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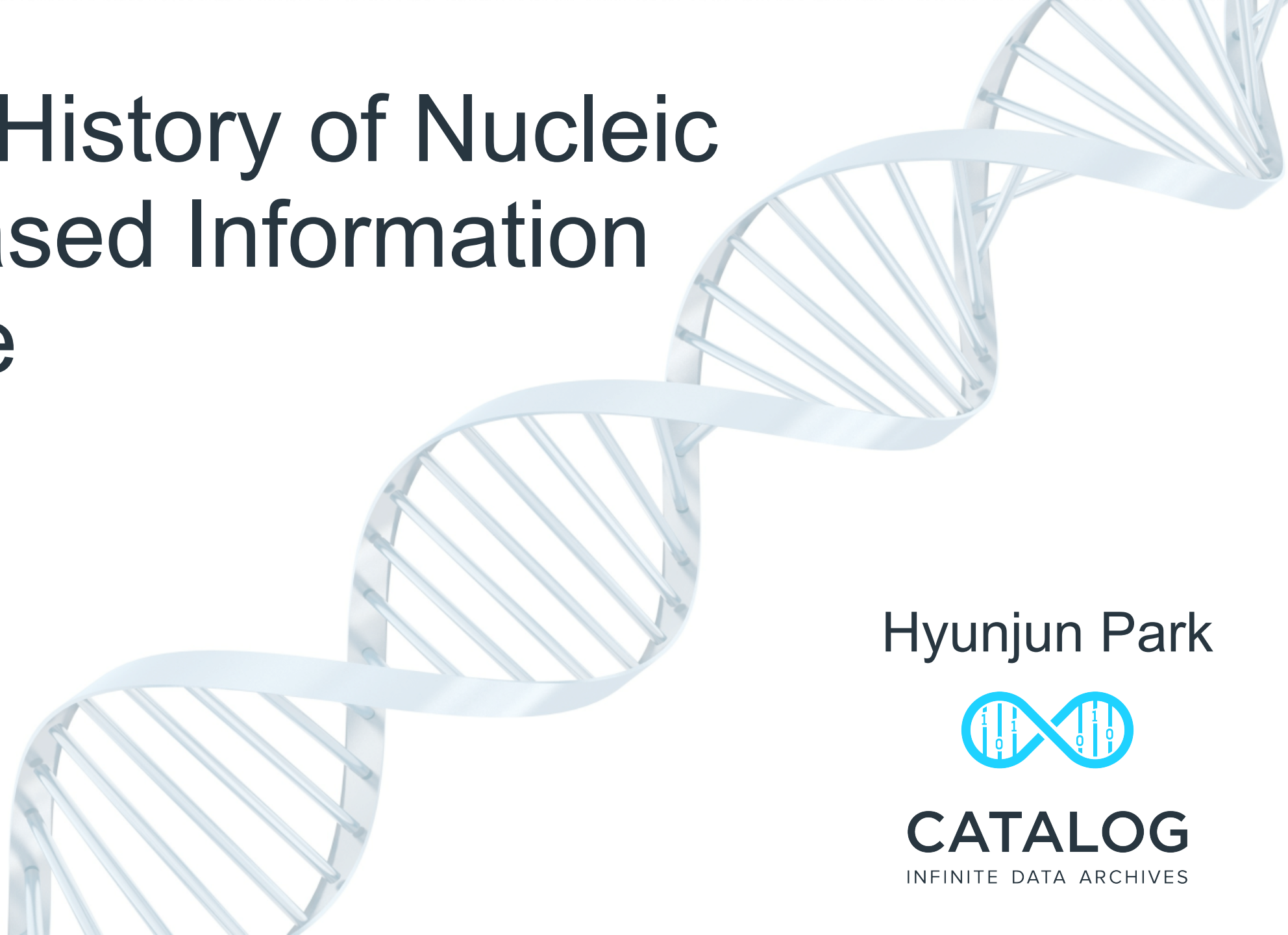
A Brief History of Nucleic Acid-based Information Storage



Hyunjun Park

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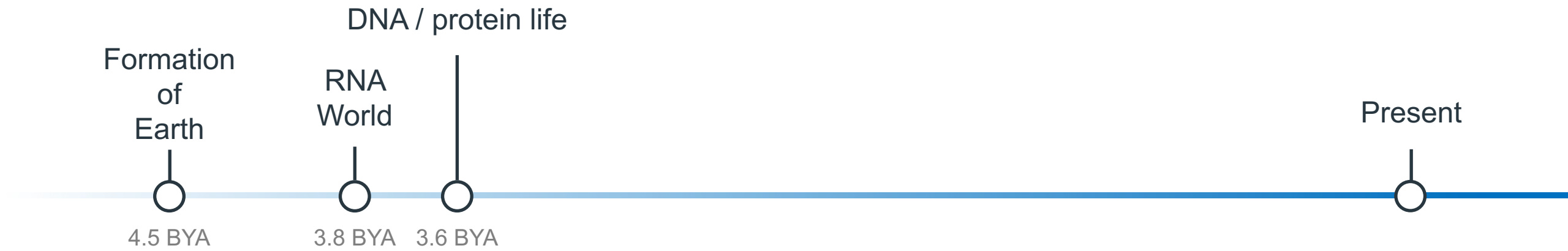

Adapted from lecture notes of Jack Szostack

First idea: (Mikhail Neiman, 1964) Published ideas on using DNA to record, store, and retrieve digital information

First artificial data stored: (Joe Davis, 1988) Designed and synthesized an 18-bp message and transformed into *E. coli*

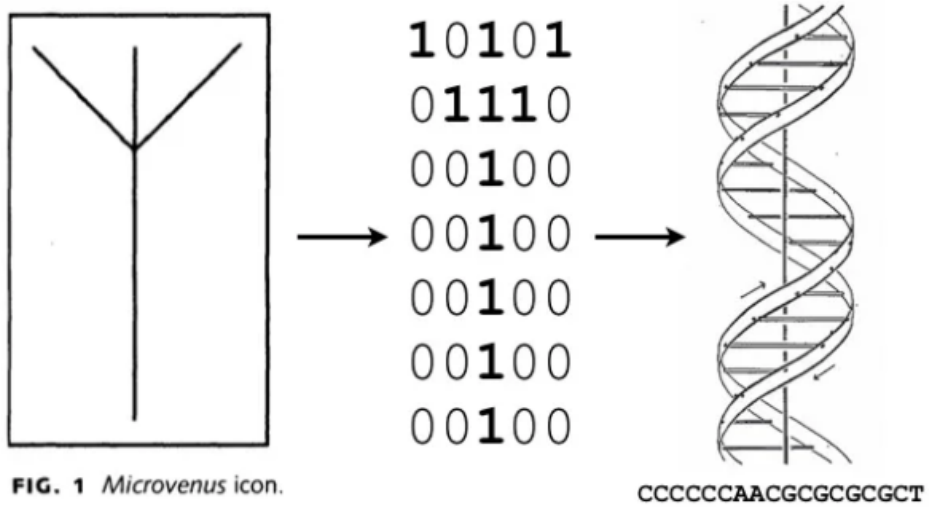

FIG. 1 *Microvenus* icon.

Agapakis, *Scientific American*, 2012

BREVIA

Next-Generation Digital Information Storage in DNA

George M. Church[1,2], Yuan Gao[3], Sriram Kosuri[1,2,*]

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Science 28 Sep 2012:
Vol. 337, Issue 6102, pp. 1628
DOI: 10.1126/science.1226355

2012 Harvard: 5 megabits of information with DNA synthesis, and read back with 10 bit errors. This work leverages next-generation synthesis and sequencing platforms to enable artificial data storage in DNA at a much larger scale than any prior work.

NATURE | LETTER

日本語要約

Towards practical, high-capacity, low-maintenance information storage in synthesized DNA

Nick Goldman, Paul Bertone, Siyuan Chen, Christophe Dessimoz, Emily M. LeProust, Botond Sipos & Ewan Birney

Affiliations | Contributions | Corresponding author

Nature **494**, 77–80 (07 February 2013) | doi:10.1038/nature11875

Received 15 May 2012 | Accepted 12 December 2012 | Published online 23 January 2013

2013 European Bioinformatics Institute: Next generation synthesis and sequencing to store ~ 5 megabits of information in DNA. The paper also provides insight into the cost of their method, the scale, and the market.

Microsoft Store Products Support

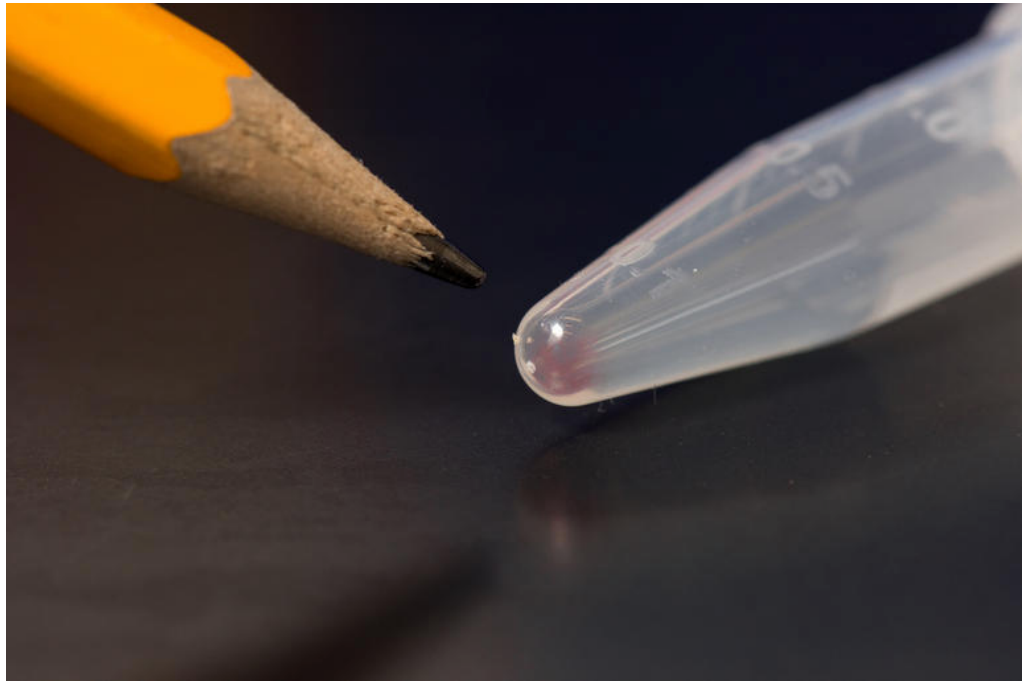
The AI Blog | The Official Microsoft Blog | The Fire Hose | Microsoft On the Issues

Microsoft and University of Washington researchers set record for DNA storage

Jul 7, 2016 | Mike Brunker

Researchers at Microsoft and the University of Washington have reached an early but important milestone in DNA storage by storing a record 200 megabytes of data on the molecular strands.

2016: Currently the largest amount of data stored in DNA (200MB). Estimated cost of DNA synthesis is $800,000



REPORT

DNA Fountain enables a robust and efficient storage architecture

Yaniv Erlich[1,2,3,*], Dina Zielinski[1]

[1]New York Genome Center, New York, NY 10013, USA.

[2]Department of Computer Science, Fu Foundation School of Engineering, Columbia University, New York, NY 10027, USA.

[3]Center for Computational Biology and Bioinformatics (C2B2), Department of Systems Biology, Columbia University, New York, NY 10027, USA.

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Science 03 Mar 2017:
Vol. 355, Issue 6328, pp. 950-954
DOI: 10.1126/science.aaj2038

2017: Current record for information density

Parameter	Church *et al.* (3)	Goldman *et al.* (4)	Grass *et al.* (5)	Bornholt *et al.* (6)	Blawat *et al.* (7)	This work
Input data (Mbytes)	0.65	0.75	0.08	0.15	22	2.15
Coding potential (bits/nt)	1	1.58	1.78	1.58	1.6	1.98
Redundancy	1	4	1	1.5	1.13	1.07
Robustness to dropouts	No	Repetition	RS	Repetition	RS	Fountain
Error correction/detection	No	Yes	Yes	No	Yes	Yes
Full recovery	No	No	Yes	No	Yes	Yes
Net information density (bits/nt)	0.83	0.33	1.14	0.88	0.92	1.57
Realized capacity	45%	18%	62%	48%	50%	86%
Number of oligos	54,898	153,335	4,991	151,000	1,000,000	72,000
Physical density (Pbytes/g)	1.28	2.25	25	–	–	214

NATURE | LETTER

日本語要約

CRISPR–Cas encoding of a digital movie into the genomes of a population of living bacteria

Seth L. Shipman, Jeff Nivala, Jeffrey D. Macklis & George M. Church

Affiliations | Contributions | Corresponding author

Nature **547**, 345–349 (20 July 2017) | doi:10.1038/nature23017

Received 22 August 2016 | Accepted 02 June 2017 | Published online 12 July 2017

2017: Most recent publications in the field.

Published at the 2017 USENIX Security Symposium; addition information at https://dnasec.cs.washington.edu/.

Computer Security, Privacy, and DNA Sequencing: Compromising Computers with Synthesized DNA, Privacy Leaks, and More

Peter Ney, Karl Koscher, Lee Organick, Luis Ceze, Tadayoshi Kohno
University of Washington
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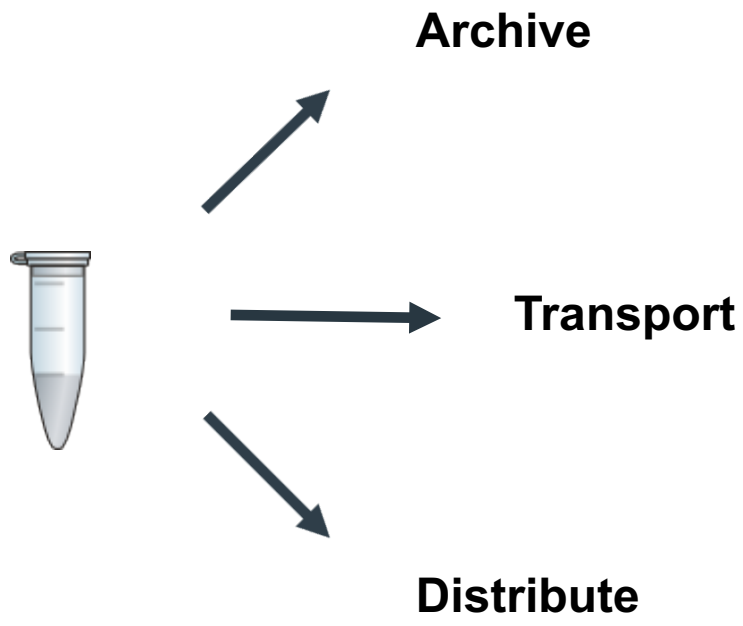
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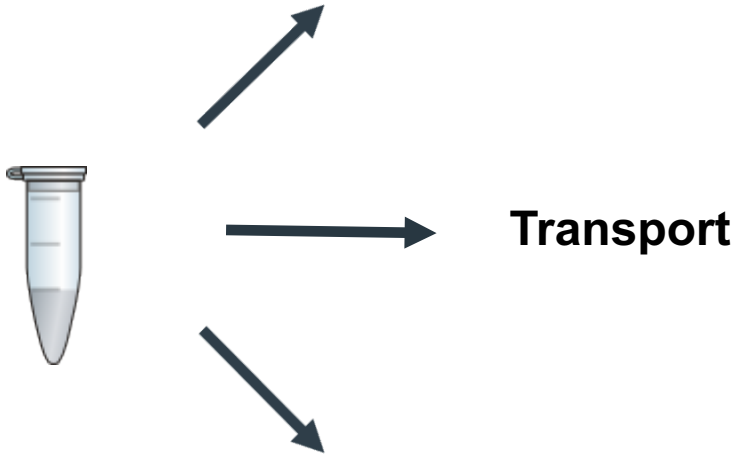

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ELSEVIER

Icarus

Volume 38, Issue 1, April 1979, Pages 148-153

Is bacteriophage φX174 DNA a message from an extraterrestrial intelligence?

Hiromitsu Yokoo *, Tairo Oshima †

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https://doi.org/10.1016/0019-1035(79)90094-0

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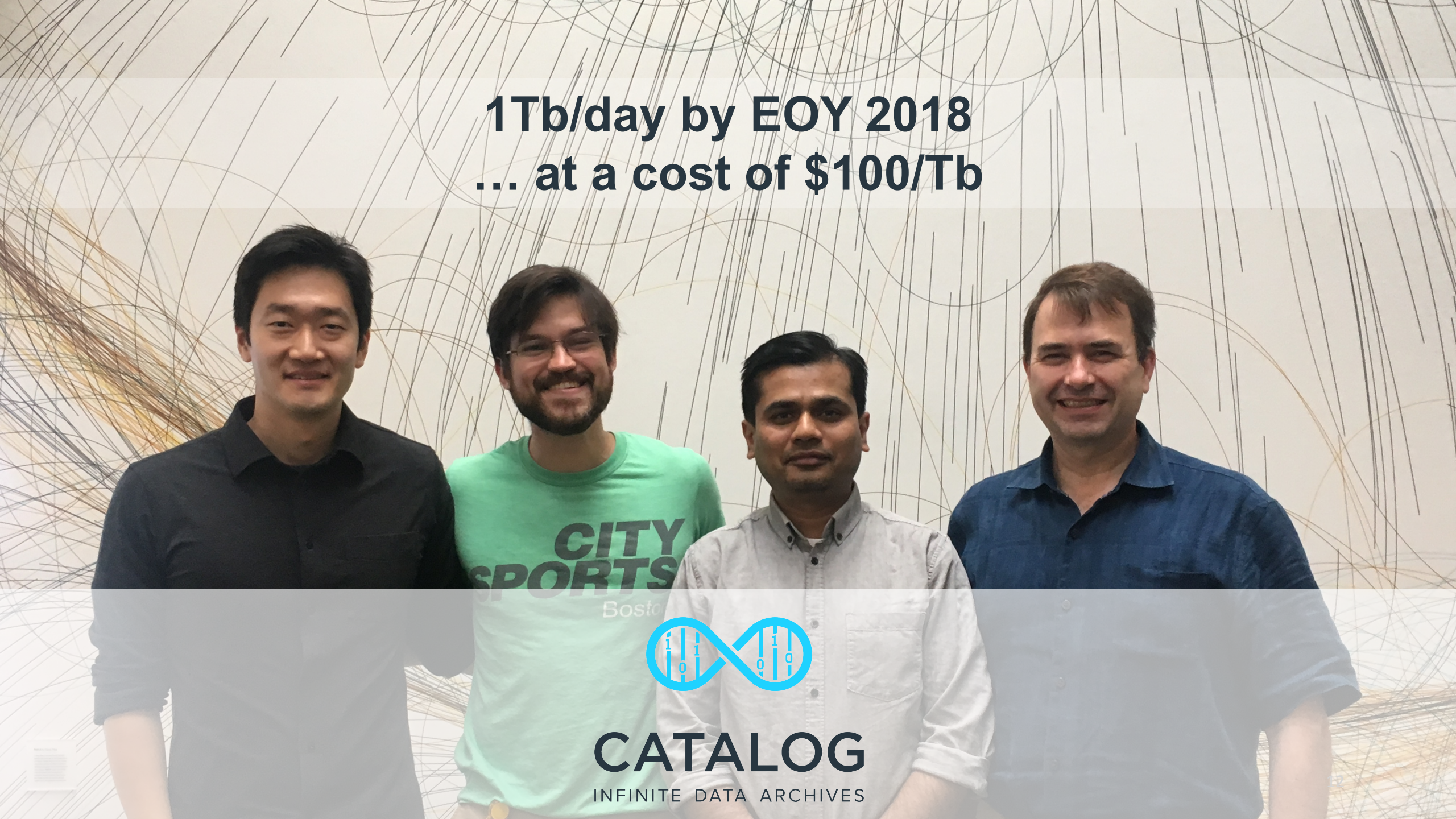
Going underground

A new job for DNA

Nature's favourite information-carrying molecule is put to work mapping subterranean resources

Economist, 3. 16. 2017

1Tb/day by EOY 2018
… at a cost of $100/Tb



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