Genetics v Genomics

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Overview

Today's Goals

- What is/are Genomics?
- How have techniques changed?
- What impact has that had on biological questions?

What is/are Genomics?

- What is Genomics?
- How is it different than Genetics?
- What allows us to do genomics instead of genetics?

What is/are Genomics?

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2. Settle on a definition of genomics (or an answer to the other questions)

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4. Vote on other answers

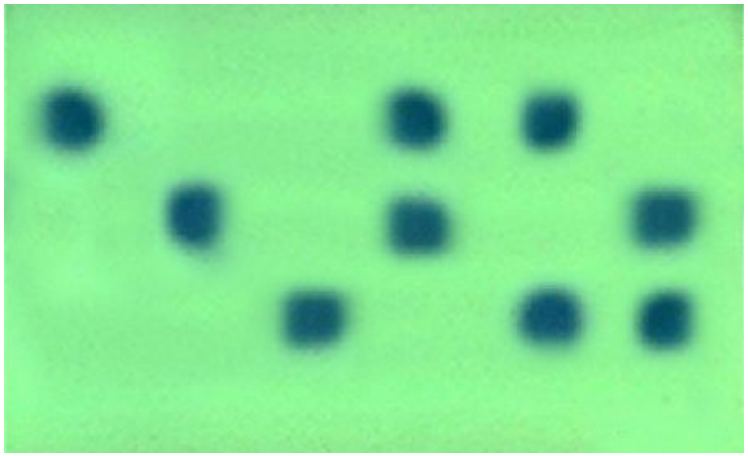
What is/are Genomics?

Brief History of Sequencing

- Allozymes
- Sanger Sequencing
- Next Generation Sequencing - NGS

Allozymes

- 1960's
- Electrophoresis separates different proteins by amino acid makeup
- First (limited) look at DNA composition

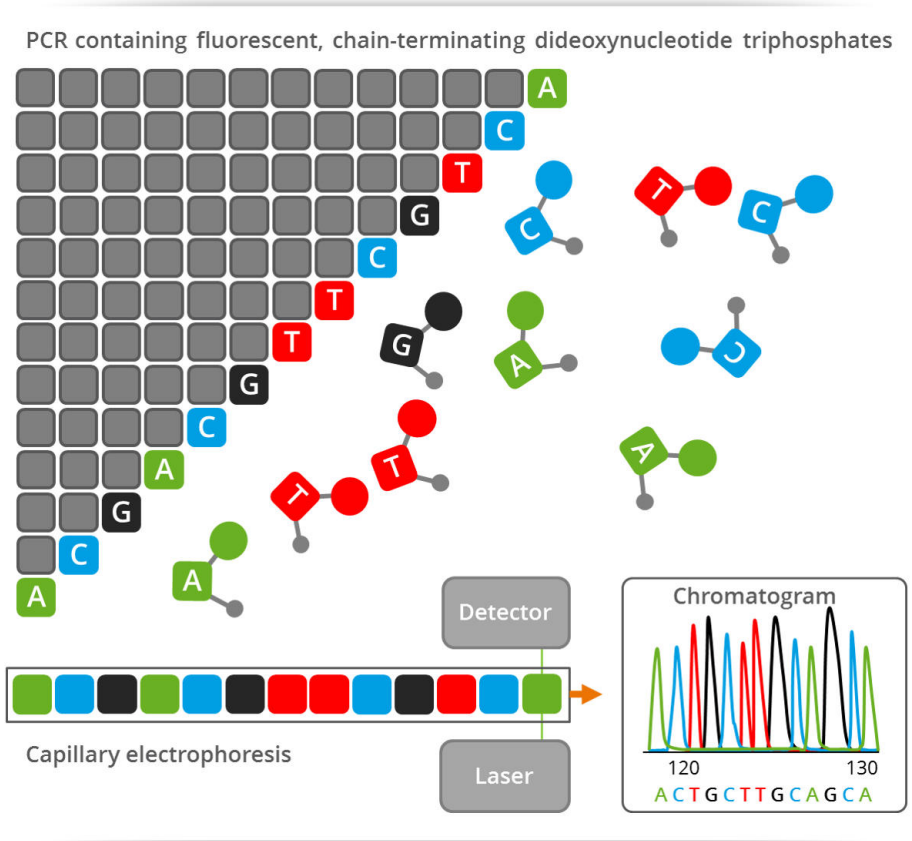


Sanger Sequencing

- 1977
- Determines the sequences a single piece of DNA up to 500bp
- Highly accurate but slow

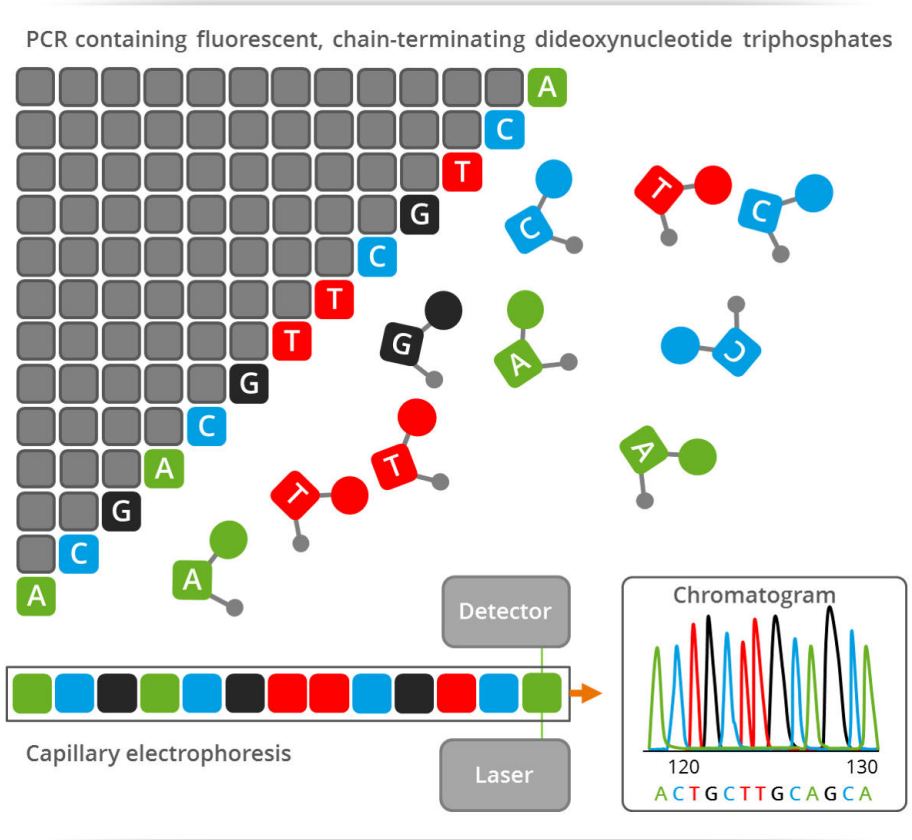
Sanger Sequencing

- Design a primer
- Run a PCR
- Chain-terminating dideoxynucleotide triphosphates



Sanger Sequencing

- Run results on a gel
- Read with a laser, determines which base ended the PCR
- Color order is sequence order

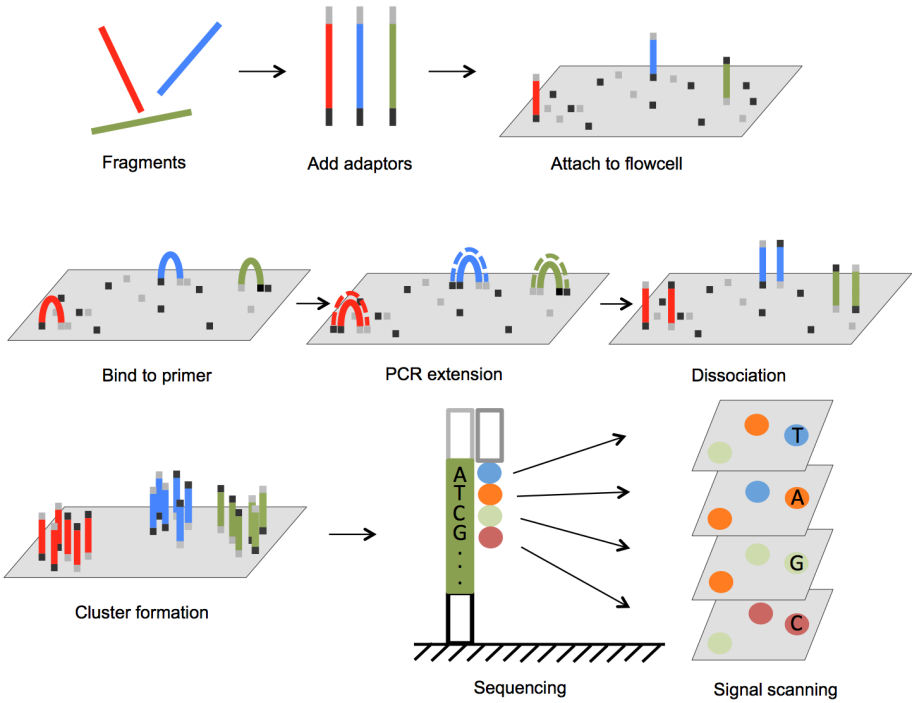


NGS Sequencing

- mid-2000's
- Many different companies and methods
- All generate far more data than Sanger

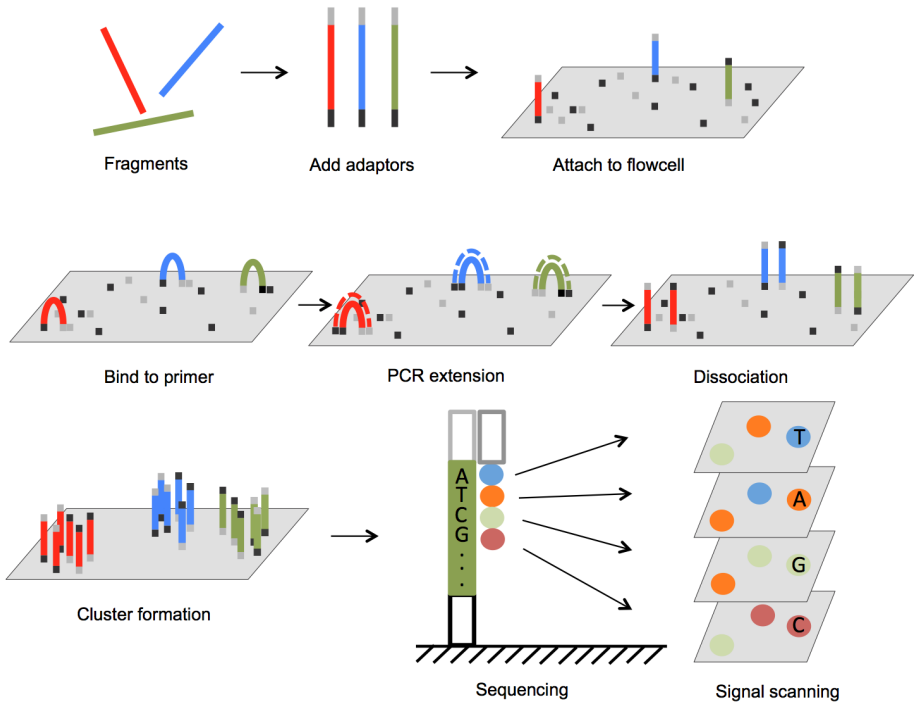
NGS Sequencing - Illumina

- Library Preparation
  - Fragment a sample of whole genomic DNA
  - Add adapters for the specific machine
- Amplify with PCR
- Read on machine (next slide)



NGS Sequencing - Illumina

- Machine attaches adapter and DNA to a fixed surface
- Amplifies single strand
- Adds a new base each cycle and images for ID



NGS Sequencing - PacBio

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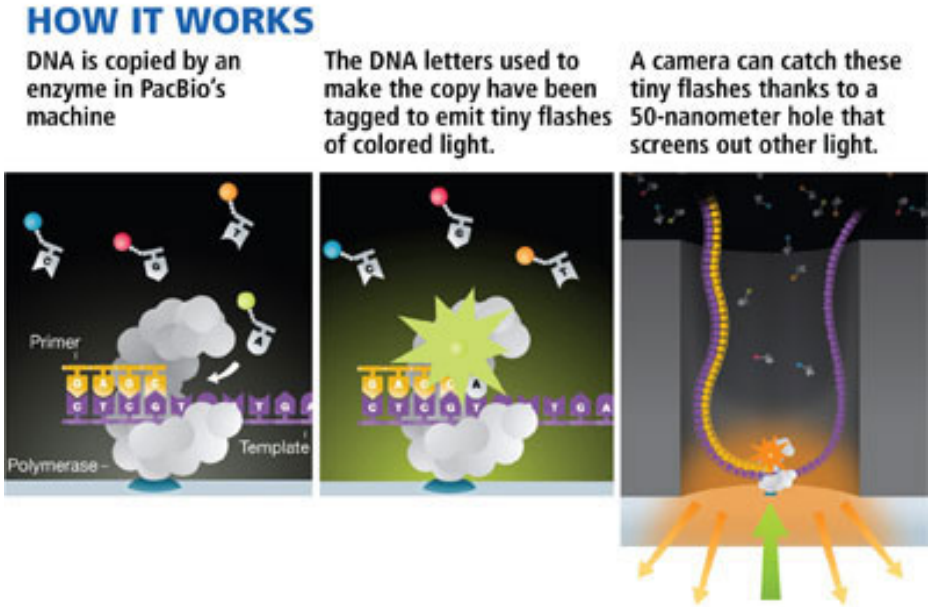
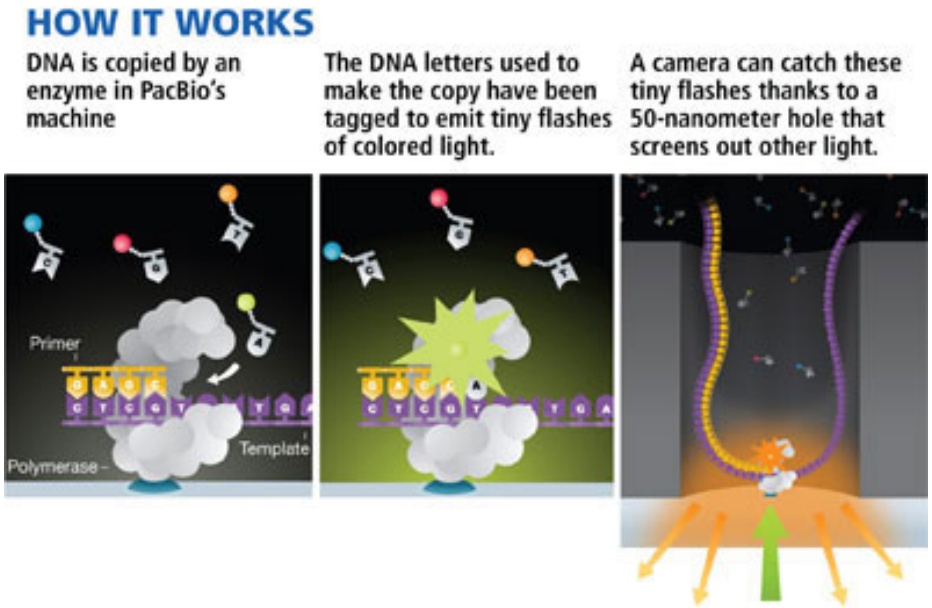


NGS Sequencing - PacBio

- A copy is made on the machine by an enzyme
- The bases used for the copy are flourescent
- As a new base is incorporated the color shows the identity



Next Generation Sequencing vs. Sanger

- Output for Quality Tradeoff
  - NGS = VERY High Output / Good Quality
  - Sanger = Low Output / Best Quality

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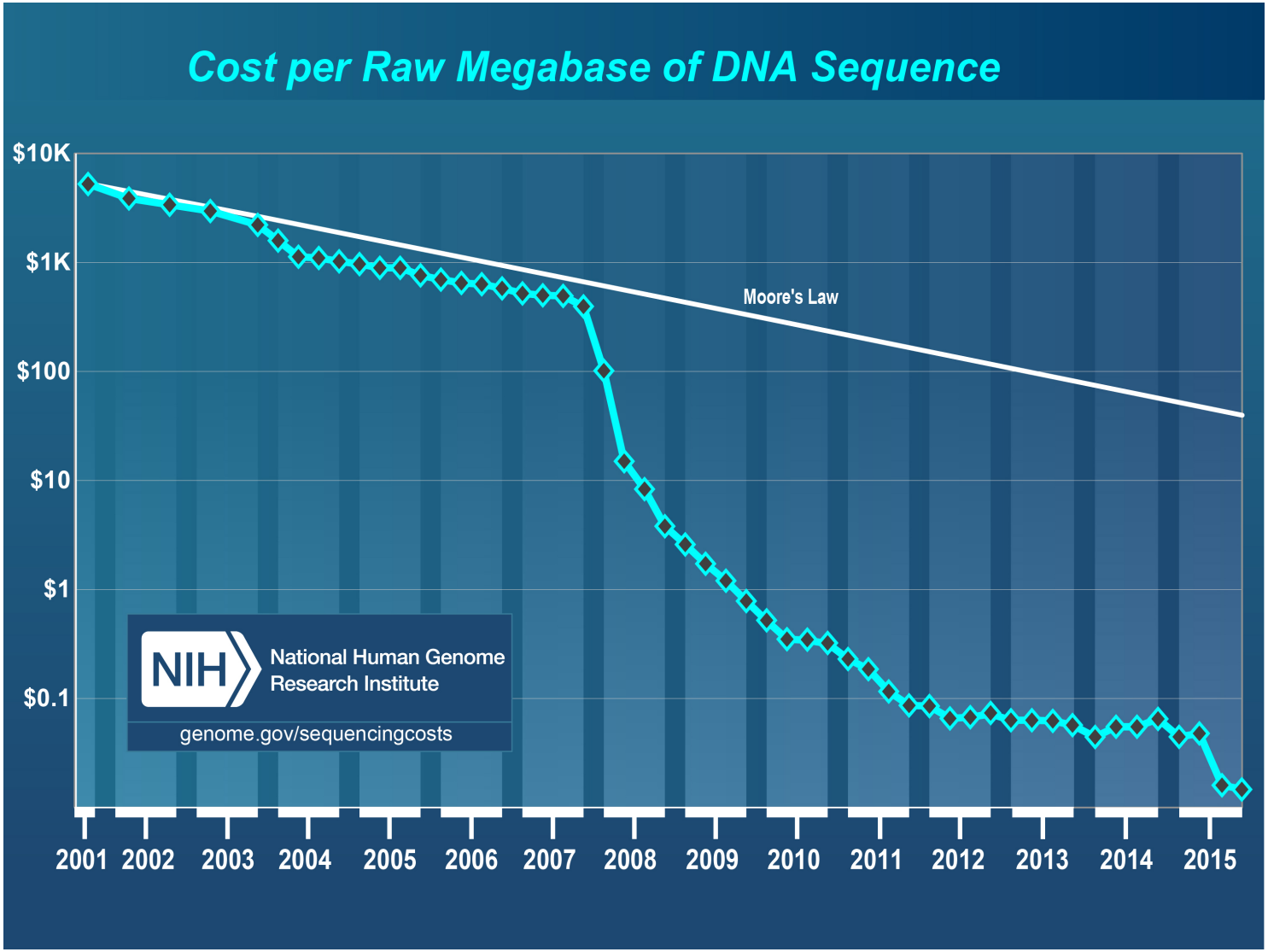
  - PacBio

Brief History of Sequencing

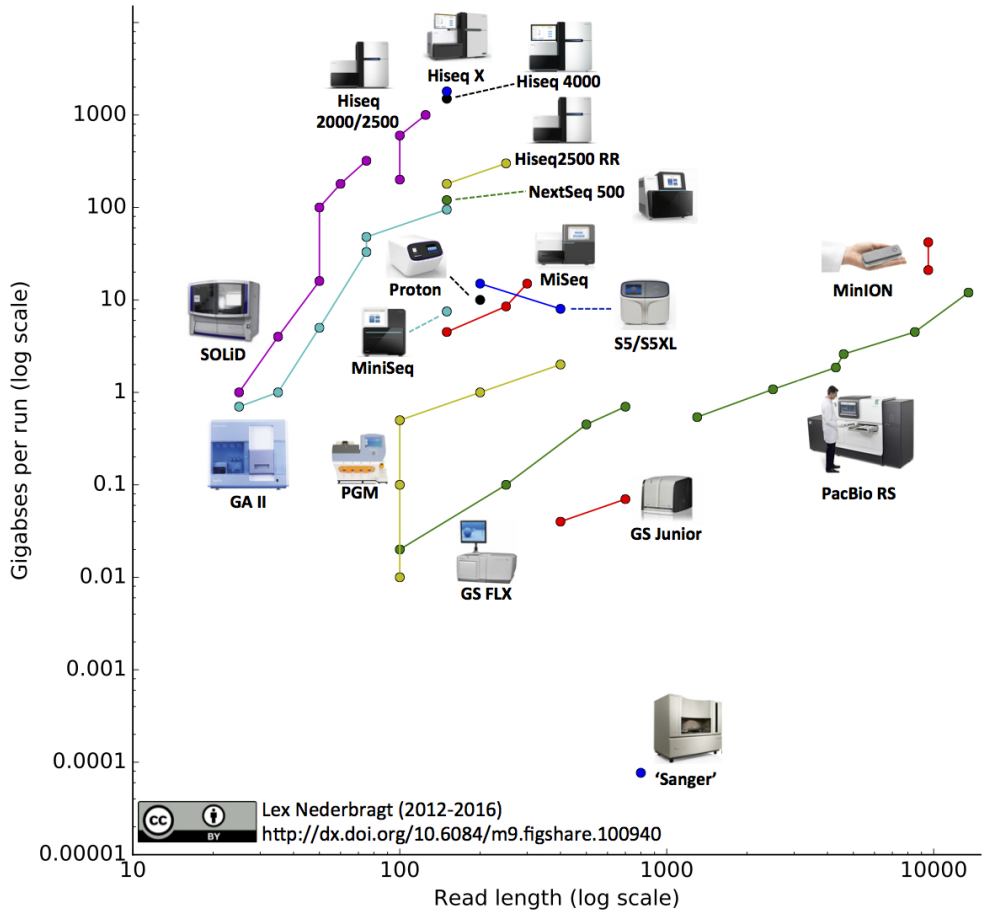
- Allozymes
  - 1960's
- Sanger Sequencing
  - 1977
- NGS - Next Generation Sequencing
  - 2000


Miles Zhang
@ymilesz
Following
This meme is everywhere, so I thought I'd add a biology twist to it.
BIOLOGISTS
NGS
SANGER SEQUENCING
7:11 PM - 25 Aug 2017

Sequencing Cost



Sequencing Output



Generational Shift

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- Data length and quality are both improving

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- Data length and quality are both improving
- How does this change the scope of research?

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   - Group's Choice:
     - Transcription Factors
     - CpG islands
     - DNA Methylation

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   - What genes underlie a specific function?
   - What is the code of the human genome?
   - Group's Choice:
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     - CpG islands
     - DNA Methylation
3. How would your group assess this question
   - in 1997?
   - in 2017?

The End