



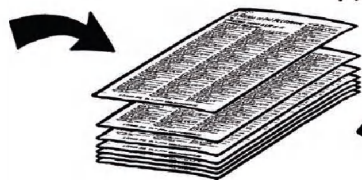
# HOW MUCH SCIENCE IS THERE?

SCIENTIFIC PUBLISHING HAS BEEN ACCELERATING—A NEW PAPER IS NOW PUBLISHED ROUGHLY EVERY 20 SECONDS. LET'S IMAGINE A BIBLIOGRAPHY LISTING *EVERY* SCHOLARLY PAPER EVER WRITTEN. HOW LONG WOULD IT BE?

IF WE CAN FIT  
140 CITATIONS  
PER PAGE...



...1000 PAGES  
PER BOOK...



...AND THEN WE START  
STACKING BOOKS...



A LIST OF PAPERS  
PUBLISHED IN 1880  
WOULD FILL  
100 PAGES.



BY 1920, THE LIST  
WOULD BE GROWING BY  
500 PAGES PER YEAR.



THE 1975 SECTION  
WOULD FILL FOUR  
HUGE VOLUMES.



TODAY, WE'RE UP TO 15  
VOLUMES PER YEAR—  
A PAGE EVERY  
45 MINUTES.



...THIS IS WHAT THE FULL LIST WOULD LOOK LIKE:

ALL SCHOLARLY ARTICLES FROM BEFORE  
1880 FIT IN JUST A FEW VOLUMES



1880

1890

1900

1910

1920

1930

1940

EINSTEIN, A. "ON A NEW THEORY OF LIGHT"  
EINSTEIN, A. "ZUR THEORIE DER BEUGUNG"  
EINSTEIN, A. "ZUR THEORIE DER BRÄUNUNG"  
EINSTEIN, A. "ZUR THEORIE DER WÄRMEDIELEKTRICITÄT"

HOBBLE, E. "EFFECTS OF THE DISTANCE OF NEBULAE"  
HOBBLE, E. "THE DISTANCE OF NEBULAE"  
HOBBLE, E. "THE DISTANCE OF NEBULAE"



1880: SCIENCE FOUNDED

1869: FIRST ISSUE  
OF NATURE

1999

2000

2001

2002

2003

2004

1999: NIH DIRECTOR PROPOSES AN  
ARCHIVE OF FREE BIOMED PAPERS

2000: PUBMED  
CENTRAL DEBUTS  
PLOS FOUNDED

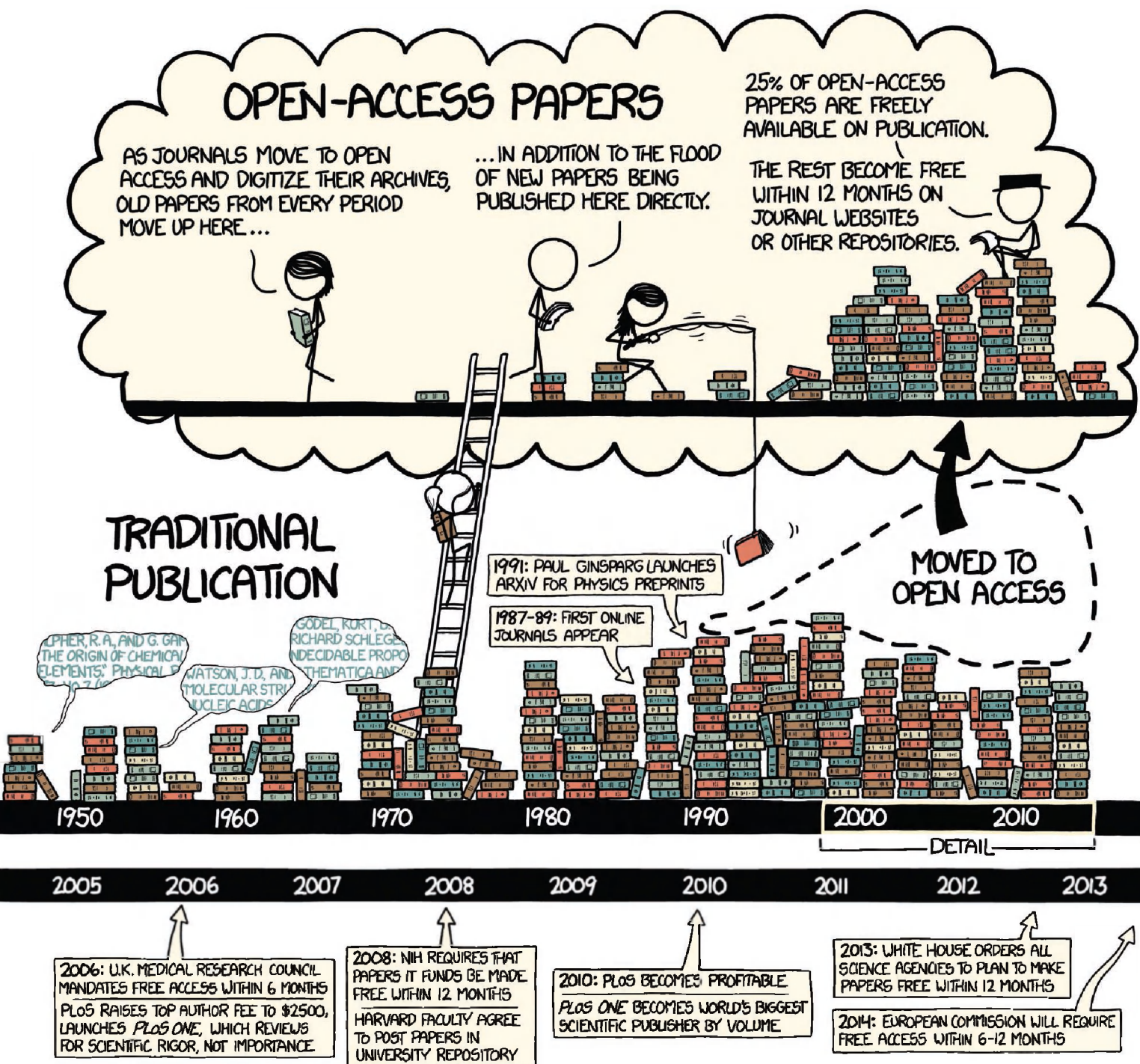
2001: 30,000 SCIENTISTS CALL FOR BOYCOTT  
OF JOURNALS THAT DON'T ALLOW FREE  
ACCESS ON PUBMED WITHIN 6 MONTHS

2002: BIOMED CENTRAL BEGINS  
CHARGING \$500 AUTHOR FEE  
HHMI AGREES TO PAY AUTHOR FEES  
FOR OPEN-ACCESS PUBLICATION

2003: PLOS BIOLOGY  
LAUNCHED, CHARGES  
\$1500 AUTHOR'S FEE

# HOW OPEN IS IT?

SINCE THE ADVENT OF THE WEB, MUCH OF SCIENTIFIC PUBLISHING HAS BEEN MOVING TO OPEN ACCESS. ACCORDING TO SCIENCE-METRIX, OPEN ACCESS REACHED A "TIPPING POINT" AROUND 2011: MORE THAN 50% OF NEW RESEARCH IS NOW MADE AVAILABLE FREE ONLINE.



BY RANDALL MUNROE • REPORTING BY JOCELYN KAISER AND DAVID MALAKOFF