

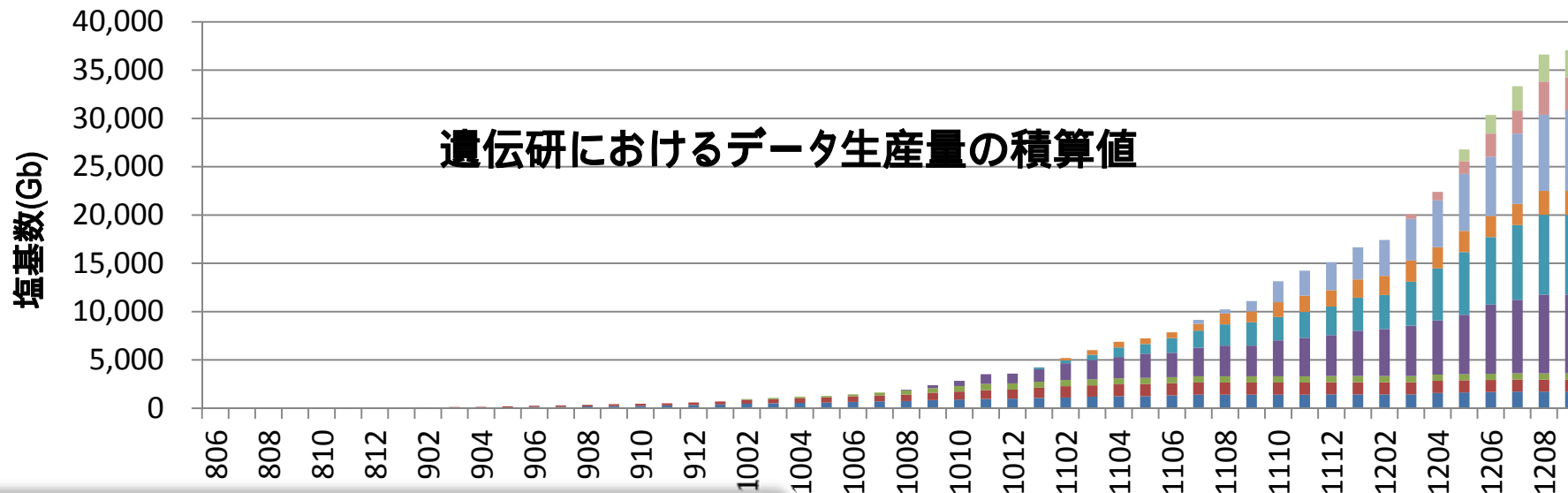
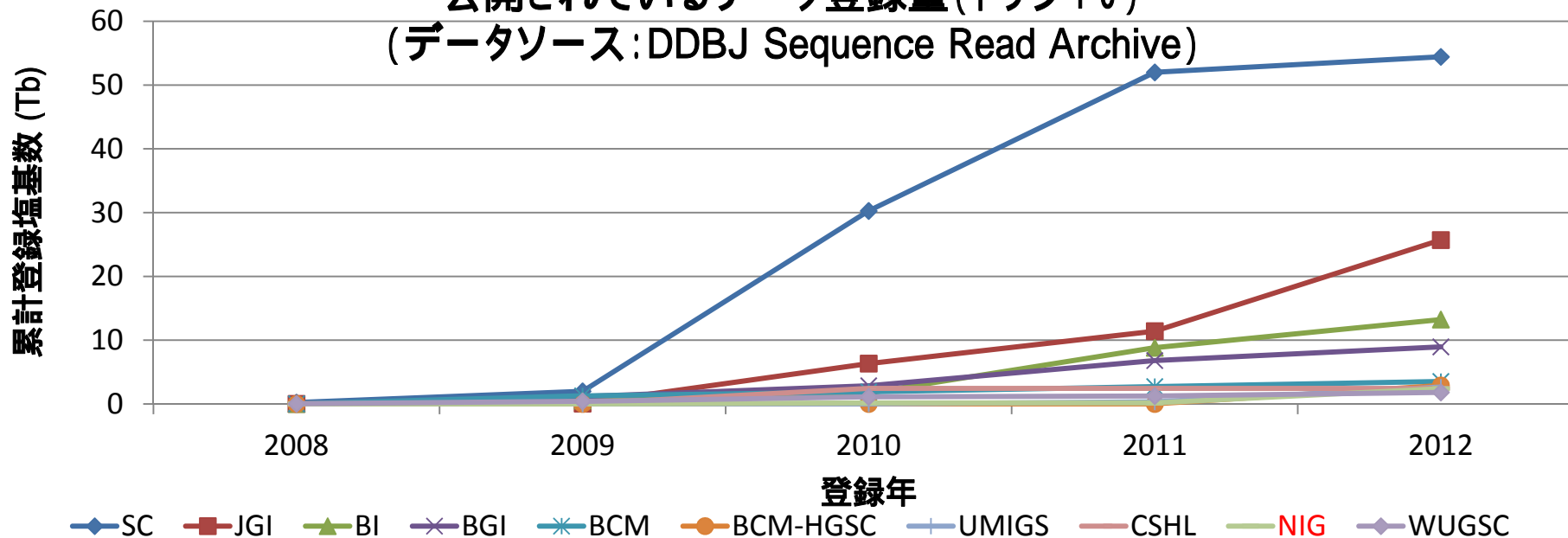


Genomics and New-Generation Sequencing Based Big-Data Biology

国立情報学研究所・国立遺伝学研究所

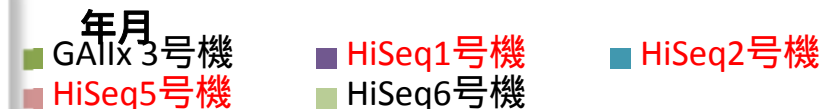
藤山秋佐夫

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

1st NGS

Surface

GS20

FLX

Helicos

GA

SOLID

2010

Solid state

FLX Ti

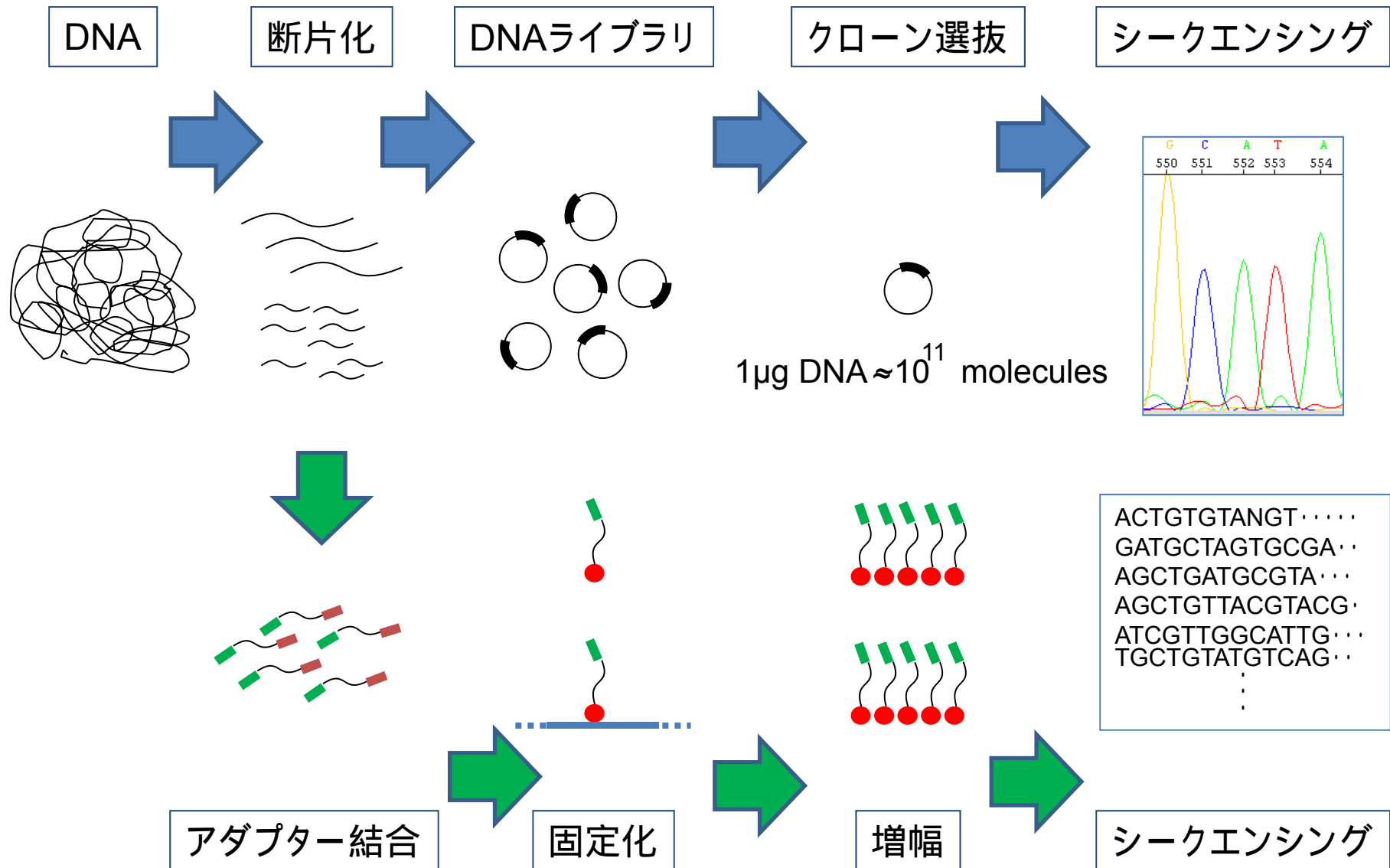
PGM

HiSeq2000, SOLiD4

MiSeq

PacBio RS

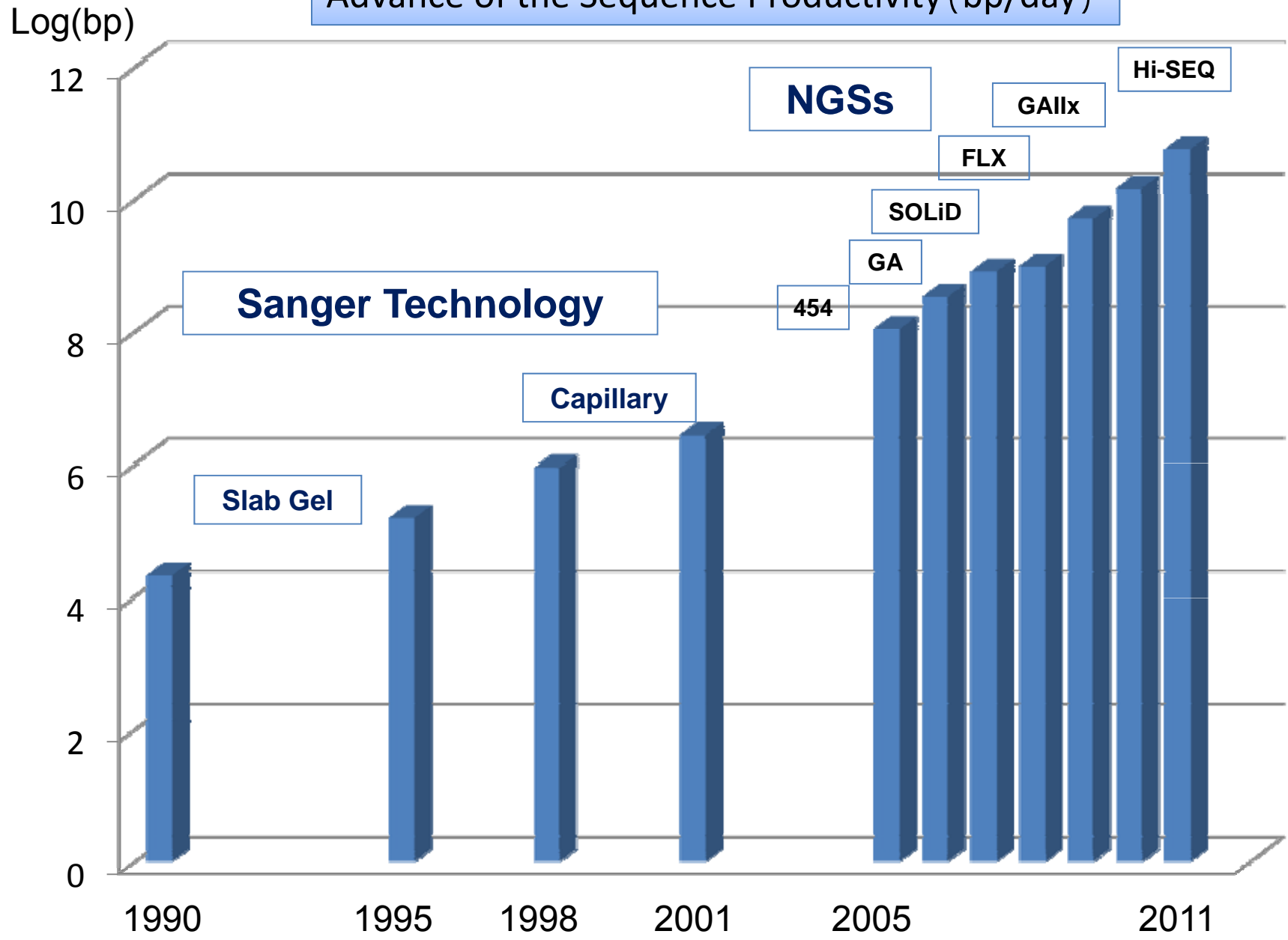
?

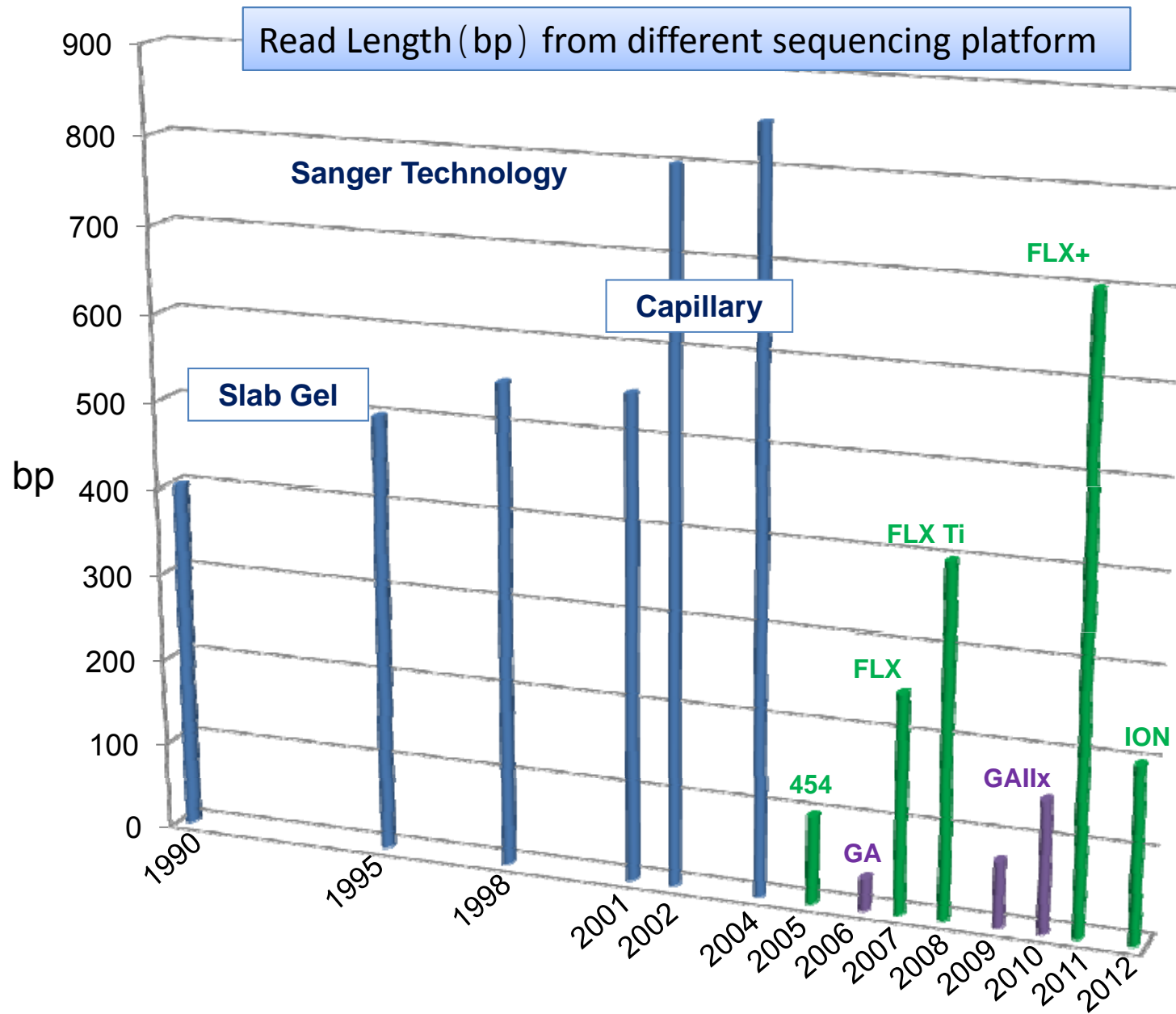


ゲノムDNA配列決定の流れ

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)

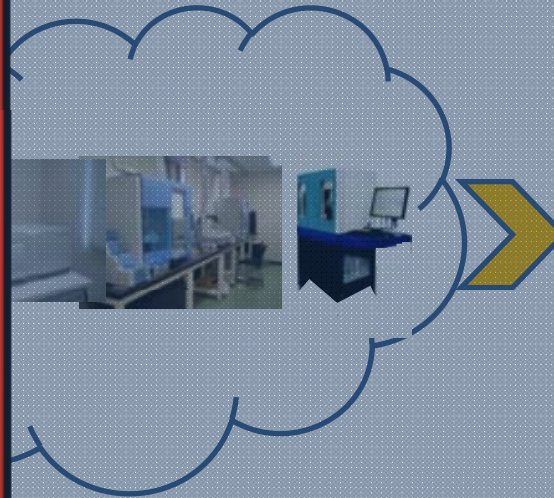




Biological Processes that Concern Nucleic Acids

- 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...

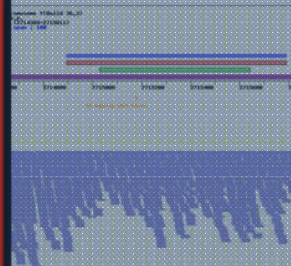
Next-Generation Genome Analyzers



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

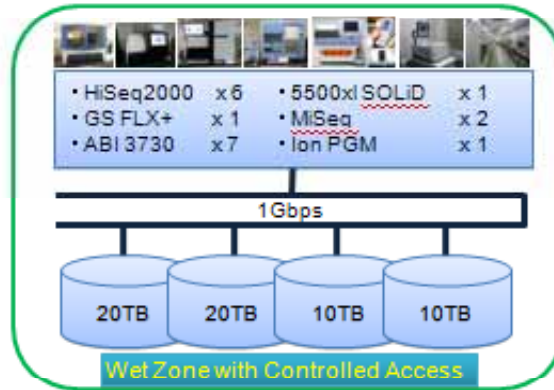


ABI/Ion Torrent Ion PGM

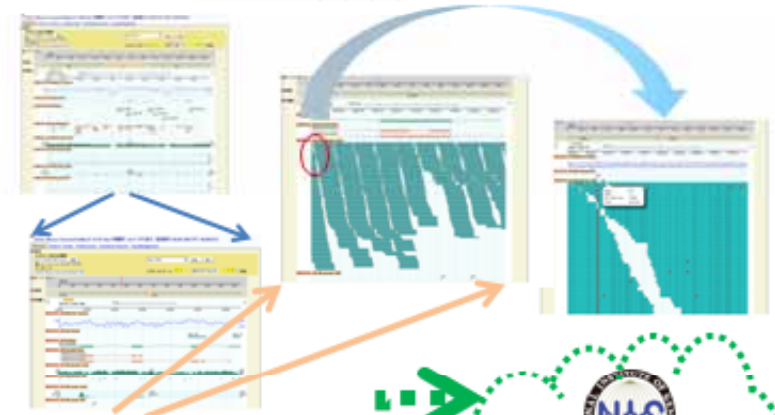


PACBIO PACBIO RS

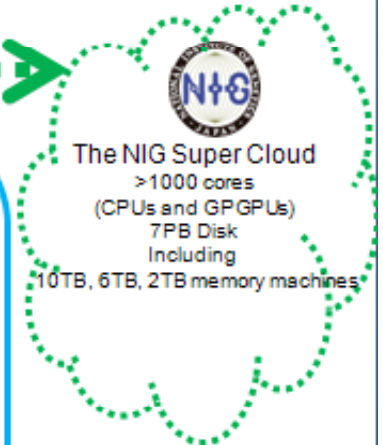
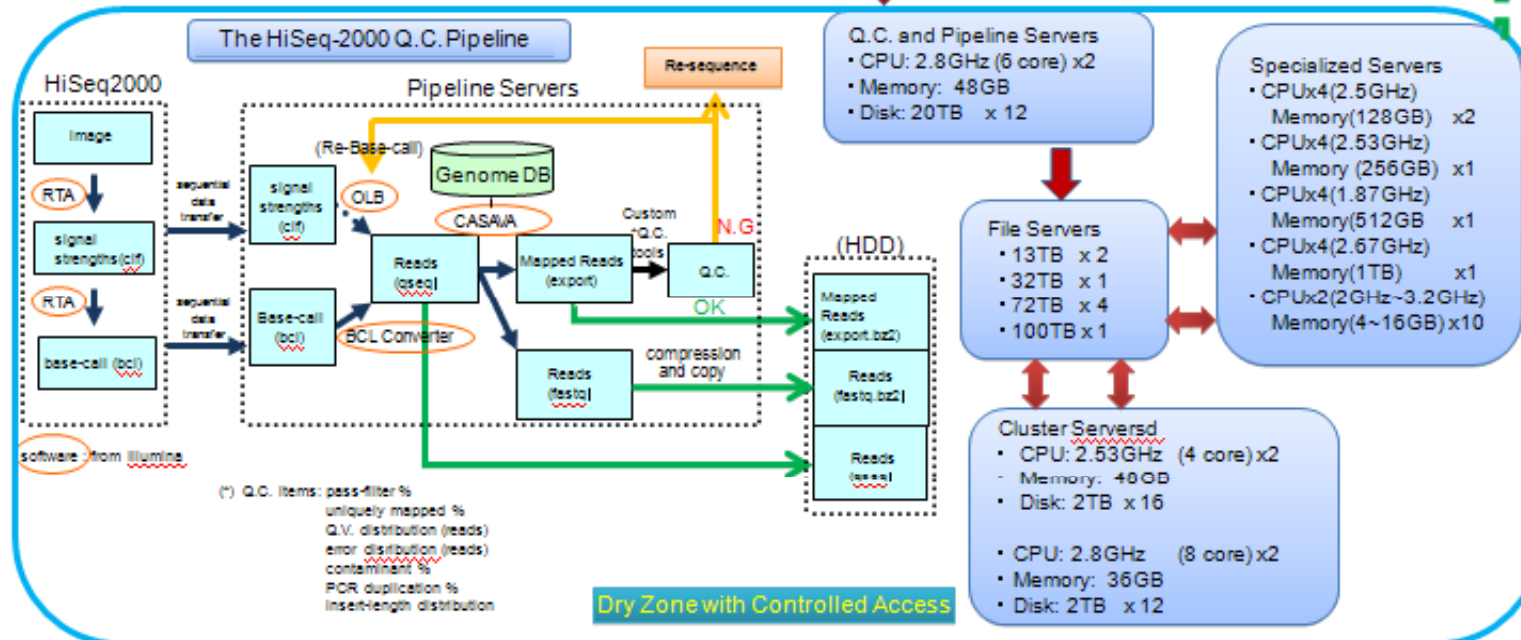
SEQUENCERS and Connections



Genome Browser

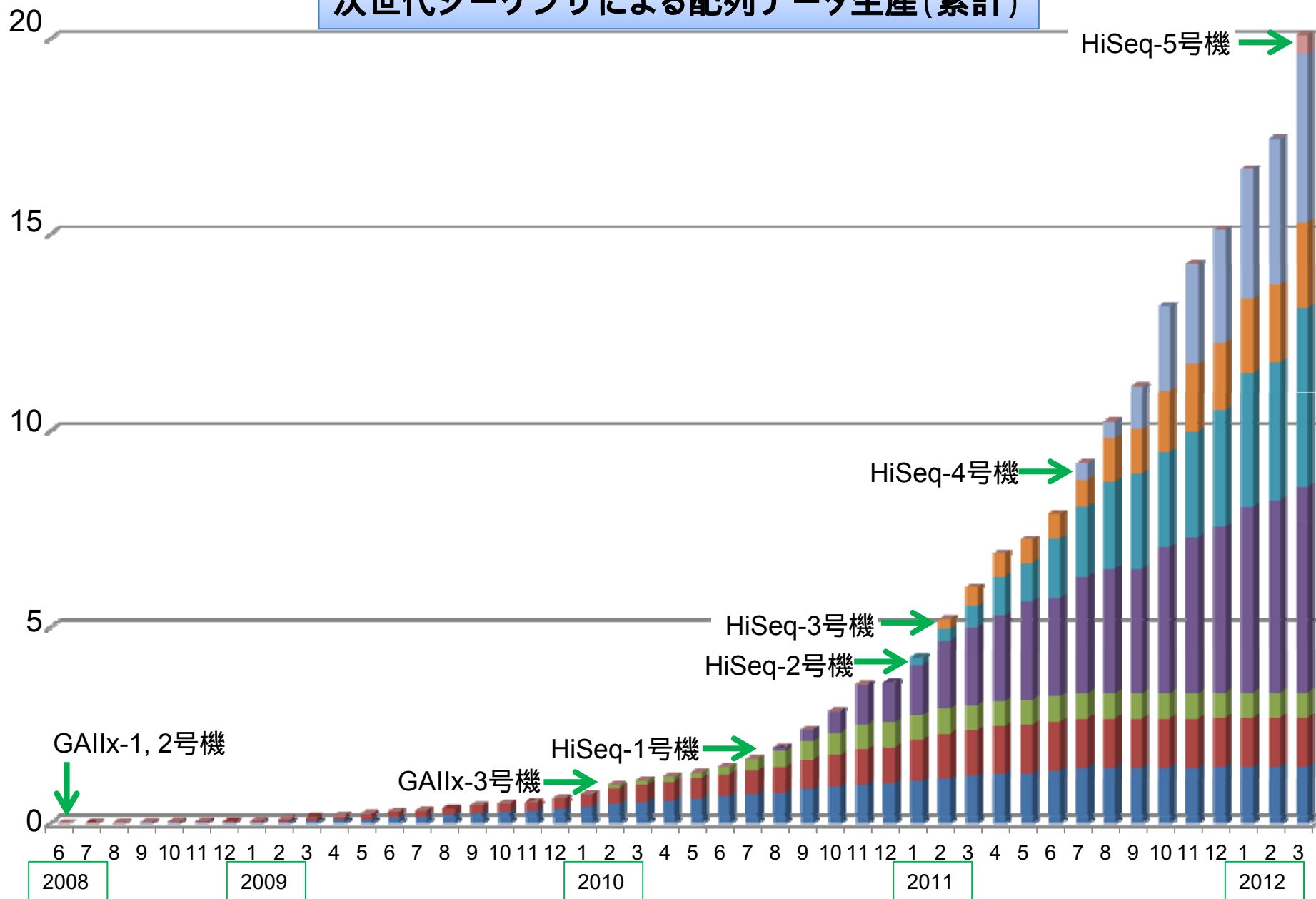


10 Gbps

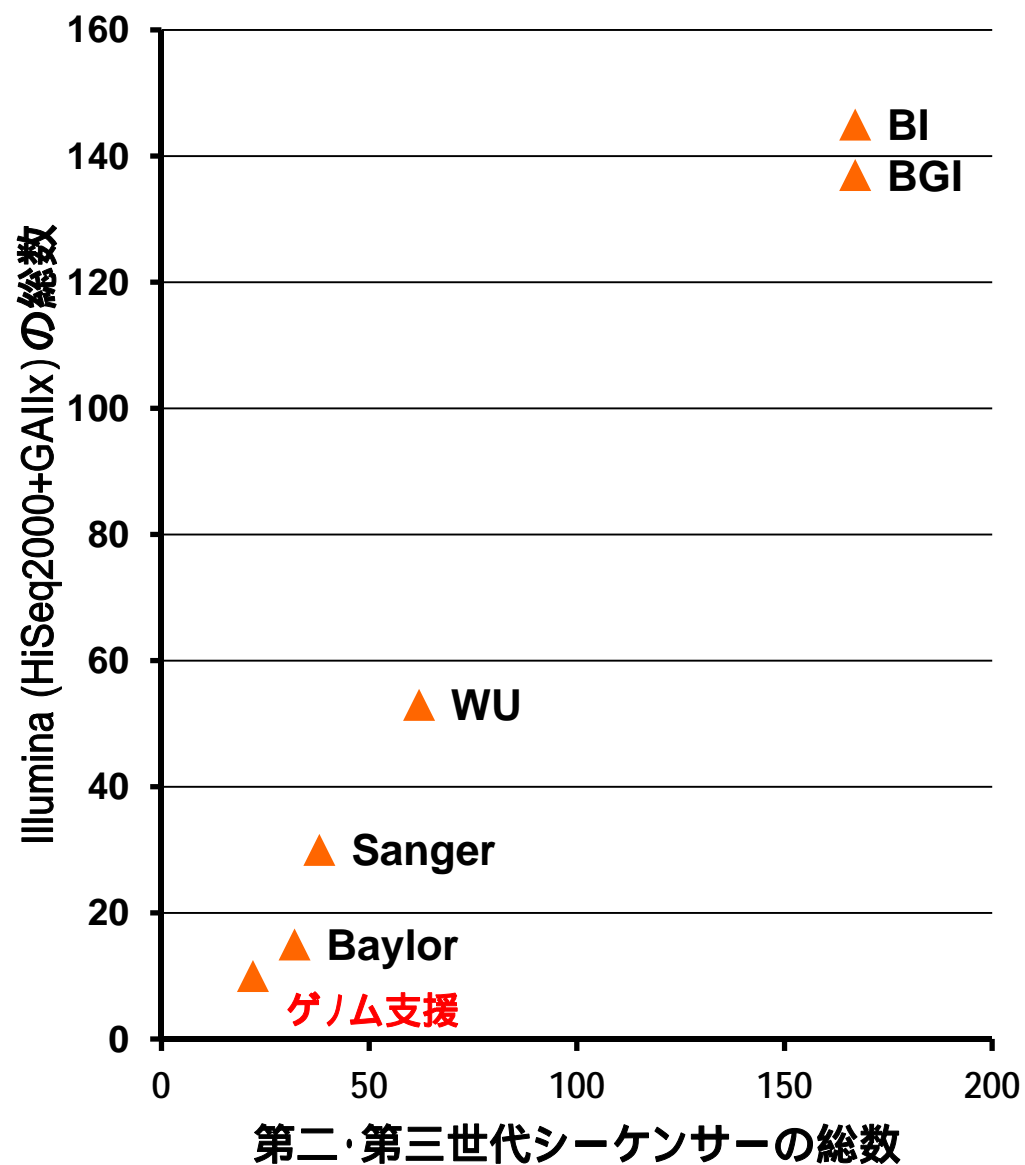


塩基数 (x10¹² bp)

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