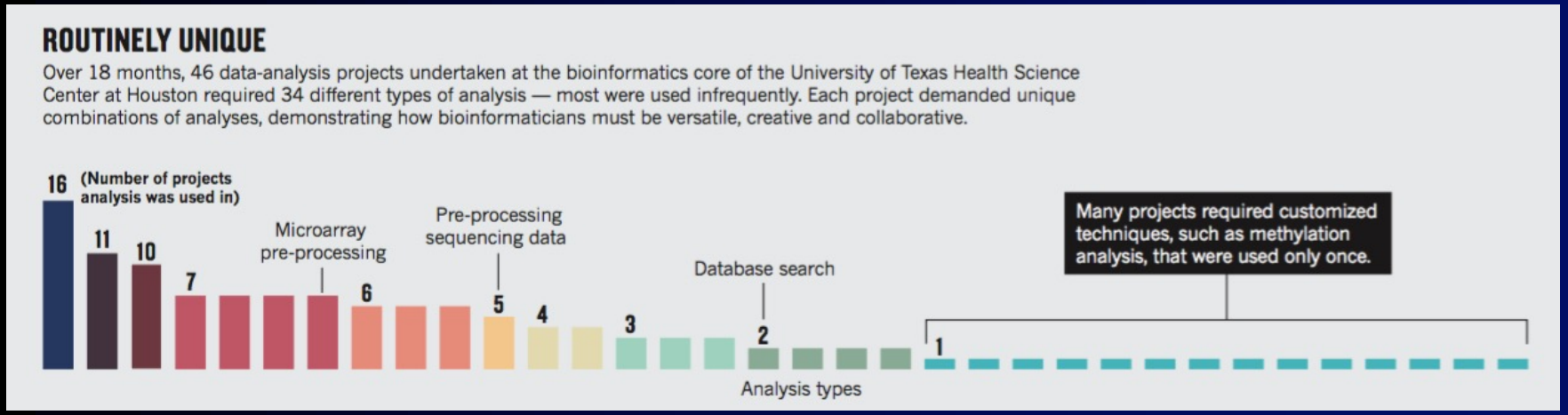
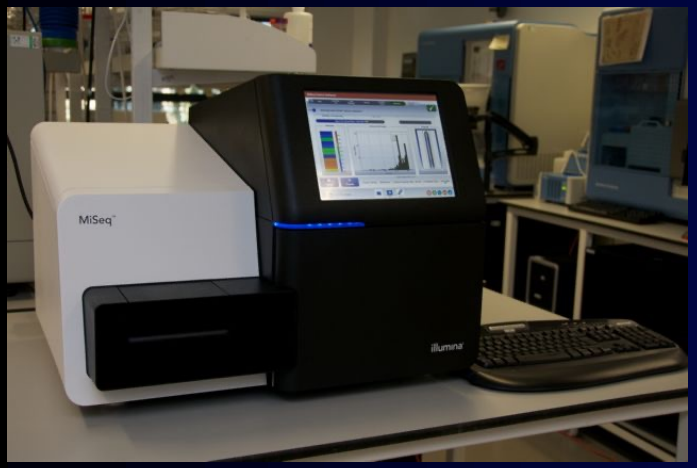
Bioinformatics



J. Chang. 2015. Core services: Reward bioinformaticians. Nature 520:151-2.

Bioinformatics

- Even 10 years ago collecting low- to mid-volume data (e.g. DNA sequencing) was slow and expensive
- Now – large scale data collection fast and inexpensive

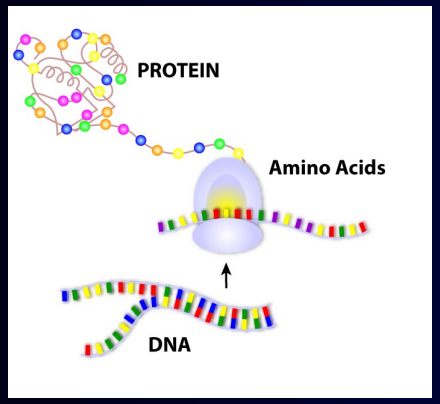


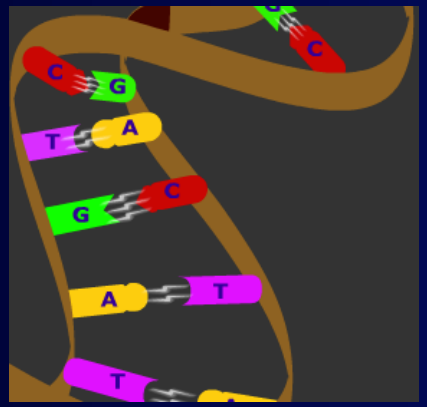
Illumina DNA Sequencer

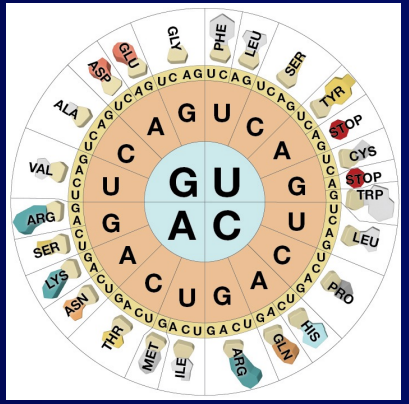
Nanopore DNA Sequencer

- DNA sequencing is quickly becoming an "assay" – performed by many researchers whose primary goal is not bioinformatics
- We now need a balance between bioinformatics labs / core facilities and translating the skill set to researchers in all areas of bioscience

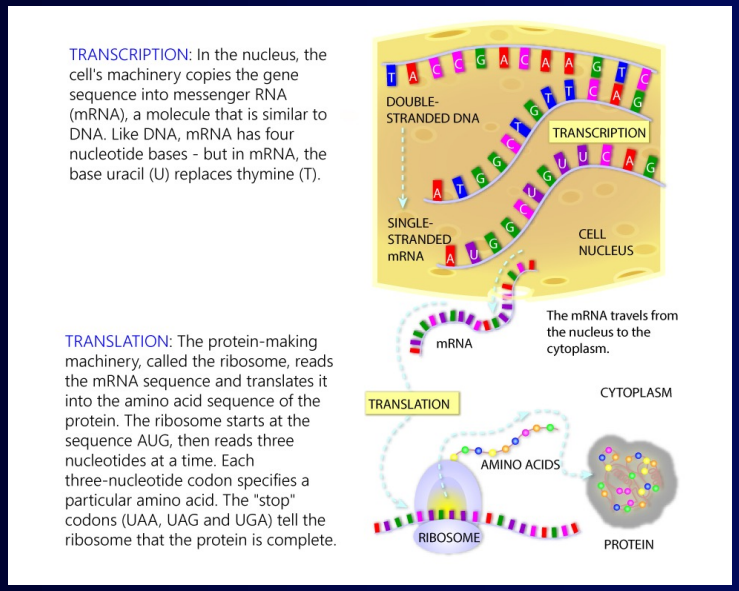
Central Dogma







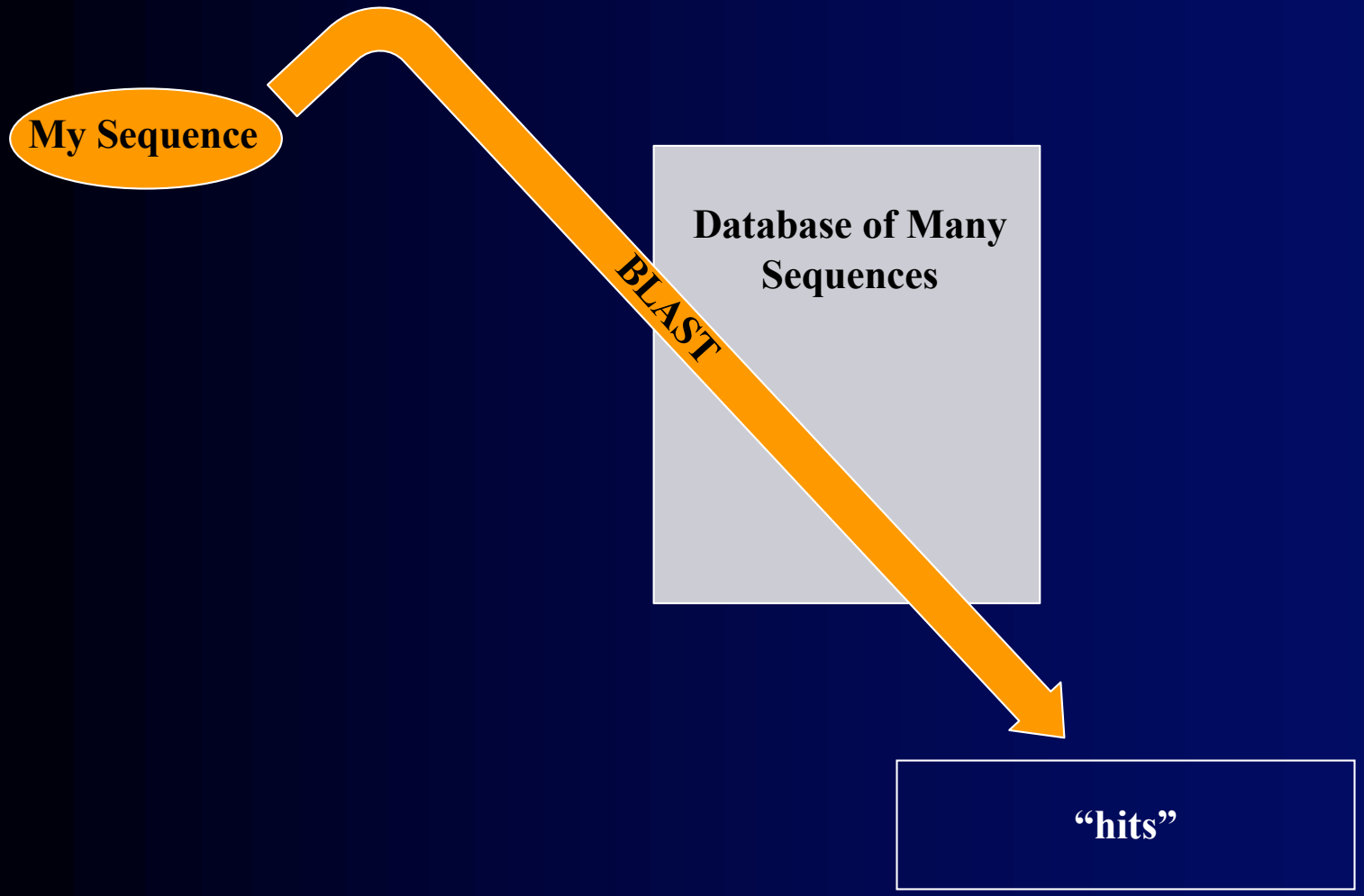
Images from "Genetic Science Learning Center, University of Utah, http://learn.genetics.utah.edu."



adenine and guanine are purines

cytosine, thymine, and uracil are pyrimidines

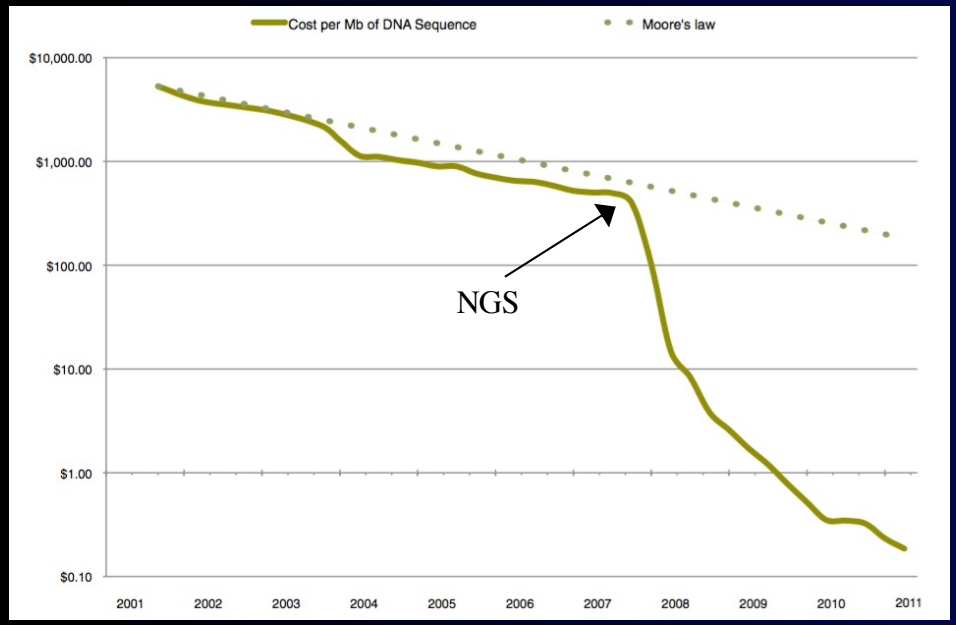
Basic Local Alignment Search Tool (BLAST)



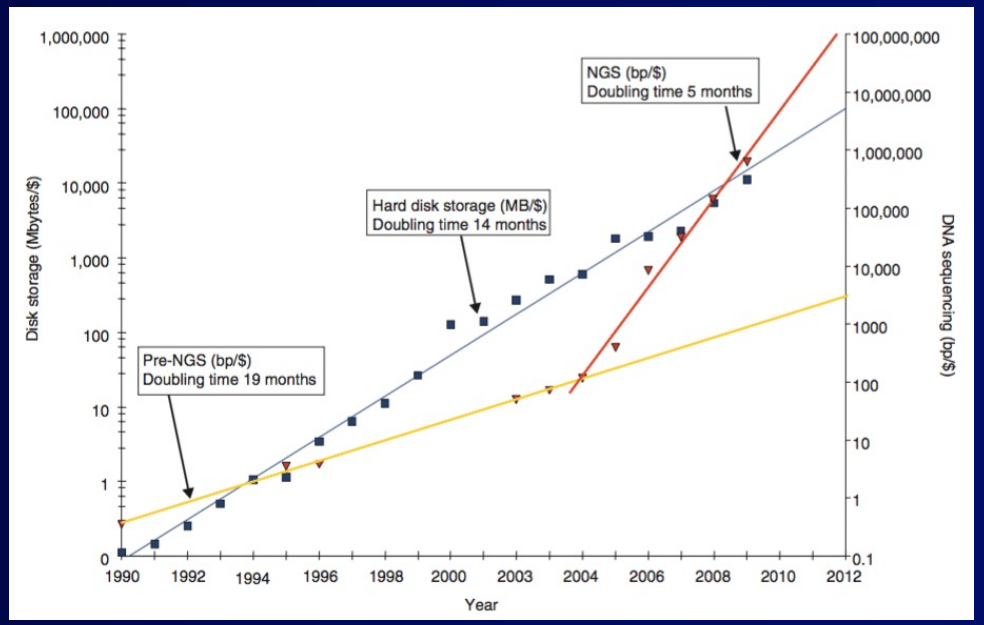
Moore's Law & Kryder's Law

- Moore's Law - computer processor speed doubles every ~18 months
- Kryder's Law - disk storage capacity doubles every ~14 months

- Will advances in DNA sequencing outstrip Moore's and Kryder's law?

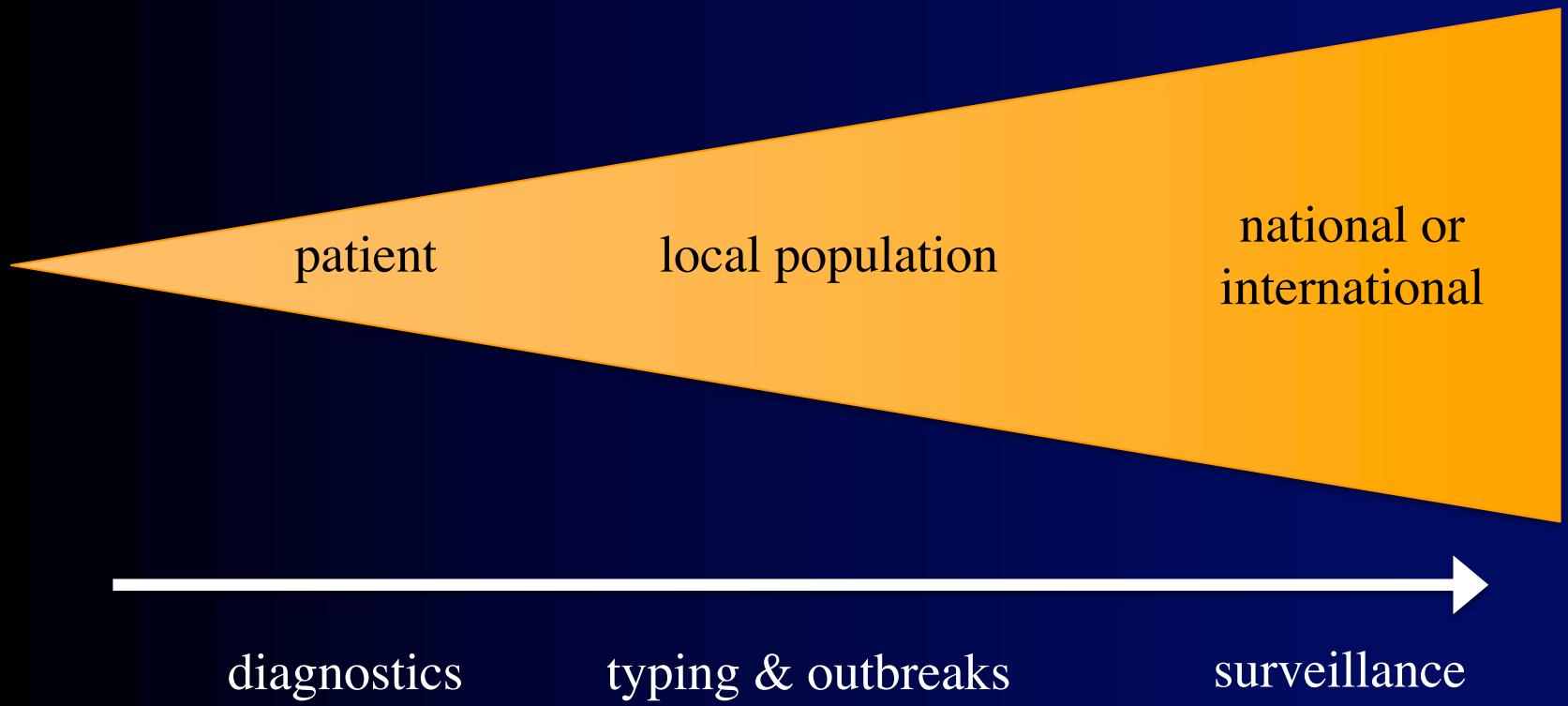


Sboner et al. 2011. The real cost of sequencing: higher than you think! Genome Biol. 12(8):125.



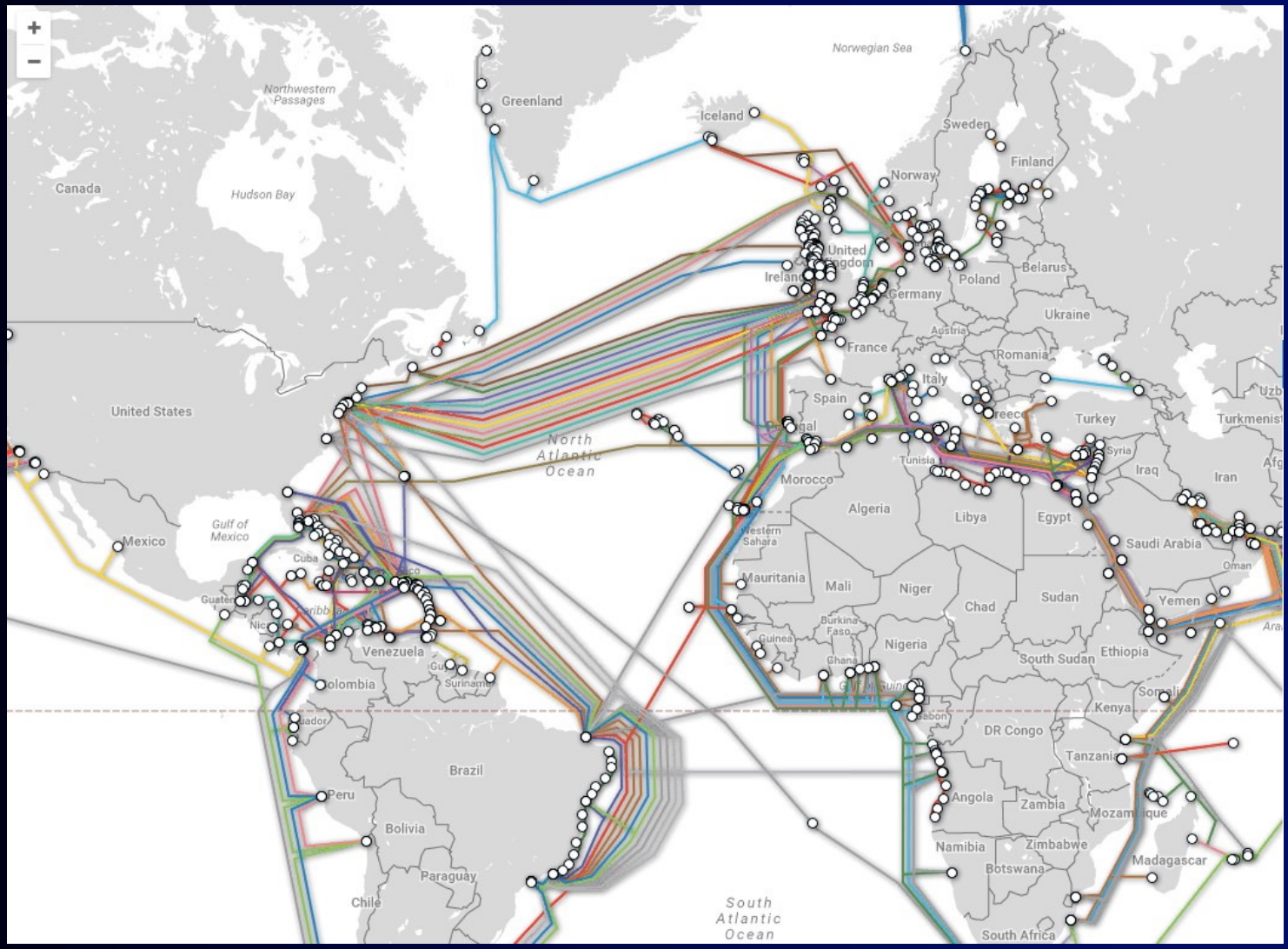
Stein. 2010. The case for cloud computing in genome informatics. Genome Biol. 11(5):207.

Molecular Epidemiology



How are we going to move all that data?

- Butters' Law (optical fiber capacity doubles every ~9 months)



Bacteria are evolving drug resistance faster than we can discover new drugs

Editorial

The serious threat of multidrug-resistant and untreatable gonorrhoea: the pressing need for global action to control the spread of antimicrobial resistance, and mitigate the impact on sexual and reproductive health

Francis Ndowa,[1,2] Manjula Lusti-Narasimhan,[3] Magnus Unemo[4]

EDITOR'S CHOICE

STIs remain a major cause of morbidity and mortality worldwide. The WHO estimated that >498 million new cases of syphilis, gonorrhoea, chlamydial infection and trichomoniasis occurred

were abandoned as first-line empiric treatment for gonorrhoea in the Asia-Pacific region already in the mid-to-late 1990s and, subsequen
of Africa.[3]
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Journal of Antimicrobial Chemotherapy (2009) **64**, *Suppl. 1*, i29–i36
doi:10.1093/jac/dkp255

JAC

Has the era of untreatable infections arrived?

David M. Livermore*

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Antibiotic resistance is a major public health concern, with fears expressed that we shortly will run out of antibiotics. In reality, the picture is more mixed, improving against some pathogens but worsening against others. Against methicillin-resistant *Staphylococcus aureus* (MRSA)—the highest profile pathogen—the range of treatment options is expanding, with daptomycin, linezolid and tigecycline all launched, and telavancin, ceftobiprole, ceftaroline and dalbavancin anticipated. There is a greater problem with enterococci, especially if, as in endocarditis, bactericidal activity is needed and the
ycin, telavancin and razupenem
disturbing spread of extended-
s forcing increased reliance on
e spread of metallo-, KPC and
chanisms include various novel
the carbapenemase types now
noner in non-fermenters than in
n *Acinetobacter baumannii* and
***sa*. No agent in advanced devel-**
ess-toxic, polymyxin derivatives
e activity against *A. baumannii*
urprising problem is *Neisseria*
and where there is now little in
sistance is emerging.

Neisseria gonorrhoeae

Review

Cell PRESS

The emerging NDM carbapenemases

Patrice Nordmann[1], Laurent Poirel[1], Timothy R. Walsh[2] and David M. Livermore[3]

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[2] University of Queensland, Centre for Clinical Research, University of Queensland, Brisbane, Australia
[3] Health Protection Agency Microbiology Services – Colindale, London NW9 5EQ, UK

Carbapenems were the last β-lactams retaining near-universal anti-Gram-negative activity, but carbapenemases are spreading, conferring resistance. New Delhi metallo-β-lactamase (NDM) enzymes are the latest carbapenemases to be recognized and since 2008 have been reported worldwide, mostly in bacteria from patients epidemiologically linked to the Indian subcontinent, where they occur widely in hospital and community infections, and also in contaminated urban water. The main type is NDM-1, but minor variants occur. NDM enzymes are present largely in Enterobacteriaceae, but also in non-fermenters and Vibrionaceae. Dissemination predominantly involves transfer of the *bla*$_{NDM-1}$ gene

Reports from India itself indicate significant local prevalence [6–11]: a hospital in Varanasi (North) identified an NDM-1 prevalence rate of 6.9% among 780 consecutive, non-duplicate enterobacterial isolates from outpatients and hospitalized patients between February 2010 and July 2010 [12], with remarkably similar data (5–8% prevalence according to specimen type) among Enterobacteriaceae from a major hospital in Mumbai [13,14], whereas 18.5% of in- and outpatients in Rawalpindi, Pakistan carried bacteria with NDM-1 in their gut flora [15]. These studies, and many other individual reports, point to widespread prevalence in the subcontinent, and retrospective testing of survey collections shows that bacteria with NDM-1 were