

Sequencing 101

(The incomplete) history of sequencing

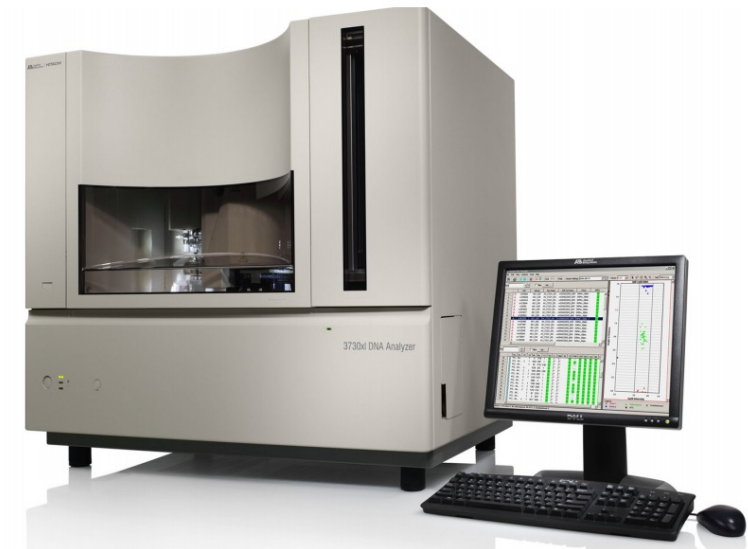
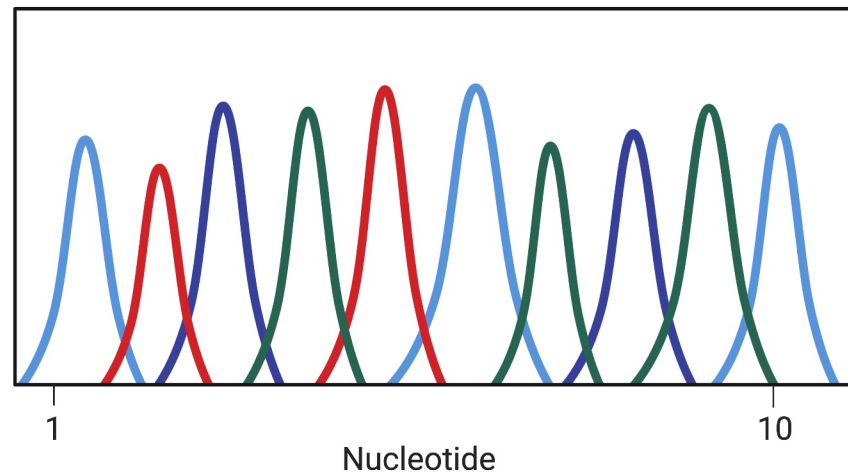
High-throughput Sanger sequencing

Dye-terminators and capillary electrophoresis

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High-throughput Sanger sequencing

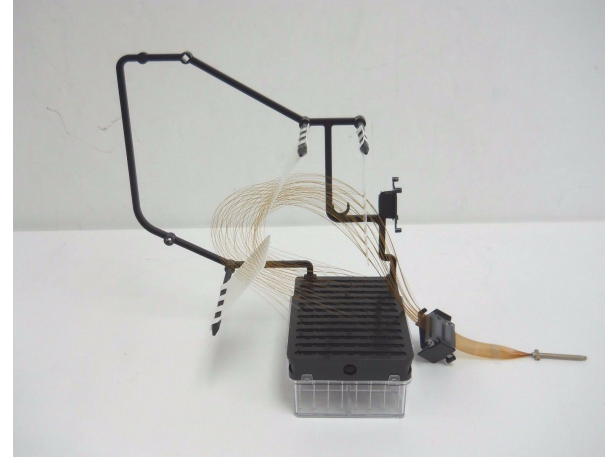
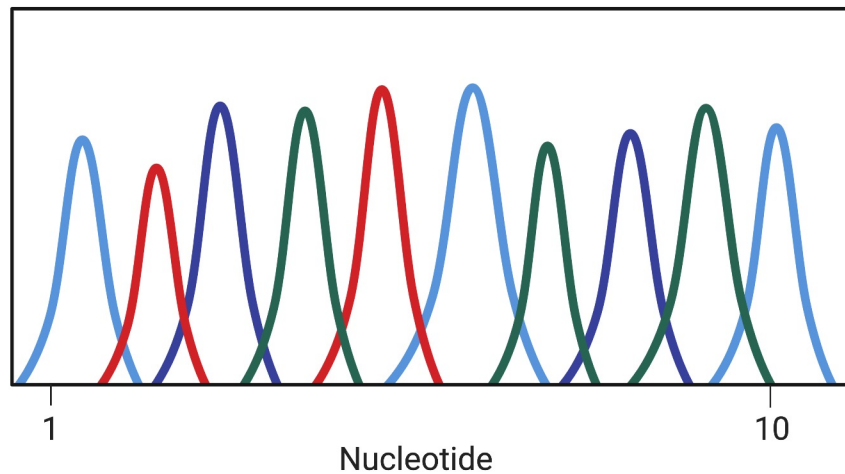
Dye-terminators and capillary electrophoresis



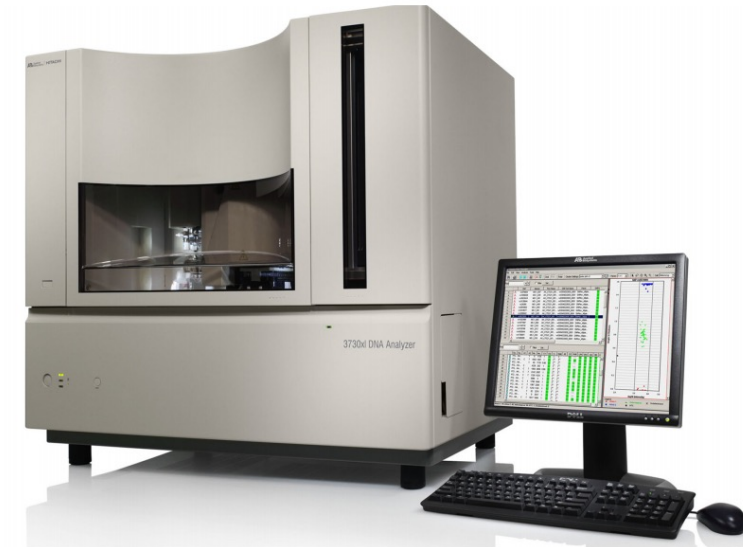
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High-throughput Sanger sequencing

Dye-terminators and capillary electrophoresis



48/96 –capillars
Read length < 900 bp
< 90 Kbp / run



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Sequencing by synthesis:

Pyrosequencing

Genome sequencing in microfabricated high-density picolitre reactors

Marcel Margulies, Michael Egholm, [...] Jonathan M. Rothberg 

Nature **437**, 376–380(2005) | [Cite this article](#)

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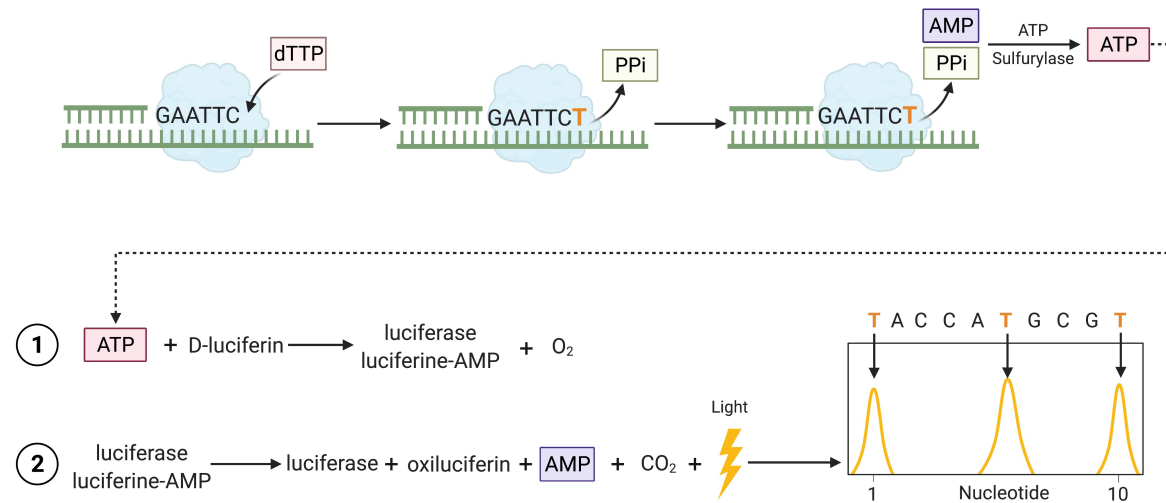
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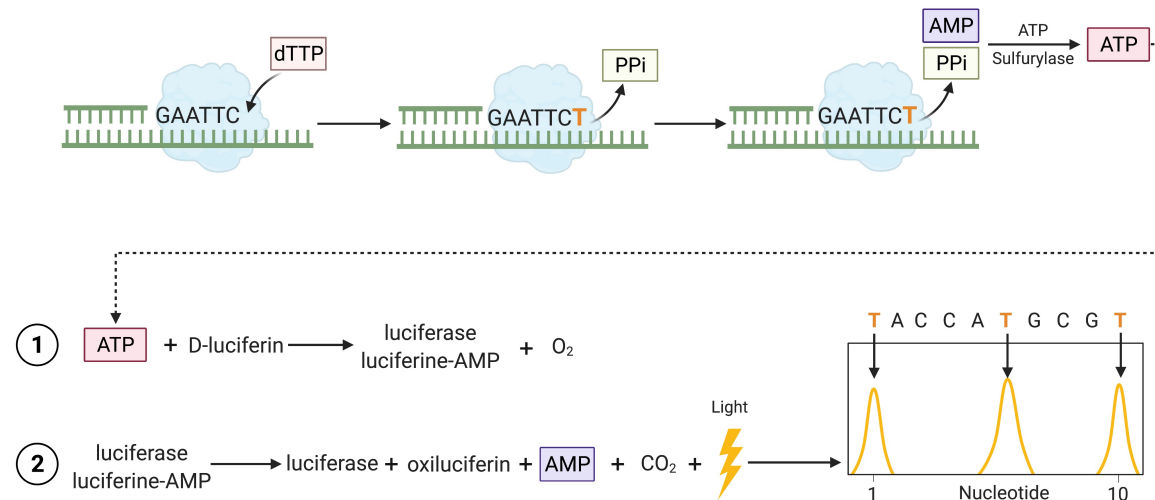
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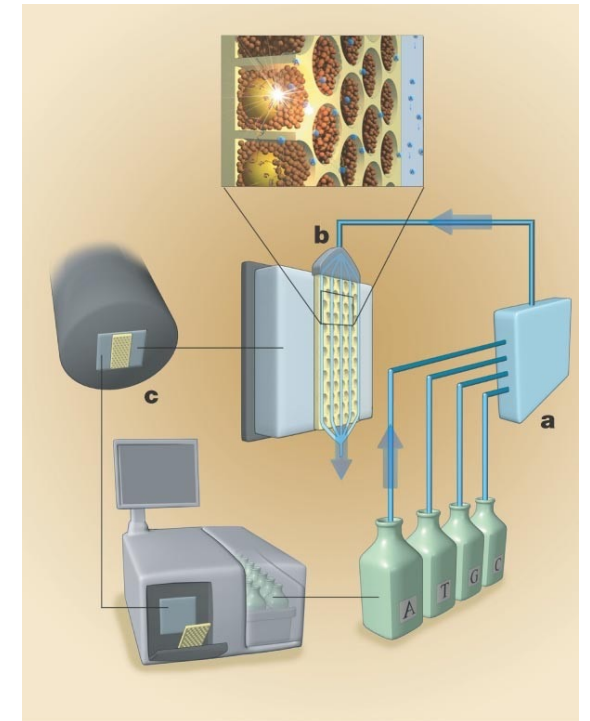
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Margulies et al., 2005. *Nature*

Read length ~ 400–1000 bp
20 – 600 Mbp / run

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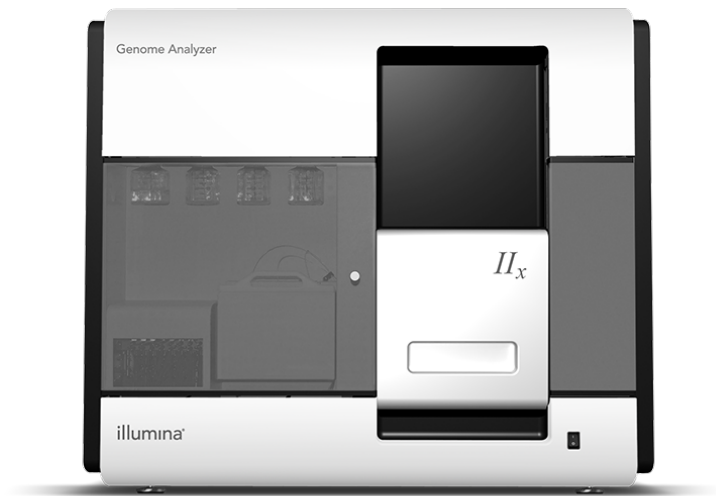
Short-read sequencing



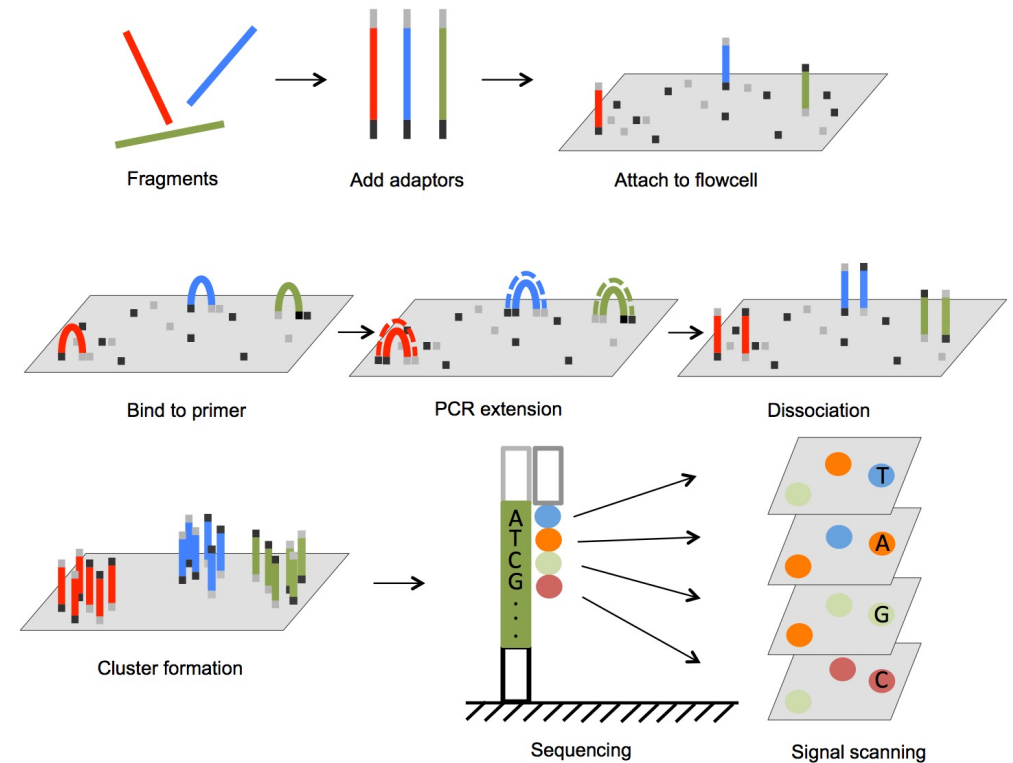
Illumina (Solexa)
Genome Analyzer, 2006
1 Gbp / run

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Sequencing by synthesis: Short-read sequencing



Illumina
Genome Analyzer IIx, 2008
20 Gbp / run (9.5 days)



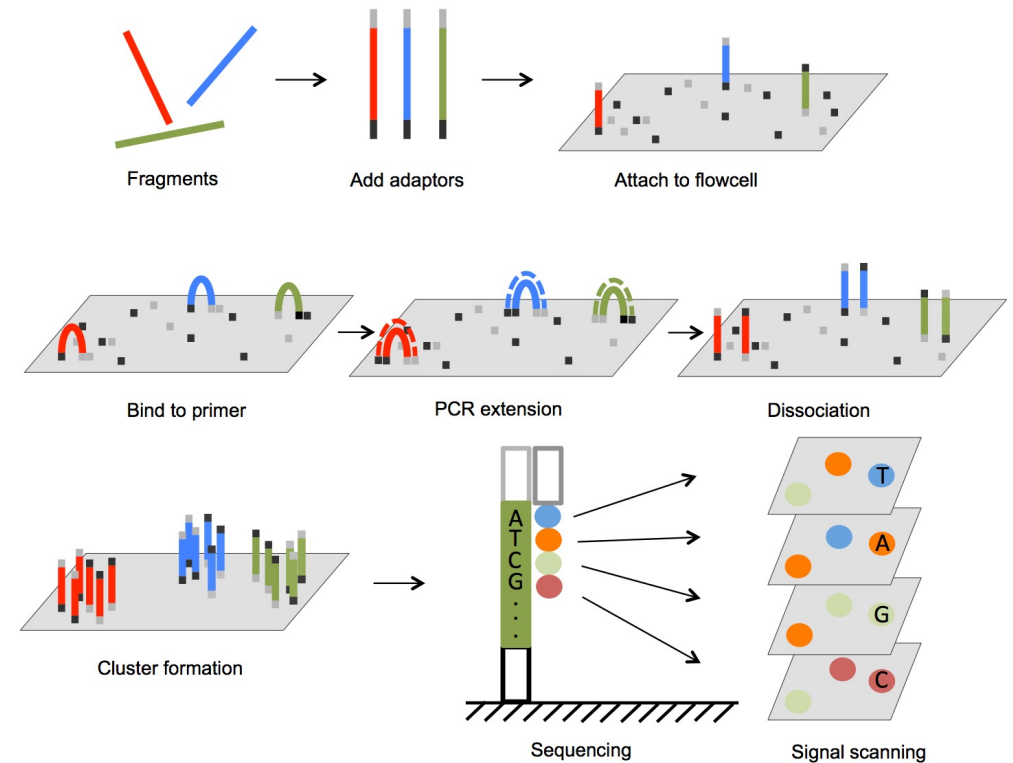
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Short-read sequencing



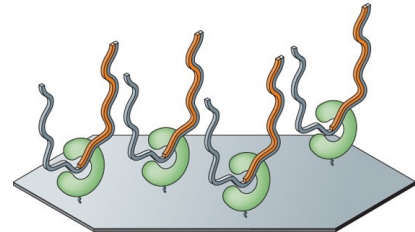
1 Gbp – >1 Tbp / run (~1–2 d)



(The incomplete) history of sequencing

Third revolution: Long-read sequencing

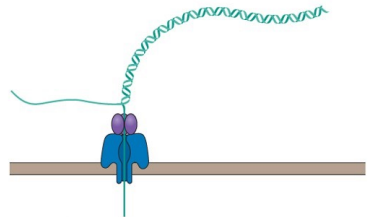
The Third Revolution
Single-molecule sequencing



Pac Bio SMRT sequencing

- Sequencing by synthesis
- Single-molecule templates
- Low accuracy but long read lengths

For example, PacBio RS
(Pacific Biosciences)



Oxford Nanopore sequencing

- Nanopore sequencing
- Single-molecule templates
- Low accuracy but long read lengths

For example, MinION
(Oxford Nanopore)

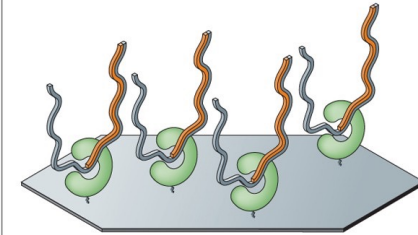
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Third revolution: Long-read sequencing



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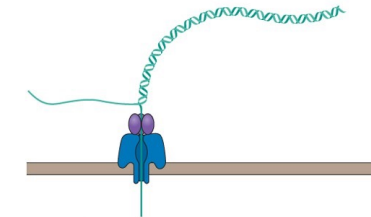
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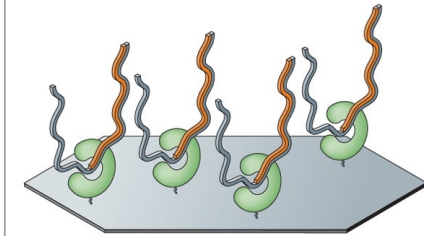
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Third revolution: Long-read sequencing



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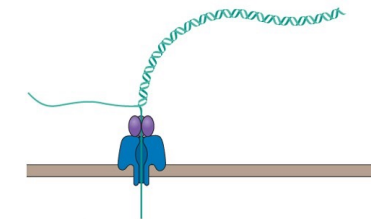
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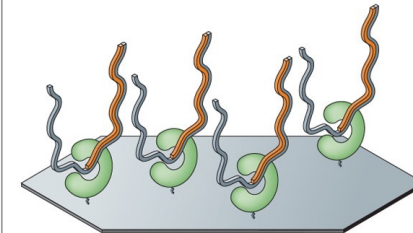
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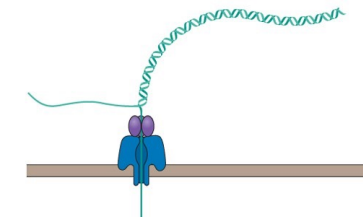
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Sequel II
HiFi reads:
Read length:
20 kb
30 Gbp /run
(99.92 % acc.)

Minion:
Read length:
> 4 Mb
1–50 Gbp /run
(~ 97 % acc.)
Real-time!