

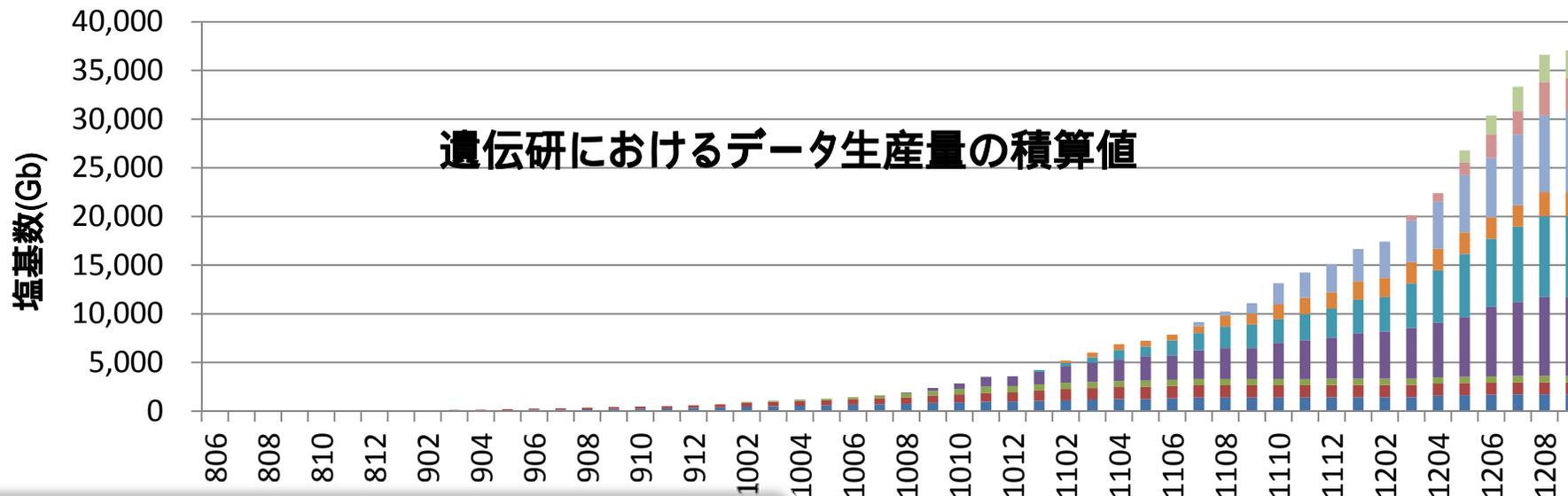
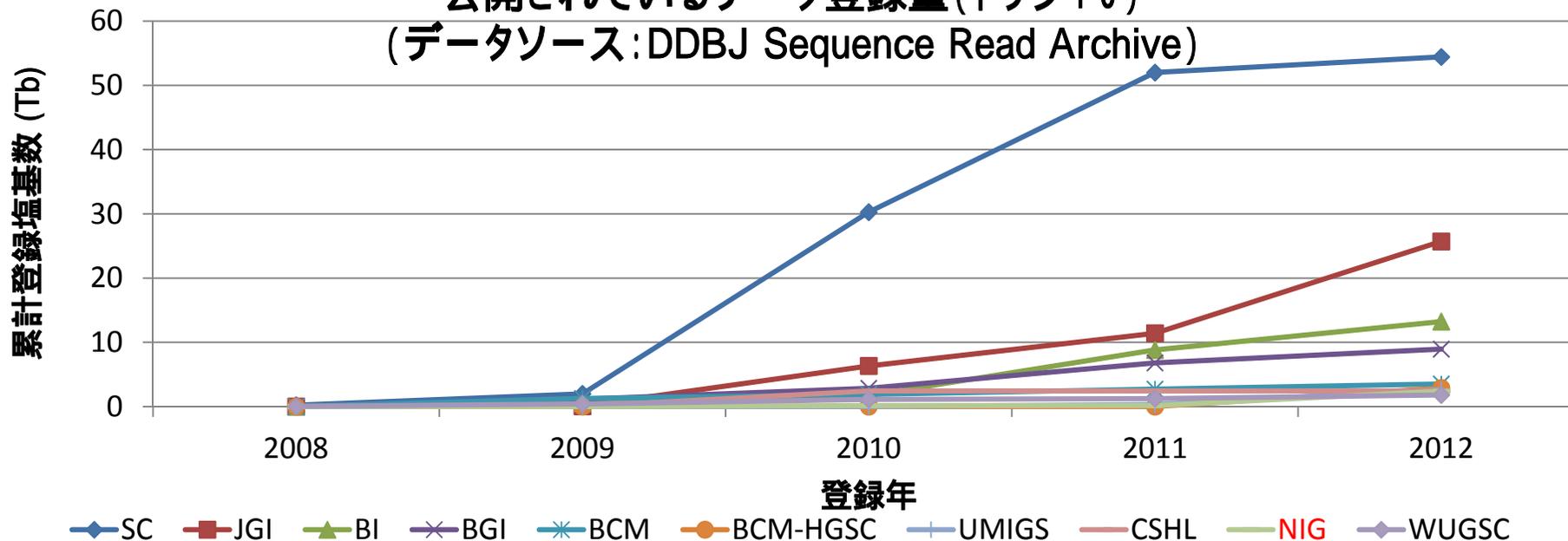


# Genomics and New-Generation Sequencing Based Big-Data Biology

国立情報学研究所・国立遺伝学研究所

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## 公開されているデータ登録量(トップ10) (データソース:DDBJ Sequence Read Archive)



### すばる望遠鏡の出力データ量

2002年2月 55.1 GB/night x 365 => 20 PB/Year

天文月報 2002年6月272-277



# Evolution of DNA/RNA Sequencing Technology

1953

Double Helix

1960

1970

DNA Recombination *in vitro*

Chemistry/Physics

Biochemistry/Molecular Biology

RNA World

1980

DNA Sequencing

Maxam&Gilbert

Sanger

Slab gel

PCR

Automated DNA Sequencer

1990

Human Genome Project

ABI 373

ABI 377

2000

Capillary

ABI 3700

ABI 3730xl

1<sup>st</sup> NGS

Surface

GS20

FLX

Helicos

GA

PGM

HiSeq2000, SOLiD4

SOLID

2010

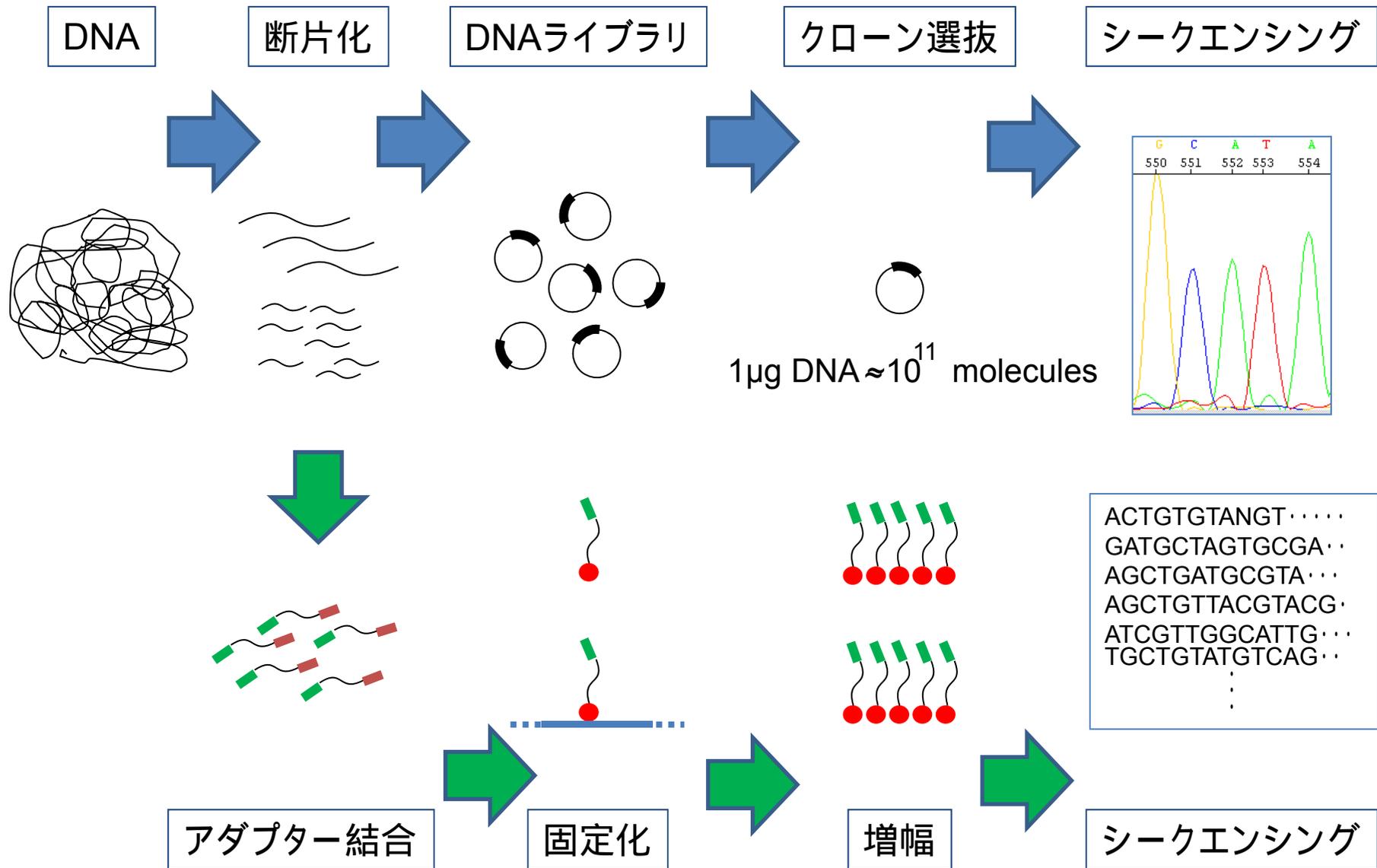
Solid state

FLX Ti

MiSeq

PacBio RS

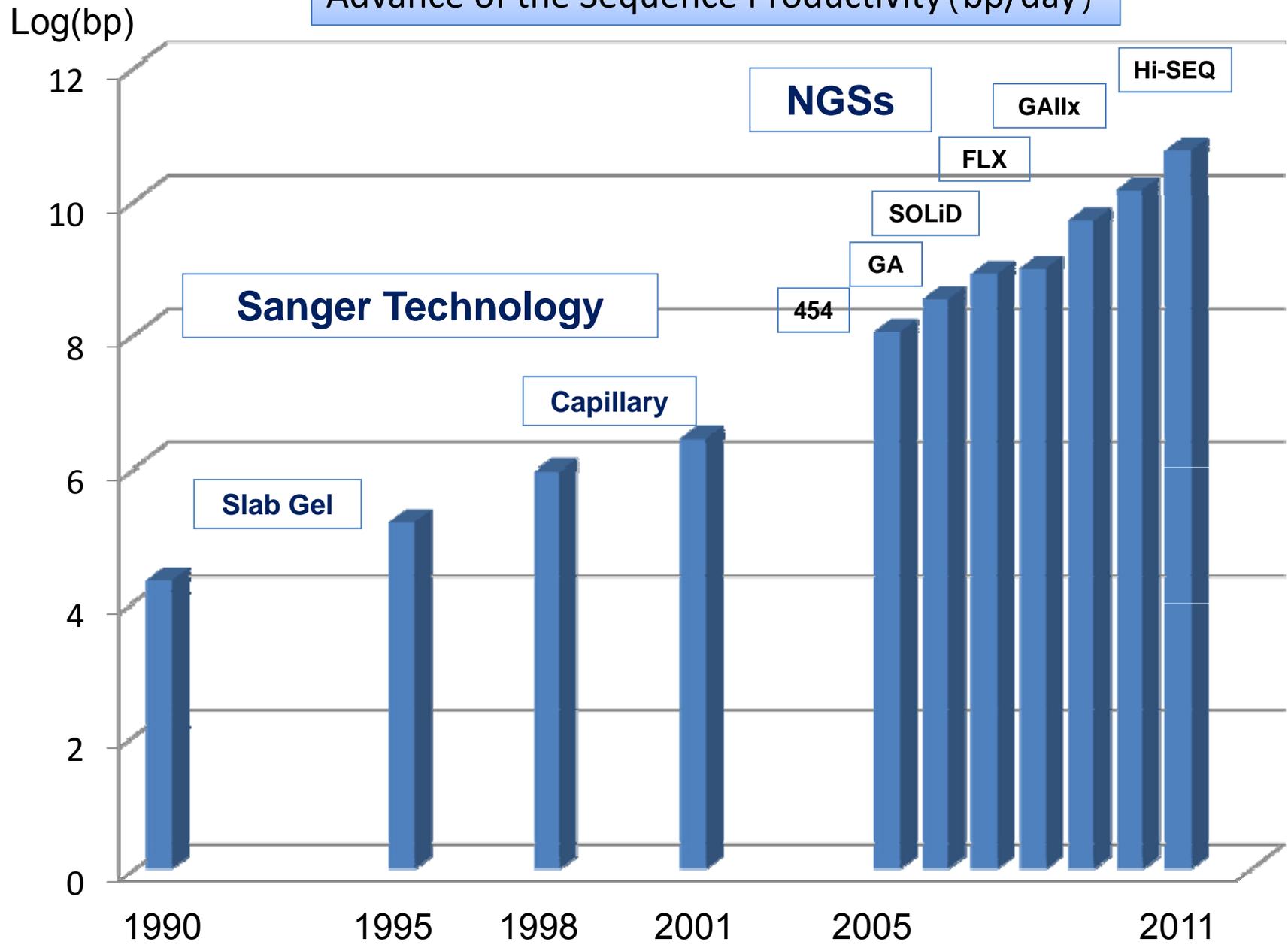
?

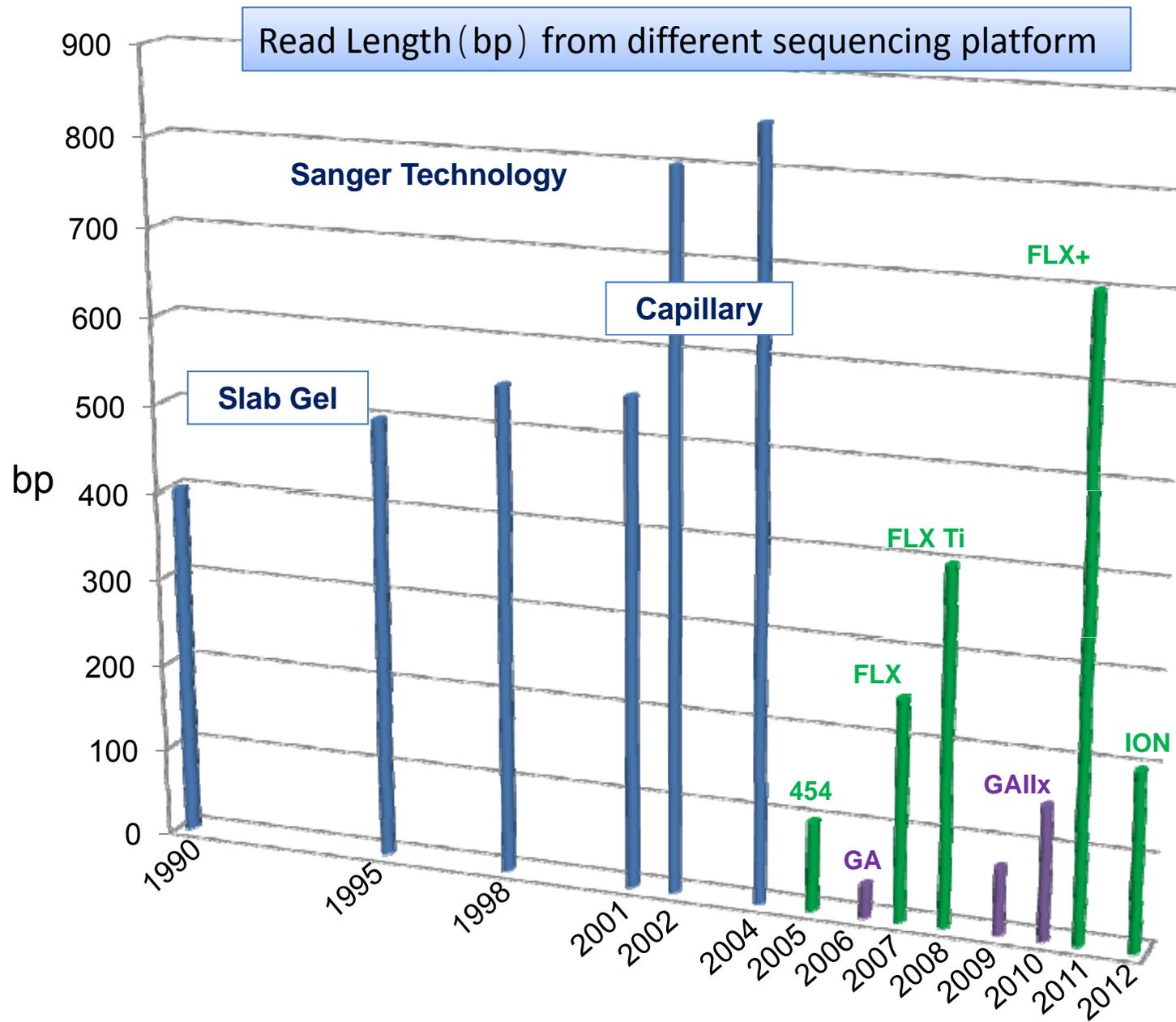


### ゲノムDNA配列決定の流れ

上が典型的なサンガー法によるシーケンシング過程で、下部に示したのが次世代型シーケンシングの一般的な過程である。

# Advance of the Sequence Productivity (bp/day)

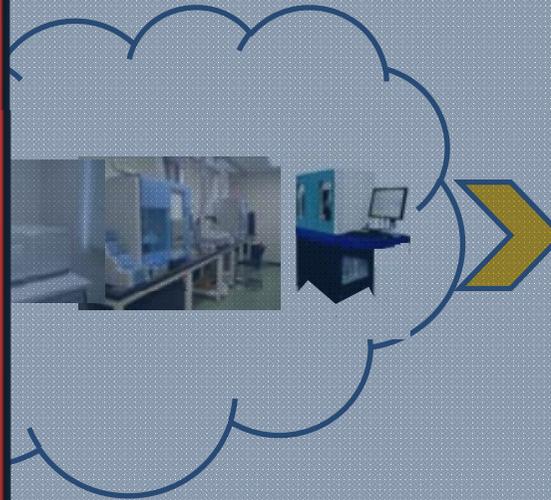




## Biological Processes that Concern Nucleic Acids

- Genomic Variance
  - Whole
  - Targeted
  - Meta genomics
    - Environment
    - Symbiosis
  - Mutation detection
- DNA Modification
  - Methylation
  - Histones
  - Nuclear compartment
  - other
- Fragment count
  - Replication
  - Recombination
  - Nucleosomes
- Transcriptome
  - ncRNAs
- RNA Modifications/TC Factors
- Ancient DNA
- ? Whatever you think of...

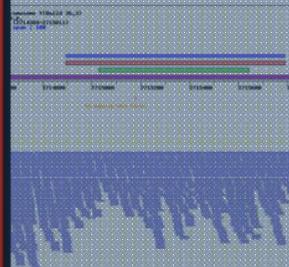
## Next-Generation Genome Analyzers



## Outputs

>  $10^6 - 10^8$   
Sequenced DNA  
Fragments of  
50 – 500 ntds

## High-Performance Computing



- Sequencing
  - De novo*
  - Re-seq
  - Structural variants
  - SNPs/indels
- Fragment count





ABI/HITACHI 3730xl



Illumina GAIIX



Roche/454 GS-FLX



ABI 5500xl



Illumina/Solexa HiSeq-2000



Illumina/Solexa MiSeq

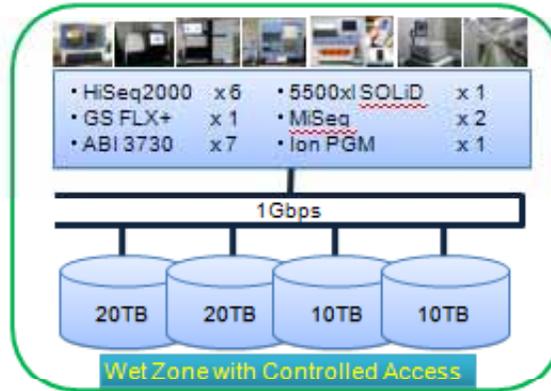


ABI/Ion Torrent Ion PGM

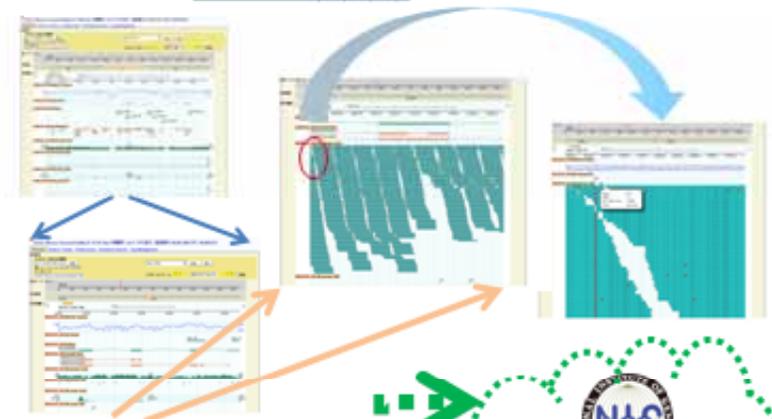


PACBIO PACBIO RS

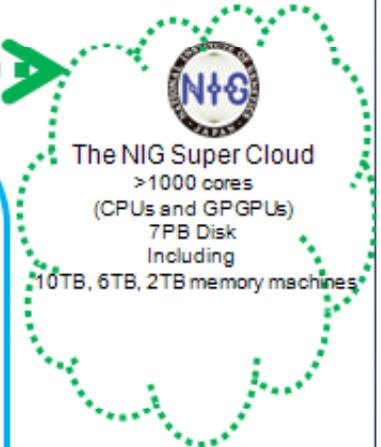
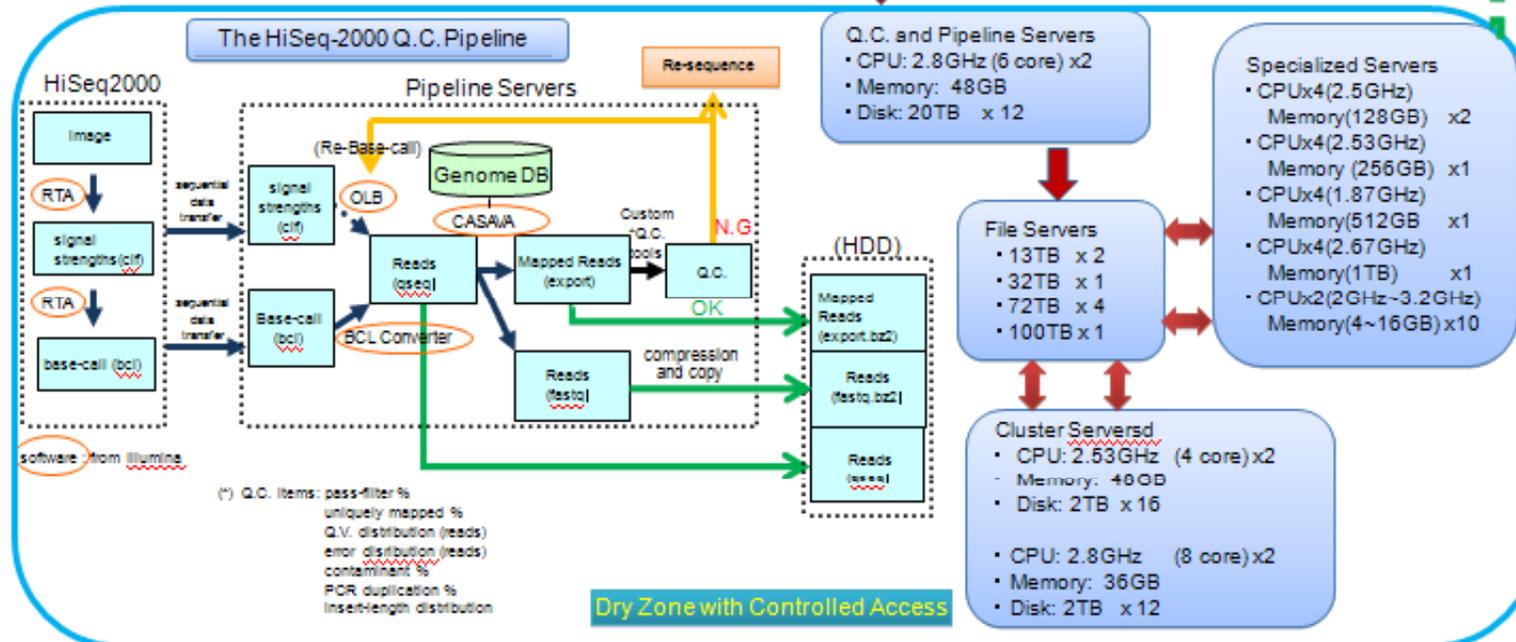
### SEQUENCERS and Connections



### Genome Browser

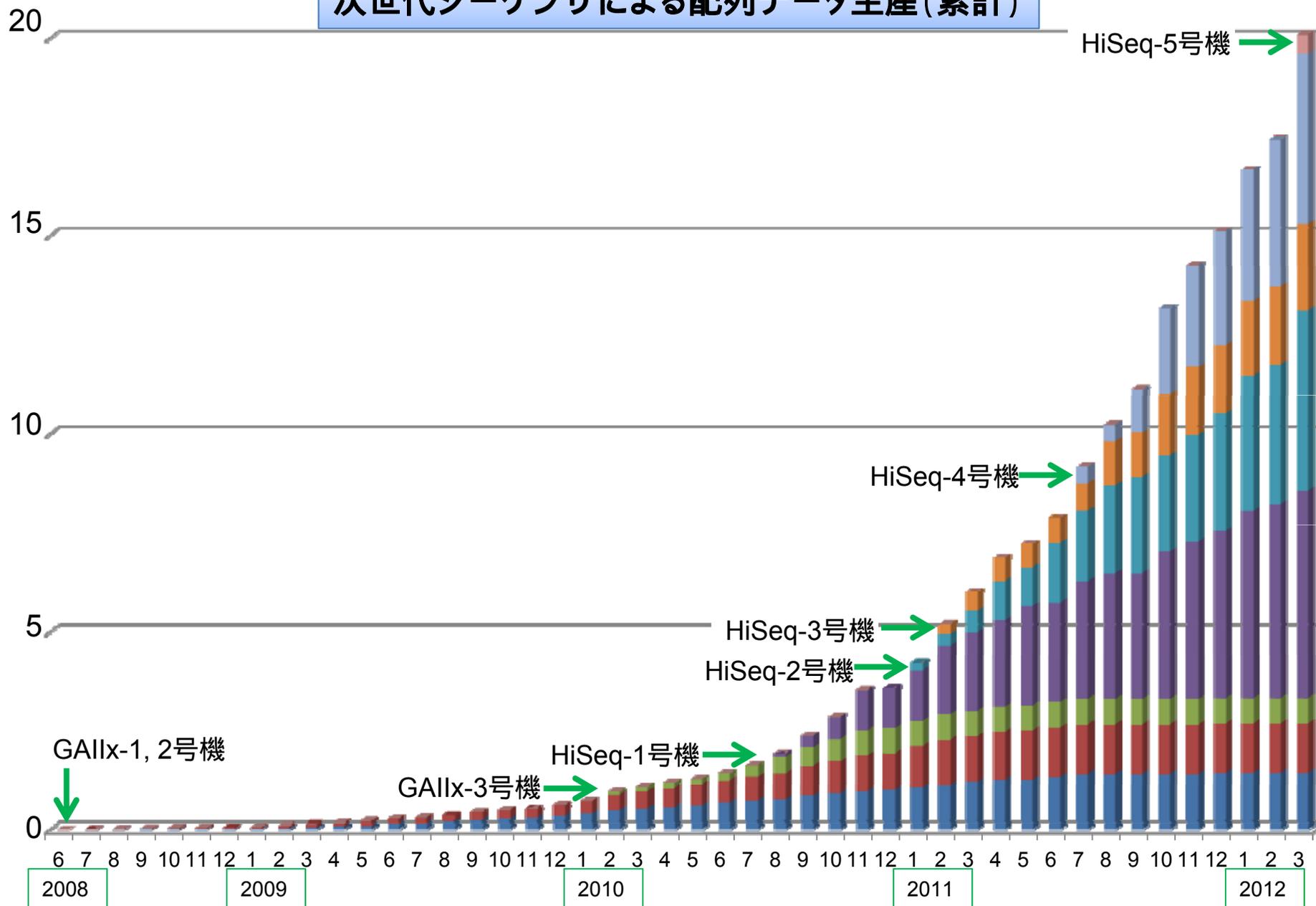


10 Gbps

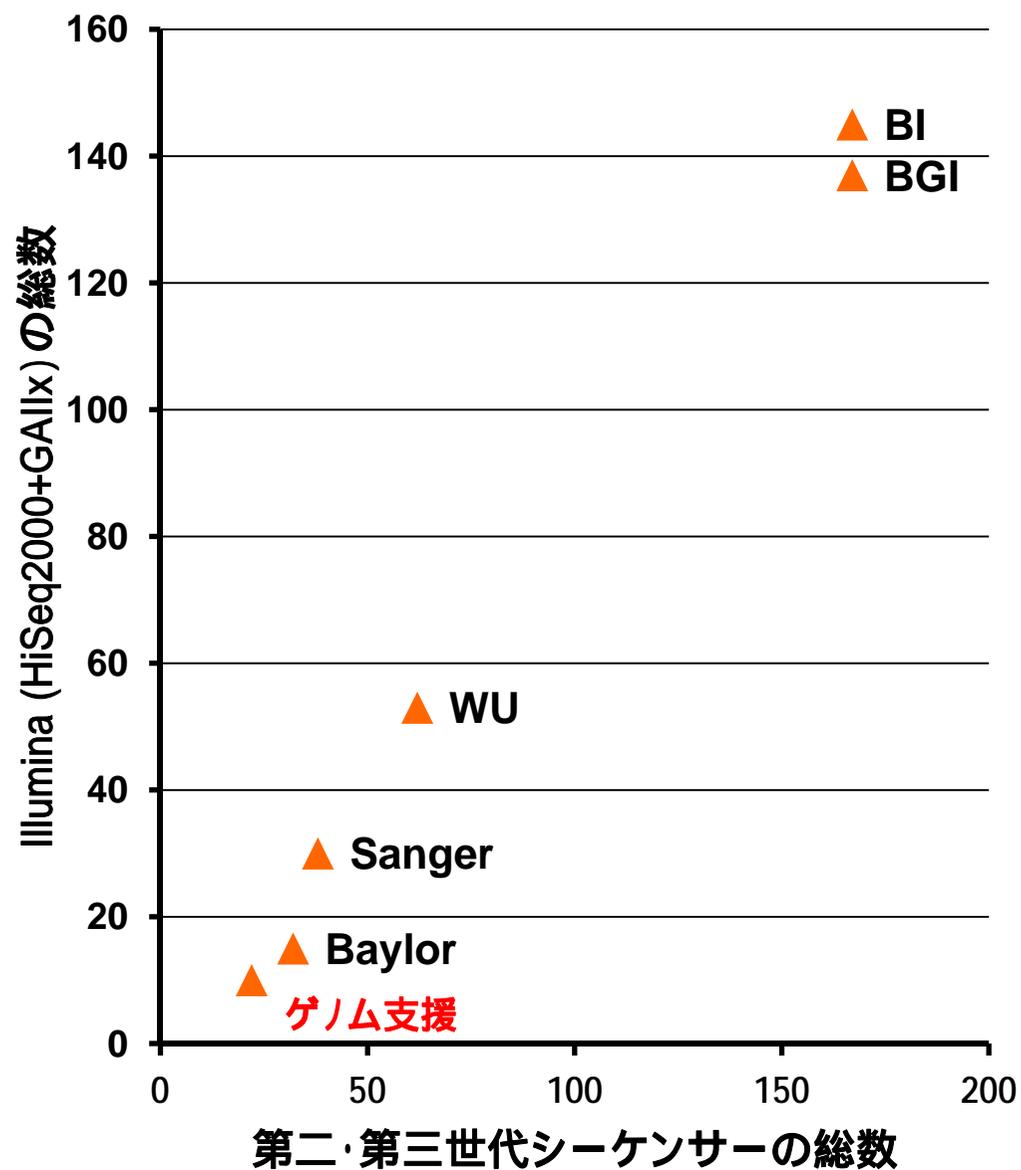


塩基数 (x10<sup>12</sup> bp)

次世代シーケンサによる配列データ生産(累計)



# 主要ゲノムセンターの設備



日本国内には数百台！



大学共同利用機関法人 情報・システム研究機構

**国立遺伝学研究所**

**先端ゲノミクス推進センター  
&  
生命情報研究センター  
比較ゲノム解析研究室**