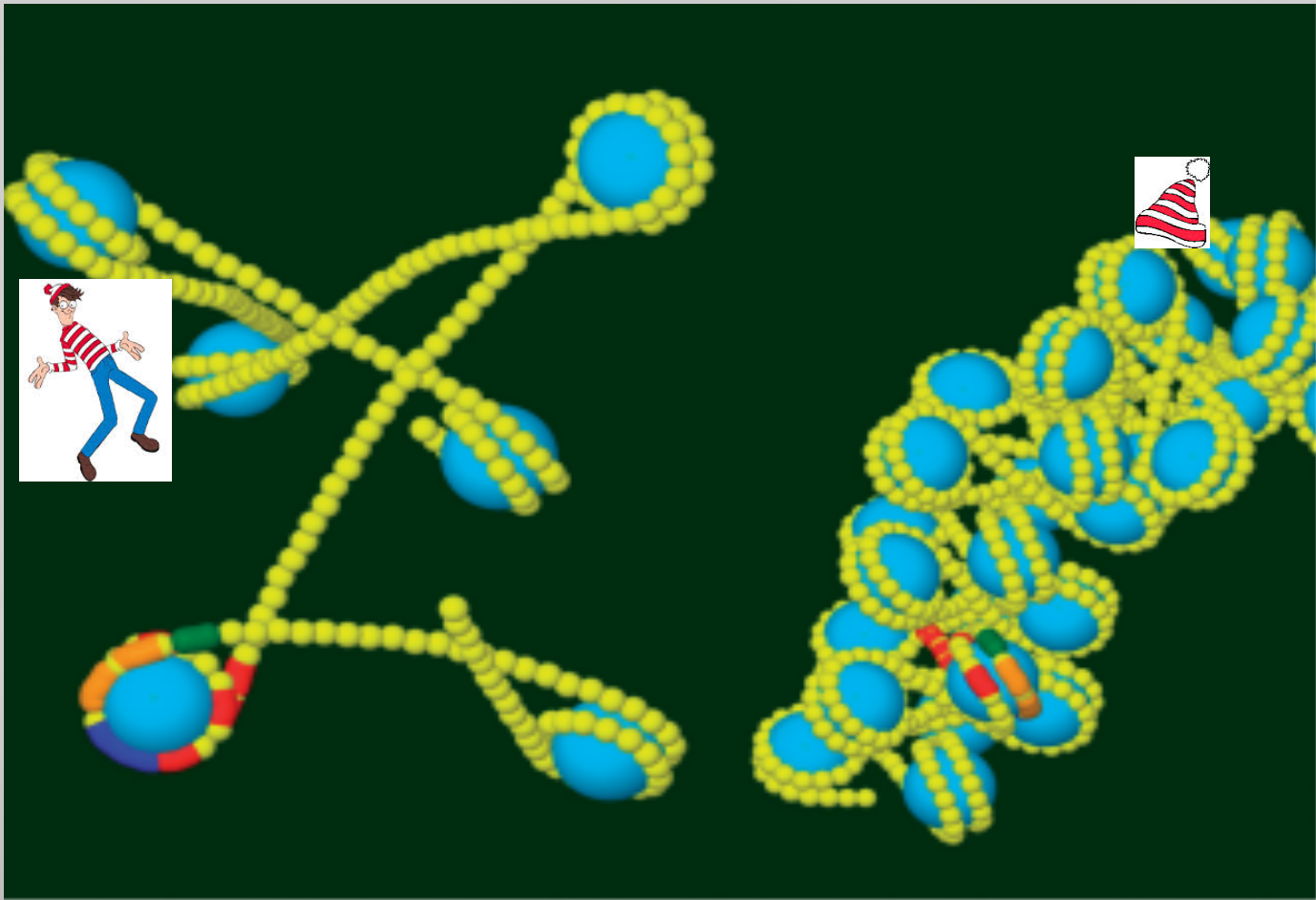


DNA basics



- The genomes of higher organisms exist not just as long strands of DNA in the familiar Watson-Crick double helix, but rather they are associated with proteins, called histones, that fold and package the DNA such that it fits into the cell nucleus
- Out of that we are going to look at a 147 base pair sequence because there are roughly 147 base pairs wrapped around a histone core
- As a case study we will look at 6 nucleosomes (histone cores) in the Mouse Mammary Tumor Virus (MMTV)
- More specifically We will study the 1st nucleosome; nucleosome A

6 nucleosomes in the MMTV



Nucleosome A....

- Looking for it:

- There are 4^{147} OR about 10^{88} possible sequences of a nucleosome
- (That's 1 with 88 zeroes behind it)
- Searching for Nucleosome A is like
- Like **searching** for **Waldo**

HUGE!!



- Reason to look for Nucleosome A:

- Has popped up in other research. The MMTV is a model system for hormone regulation.
- Dr. Bishop has personal history with it from graduate school... idea of ongoing research

Mutations in DNA

- Point mutation or change of one amino acid in the histone core can change the way DNA interacts with the histone core.
- DNA becomes more mobile because it does not attach as securely as it would without mutations.. .this changes the entire nature of the nucleosome

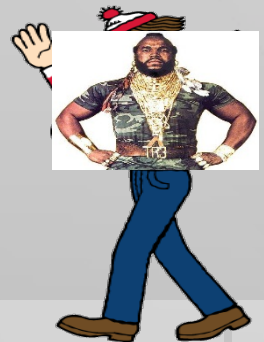


Study of MMTV

- MMTV – Mouse Mammary Tumor Virus
- MMTV is a popular sequence of DNA that has been studied a lot over the years. Scientists now know how to use it for other purposes.
- Acts as a hormone regulated switch.
- In the presence of hormones, MMTV turns on gene expression. Scientists will put MMTV in front of whatever gene they are trying to express.
- Placing the hormones in a test tube with the MMTV cells ...

WHAMMO!

The gene is made!!





MMTV - Mouse Mammary Tumor Virus

- In mice

- they pass the virus on to their young through breast milk

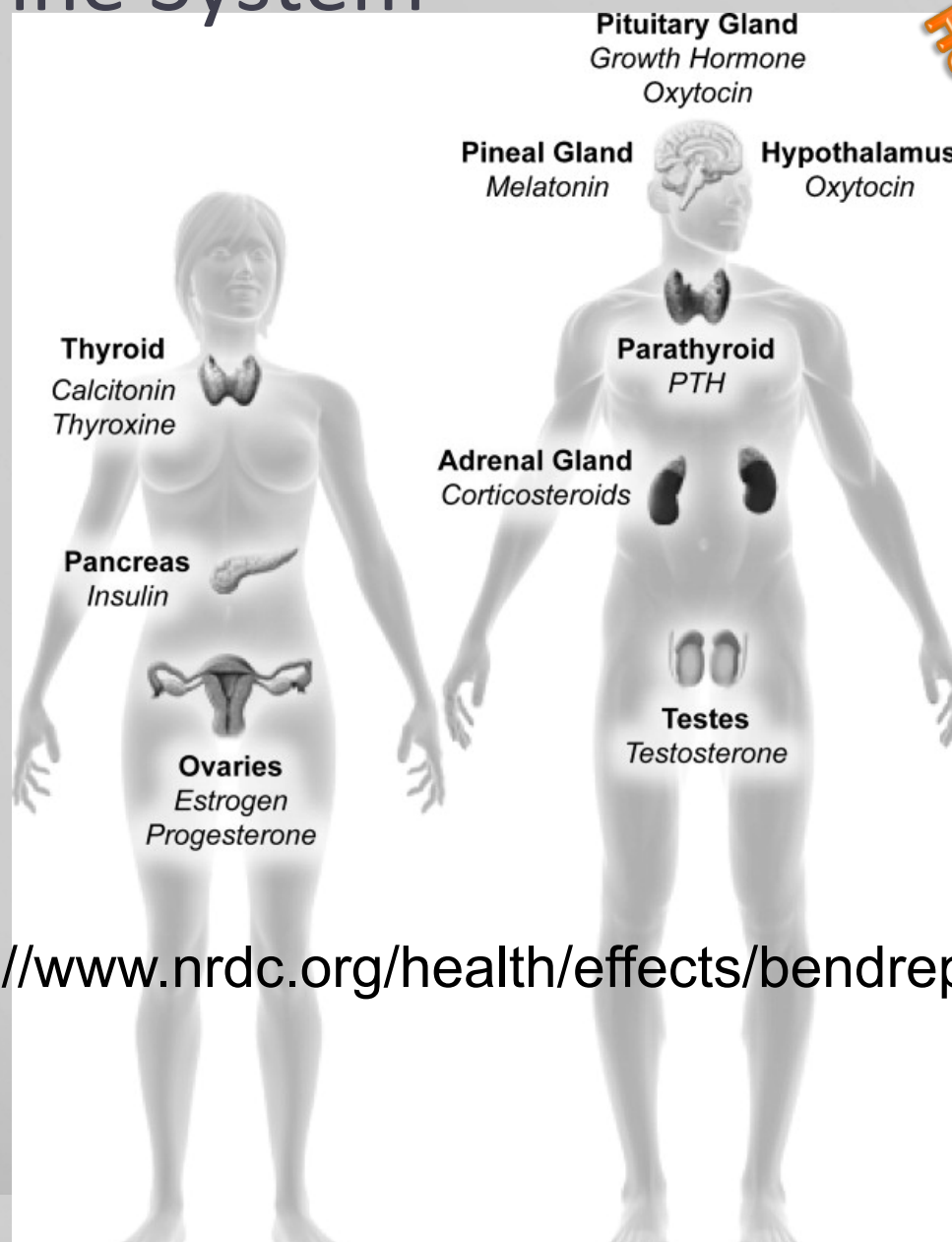
- tumors tend to be benign

- Causes Leukemia [1]

- In humans

- Controversial to it's role with breast cancer
 - Evidence to suggest that it plays a role in breast cancer
 - Correlation between breast cancer and leukemia – viral sequence has been found in both of these cancers
 - Have found MMTV like DNA in breast cancer [2]
 - Possible spread of the virus is transmission through our pets

The Endocrine System



How does this relate to energy??

<http://www.nrdc.org/health/effects/bendrep.asp>



The endocrine system: a short list

Pituitary and Hypothalamus:

Growth Hormones: cell size and number, bones

Thyroid Hormones: Temperature and metabolism

Oxytocin: contractions.

Prolactin milk production

Antidiuretic: water balance and blood pressure

Gonadotropins: FSH & Luteinizing Hormone controls gonads, menstruation

Adrenal

Epinephrine & norepinephrine: flight and fight

Mineralocorticoids: electrolyte balance

Glucocorticoids: immune response and inflammation

Thyroid:

Metabolism, growth & development, sexual maturity

Pancreas

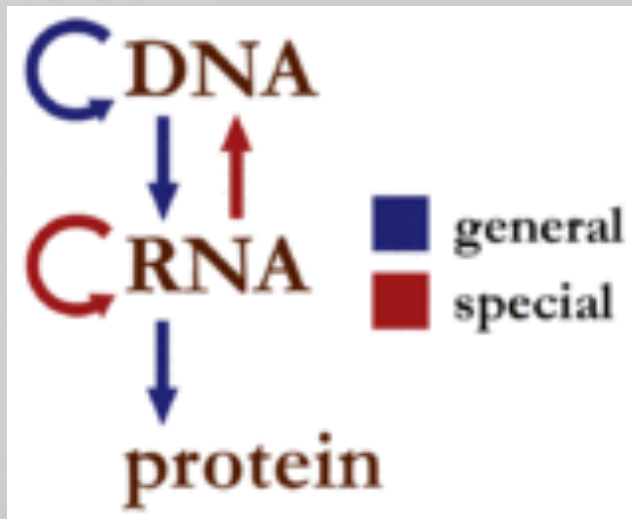
Insulin and glucagon: blood glucose levels

Gonads:

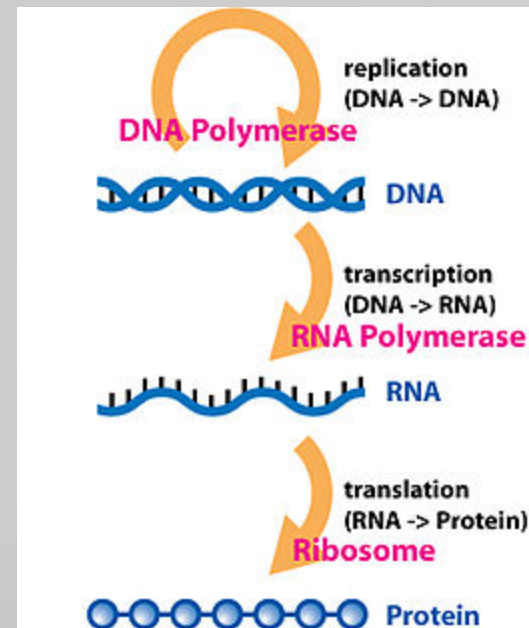
Testosterone, Estrogen & Progesterone: secondary sexual characteristics

Activity Time!!

- We will write your name using reverse transcriptase to create a knitted bracelet representing DNA base pairs



[How to video](#)



Bibliography

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