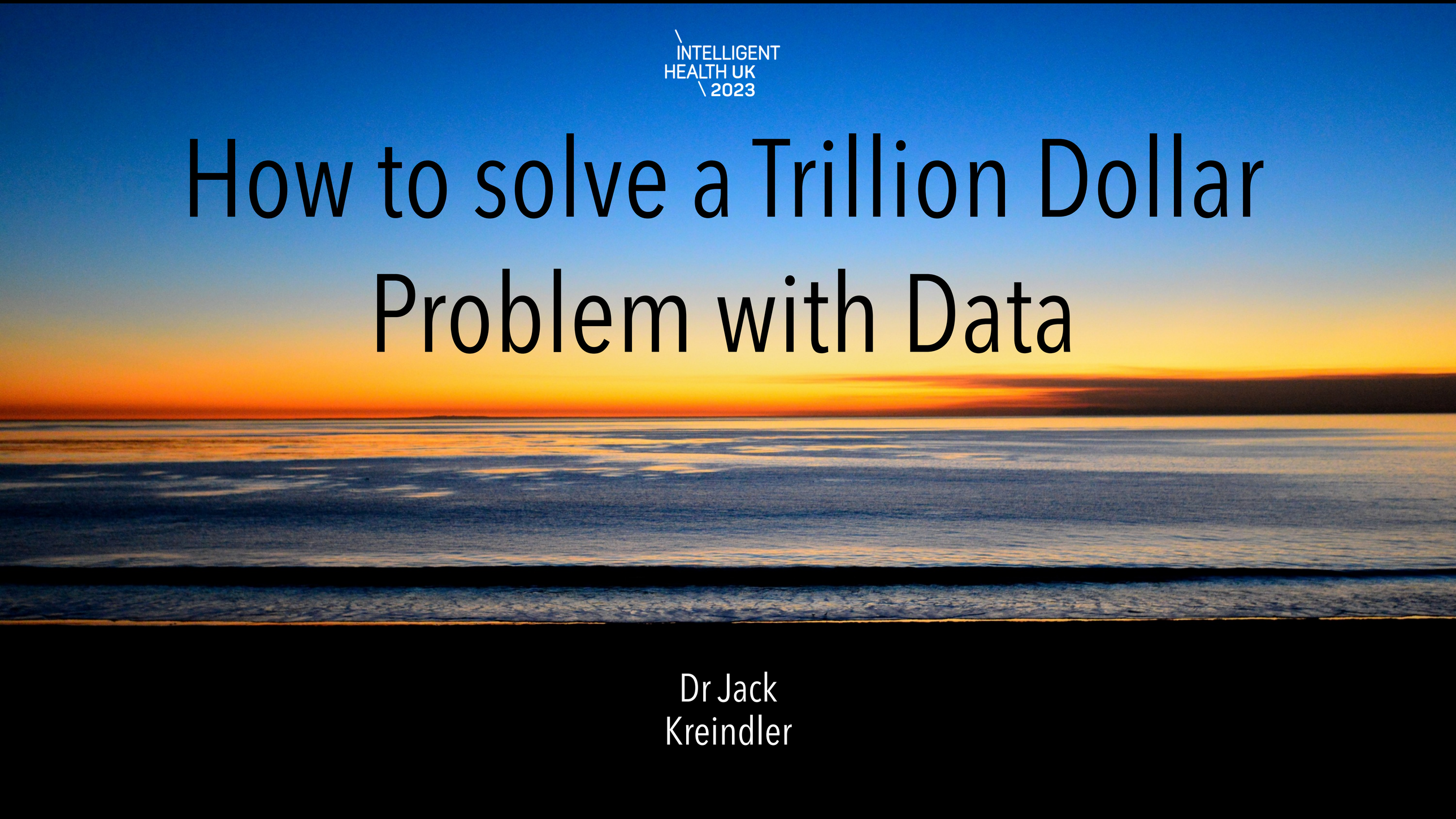


How to solve a Trillion Dollar Problem with Data

Dr Jack
Kreindler

42

1 The accelerating pace of change ...

Agricultural Revolution ← 8,000 years → Industrial Revolution ← 120 years → Light-bulb ← 90 years → Moon landing ← 22 years → World Wide Web ← 9 years → Human genome sequenced

2 ... and exponential growth in computing power ...

Computer technology, shown here climbing dramatically by powers of 10, is now progressing more each hour than it did in its entire first 90 years

3 ... will lead to the Singularity

2045
Surpasses brainpower equivalent to that of all human brains combined

Surpasses brainpower of human in 2023

Surpasses brainpower of mouse in 2015

Colossus
The electronic computer, with 1,500 vacuum tubes, helped the British crack German codes during WW II

UNIVAC I
The first commercially marketed computer, used to tabulate the U.S. Census, occupied 943 cu. ft.

Apple II
At a price of $1,298, the compact machine was one of the first massively popular personal computers

Power Mac G4
The first personal computer to deliver more than 1 billion floating-point operations per second

COMPUTER RANKINGS
By calculations per second per $1,000

Analytical engine
Never fully built, Charles Babbage's invention was designed to solve computational and logical problems

Hollerith Tabulator
IBM Tabulator
National Ellis 3000
Zuse 2
Zuse 3
ENIAC
IBM SSEC
BINAC
EDVAC
Whirlwind
Datamatic 1000
DEC PDP-4
IBM 1130
IBM 1620
DEC PDP-10
Data General Nova
Intellec-8
IBM PC
Compaq Deskpro 386
Pentium PC
Pentium II PC
Dell Dimension 8400
Mac Pro
Nvidia Tesla GPU & PC

10^{26}
10^{20}
10^{15}
10,000,000,000
100,000
1
0.00001

ELECTROMECHANICAL — RELAYS — VACUUM TUBES — TRANSISTORS — INTEGRATED CIRCUITS

1900 1920 1940 1960 1980 2000 2011 2020 2045

World Wide Web

9 years

Human genome sequenced

3 ... will lead to the Singularity

2045
Surpasses brainpower equivalent to that of all human brains combined

Surpasses brainpower of human in 2023

SQUIBB'S AGUE SPECIFIC

"I am generally prejudiced against patent medicines, but SQUIBB'S I have found handy and effective in all kinds of fever."—Rev. M. G. GOLDSMITH, Hyderabad, Deccan.

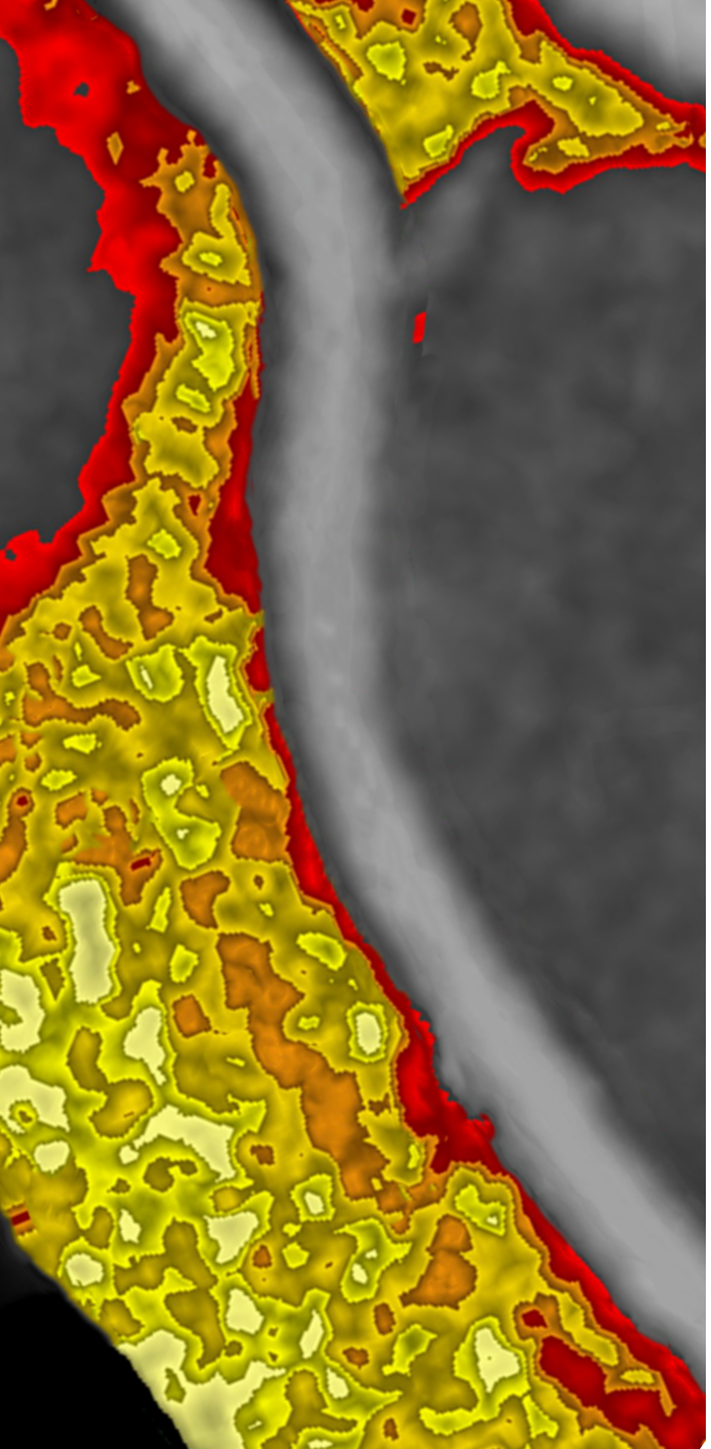
The MASTER MEDICINE *FOR*

MALARIA
INFLUENZA
& ALL FEVERS

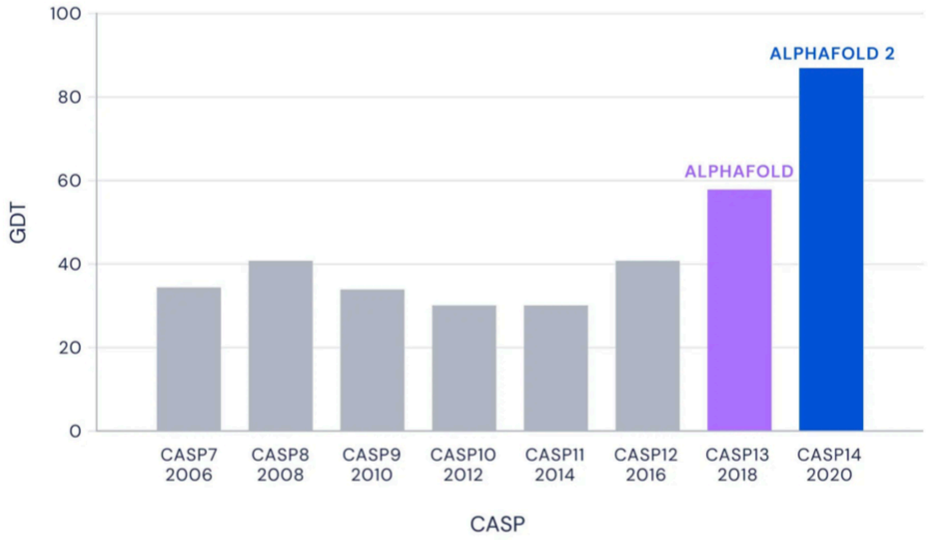
MADON SONS & CO.
QUALIFIED CHEMISTS
BOMBAY

"SQUIBB'S AGUE SPECIFIC is doing wonders. All who have tried it are swearing by it."—G. J. FANCY, Loco Dept., A. & B. Rly., Assam.

FOR THE MILLIONAIRE AND THE MILLIONS

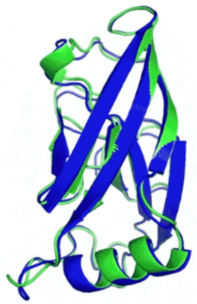


Median Free-Modelling Accuracy



Improvements in the median accuracy of predictions in the free modelling category for the best team in each CASP, measured as best-of-5 GDT.

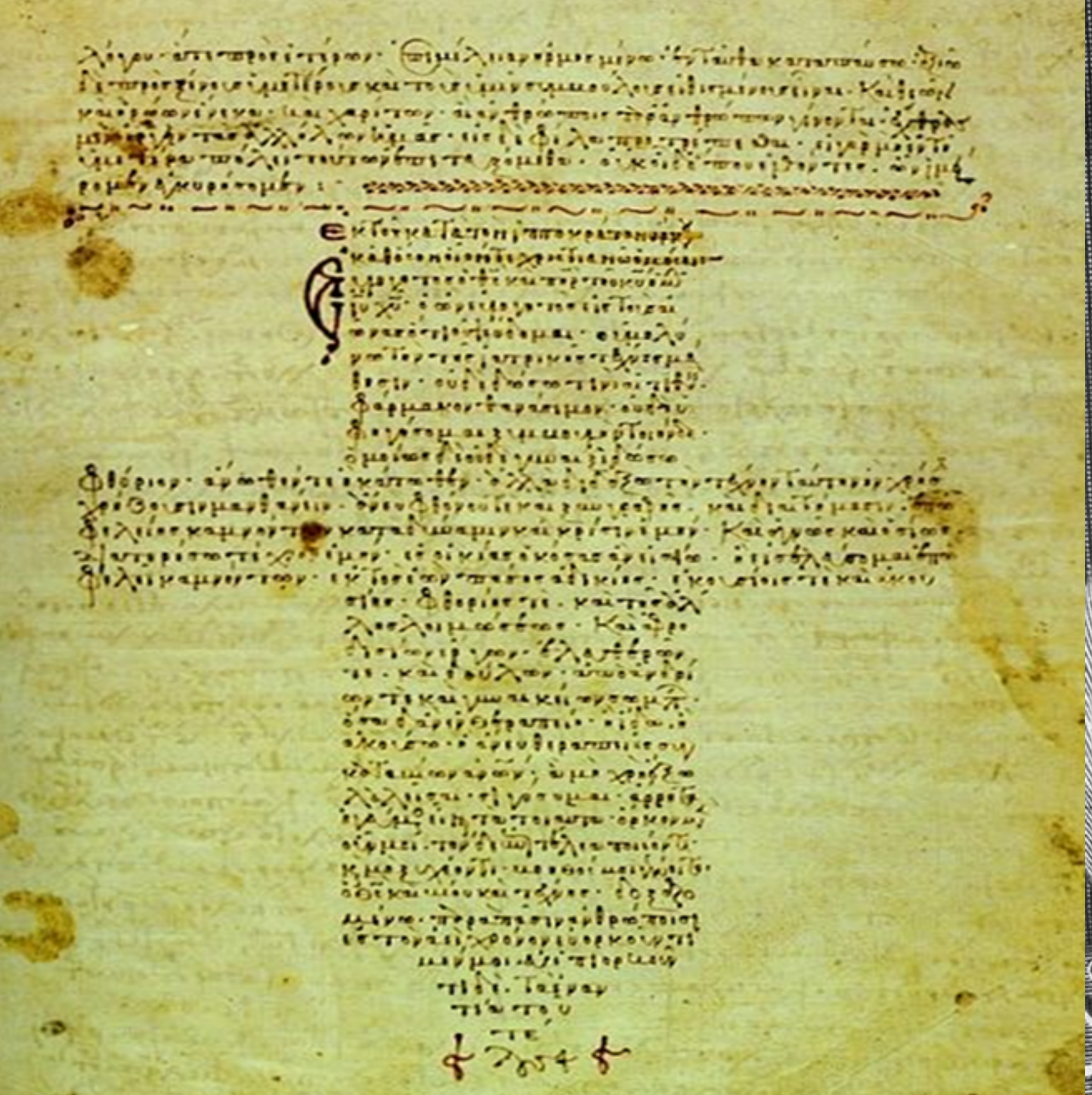
T1037 / 6vr4
90.7 GDT
(RNA polymerase domain)

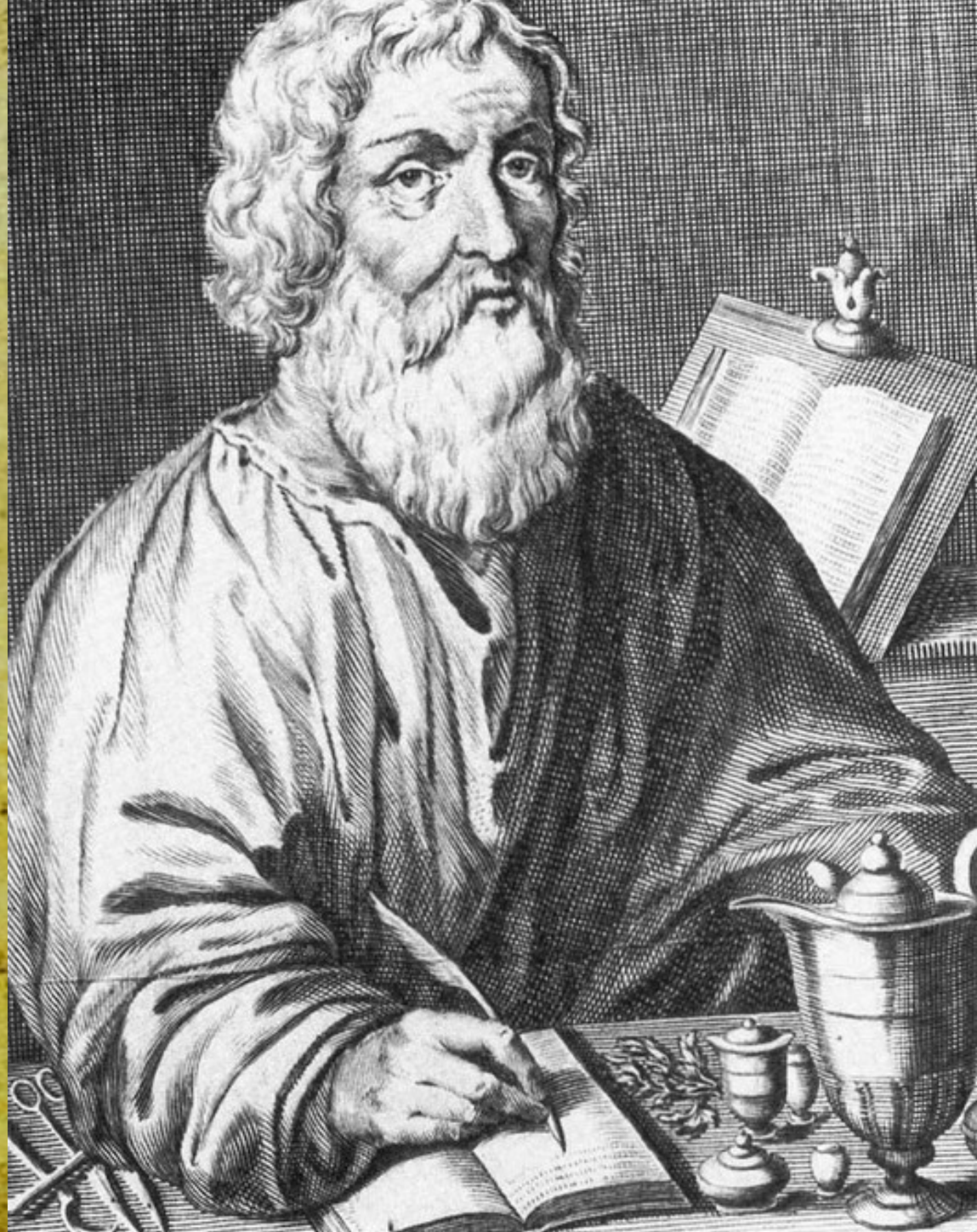


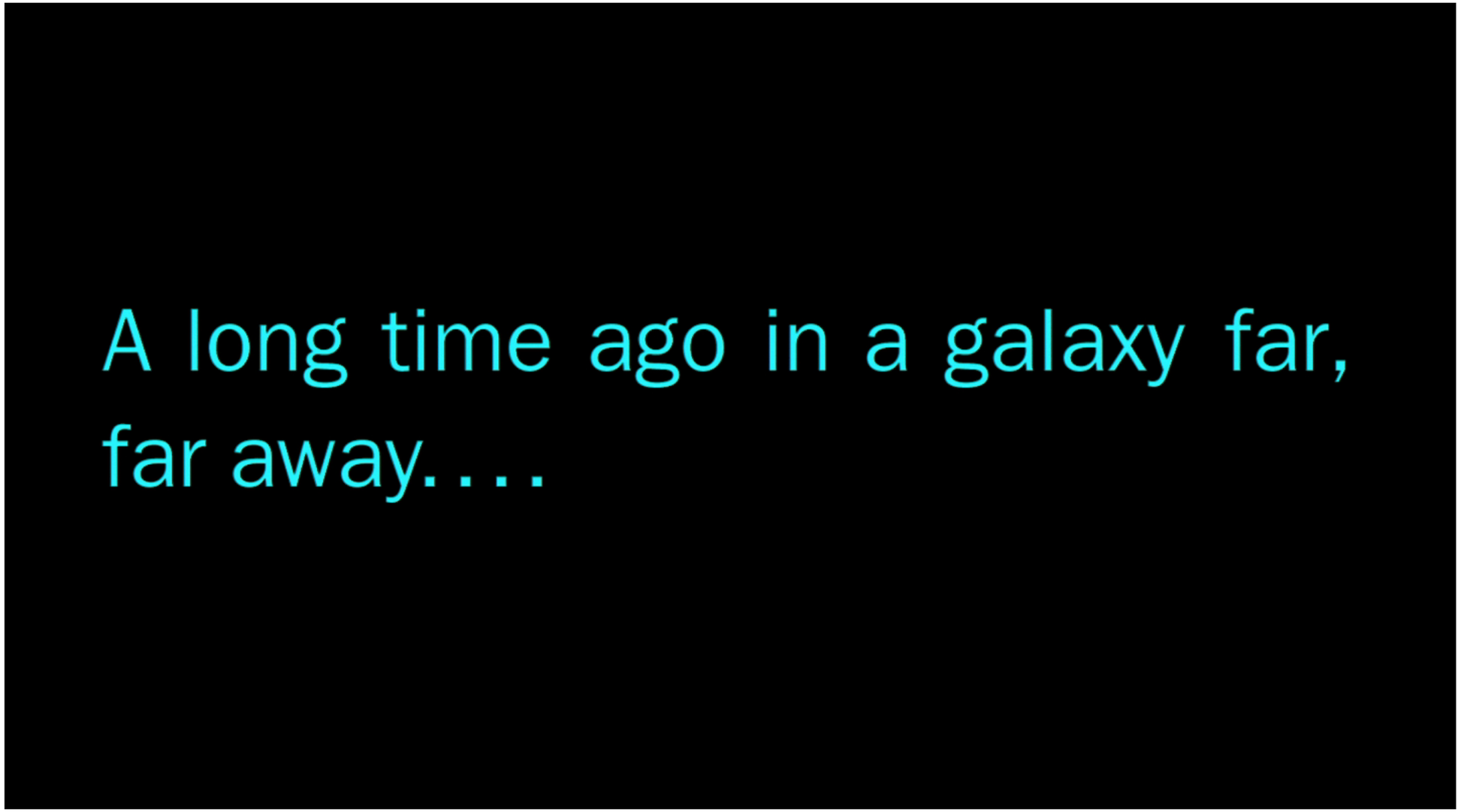
T1049 / 6y4f
93.3 GDT
(adhesin tip)

Experimental result
Computational prediction

Two examples of protein targets in the free modelling category. AlphaFold predicts highly accurate structures measured against experimental result.






A long time ago in a galaxy far,
far away....

ANGER ISSUES

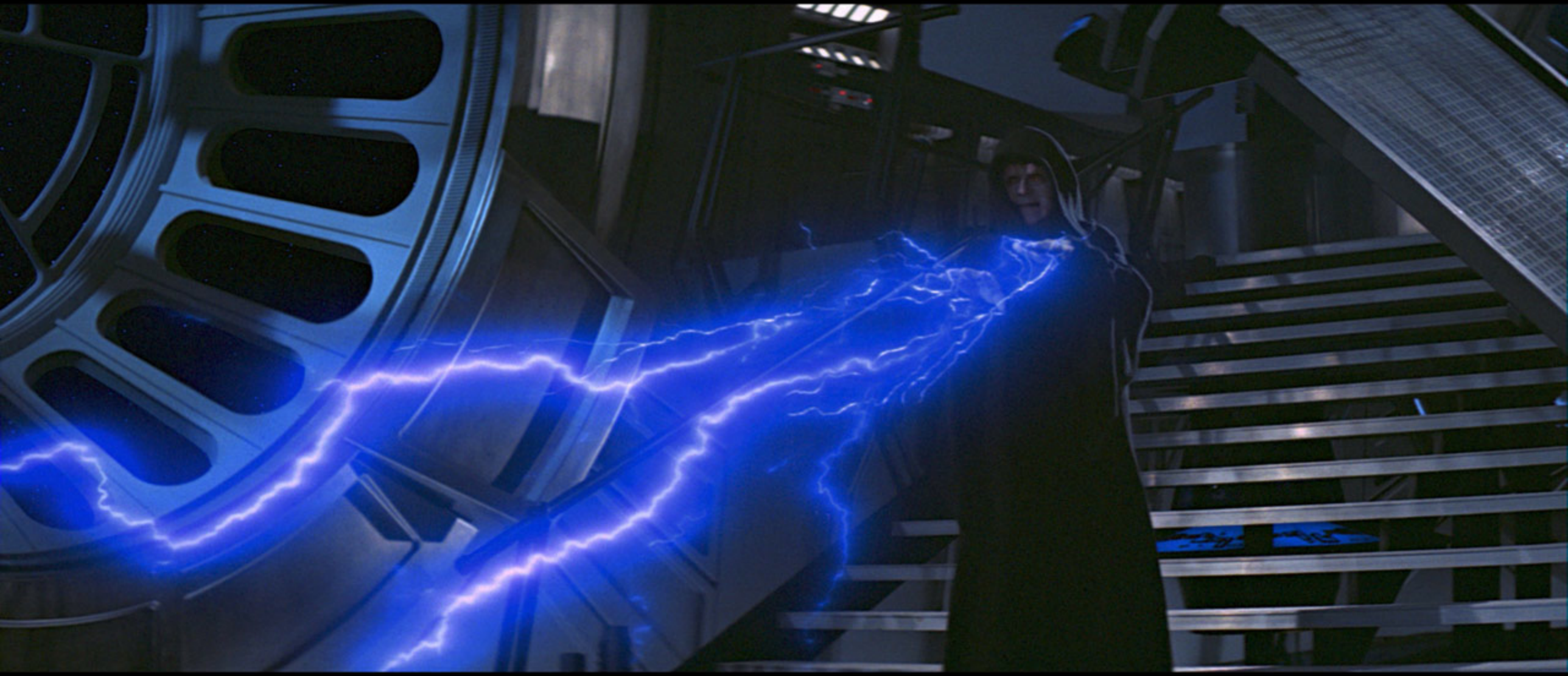
100% BURNS

ASTHMA /COPD

QUADRAPLEGIA

MULTI ORGAN FAILURE

ATHLETE'S FOOT

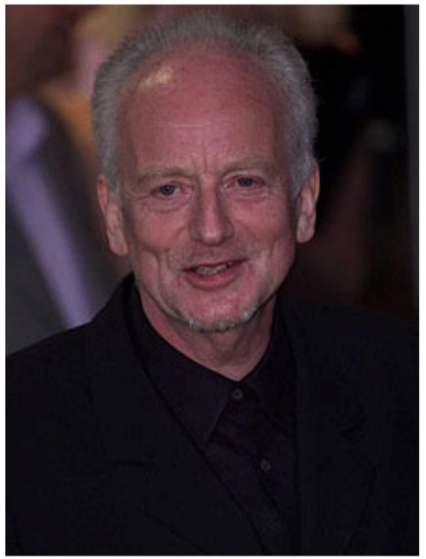


Star Wars Emperor Ian McDiarmid tells his ambulance to wait until he finishes West End play

An award-winning actor who played the evil Emperor in the Star Wars movies was taken ill on stage but instructed an ambulance to wait until the performace had finished before being leaving for hospital.

By Nick Allen
8:51AM BST 24 Oct 2008

Ian McDiarmid, 64, began suffering from dizzy spells towards the end of the play but concealed his condition so well that the audience didn't notice and critics later gave him glowing reviews.



Ian McDiarmid is a highly distinguished stage actor

Backstage staff feared he was suffering a heart attack and called an ambulance ten minutes before the performance was due to end. It arrived seven minutes later.

But the heroic actor finished his performance and then took the curtain call at the Gielgud Theatre in London's West End before getting in the ambulance.

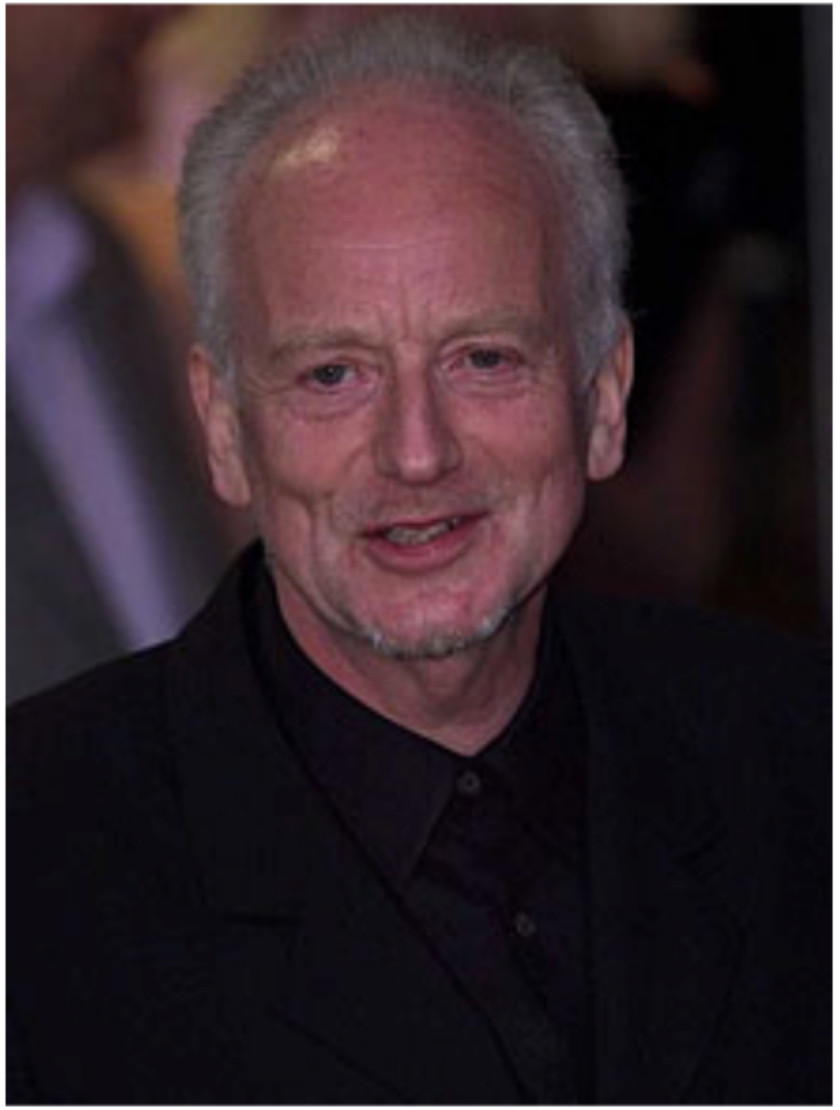
McDiarmid had been playing the Father in Luigi Pirandello's Six Characters in Search of an Author.

He is a highly distinguished Scottish stage actor but is most famous for his Hollywood role as the Emperor Palpatine in George Lucas's Star Wars films.

How about that?
News »
Celebrity news »

In Politics

Pictures of the week



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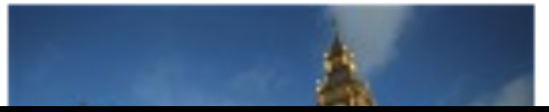
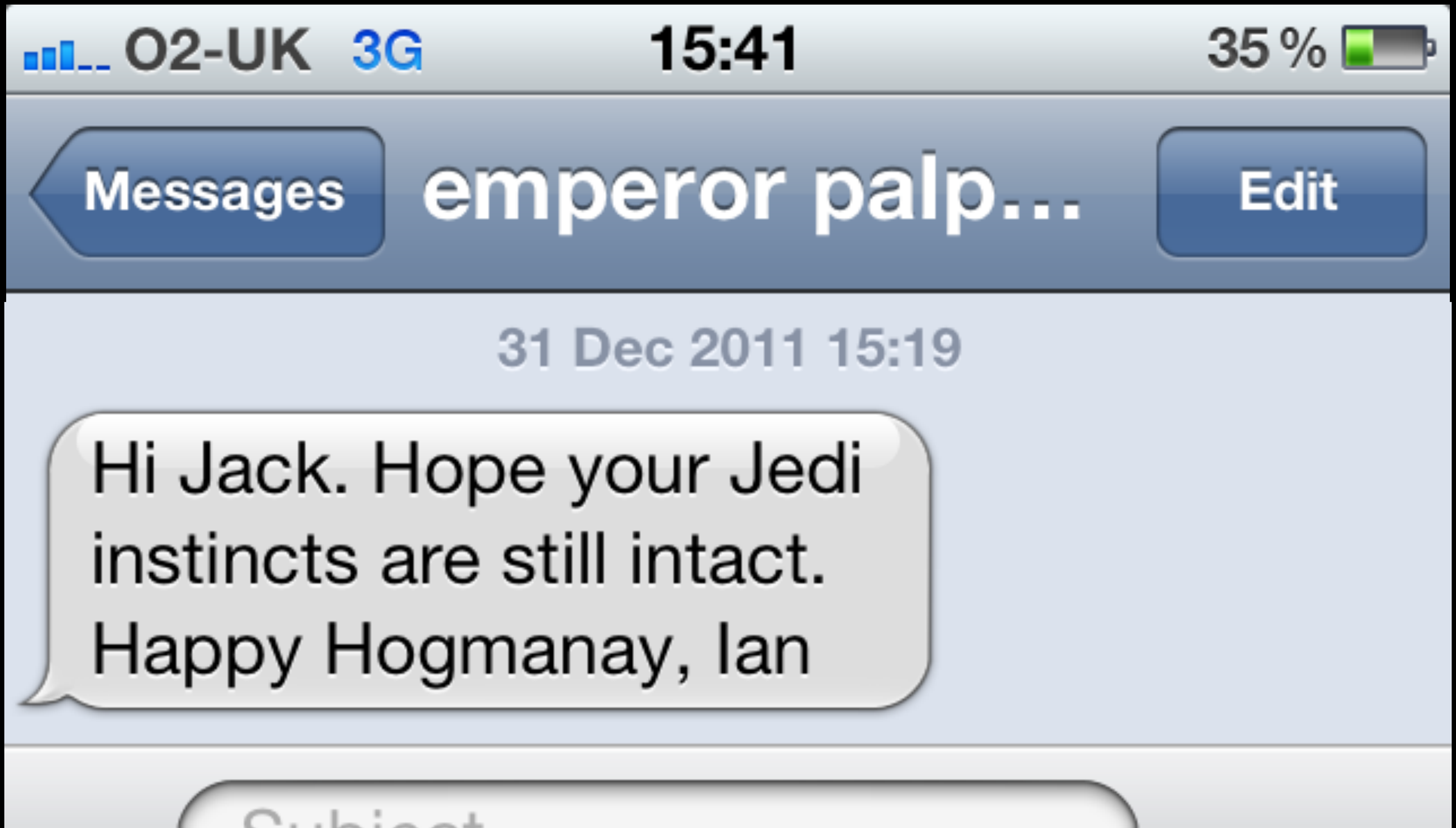
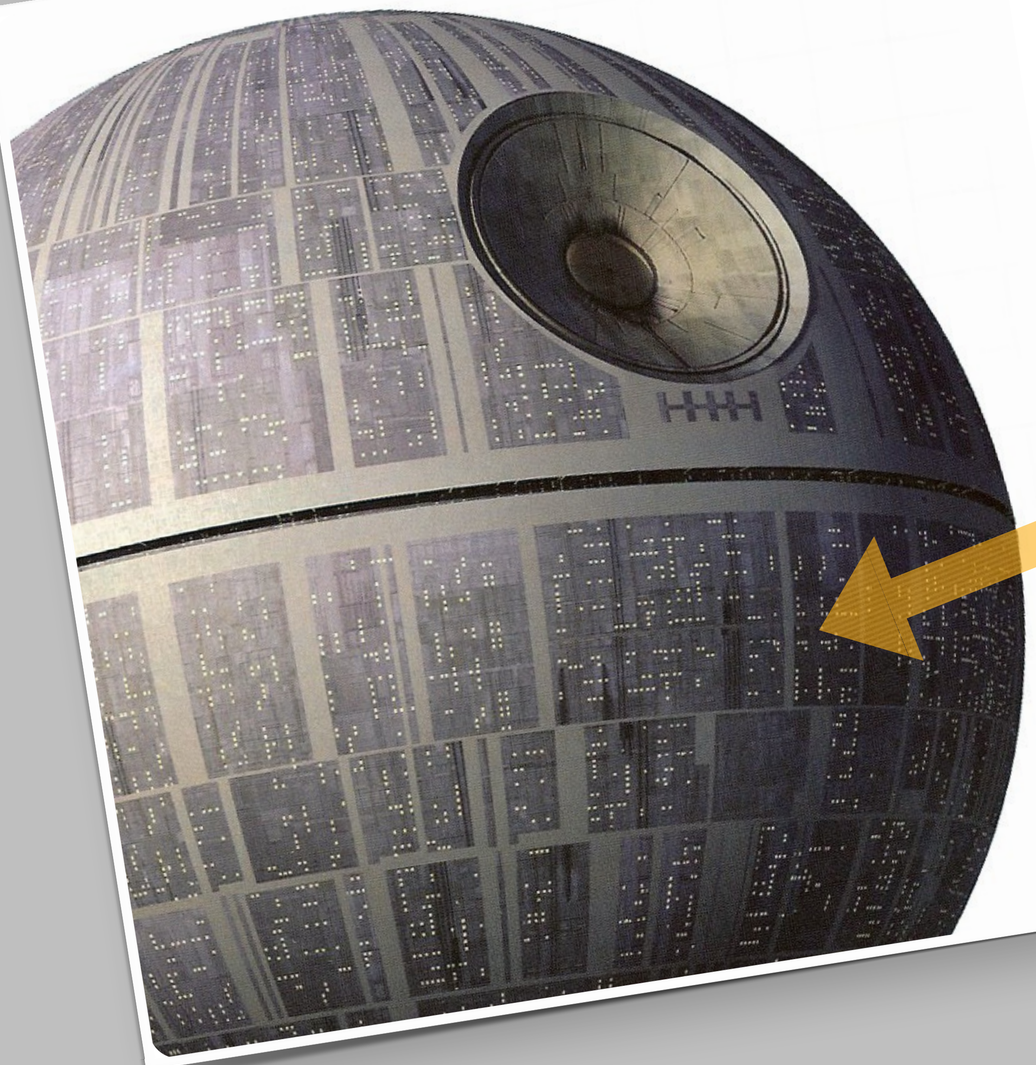



O2-UK 3G
15:41
35 %
Messages
emperor palp...
Edit
31 Dec 2011 15:19


O2-UK 3G
15:41
35 %
Messages
emperor palp...
Edit
31 Dec 2011 15:19
Hi Jack. Hope your Jedi instincts are still intact. Happy Hogmanay, Ian



DR JACK KREINDLER
IMPERIAL PHYSICIAN

MEDICAL WING
FLOOR 201,045
DS 90210
THE DEATH STAR

(JUST PAST CATERING)

@drjackuk
phantom.medic@gmail.com

HUMAN PERFORMANCE SCIENCE

DOCTORS AND SCIENTISTS SAID THAT BREAKING THE FOUR-MINUTE MILE WAS IMPOSSIBLE, THAT ONE WOULD DIE IN THE ATTEMPT. THUS, WHEN I GOT UP FROM THE TRACK AFTER COLLAPSING AT THE FINISH LINE, I FIGURED I WAS DEAD.

Roger Bannister

HUMAN PERFORMANCE SCIENCE


CENSORED
CENSORED
CENSORED
CENSORED
CENSORED
AGE
HEIGHT
WEIGHT
TEAM
MMA
34
6FT 2IN
LIGHT HEAVY
BJA PRIZEFIGHTERS
& ANDY ROBERTS BJJ
3-0-0
DR JACK KREINDLER
VS
NICK CHAPMAN


UCMMA
ULTIMATE CHAMPIONS
BADBOY


REST


ICE

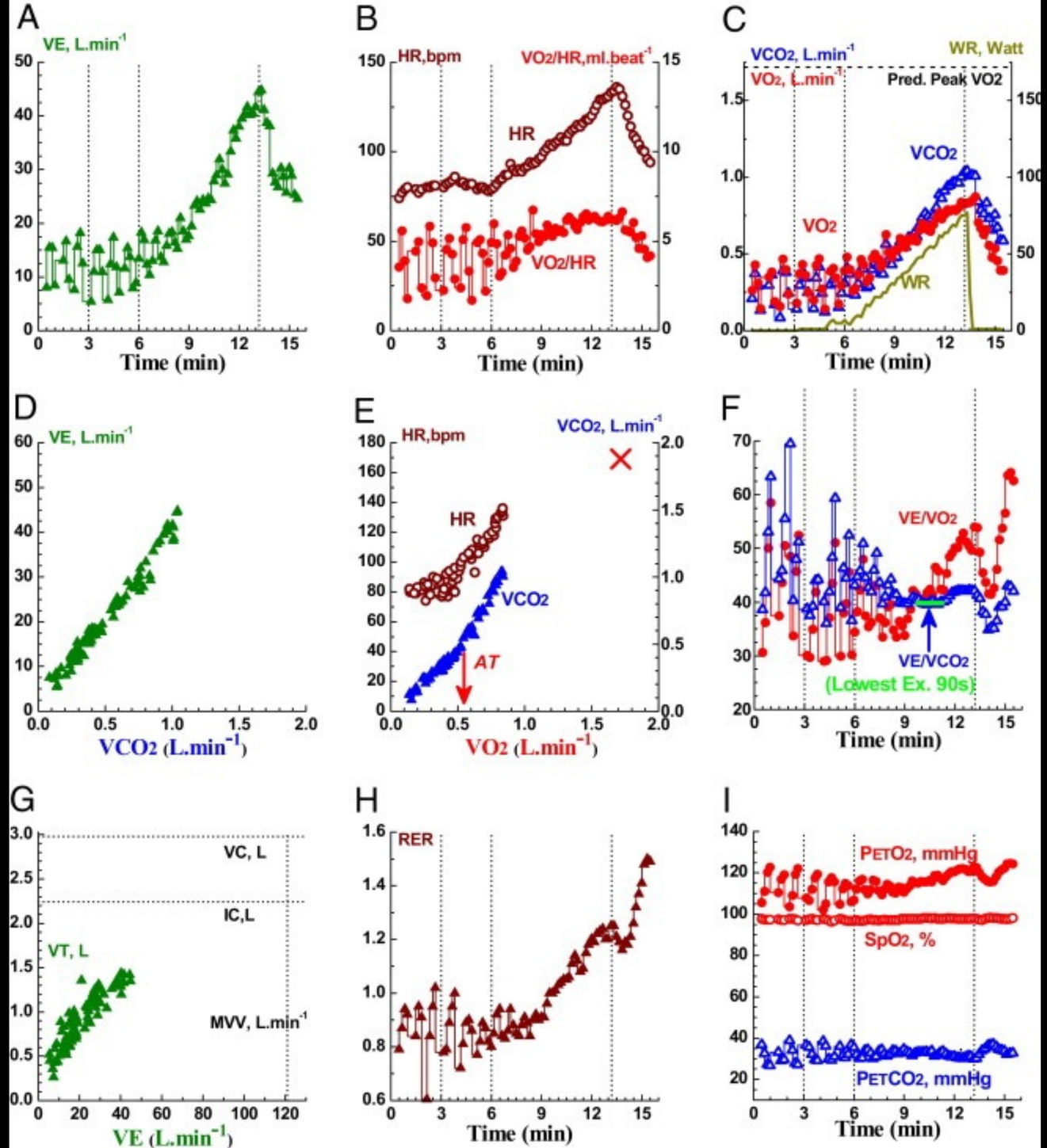

COMPRESSION


ELEVATION

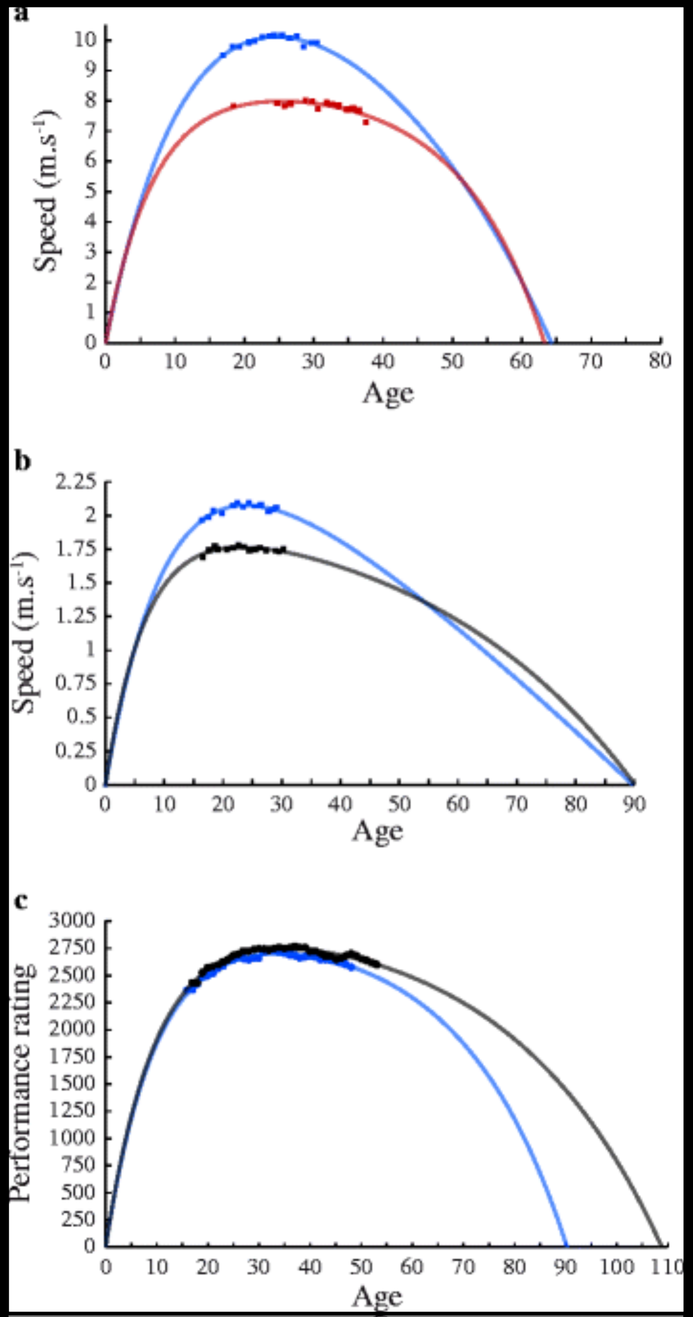

RA
MF 0.86
TI 160.0
TR 4780.0
TE 32.0
TA 03:45
BW 161.0
p2 MINORM/DIS2D
A3VIR
c:FL_BO1.2-SP3.5
tir2d1_8/148

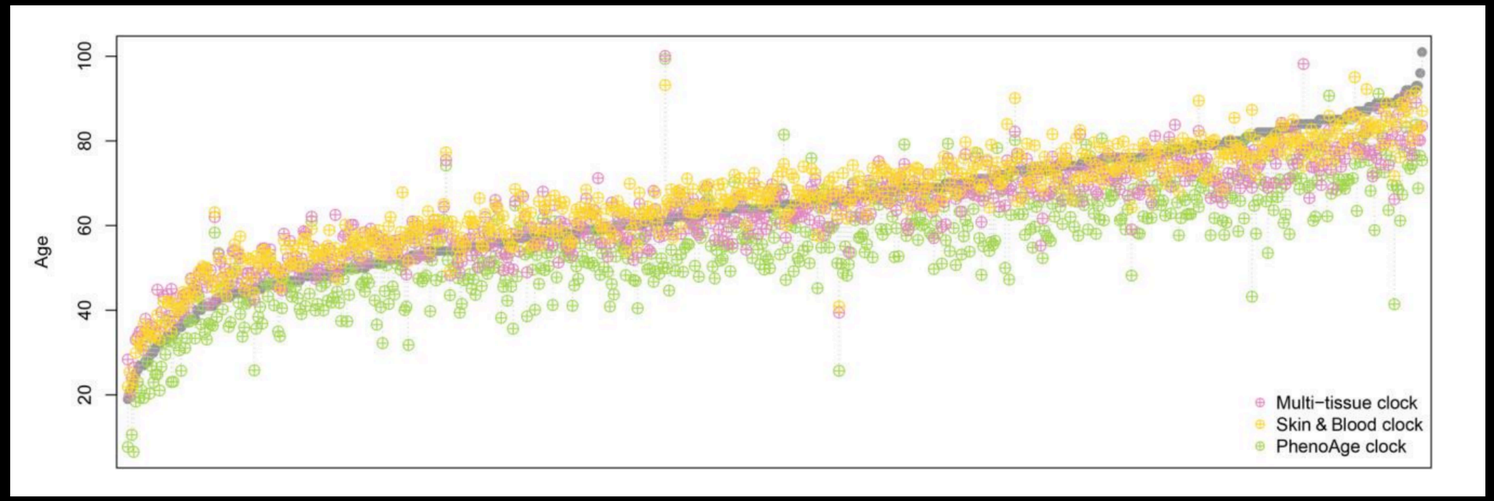

CHP
CENTRE FOR HEALTH &
HUMAN PERFORMANCE


WELCOME TO
EREST BASE CAMP LABORATORY


A
VE, L.min-1
Time (min)
B
HR,bpm
VO2/HR,ml.beat-1
HR
VO2/HR
Time (min)
C
VCO2, L.min-1
WR, Watt
VO2, L.min-1
Pred. Peak VO2
VCO2
VO2
WR
Time (min)
D
VE, L.min-1
VCO2 (L.min-1)
E
HR,bpm
VCO2, L.min-1
HR
VCO2
AT
VO2 (L.min-1)
F
VE/VO2
VE/VCO2
(Lowest Ex. 90s)
Time (min)
G
VC, L
IC,L
VT, L
MVV, L.min-1
VE (L.min-1)
H
RER
Time (min)
I
PETO2, mmHg
SpO2, %
PETCO2, mmHg
Time (min)

WTF!?


a
Speed (m.s-1)
Age
b
Speed (m.s-1)
Age
c
Performance rating
Age


Age
Multi−tissue clock
Skin & Blood clock
PhenoAge clock


FINNAIR


100,0000,000

100 000 000 000
GIGABYTES PER YEAR

300 000 000 000

PAGES

PER SECOND!

2 to 20 years: Boys
Stature-for-age and Weight-for-age percentiles

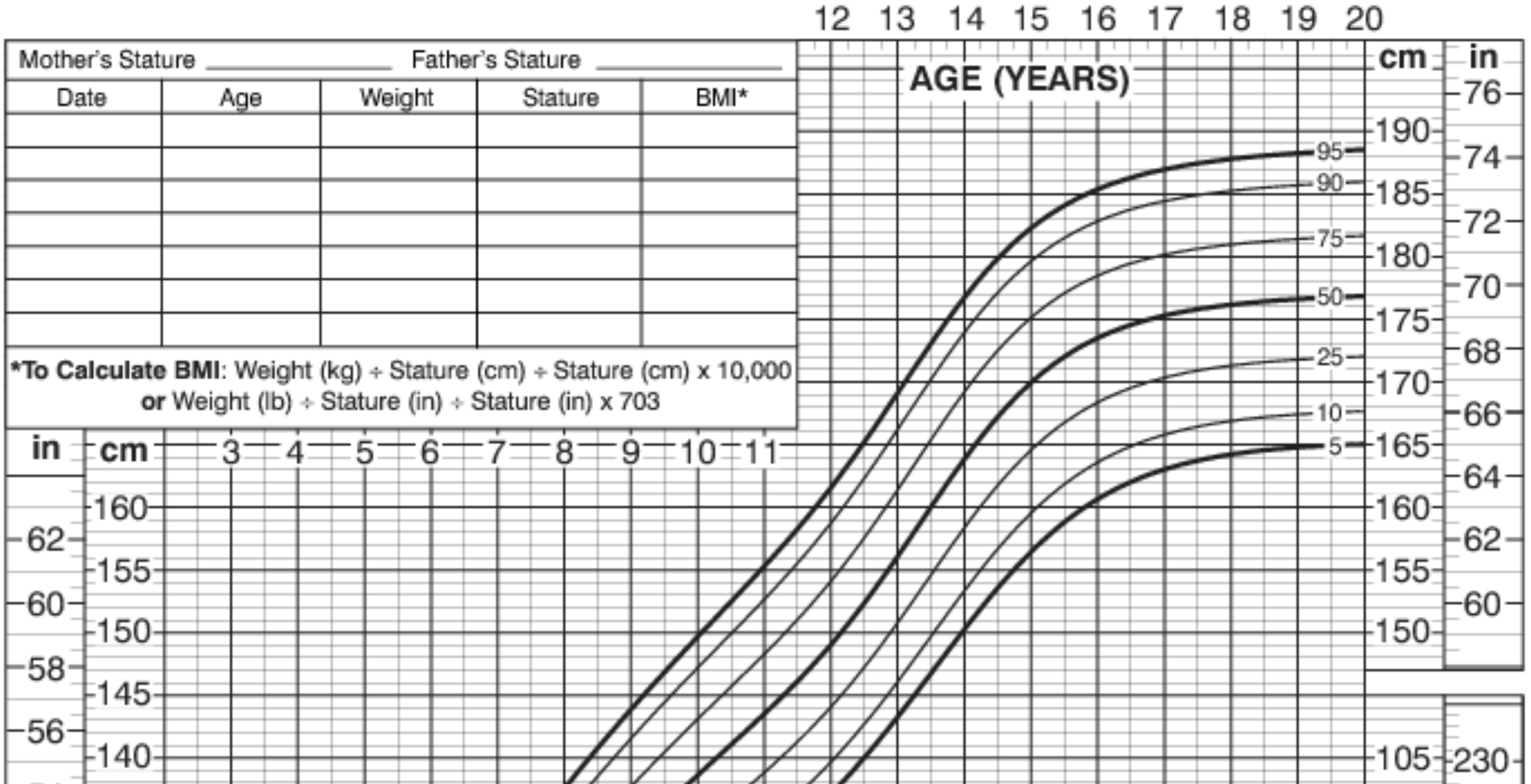
NAME _____

RECORD # _____

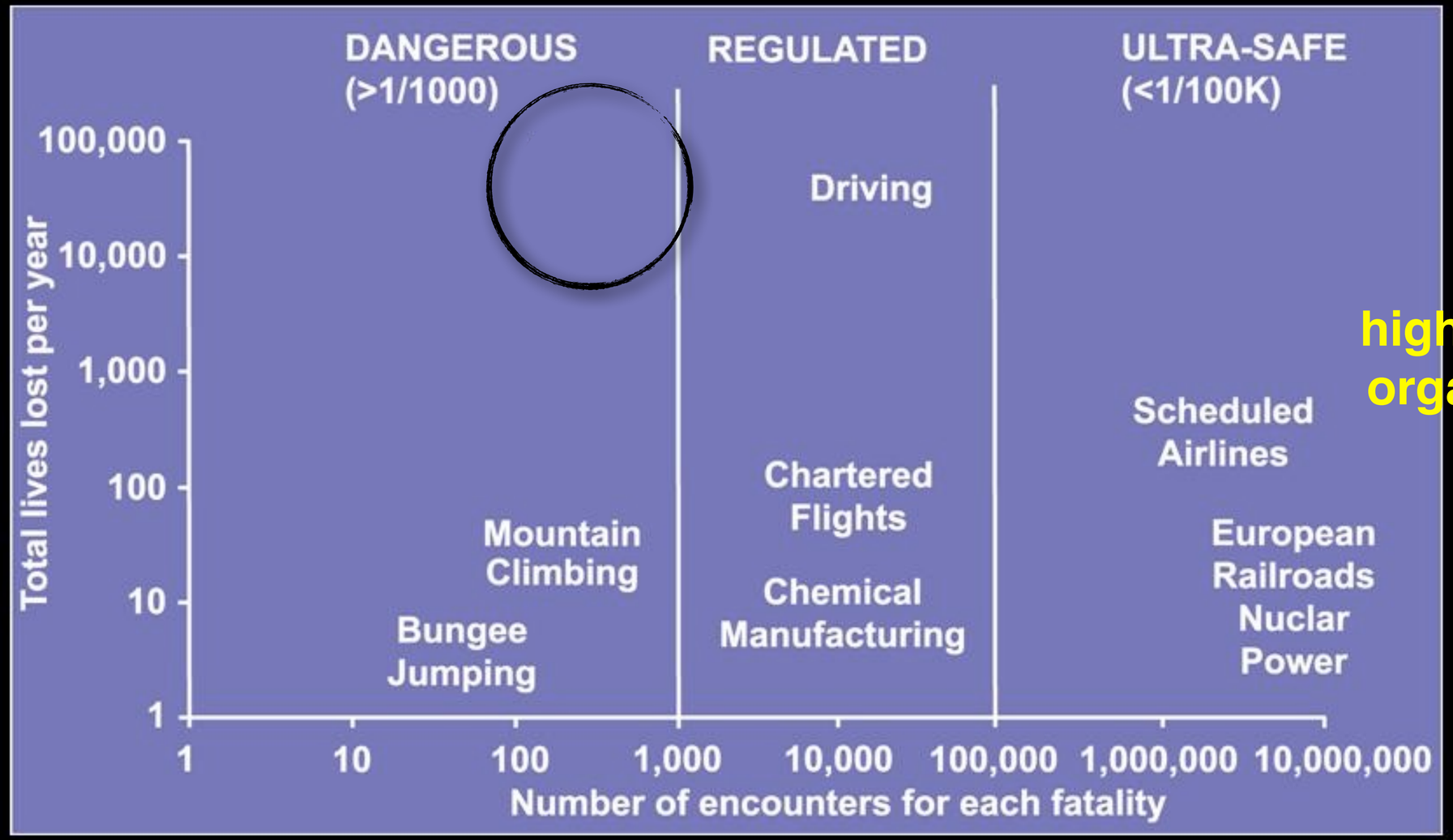
Mother's Stature _____ Father's Stature _____

Date	Age	Weight	Stature	BMI*

***To Calculate BMI**: Weight (kg) ÷ Stature (cm) ÷ Stature (cm) x 10,000
or Weight (lb) ÷ Stature (in) ÷ Stature (in) x 703



HOW SAFE IS HEALTHCARE?



high-reliability organisations

Singularity University | Futuremed Program February 2012


5:10 PM
Carbs
138
mg/dL
138 mg/dL
Tues, Apr 3, 2012, 5:10 PM EDT
Pre-Dinner
Add Note
Info
Share
Data
Add
Home
138
04/03/12

FORA


400
350
300
250
200
150
100
50
160
02:03 P
3hr
OK
C
dexcom


FORA
104

GLASS
IS
HARD
TO
SEE
AFTER
A
15
HOUR
DAY
IN
THE
EARLY
AM

My Vitals Dashboard

Alan Shearer

CHHP

BATTLE of the BACKSIDES

Current Vitals

Local Time: 12:19:21 GMT

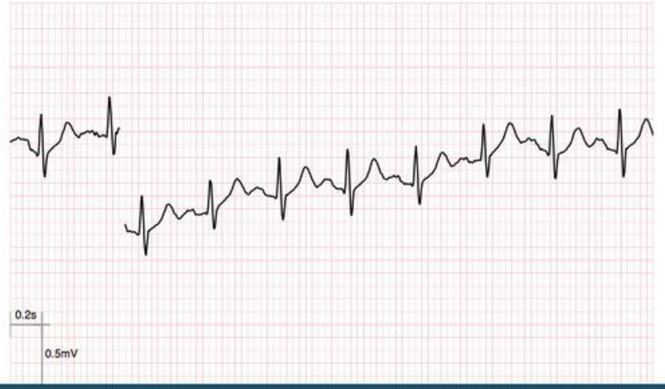
121 BPM HEARTRATE	19 BrPM RESPIRATION	99 % STRESS
39280 STEPS	11271 Cal TOTAL ENERGY EXPENDITURE	489 Cal/hr RATE OF ENERGY EXPENDITURE
33.7 °C SKIN TEMPERATURE	POSTURE	0.0 g ACTIVITY

Current ECG

-1.5mV to 1.5mV | -3.5mV to 3.5mV | -10mV to 10mV

Local Time: 12:19:21 GMT

ECG Time: 12:17:59 GMT



My Vitals Dashboard

Robbie Savage

CHHP

BATTLE of the BACKSIDES

Current Vitals

Local Time: 12:19:21 PM

102 BPM HEARTRATE	15 BrPM RESPIRATION	89 % STRESS
38186 STEPS	9822 Cal TOTAL ENERGY EXPENDITURE	346 Cal/hr RATE OF ENERGY EXPENDITURE
33.2 °C SKIN TEMPERATURE	POSTURE	0.1 g ACTIVITY

Current ECG

-1.5mV to 1.5mV | -3.5mV to 3.5mV | -10mV to 10mV

Local Time: 12:19:21 PM

ECG Time: 7:17:58 PM

onyx950 (in main/data/Device Types)

JointlyHealth

tree

- main
  - data
    - Clients
    - Admin Users
    - Disease Models
      - COPD
        - workflows
          - satsWorkflow
            - nominal
            - satsDepres
            - satsCritical
        - trackers
          - risingBP
        - statTrackers
          - satsTSA
          - satsWavelet
          - neuralTracker
      - CHF
    - RFI Designs
    - Sensor Data Types
    - Device Types
      - onyx950
      - uc321PBT
      - ua767pbt
      - foraW310b
    - IVR Designs

Details | Test Plan

Device name: Onyx II 9560 Pulse Oximeter

Data type
sats
heartRate

Data point: Oxygen Saturation

Regular expression: SpO2=([0-9.]+)\s*%

Image: /site/images/devices/onyx9560.jpg

risingBP (in main/data/Disease Models/COPD/trackers)

JointlyHealth

tree

- main
  - data
    - Clients
    - Admin Users
    - Disease Models
      - COPD
        - workflows
        - trackers
          - risingBP
        - statTrackers
      - CHF
    - RFI Designs
    - Sensor Data Types
    - Device Types
    - IVR Designs

Basics | **Compositor** | EPL Code | Actions

If blood pressure rises by 4% per day over 4 days and oxygen saturation goes below member average minus 5% for ...

3 days

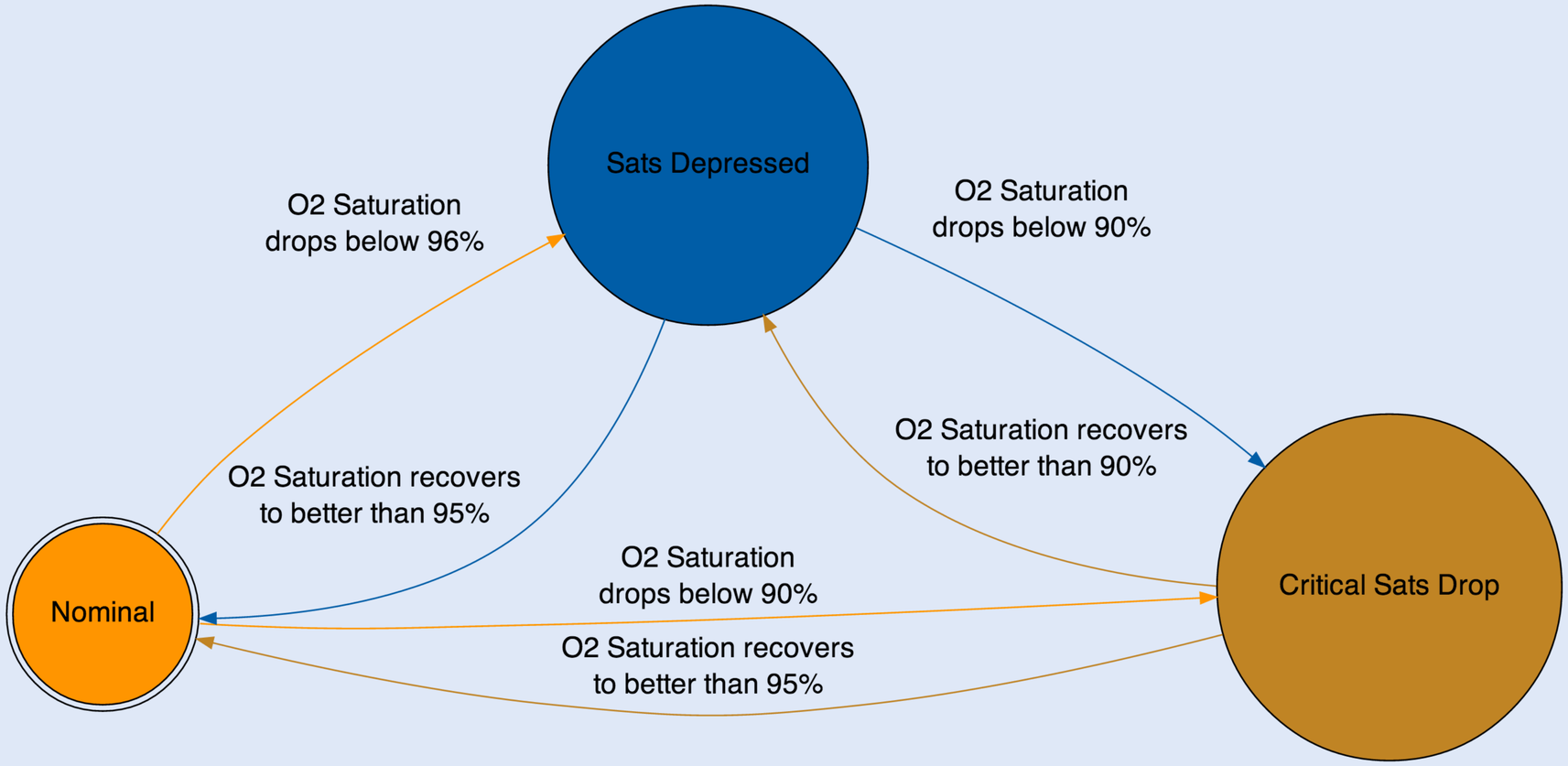
Save Cancel

Save | Save and close | Cancel

tree

- main
  - data
    - Clients
    - Admin Users
    - Disease Models
      - COPD
        - workflows
          - satsWorkflow
            - nominal
            - satsDepres
            - satsCritical
          - trackers
            - risingBP
          - statTrackers
            - satsTSA
            - satsWavelet
            - neuralTracker
        - CHF
    - RFI Designs
    - Sensor Data Types
    - Device Types
    - IVR Designs

Basics | **Diagram** | States



Refresh

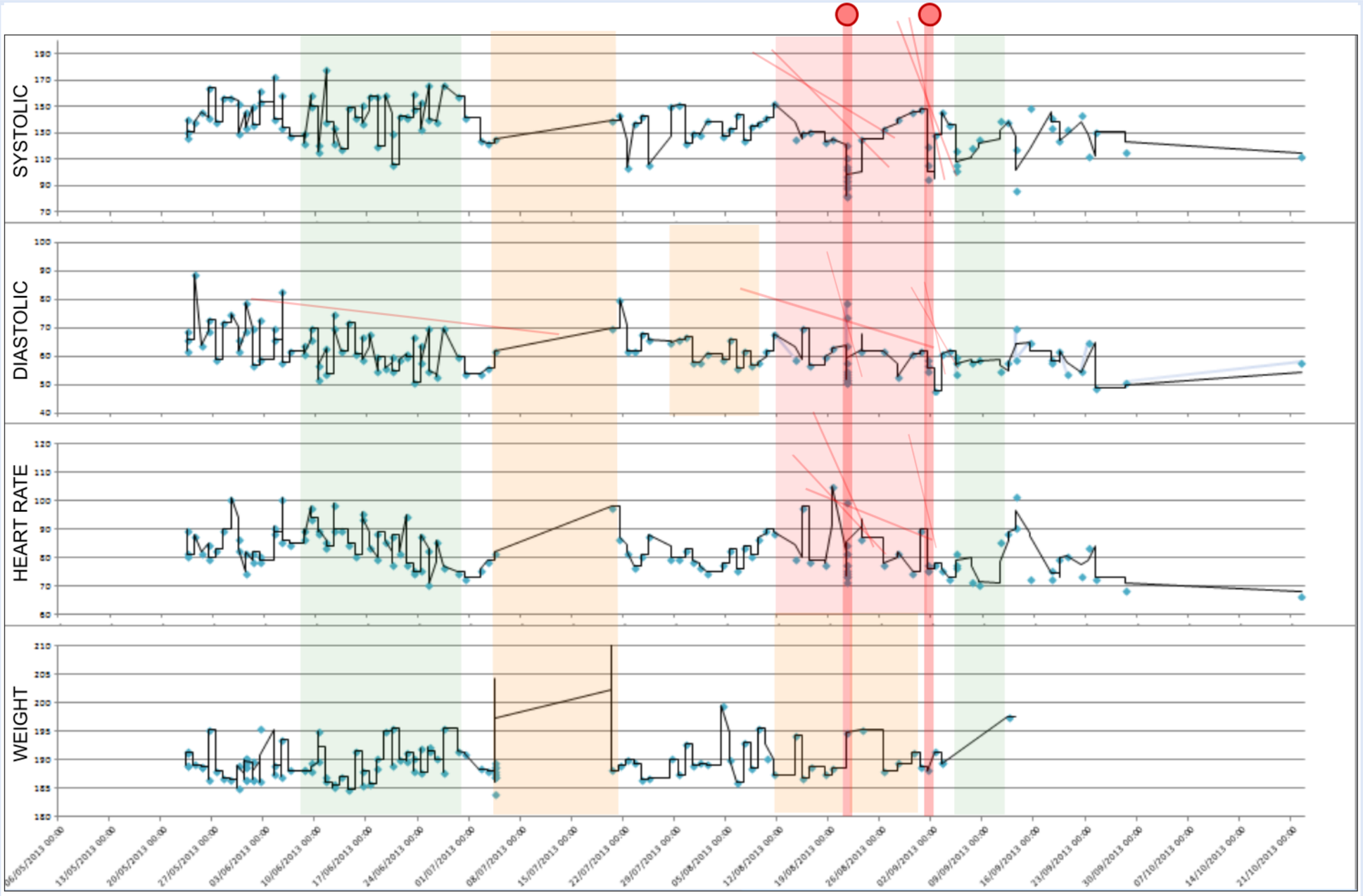
neuralTracker (in main/data/Disease Models/COPD/statTrackers)

JointlyHealth

tree

- main
  - data
    - Clients
    - Admin Users
    - Disease Models
      - COPD
        - workflows
          - satsWorkflow
            - nominal
            - satsDepres
            - satsCritical
        - trackers
          - risingBP
        - statTrackers
          - satsTSA
          - satsWavelet
          - neuralTracker
      - CHF
    - RFI Designs
    - Sensor Data Types
    - Device Types
      - onyx950
      - uc321PBT
      - ua767pbt
      - foraW310b
    - IVR Designs

Basics | R Code | **Test**



Refresh

JointlyHealth

HEART FAILURE

NEURO-DEGENERATION

COMPLEX DIABETES

CANCER

COPD & ASTHMA

AUTO IMMUNE INFLAMMATORY

PHYSICAL FRAILTY

MENTAL ILLNESS

ADDICTION

REJECTION

$3.2 trillion

U.S. healthcare spending

2015

(CMS, 2015)

PROF MARTIN ELLIOTT

MEDICAL DIRECTOR, GOSH, LONDON

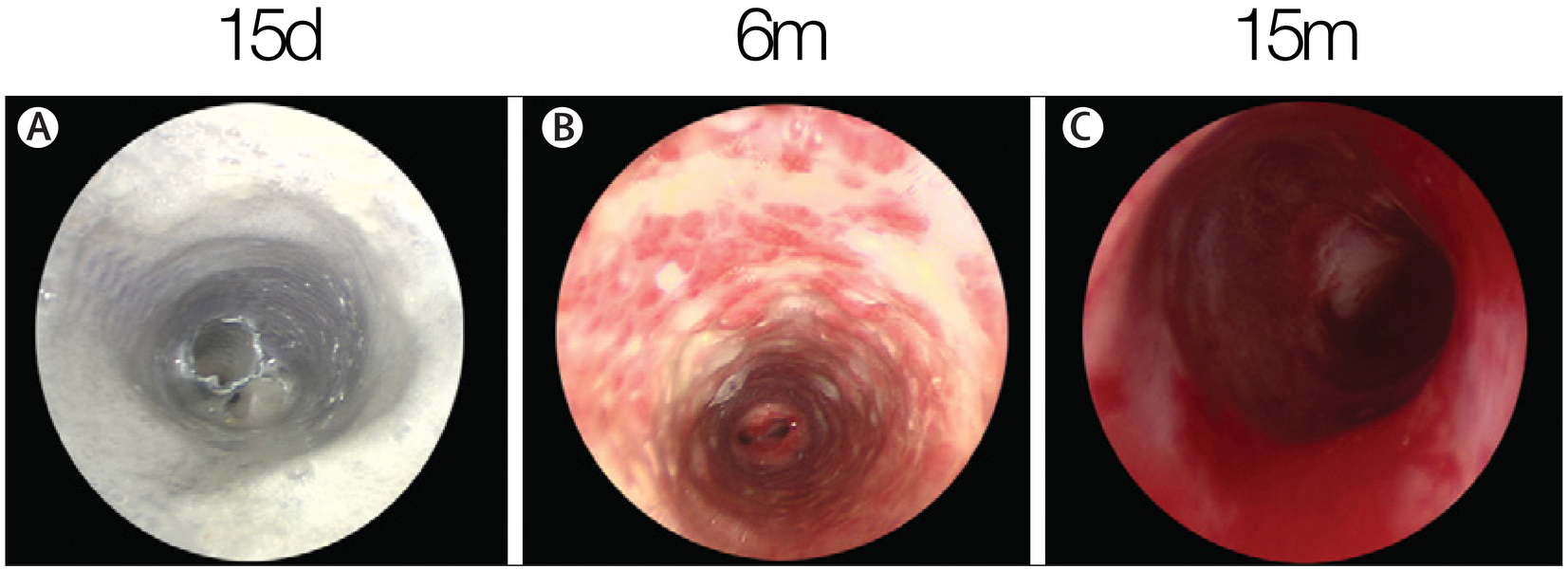


Figure 2: **Bronchoscopic appearances**

(A) Microlaryngobronchoscopy 15 days after the transplant showing a dense web covering the stent and partially occluding the lumen (A), which was cleared by regular bronchoscopies and DNAase. (B) Image at 6 months, showing that reabsorption of the stent (white areas) caused so-called cobblestones of granulation tissue with little normal epithelium. (C) At 15 months after surgery, the graft seemed to be patent, with healthy mucosa.

Elliott, MJ et al
www.thelancet.com Published online July 26, 2012 http://dx.doi.org/10.1016/S0140-6736(12)60737-51


BOOKINGS
9105

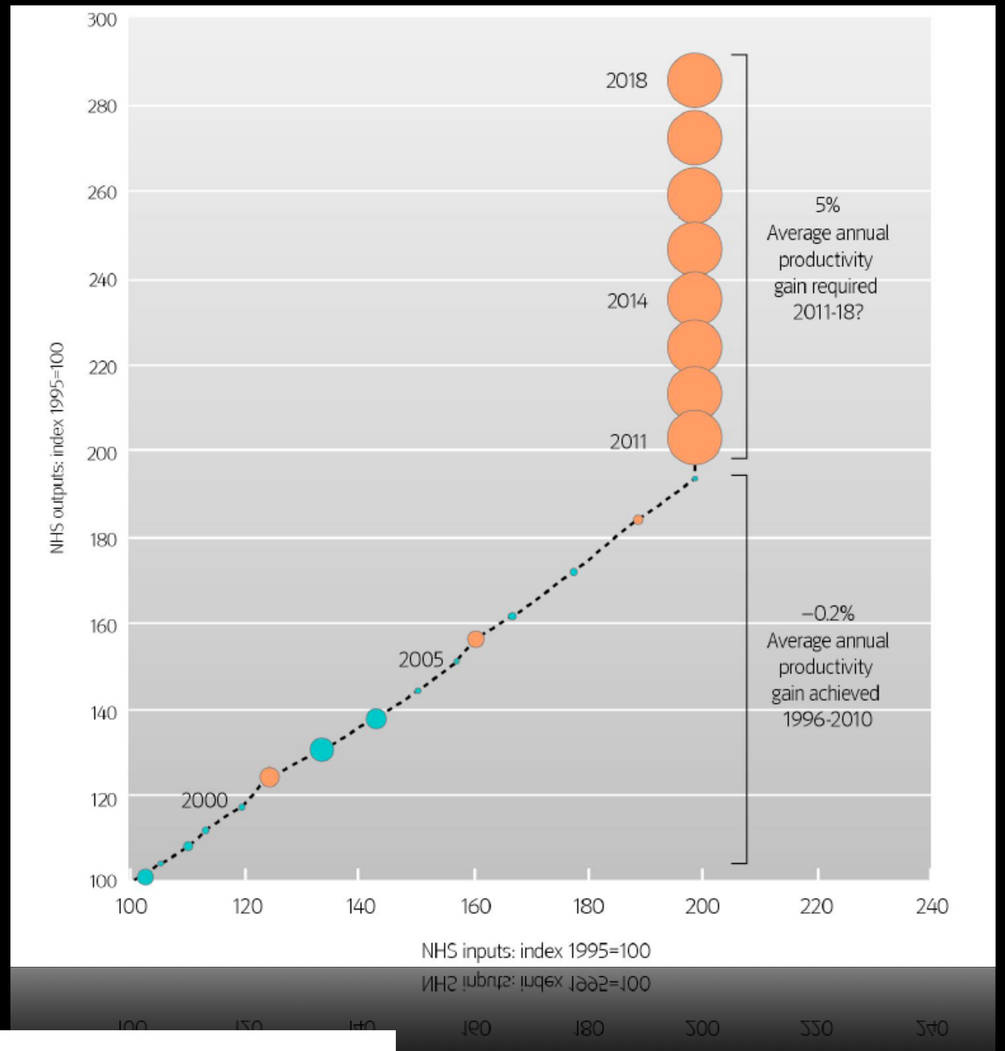
HOW AFFORDABLE IS HEALTHCARE?

Richard Douglas, Department of Health director general of policy, strategy, and finance, has reportedly said that the drive to find further efficiency savings in the NHS will continue after 2015,[1] with the total savings rising from £20bn (€24.6bn; $31bn) to a possible £50bn by 2019-20. His comments are a startling admission of the long term impact on public services of the global financial crisis and ensuing recession.

BMJ

Appleby, J
A Productivity Challenge too far?

BMJ 2012;344:e2416 doi: 10.1136/bmj.e2416 (Published 19 June 2012)



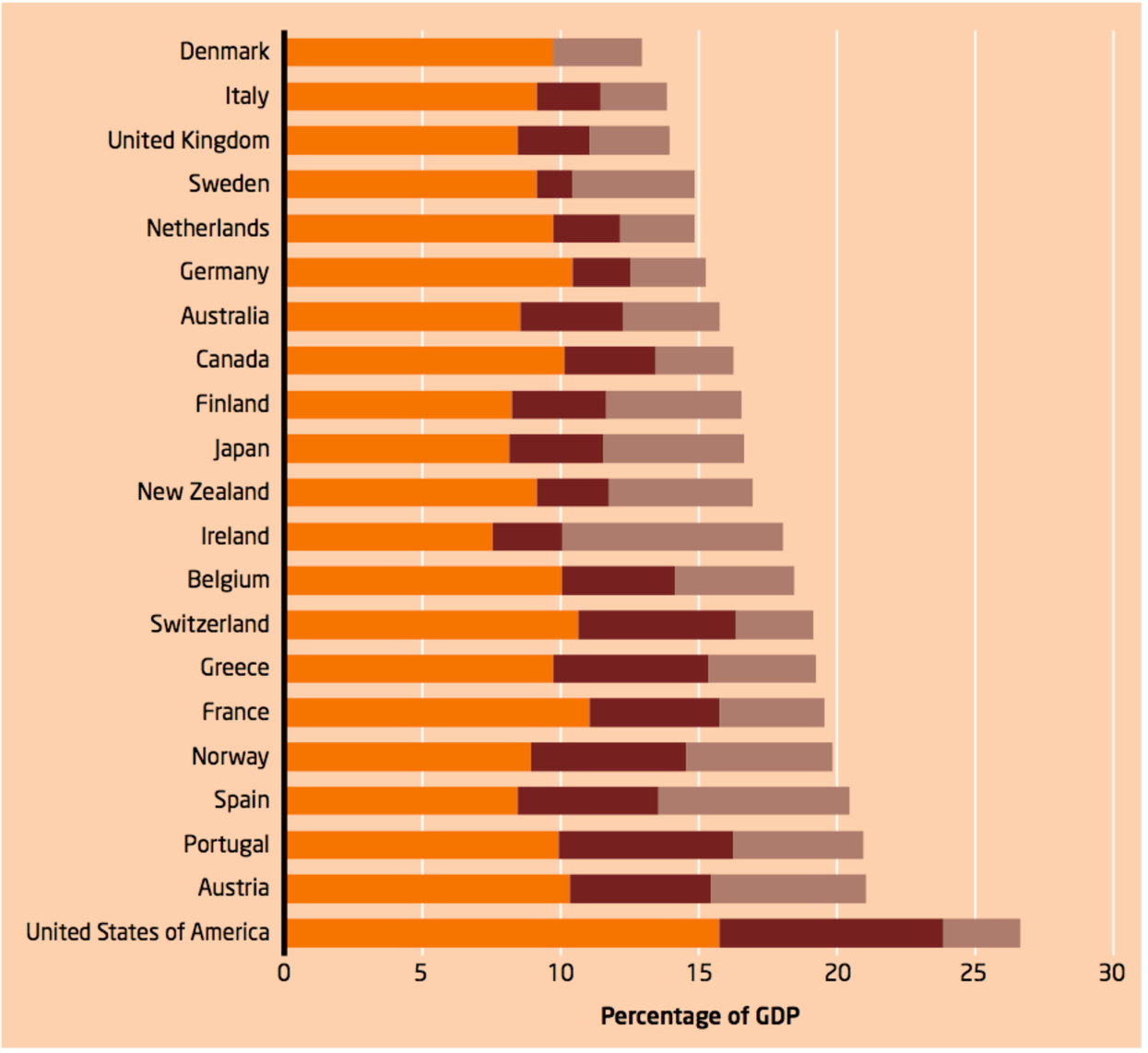
BMJ

Appleby, J
A Productivity Challenge too far?

BMJ 2012;344:e2416 doi: 10.1136/bmj.e2416 (Published 19 June 2012)

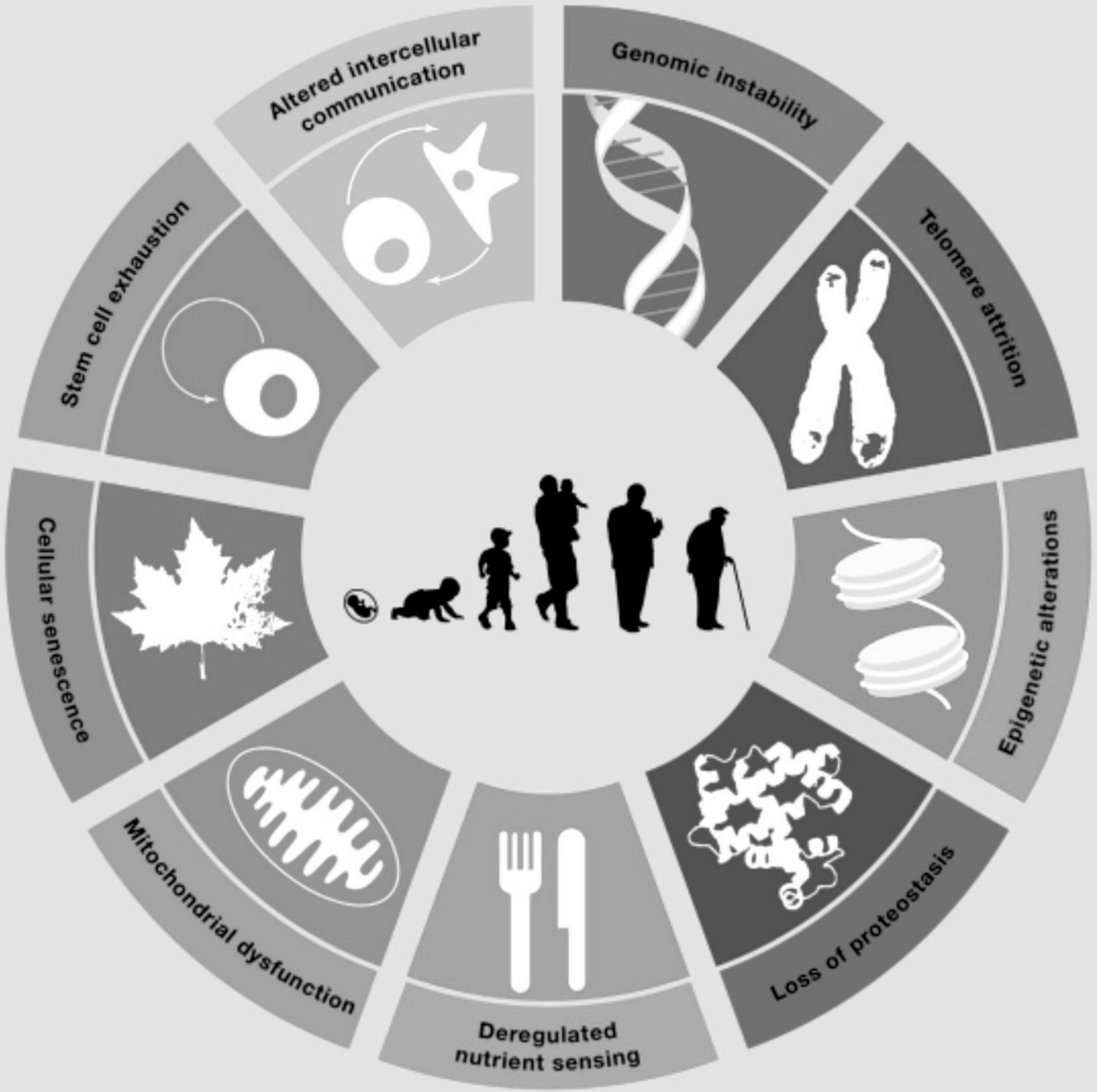
'UNDOABLE'

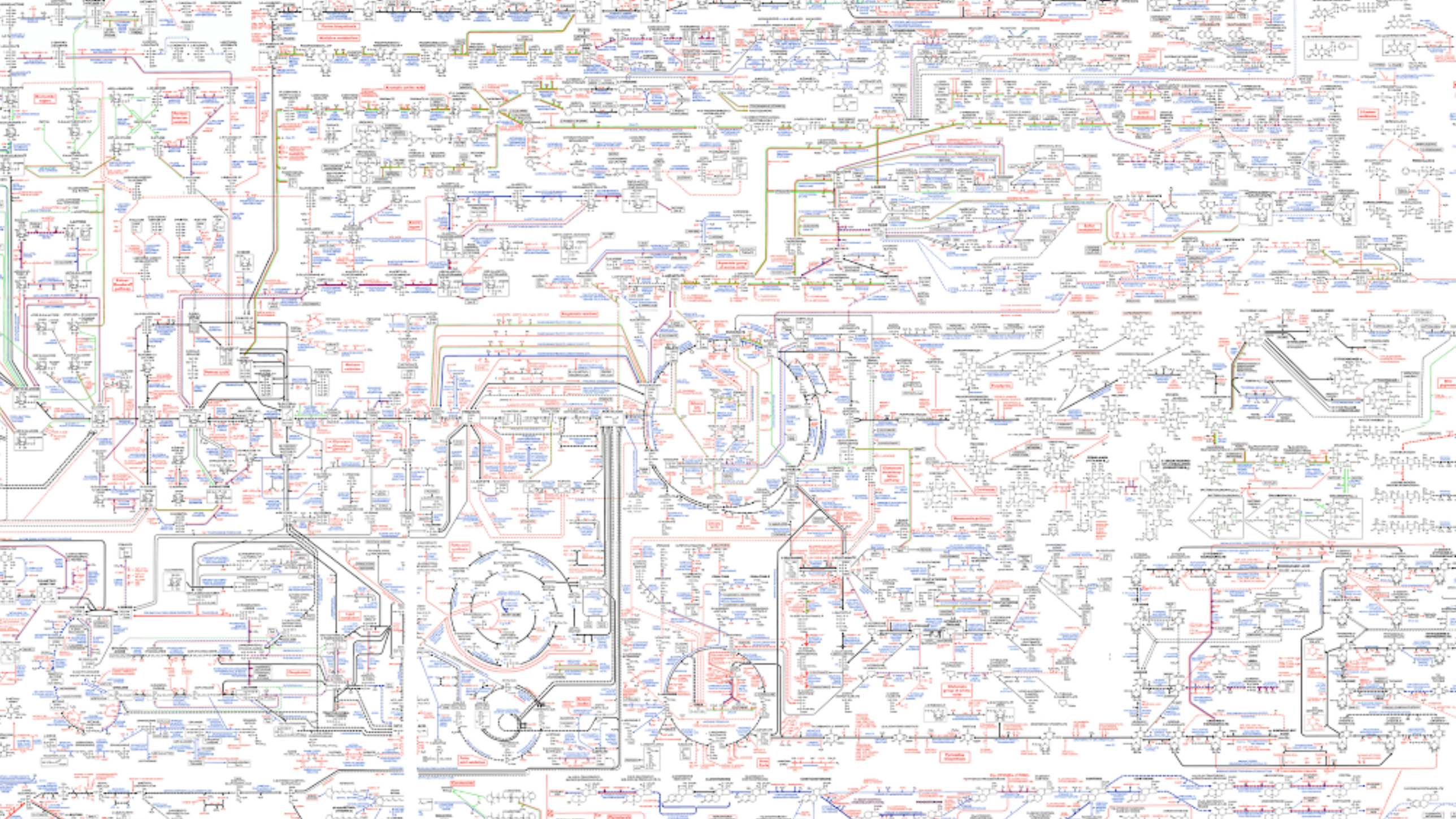
Figure 8 Projected potential growth in health care spending by 2040

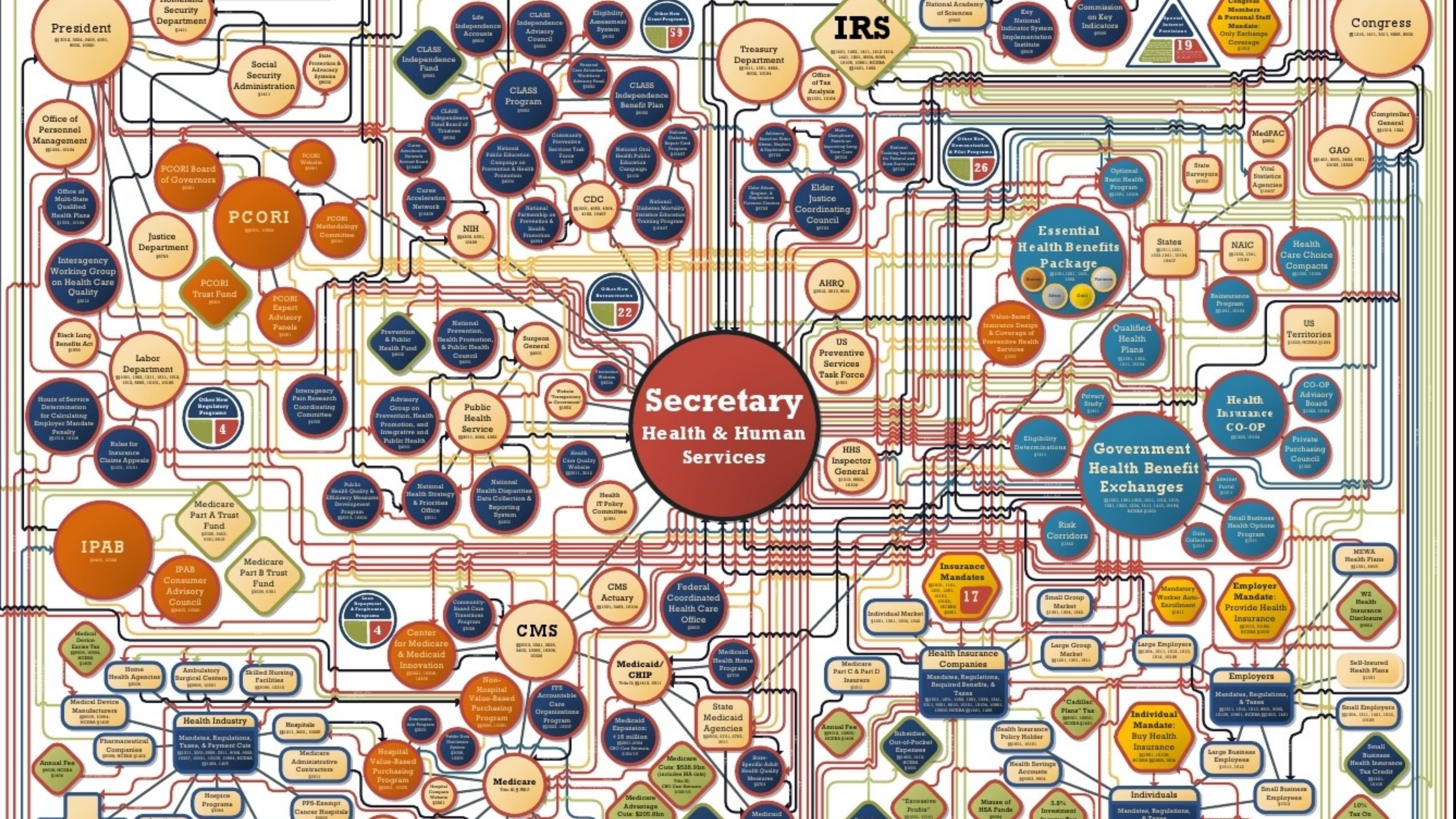


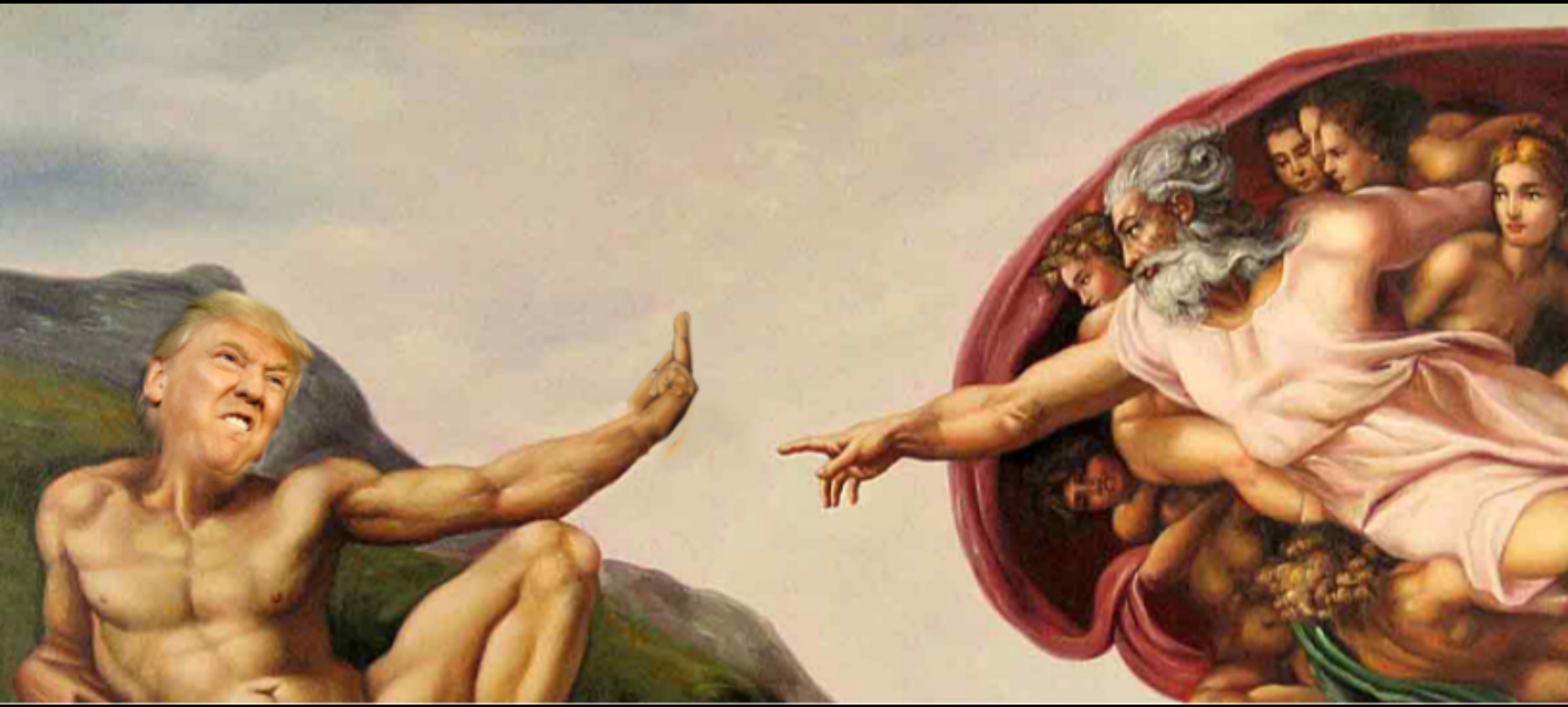
Source: Kibasi *et al* (2012)

WHAT CAUSES ALL THIS?


Genomic instability
Telomere attrition
Epigenetic alterations
Loss of proteostasis
Deregulated nutrient sensing
Mitochondrial dysfunction
Cellular senescence
Stem cell exhaustion
Altered intercellular communication




Secretary
Health & Human Services
President
Congress
IRS
Treasury Department
Office of Personnel Management
Social Security Administration
Homeland Security Department
State Protection & Advocacy Systems
Office of Tax Analysis
National Academy of Sciences
Key National Indicator System Implementation Institute
Commission on Key Indicators
Congress Members & Personal Staff Mandate: Only Exchange Coverage
Special Interest Provisions
19
Other New Grant Programs
59
CLASS Independence Fund
Life Independence Accounts
CLASS Independence Advisory Council
Eligibility Assessment System
CLASS Program
CLASS Independence Benefit Plan
CLASS Independence Fund Board of Trustees
Personal Care Attendant Workforce Advisory Panel
Other New Demonstration & Pilot Programs
26
Advisory Board on Elder Abuse, Neglect, & Exploitation
Multi-Disciplinary Panels on Improving Long-Term Care
National Training Institute for Federal and State Surveyors
Elder Abuse, Neglect, & Exploitation Forensic Centers
Elder Justice Coordinating Council
Optional Basic Health Program
State Surveyors
MedPAC
Vital Statistics Agencies
GAO
Comptroller General
PCORI Board of Governors
PCORI Website
PCORI
PCORI Methodology Committee
Office of Multi-State Qualified Health Plans
Justice Department
Interagency Working Group on Health Care Quality
PCORI Trust Fund
PCORI Expert Advisory Panels
Cures Acceleration Network
Cures Acceleration Network Review Board
NIH
National Public Education Campaign on Prevention & Health Promotion
Community Preventive Services Task Force
National Oral Health Public Education Campaign
CDC
National Partnership on Prevention & Health Promotion
National Diabetes Mortality Statistics Education Training Program
National Diabetes Report Card Program
Other New Bureaucracies
22
AHRQ
US Preventive Services Task Force
Essential Health Benefits Package
Bronze
Silver
Gold
Platinum
States
NAIC
Health Care Choice Compacts
Reinsurance Program
Value-Based Insurance Design & Coverage of Preventive Health Services
Qualified Health Plans
US Territories
Black Lung Benefits Act
Labor Department
Hours of Service Determination for Calculating Employer Mandate Penalty
Rules for Insurance Claims Appeals
Other New Regulatory Programs
4
Prevention & Public Health Fund
National Prevention, Health Promotion, & Public Health Council
Surgeon General
Prevention Website
Interagency Pain Research Coordinating Committee
Advisory Group on Prevention, Health Promotion, and Integrative and Public Health
Public Health Service
Website "Transparency in Government"
Health Care Quality Website
Privacy Study
Health Insurance CO-OP
CO-OP Advisory Board
Private Purchasing Council
Eligibility Determinations
Government Health Benefit Exchanges
HHS Inspector General
Public Health Quality & Efficiency Measures Development Program
National Health Strategy & Priorities Office
National Health Disparities Data Collection & Reporting System
Health IT Policy Committee
Internet Portal
Small Business Health Options Program
Data Collection
Risk Corridors
Medicare Part A Trust Fund
Medicare Part B Trust Fund
IPAB
IPAB Consumer Advisory Council
Insurance Mandates
17
Individual Market
Small Group Market
Mandatory Worker Auto-Enrollment
Employer Mandate: Provide Health Insurance
MEWA Health Plans
W2 Health Insurance Disclosure
Self-Insured Health Plans
Large Employers
Large Group Market
Medicare Part C & Part D Insurers
Health Insurance Companies
Mandates, Regulations, Required Benefits, & Taxes
Employers
Mandates, Regulations, & Taxes
Small Employers
Small Business Health Insurance Tax Credit
Large Business Employers
Small Business Employers
Individual Mandate: Buy Health Insurance
"Cadillac Plans" Tax
Health Insurance Policy Holder
Health Savings Accounts
Subsidies: Out-of-Pocket Expenses
Annual Fee
Individuals
Mandates, Regulations, & Taxes
Misuse of HSA Funds
3.8% Investment Income Tax
"Excessive Profits"
10% Tax On
Center for Medicare & Medicaid Innovation
CMS
CMS Actuary
Federal Coordinated Health Care Office
Community-Based Care Transitions Program
Non-Hospital Value-Based Purchasing Program
ITS Accountable Care Organizations Program
Medicaid/ CHIP
Medicaid Health Home Program
State Medicaid Agencies
Medicaid Expansion: +16 million
Medicare Cuts: $528.9bn (includes MA cuts)
State-Specific Adult Health Quality Measures
Medicare Advantage Cuts: $205.9bn
Medicaid
Medicare
Hospital Value-Based Purchasing Program
Medicare Administrative Contractors
PPS-Exempt Cancer Hospitals
Hospice Programs
Home Health Agencies
Ambulatory Surgical Centers
Skilled Nursing Facilities
Medical Device Excise Tax
Medical Device Manufacturers
Pharmaceutical Companies
Health Industry
Mandates, Regulations, Taxes, & Payment Cuts
Hospitals
Annual Fee
IPAB
Other New Repayment & Forgiveness Programs
4



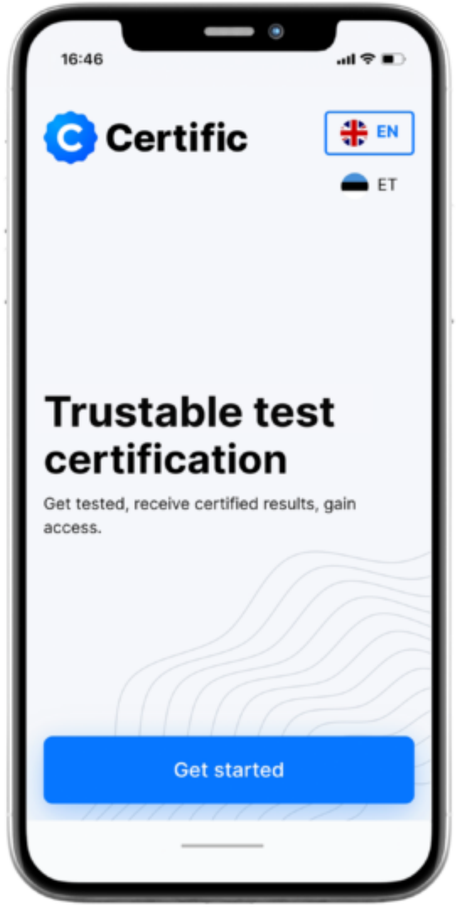

DON'T
PANIC

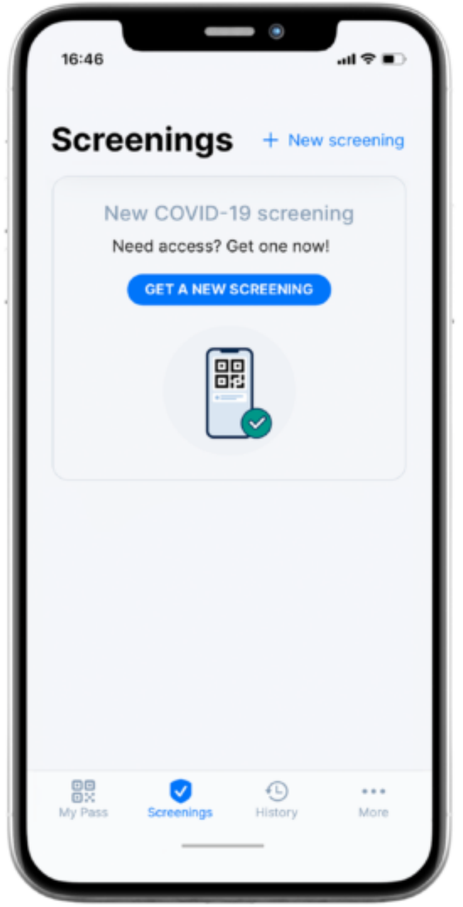
COVID

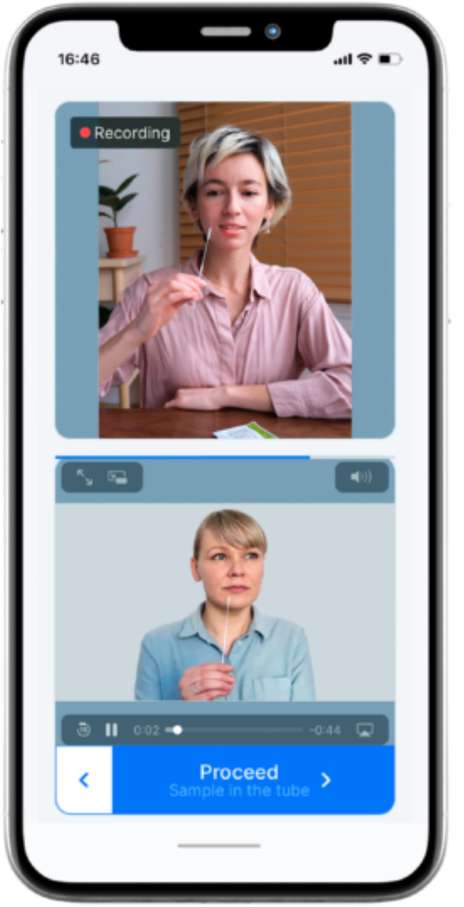
CHANGED

EVERYTHING


15TH BIRTHDAY
STANDON CALLING
22-25 JULY 2021
STANDON CALLING
15TH BIRTHDAY
STANDON CALLING
22-25 JULY 2021

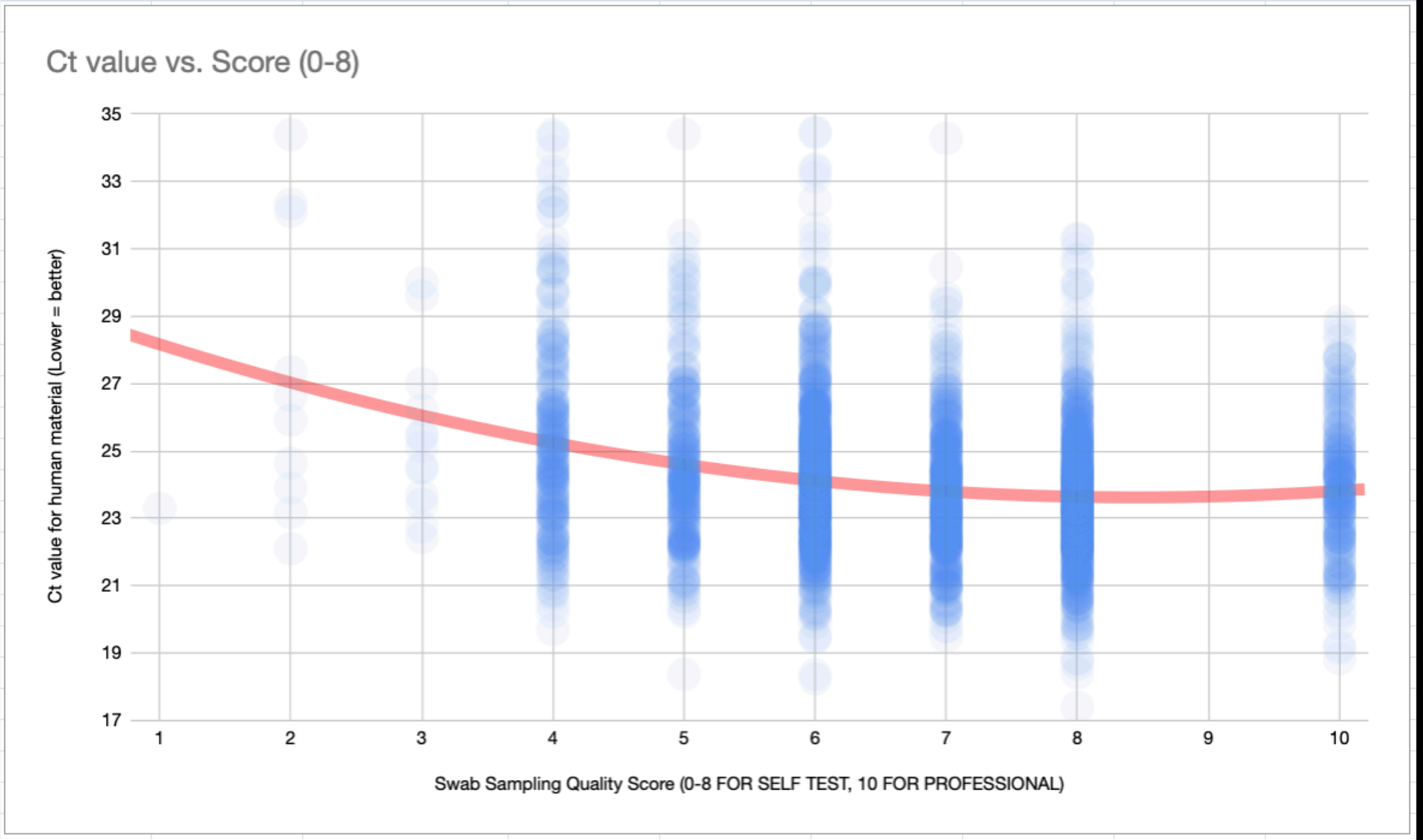

16:46
Certific
EN
ET
Trustable test certification
Get tested, receive certified results, gain access.
Get started


16:46
Screenings
+ New screening
New COVID-19 screening
Need access? Get one now!
GET A NEW SCREENING
My Pass
Screenings
History
More


16:46
Recording
0:02
-0:44
Proceed
Sample in the tube


16:46
Certific Pass
Jane Healthy
54c61e6a1f4ceeb19faf232c033367
My Pass
Screenings
History
More

SWAB SCORE	MEAN Ct Value	SD FROM MEAN	MEDIAN		Sample Size	5.00%		Z TEST
1	23.30	0.00	23.30		1			
2	27.26	4.27	26.28		10	2.64	***p***=	0.5
3	26.34	2.18	25.48		9	1.42	***p***=	0.1
4	25.29	2.83	24.92		279	0.33	***p***=	0.01
5	24.47	2.29	24.14		307	0.26	***p***=	0.0001
6	24.26	2.09	24.06		856	0.14	***p***=	0.000003
7	23.73	1.87	23.49		520	0.16	***p***=	0.000000001
8	23.55	1.83	23.38		861	0.12	***p***=	0.0000000001
Professional	23.94	1.90	23.85		250	0.24	***p***=	0.00000002



SELFCARE VS HEALTHCARE

Proceedings of Machine Learning Research 136:53–84, 2020

A Bayesian Hierarchical Network for Heterogeneous Data Sources in Medica

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Centre for Health and Human Performance

Editors: Emily Alsentzer, Matthew B. A. McDermott, Fabian
Subhrajit Roy, Stephanie L. Hyland

Abstract

The increasingly widespread use of affordable, yet often less reliable medical data and diagnostic tools poses a new challenge for the field of Computer-Aided Diagnosis: how can we combine multiple sources of information with varying levels of precision and uncertainty to provide an informative diagnosis estimate with confidence bounds? Motivated by a concrete application in lateral flow antibody testing, we devise a Stochastic Expectation-Maximization algorithm that allows the principled integration of heterogeneous and potentially unreliable data types. Our Bayesian formalism is essential in (a) flexibly combining these heterogeneous data sources and

Keywords:
Computer-Aide
able Healthcare

1. Introductio

Current medical
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(i) clinical history
exams, (ii) laborat
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contribute to the fi
agnosis (CAD), fo
main classes of me
Single modality

Commentary

Journal of the Royal Society of Medicine; 2021, Vol. 114(6)
DOI: 10.1177/0141076821

Safe management of full-capacity live/mass events in COVID-19 will require mathematical, epidemiological a economic modelling

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The importance of the live events industry to the UK economy is significant, with the creative industries[1] alone contributing £117bn to the UK economy in 2018.[1] However, the public health response to COVID-19 on various sectors of the UK economy led to an unprecedented fall in theatrical sales of 93%,[2] with the entertainment industry estimated to lose £110 m per month of full closure.[3] Several high-profile live music events have been cancelled.[4,5] There has been limited experience of the reopening of live events in other countries[6]; however, this has only been possible due to effective public health interventions to reduce community transmission to near zero levels. The sustainability of stringent border control measures to virus transmission is much debated; however, it is clear that the ability for the UK to achieve and then sustain low community transmission levels will require rigorously monitored borders and quarantine measures for inbound travellers. Widespread population immunity through vaccination (and from previous infection) will help the UK to reach low transmission levels; however, the success of the vaccine programme will largely depend on convergent evolution of the virus but this remains unknown. Additional measures to stringent social distancing, isolating at home and high uptake of the vaccination programme to achieve herd immunity to existing and emergent mutant strains of coronavirus will all be required to maintain low transmission levels in the UK. However, because of vaccine hesitancy

events due largely to enhanced exposure to aer
The economics of the live entertainment ind
requires operating to near 100% capacity to be
itable for the live event organisers. In reality,
operating at 60% capacity after reopening wil
to 6.8 m fewer event admissions, causing a redu
in £255 m in revenue over six months[3]; but even
optimistic since adherence to the strict 2-m
distancing rule would reduce capacity by more
half. Policy options will be required that balanc
risk to individuals and public health, while also
mitting the industry to reopen.

As first addressed by Melvin Benn in
LiveNation Full Capacity Plan,[7] there are cur
no policy prescriptions, systems, protocols or
tices in place to permit the return of live ente
ment at full capacity without putting people an
health system at risk by increasing the likeliho
super-spreading events. Certain self-care and
mitigation strategies such as including wearing
masks, handwashing, and social distancing and
downs are the only current non-pharmace
interventions available to reduce the basic repr
tion rate of the virus. Despite the early succes
the UK vaccination programme, increased u
and coverage alone will not guarantee elimin
of ongoing transmission or the emergence o
mutant strains. Even assuming herd imm
acquired through vaccination or infection is pos

A Predictive Modelling Framework for COVID-19 Transmission to Inform the Management of Mass Events

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Abstract

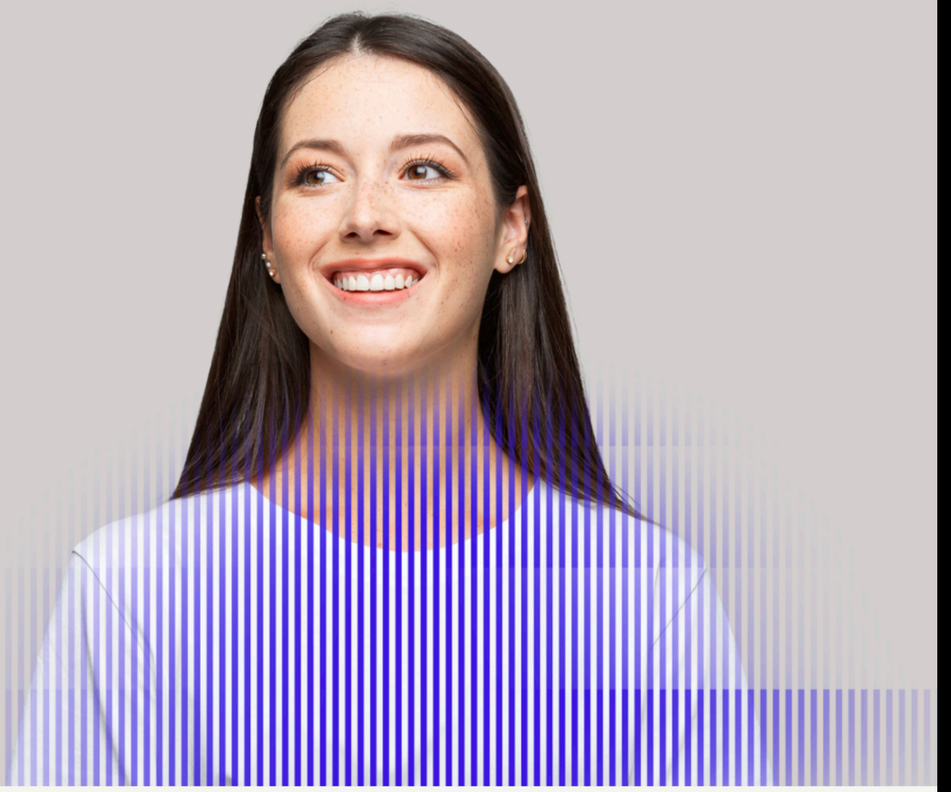
Modelling COVID-19 transmission at live events and public gatherings is essential to evaluate and control the probability of subsequent outbreaks. Model estimates can be used to inform event organizers about the possibility of super-spreading and the predicted efficacy of safety protocols, as well as to communicate to participants their personalised risk so that they may choose whether to attend. Yet, despite the fast-growing body of literature on COVID transmission dynamics, current risk models either neglect contextual information on vaccination rates or disease prevalence or do not attempt to quantitatively model transmission, thus limiting their potential to provide insightful estimates. This paper attempts to bridge this gap by providing informative risk metrics for live public events, along with a measure of their associated uncertainty. Starting with a thorough review of the literature and building upon existing models, our approach ties together three main components: (a) reliable modelling of the number of infectious cases at the time of the event, (b) evaluation of the efficiency of pre-event screening and risk mitigation protocols, and (c) modelling the transmission dynamics during the event. We demonstrate how uncertainty in the input parameters can be included in the model using Monte Carlo simulations. We discuss the underlying assumptions and limitations of our approach and implications for policy around live events management.

1. Introduction

Certific

We put power into the hands of patients

View more



100,000+ patients certified

Ease of testing
Remote certified testing at a clinical standard

Connected data
Connect to national and private healthcare databases

Faster diagnostics
Reduce the timeline for diagnosis and treatment

We aim to give professional powers to every possible patient, thus eliminating avoidable appointments and all preventable non-adherence / meds abuse.

>> Revolutionising the experience of diagnostics and care delivery for patients and relieving clinicians of all tasks patients can perform.

>> Meeting or exceeding medical laboratory standards at population scale with a new generation of remote POC Quality Management and Certification Technology.

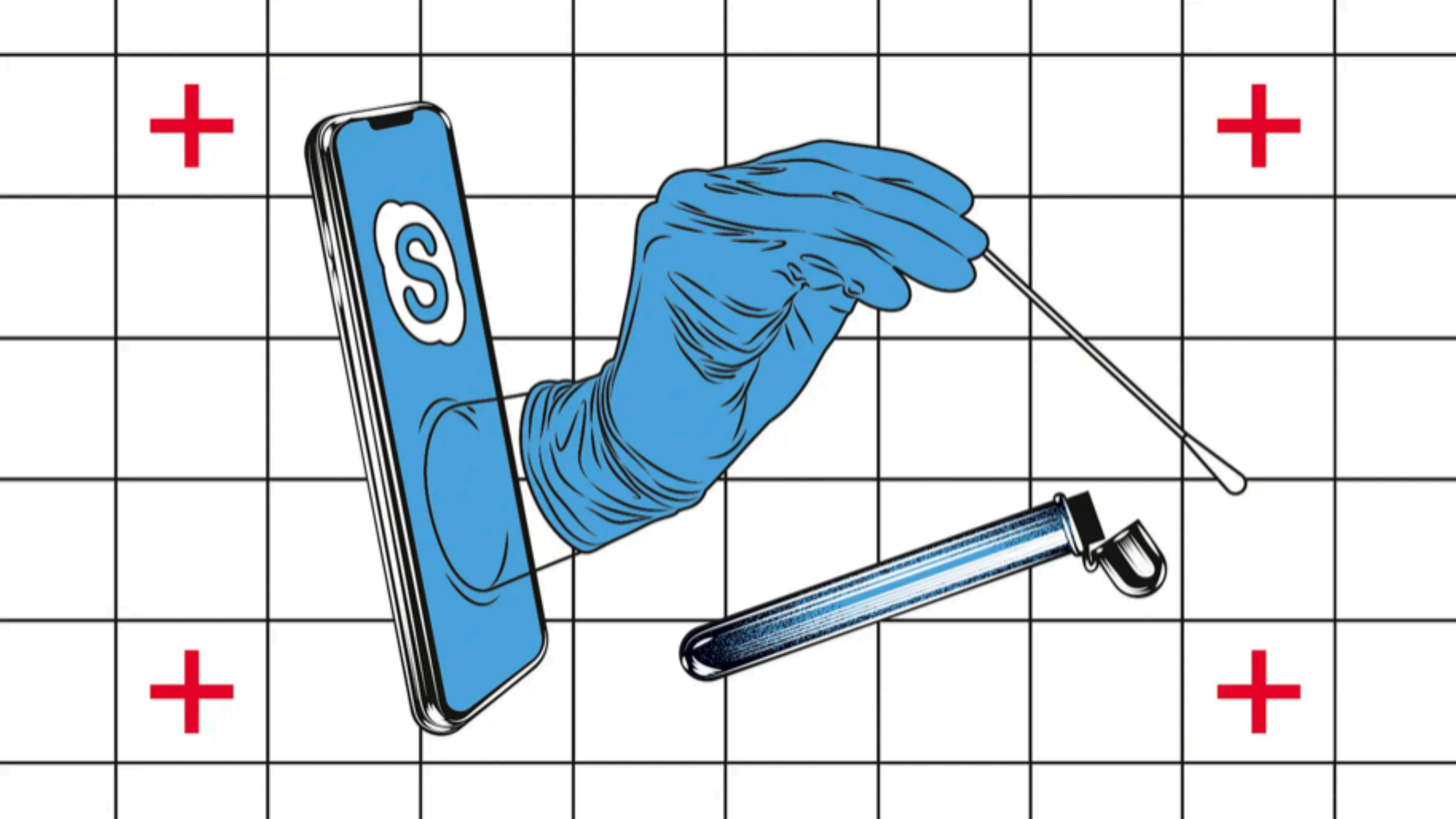
Transforming Healthcare through Self-Care.

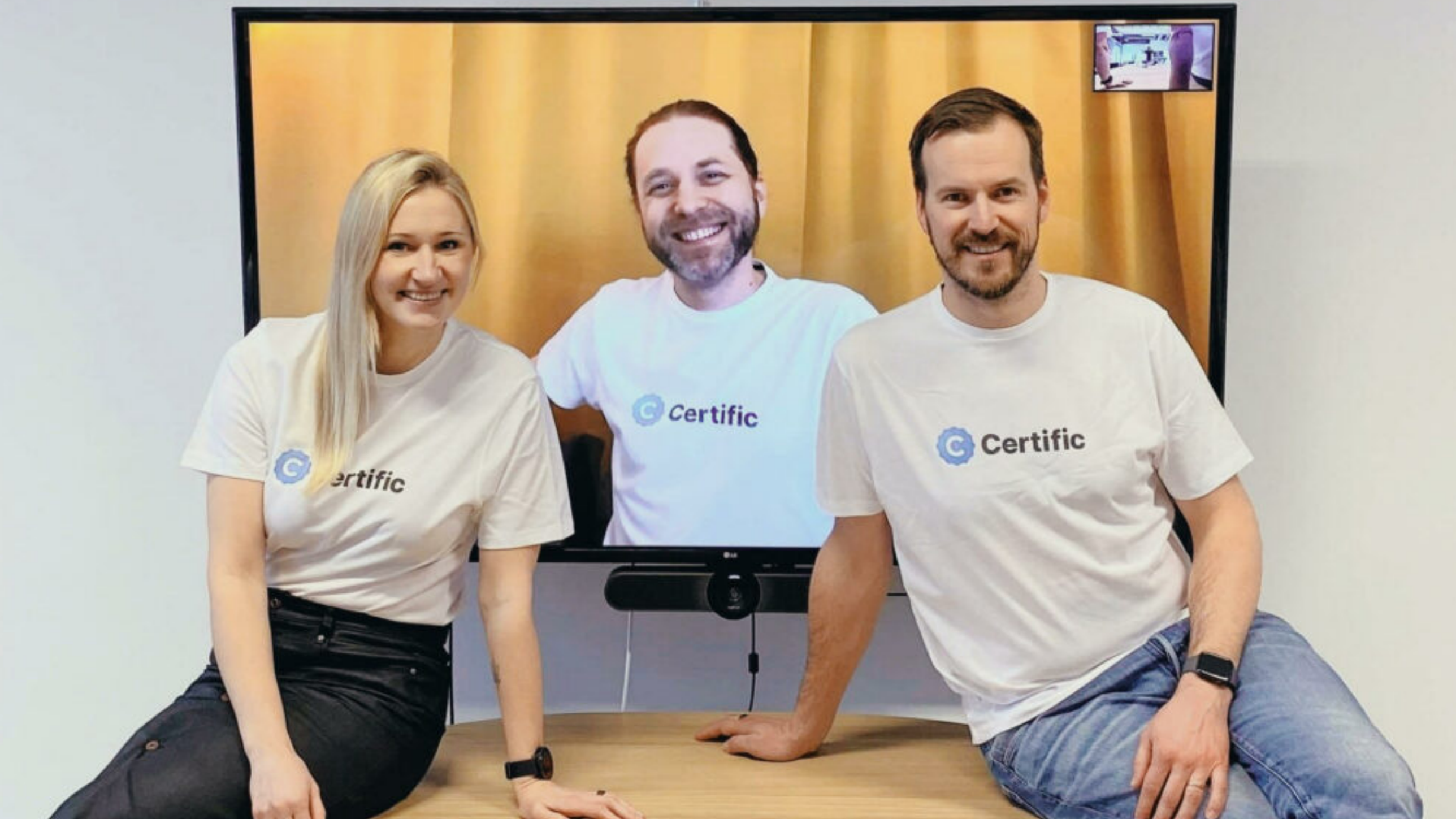
ELIMINATE ALL AVOIDABLE **APPOINTMENTS**

ELIMINATE ALL AVOIDABLE **NON-ADHERENCE**

ELIMINATE ALL AVOIDABLE **INACCESSIBILITY**

ELIMINATE ALL AVOIDABLE **DISENGAGEMENT**




Certific
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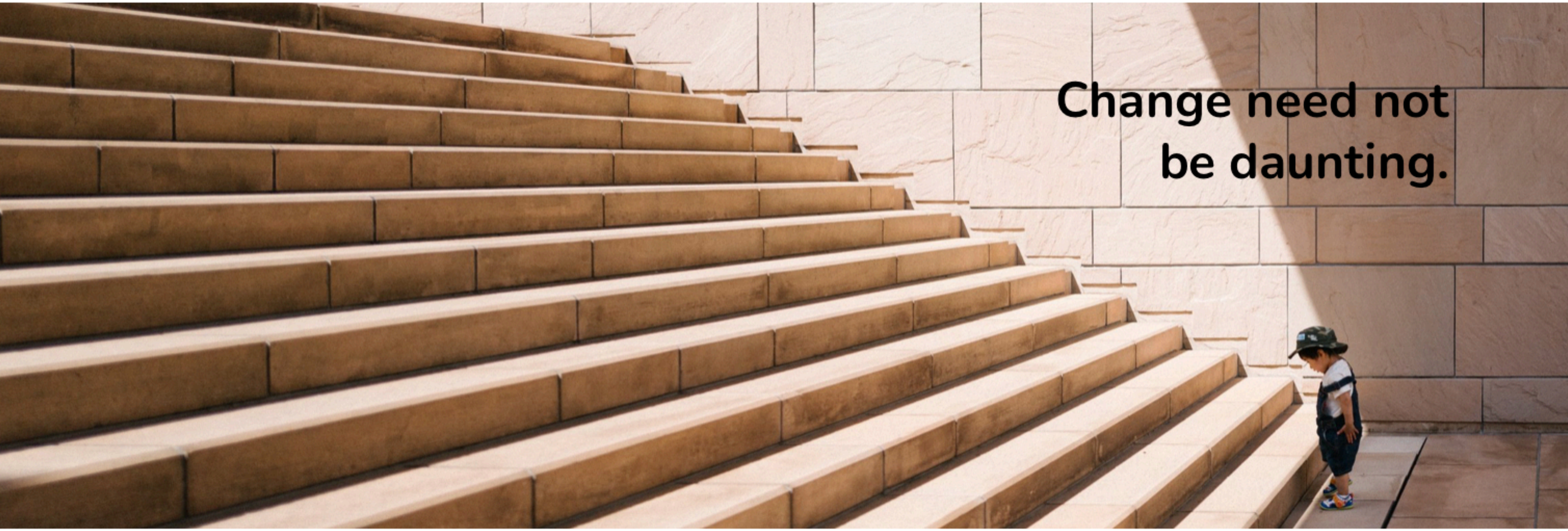
WELLFOUNDED

The WELLFOUNDED® Programme



Some of their specific **Problems**

wellFOUNDED

68% struggle with **sleep** and have disrupted circadian biology*[1]

Burn-out and **team disharmony** are two common reasons for failure*[2]

Higher likelihood of psychological disorders (e.g. **ADHD, bipolar disorder**)*[3]

80% are not getting enough **exercise** to maintain their health*[4]

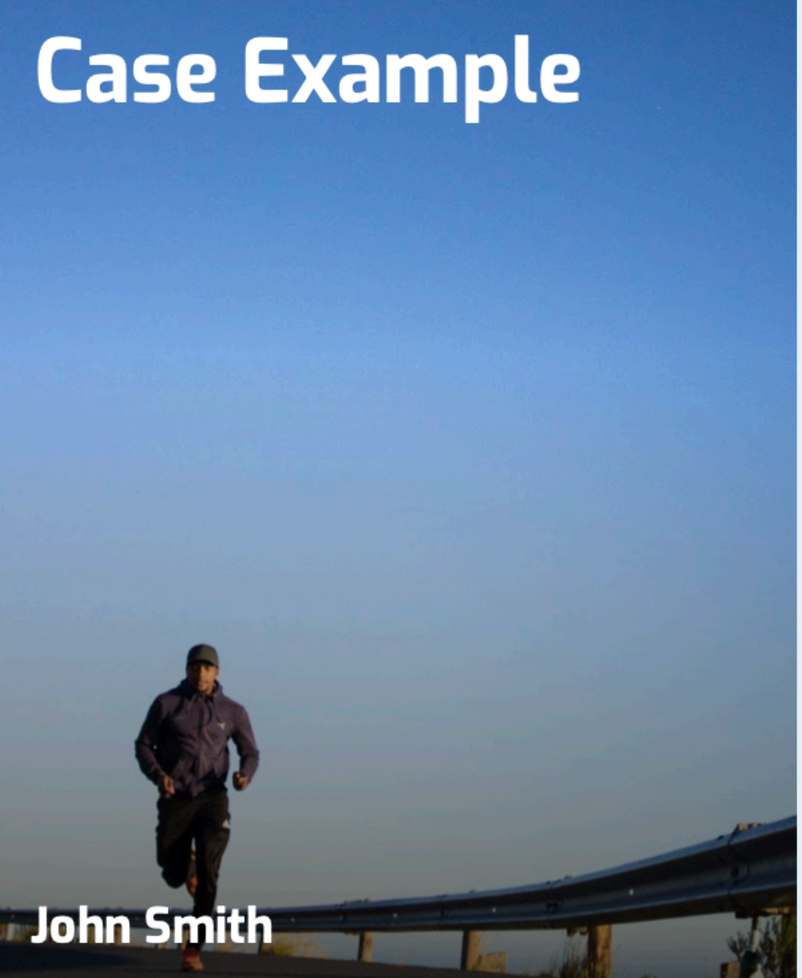
Body Mass Composition shows **high % fat** and **low % muscle mass***[4]

Unbalanced **nutrition** or poor eating behaviours causing cognitive and physical deficit*[4]

Source:

1) The Entrepreneur Pressure & Wellbeing Study for founders in the UK 2019 (wearesixty.org)
2) Top 12 Reasons Why Start-Ups Fail - CB Insights
3) The prevalence and co-occurrence of psychiatric conditions among entrepreneurs and their families
4) Internal data from 15+ years of experience

Case Example



John Smith

Age: 35

Weight: 87 kg

Height: 180 cm

Profession: CPO & Founder of fintech start-up

Before

BMI: 27

Body fat: 25%

Muscle mass: 68% (low)

VO2Max: <85% predicted

Bloodwork: Vitamin D < 20 nmol/L, moderate hyperlipidemia

Sleep score: 70

HRV: 51 (low)

Nutrition: excess sugar, low protein, problems with bloating

Psyche: risk of burn-out

Leadership: co-founder conflicts

After

BMI: 24

Body fat: 17%

Muscle mass: 75% (normal)

VO2Max: >100% predicted

Bloodwork: Vitamin D = 55 nmol/L, no hyperlipidemia

Sleep score: 85

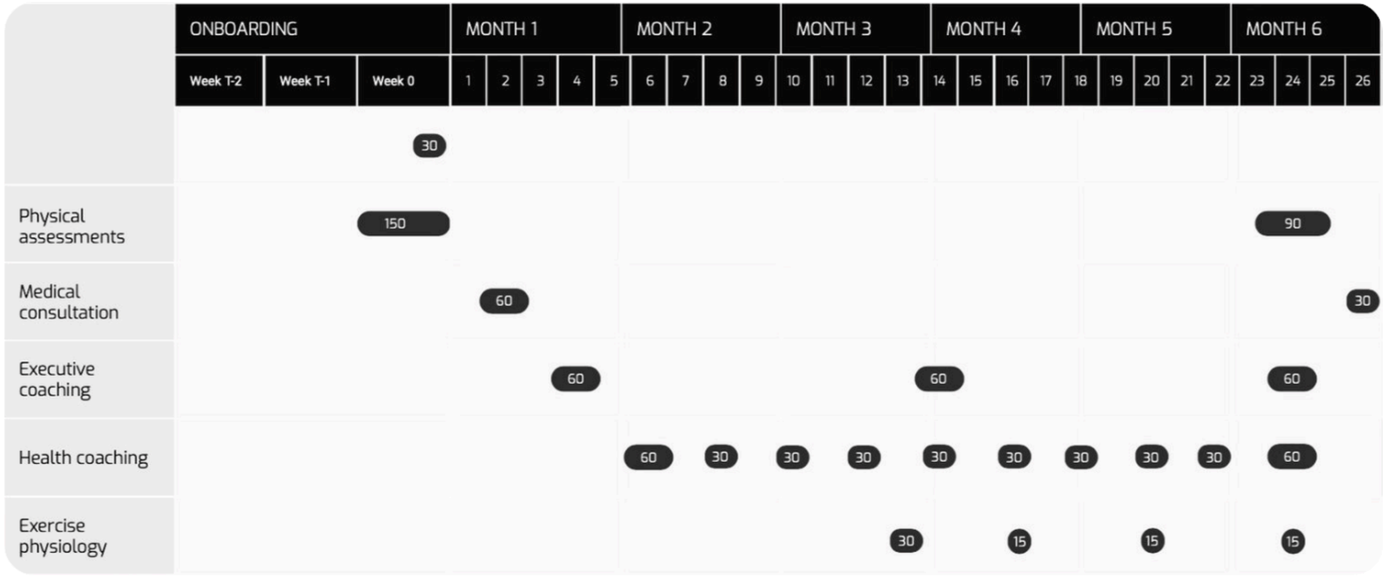
HRV: 65 (normal)

Nutrition: balanced, no bloating

Psyche: implemented wellbeing practices into lifestyle

Leadership: overcame conflicts through coaching

Methodology v1.1: Schedule



Some of the cool tech we use, and you get.

We use a continuously evolving set of biosensors and technologies that you get in the programme and get to keep as a programme Alum in our ongoing WellFounded membership. In our research, we track, test and study almost every promising wearable and remote medicine device being developed. The future of medicine and human performance science will be delivered ‘virtually anywhere’. WellFounded was built as an example of a future health service combining technology with the best minds.

“But I already have this device!”

Don’t panic! We have a simple policy of taking this off the price of the programme or crediting you for future services.

- OURA for Sleep
- CGM & ZOE for Metabolism
- First Beat & Withings Scan for Physiology
- WellFounded App for Comms & Records
- A little sprinkling of AI for Speed

INSPIRE 22/23: SOUTH POLE RESEARCH EXPEDITION

The World's Most Remote Clinical Trial.

INSPIRE 22
INTERDISCIPLINARY SOUTH POLE INNOVATION & RESEARCH EXPEDITION

INSPIRE - Interdisciplinary South Pole Innovation and Research Expedition: A Groundbreaking study of human health, diet and metabolism, wearable tech, and to discover the extraordinary goals women and men can **equally** achieve, in the first ever clinical trial to be undertaken on all 7 continents at the same time.

Professor Chris Imray Major Natalie Taylor Dr Jack Kreindler Dr Ryan Jackson

INSPIRE22 example user journey:

See a post on social	• This could be a participant profile or one of the campaign posts
Visit website	• Find out more about INSPIRE22 and sign up to take part from home
Create profile	• Users will be encouraged (but not obligated!) to share their height, weight, biological sex and whether they eat a plant- or animal-based diet to create their own profile
Weekly challenges	• Physical challenges that mirror those of the expedition team will be shared via the website and social media. People can prove they took part by sharing a picture, video or data from their phone or other tracking tech
Win tech!	• The more you participate, the greater your chance of winning a piece of wearable tech at the end of the study donated by our sponsors. Winners will be announced on the website and social media
Support science	• Results from the expedition (primary clinical trial) and the self-reported data from people at home (secondary study) is published

Single-minded proposition:

Health tech allows us to take on the very greatest of challenges

Call to action:

Join the World's most remote clinical trial from home

Our audience:

People who are interested in extreme/endurance sports, technology, science and/or gender equality

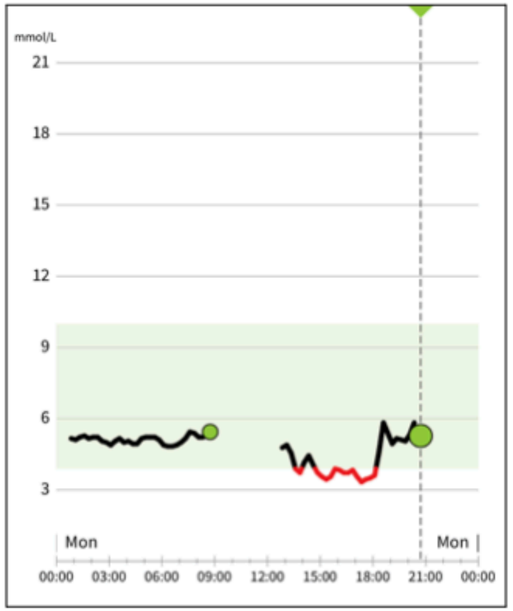
WHY NOW?

This is an exciting moment in history. Technology and healthcare are intersecting in previously unimaginable ways. People are prioritizing their health and embracing technology to help them do so.

Author	Dr Jack Kreindler
Created	Jan 31, 2023
Version	1.0
Version date	Jan 31, 2023

Case

This case reflection pertains to a patient who was on our INSPIRE South Pole Last Degree expedition Jan 2023. It is therefore a quite recent case but a very interesting one with some interesting implications for my practice in extreme environments and mountain medicine, but also to patients closer to home. The background of this expedition can be found on inspire22.co.uk. The expedition consisted of two groups, Coast to Pole c.50 days and Last Degree 10 days. One of the participants in the 10 skiing the Last Degree was in his mid 20's and of elite level fitness. Each of the participants volunteered to measure their glucose by continuous subdermal glucometry in this case the Abbott Freestyle Libre where part of the future study intent is to qualitatively evaluate the effectiveness and usability of this wearable device in extreme environments translating to what that means to people in normal domestic conditions who do not have the capability to use technology with as much ease as fit, young and technologically native individuals. The subject presented as a clinical case by way of absence from the team meal tent on evening 4 of the expedition. The subject was uncustomarily lethargic and without appetite describing himself as cold and the most exhausted he has ever been in their life. They appeared to be not swift to answer questions, incoherent and dyspraxic with a differential diagnosis of Acute Mountain Sickness / Cerebral Oedema. There is no route 'down' from the effective 3,300m altitude and definitive care can be up to 2 weeks away. Fortunately the subject was wearing the CGM and through clothing including a down jacket. The CGM data revealed is pictured here from a later screen shot.



Participant_id	Date_of_Test_measurement	Age_at_measurement	Sex_at_brith	Percieved_effort_averages	Day_7_Ice-Q_(isolated_confined,_extreme_environment_questionnaire)	5. Group members are supportive of one another.	17. Group members encourage each other in reaching their goals.	1. Group members can understand what others in the group are going through.	9. Group activities are easy to follow.	13. Group members learn new ways of solving problems.	15. I feel physically fit.	7. I feel physically relaxed.	4. I would like more interesting things to do.	12. Sometimes, I feel bored.	18. I am overtired.	10. I am asked to do too much at work.	19. There is too much repetition in my activities.	3. I did not get enough sleep.	11. I am dead tired after work.	2. My job requires working very fast.	14. My job requires long periods of in	16. I feel that I am doing the	8. Many things I h	6. My g
	mmm/dd/yyyy	years	M/F		1(never)-6(always)	social	social	social	social	social	physical	physical	emotional	emotional	physical	occupational	emotional	physical	physical	occupational	occupational	emotional	emotional	occupational
NRS	2 Jan 2023	25.0	Male	4.9		6	6	6	5	4	6	3	2	3	3	3	2	1	4	3	6	5	5	5
JD	2 Jan 2023	33.2	Female	3.0		6	6	5	6	5	6	4	3	1	2	5	3	5	4	6	5	2	2	6
JB	2 Jan 2023	33.2	Male	4.6		6	5	4	5	4	5	5	2	4	4	5	3	4	5	4	5	4	5	3
IC	2 Jan 2023	36.3	Male	3.6		4	5	3	5	4	5	2	2	2	5	3	3	5	5	3	4	6	6	5
TH	2 Jan 2023	41.6	Male	3.4		6	5	6	5	4	5	6	4	2	2	2	4	2	2	3	4	4	5	4
RJ	2 Jan 2023	43.9	Male	3.6		6	5	5	4	5	5	5	5	5	3	5	3	3	3	5	5	4	5	6
AO	2 Jan 2023	44.5	Male	5.9		5	5	5	5	5	4	4	1	2	3	3	4	4	3	4	4	5	5	4
JK	2 Jan 2023	48.4	Male	4.8		6	6	5	4	6	5	2	1	2	4	3	4	6	5	6	4	4	5	6
FG	2 Jan 2023	48.4	Male	4.9		6	6	6	6	6	6	1	1	2	4	2	2	5	5	2	2	6	4	6
KR	2 Jan 2023	59.2	Male	4.1		6	5	5	5	6	6	4	5	5	2	2	5	2	3	6	4	6	5	5

14. Inspired	16. Determined	1. Interested	19. Active	3. Excited	9. Enthusiastic	10. Proud	12. Alert	5. Strong	17. Attentive	8. Hostile	13. Ashamed	6. Guilty	4. Upset	18. Jittery	11. Irritable	7. Scared	20. Afraid	2. Distressed	15. Nervous	Positive_Affect_Sc	Negative_Affect_Sc
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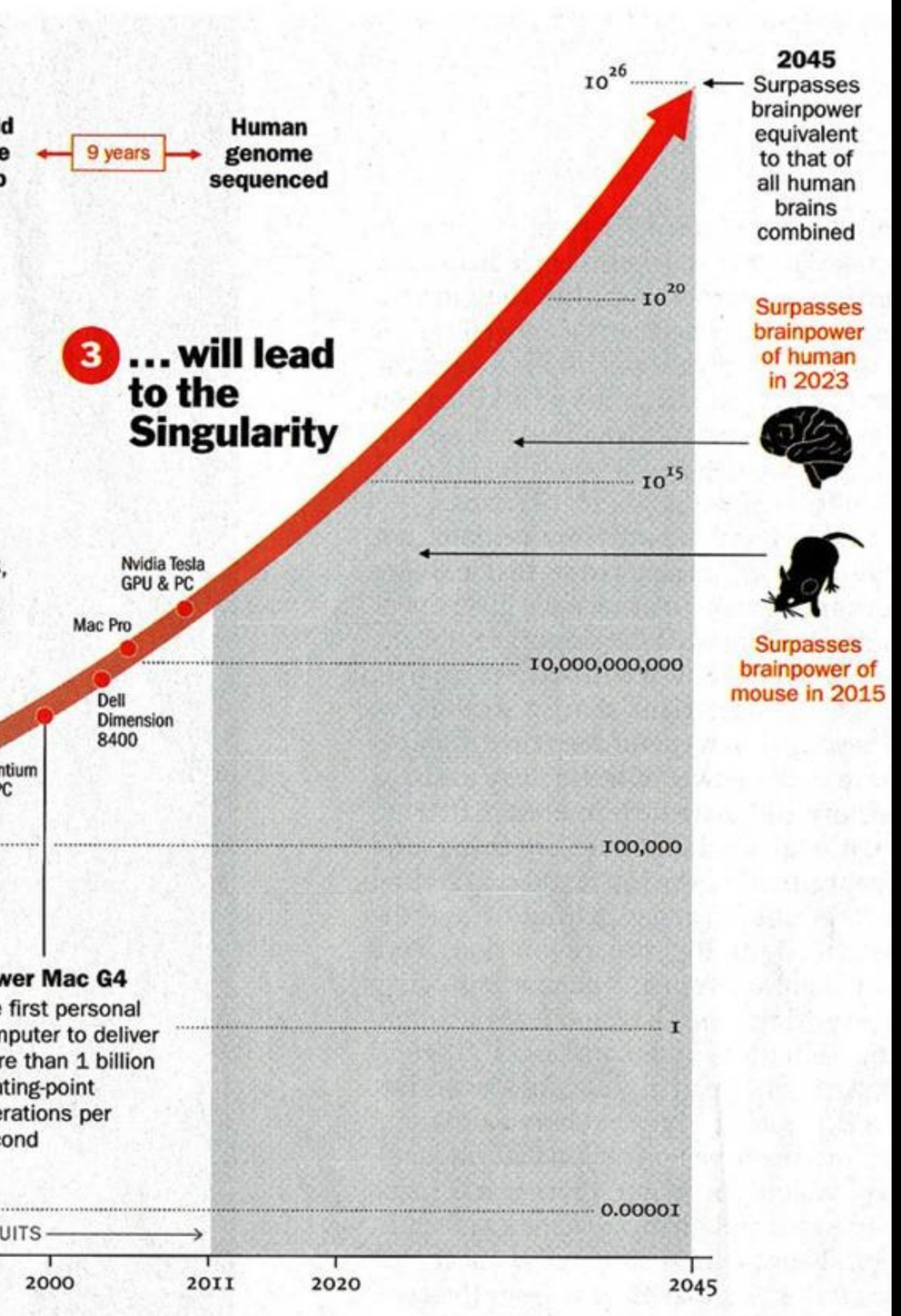
5	5	5	5	4	4	4	4	4	4	1	1	1	1	1	1	1	1	2	2	44	12
5	5	5	5	5	4	5	5	4	4	1	1	2	1	1	1	1	2	1	3	47	14

TECHNOLOGY

CREATIVITY

HUMANITY



"Do not underestimate the power Exponential Technology."

“Do not underestimate the power
Exponential Technology.”

“Do not underestimate the power
of us Human Beings.”

“Do not underestimate the power
Exponential Technology.”

“Do not underestimate the power
of us Human Beings.”

“Do not underestimate the power
of the Dark Side.”

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