

You Are What Your Mother Ate: The Science of Epigenetics

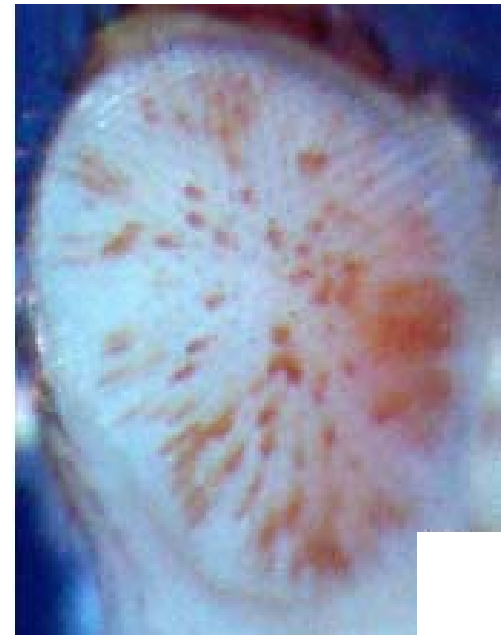


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October 6, 2010

Part III: Epigenetics: Past, Present, & Future

How did we discover epigenetics?



Eye Color in Fruit Flies (1938)

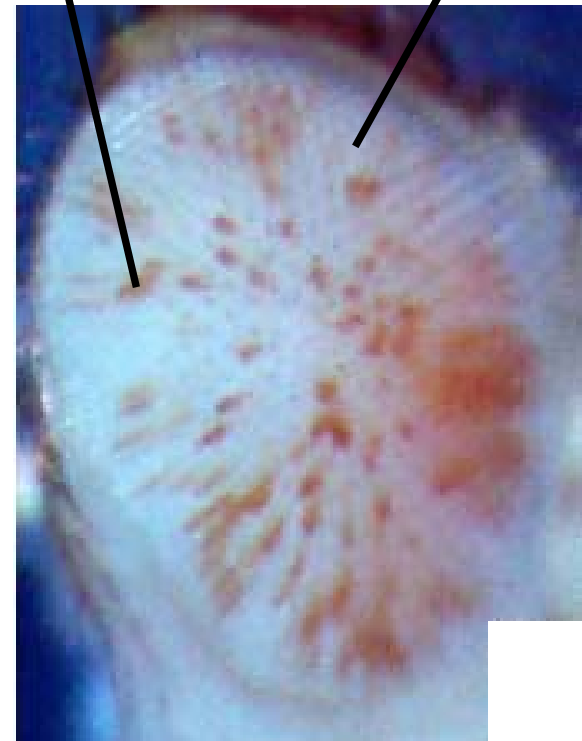
Pigmentation gene:



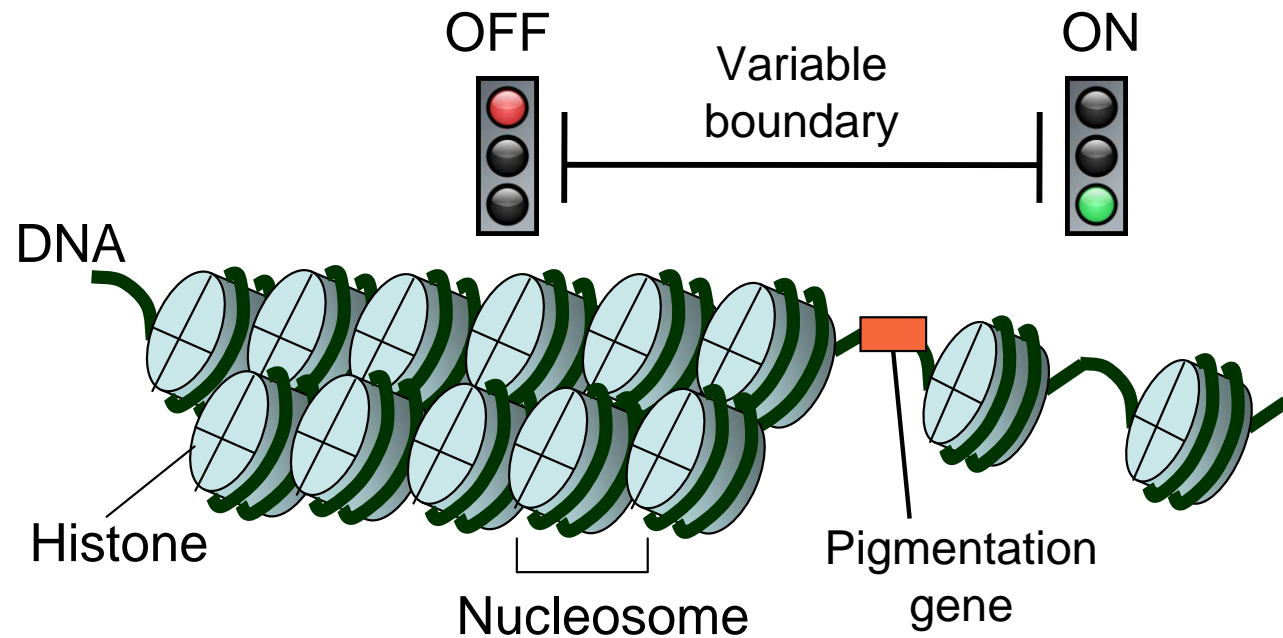
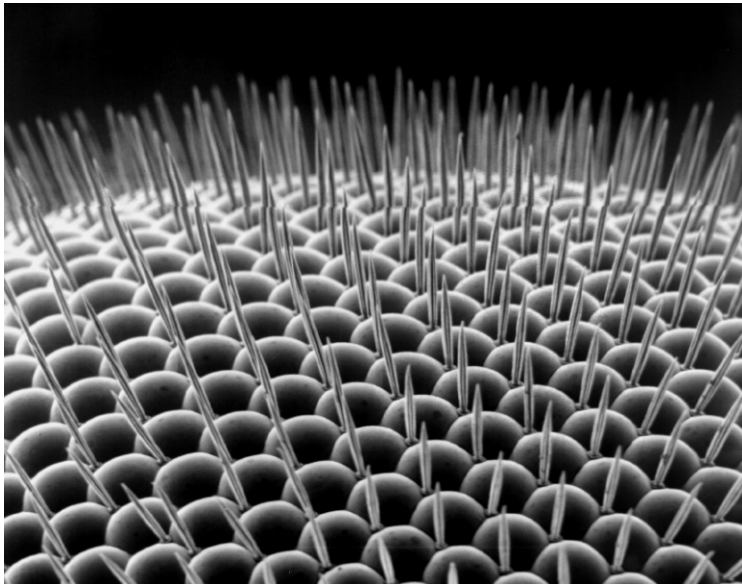
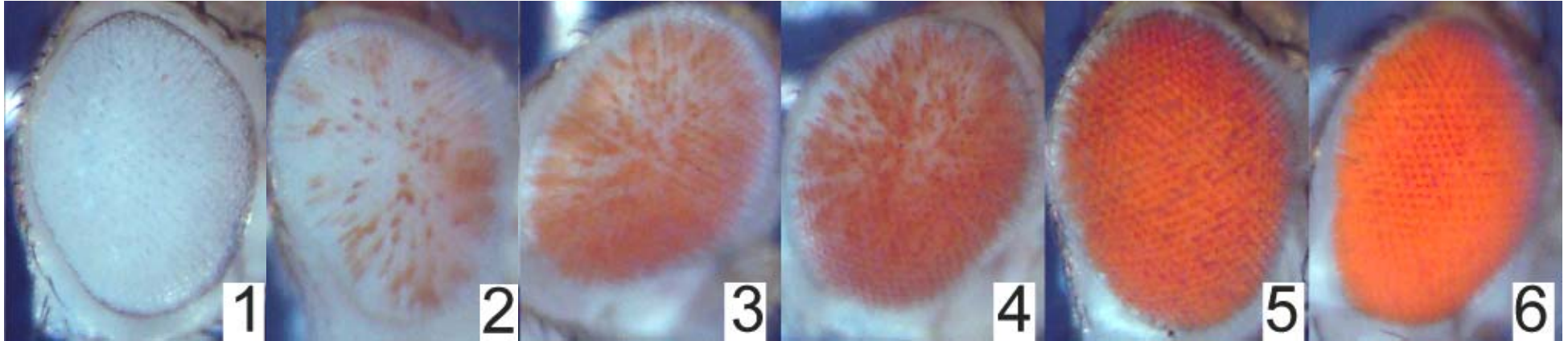
ON



OFF



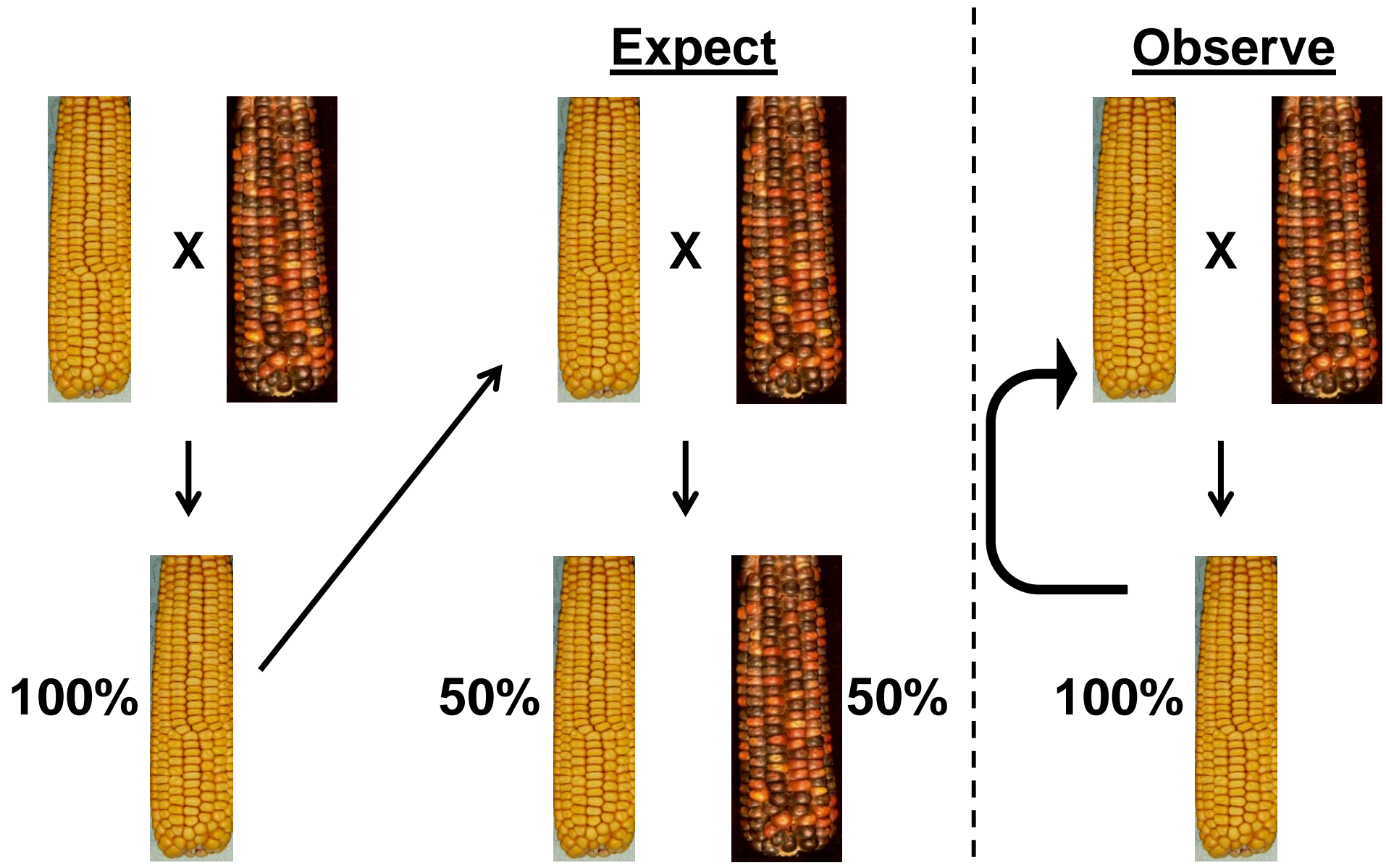
Eye Color in Fruit Flies (1938)



Color changing corn (?!)

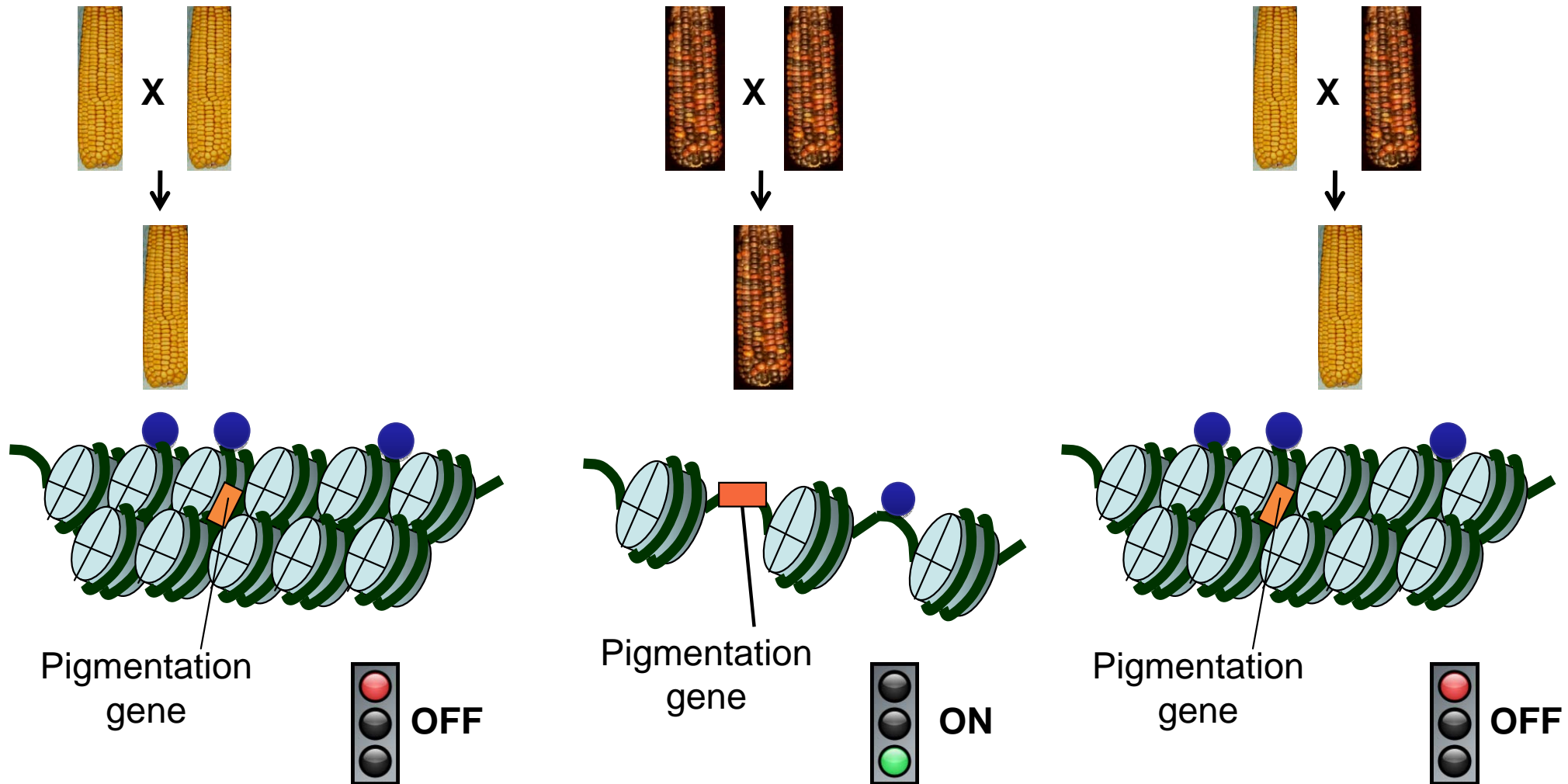


Paramutation (1956)



Paramutation (1956)

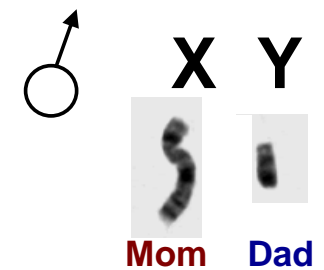
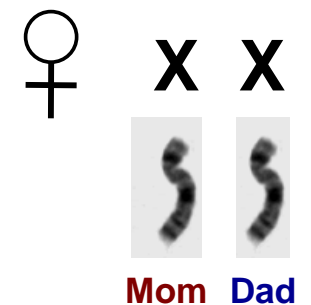
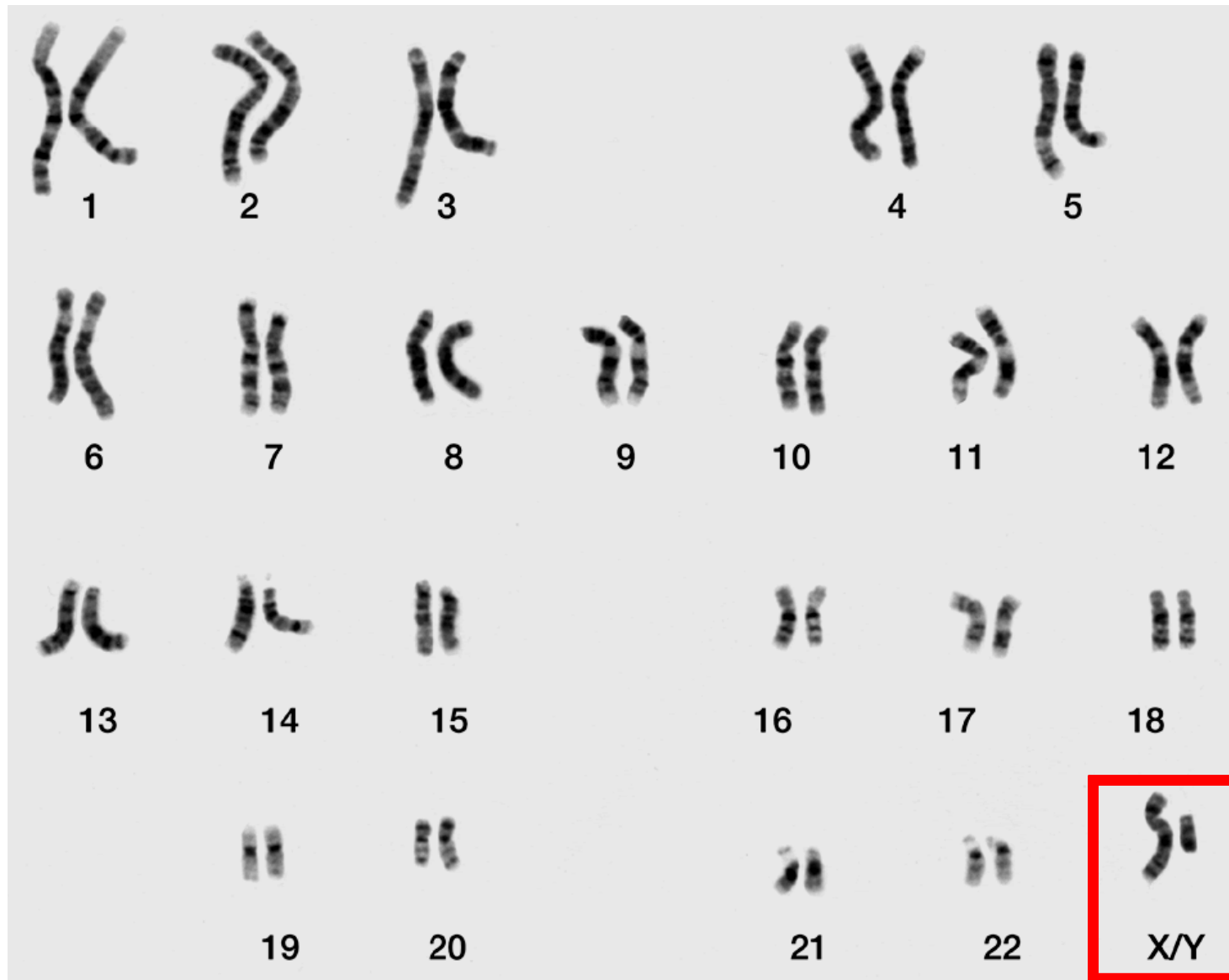
All have identical DNA sequences



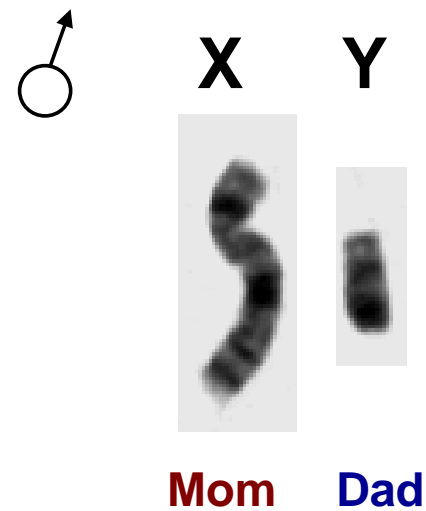
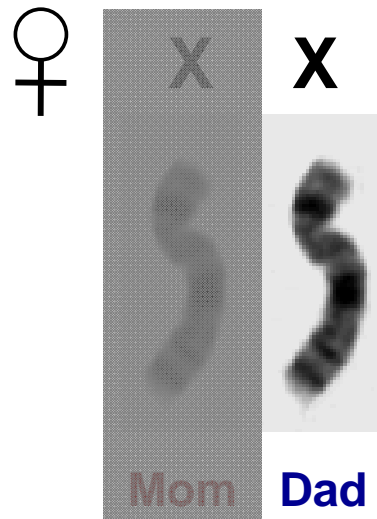
The Case of the Calico Cat



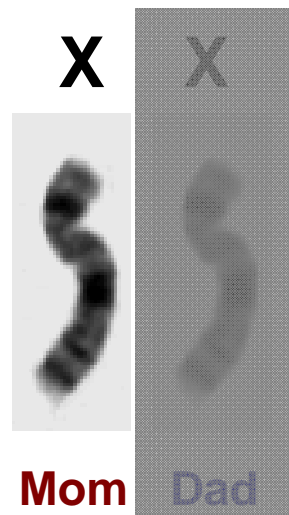
What are sex chromosomes?



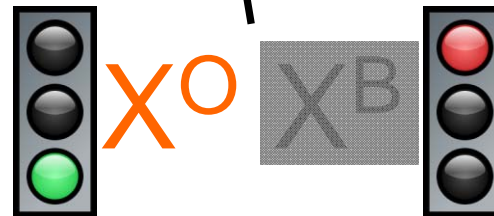
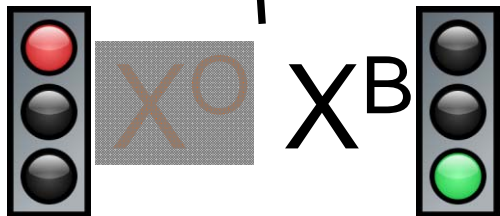
Are two X's better than one?



or



X-inactivation (1961)

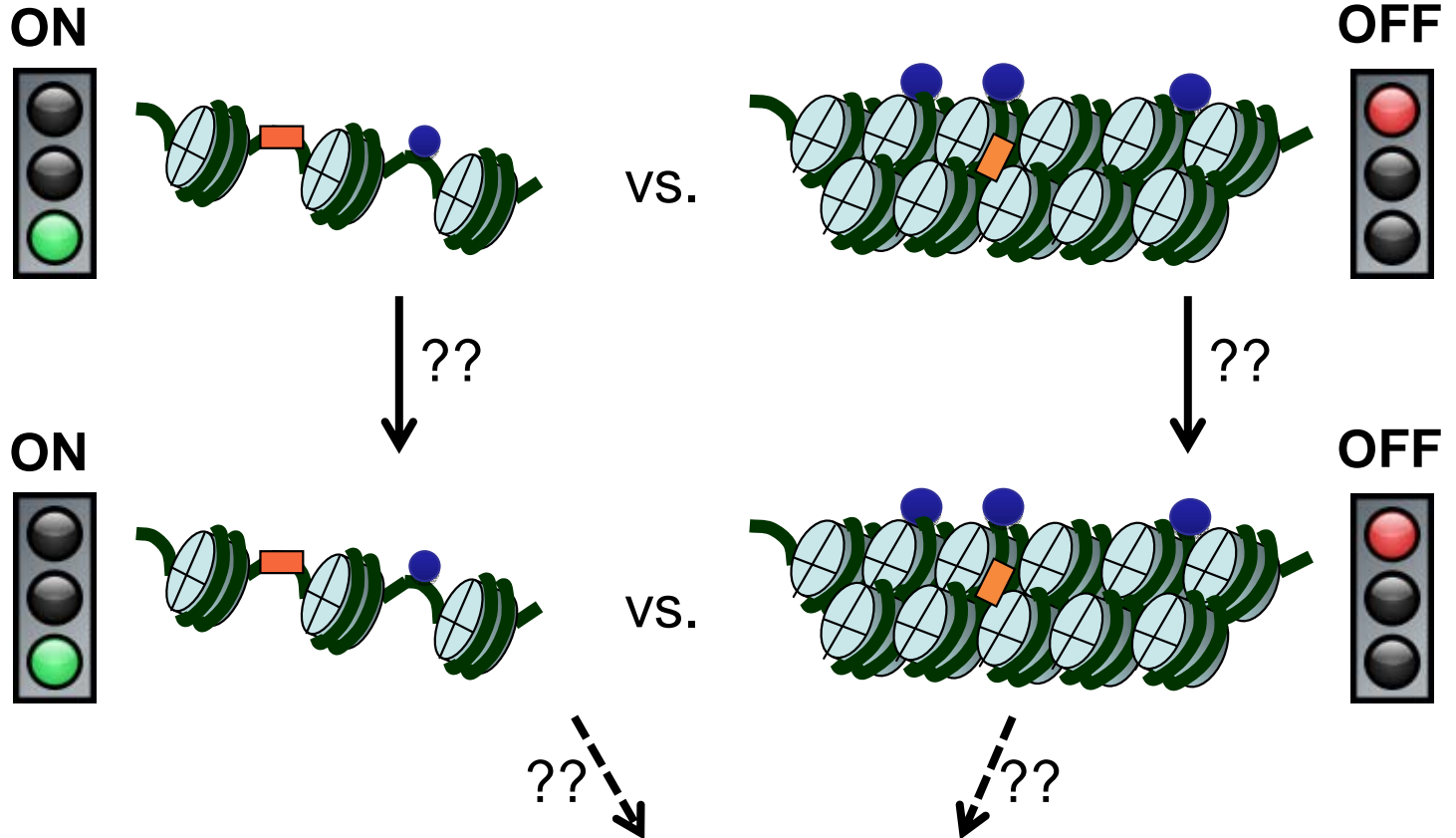


Key Points

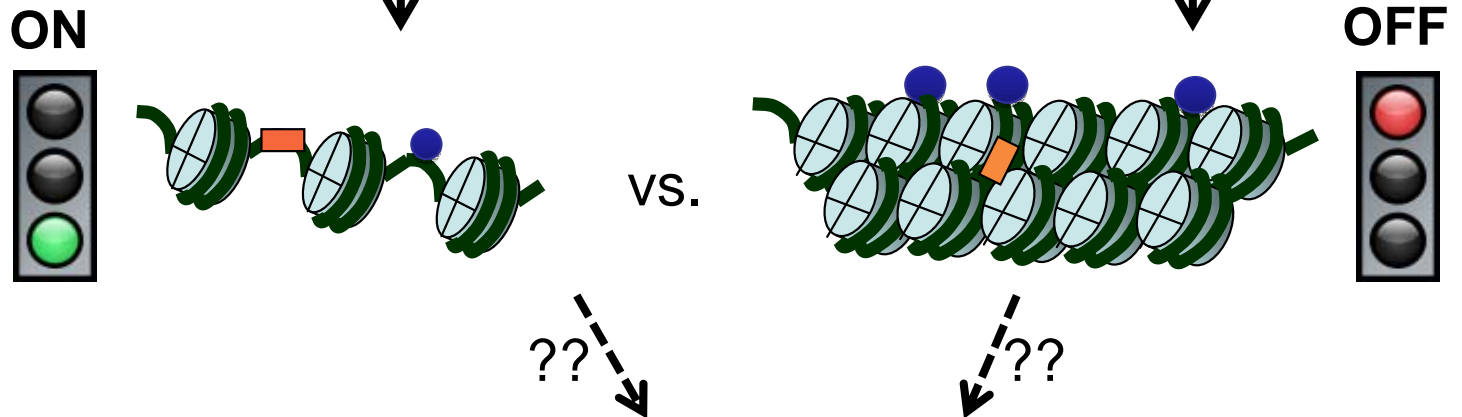
1. A gene's local 'environment' is important
2. Changes to a gene's environment can be stably inherited

Major Open Questions

**Where?
When?**



Memory?



What gets passed on?



What gets passed on in mice?

Study published August 2010

Question: Does the Y chromosome pass on epigenetic information?

Looked at a panel of behavioral traits

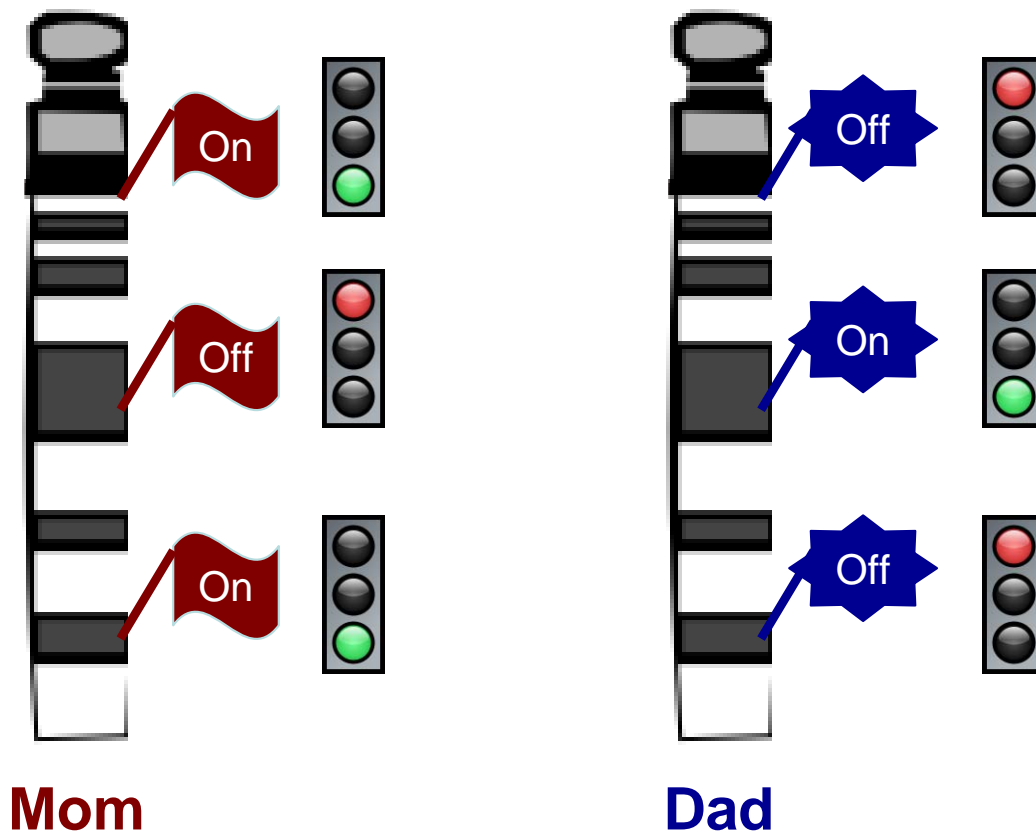


Found epigenetic effects to be on par with genetic effects

A Tale of Two Chromosomes

Imprinting:

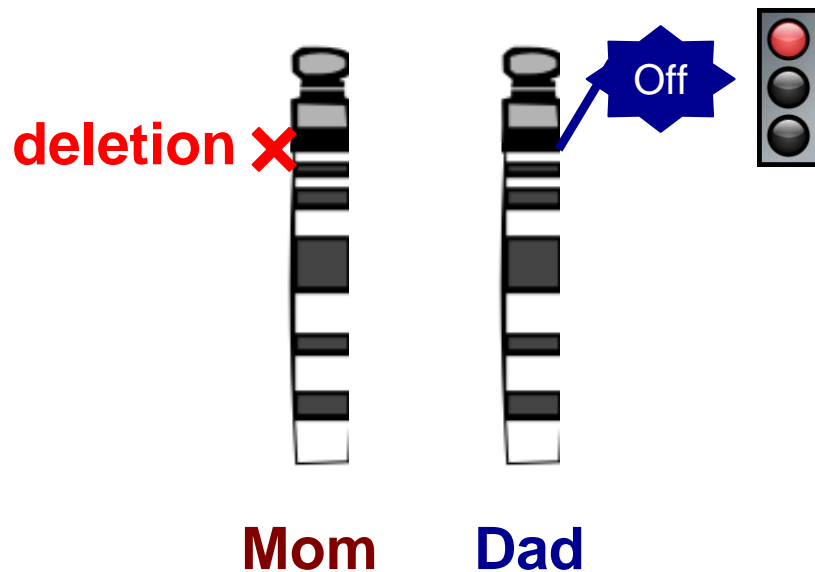
When parental chromosomes are marked differently



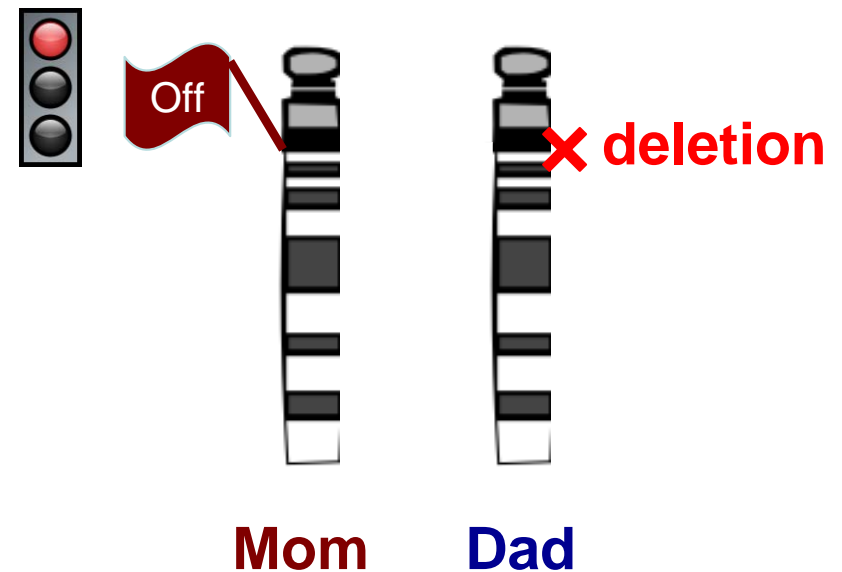
Imprinting & Chromosome 15



Angelman Syndrome



Prader-Willi Syndrome



Imprinting – More widespread than we thought?

Study published August 2010

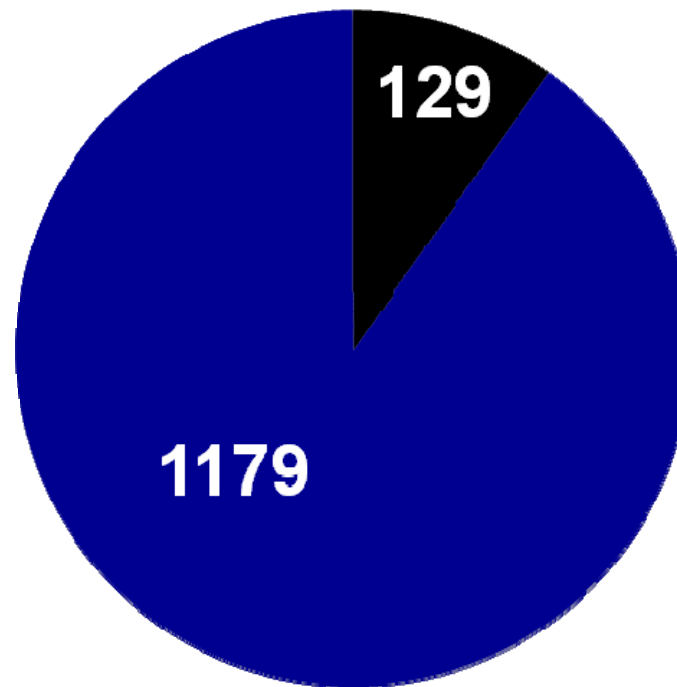
Looked at imprinting in the mouse brain



Imprinted genes

■ Known

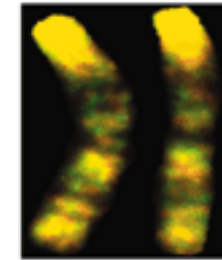
■ New



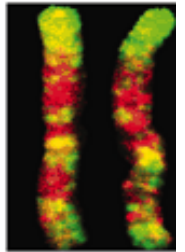
Other epigenetic effects

Epigenetics & Cancer

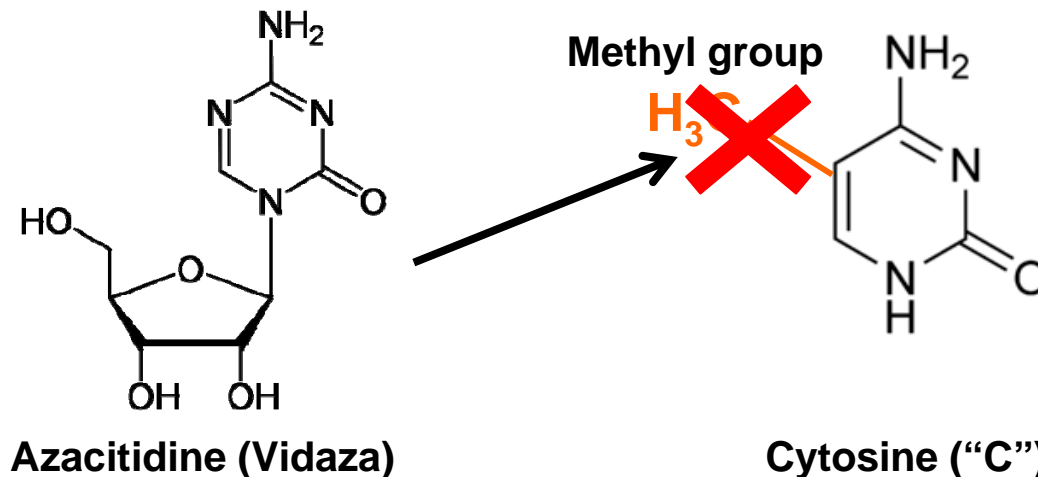
- Myelodysplastic Syndromes (MDS)
 - Disease of bone marrow
 - High risk of leukemia
 - Delayed onset (>60 years old)



3 yrs



50 yrs



First MDS drug
to show a
survival benefit

Epigenetics & Memory



**Mouse with
memory defects**

**Exposure to 'lively'
environment**



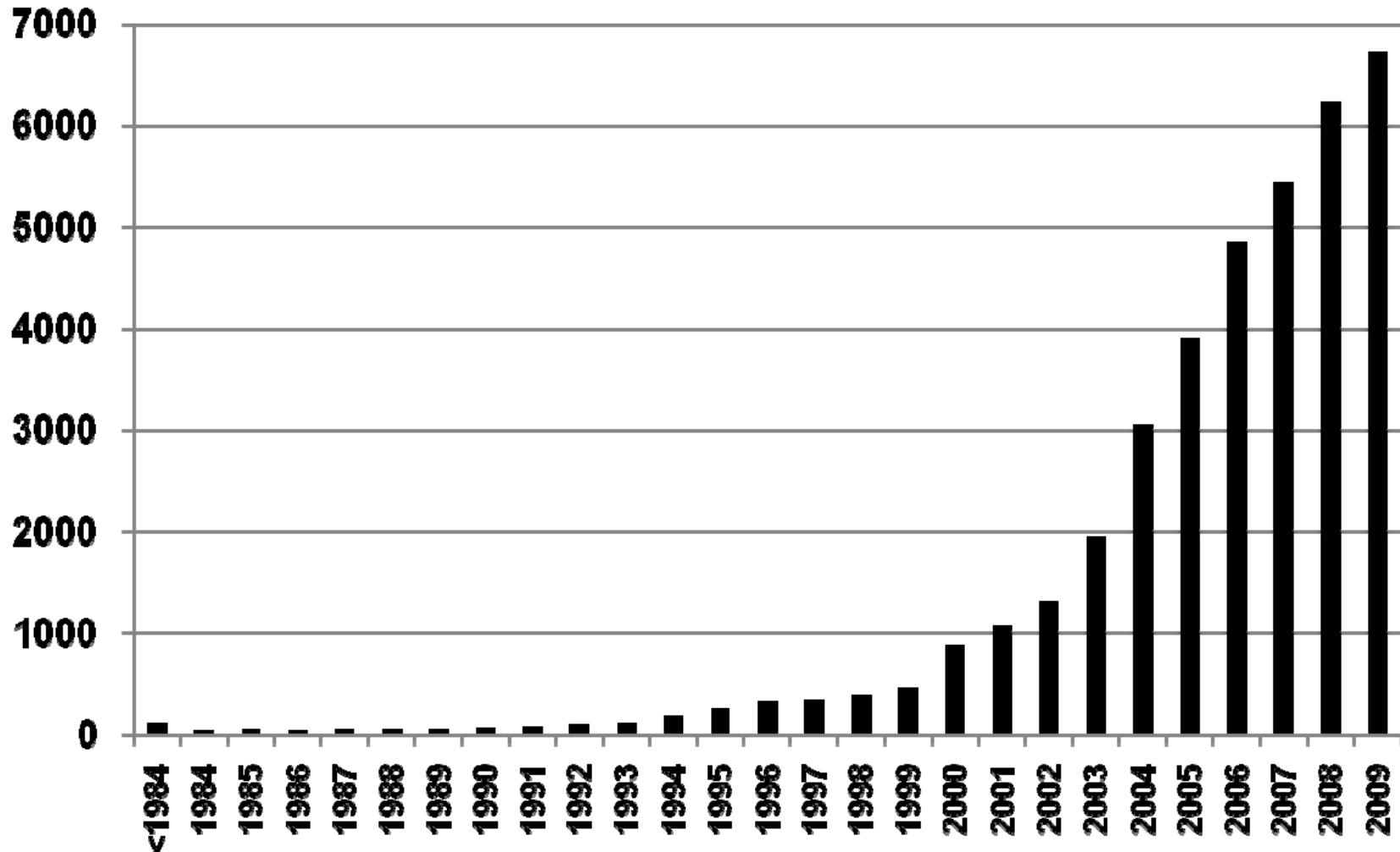
**Mouse with
improved memory**



**Offspring with
improved memory!**

Tip of the Iceberg?

'Epigenetics' articles/year



Summary

- ‘Weird’ phenomena in model systems gave us early clues about epigenetics
- Scientists are actively trying to understand how epigenetic information is specified and transmitted
- Epigenetics can inform our design of therapeutics
- We still have a lot to learn about epigenetics!

Thank you!

Questions?

Thank you!

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