



Disruption på vej i sundhedsvæsenet

Thomas Riisgaard Hansen
kiteinvent.com



Slide fra præsentation

Her er en version af de slides, der blev præsenteret mandag d. 8. maj 2017 på DTU.

Jeg håber præsentationen var inspirerende og du er meget velkommen til at skrive hvis der er specielle områder du er interesseret i eller med generel tilbagemelding på præsentationen.

Jeg er også meget interesseret i at høre hvis du kender til spændende projekter eller selv er i gang med spændende projekter, der kan forandre vores sundhedsvæsen.

Du kan fange mig på mailen: thomas@kiteinvent.com

På LinkedIn poster jeg interessante trends, så der kan du også enten connecte eller følge mig: www.linkedin.com/thomasr/

På Twitter deler jeg links som jeg finder interessante indenfor trends i sundhed @thomasrdk

God fornøjelse,

Thomas Riisgaard Hansen



Baggrund

Thomas Riisgaard Hansen

Arbejdet snart 15 år med innovation, teknologi og sundhed
Co-founder af Cetrea



Kite Invent Aps

Innovationsfirma, der arbejder med strategisk innovation og entrepreneurship. Hjælper nystartede firmaer, eksisterende sundhedsaktører og det offentlige indenfor sundhed og teknologi



Baggrund for præsentationen

Exponential Medicine 2015 & 2016, HIMSS 2016 + dybdegående research
Hvilke værktøjer, ideer og frontline forskning kan vi lade os inspirere af fra Silicon Valley/USA og anvende i Danmark?



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De fire disruptive trends



Fra sygdom til sundhed



Mod præcisionsbehandling



Menneske 2.0



Sundhed til alle

Disruption

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Disruption og innovation



Investering i healthcare disruption

Alphabet's Verily, Sanofi to Invest \$500 Million in Diabetes

By James Paton
12, september 2016 07:00 CEST Updated on 12, september 2016 09:55 CEST

JUN 14, 2015 @ 09:29 AM 1,318,3 VIEWS

Why Apple Is The Most Important Health Company In The World

Bill Gates' foundation to invest \$5 billion in Africa over five years

By Allen Cone | Updated July 18, 2016 at 11:40 a.m. [Share](#)

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IBM Is Counting on Its Bet on Watson, and Paying Big Money for It

By STEVE LIEBREICH OCT 20, 2016

Microsoft announces new AI-powered health care initiatives targeting cancer

by James Vincent | @jvhoover | Sep 29, 2016, 7:03am EDT

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Human Longevity, Inc. Completes \$220 Million Series B Financing

(SAN DIEGO, CA)—April 4, 2016—Human Longevity, Inc. (HLI), the genomics-based, technology-driven company, announced today that the company has completed an offering of Series B Preferred Stock, raising in excess of \$220 million. HLI previously raised \$80 million in its Series A offering which closed in Summer 2014.

With 11 drugs in pipeline, Moderna wants to raise \$600m



Top 10 Trending Article

Most Viewed Most Commented

Two-month-old Methuen child exposed to fentanyl

Doctors curb opioids, but more

Chan Zuckerberg Initiative announces \$3 billion investment to cure disease

By CHAN ZUCKERBERG AND PRISCILLA CHAN

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The Daily Crunch

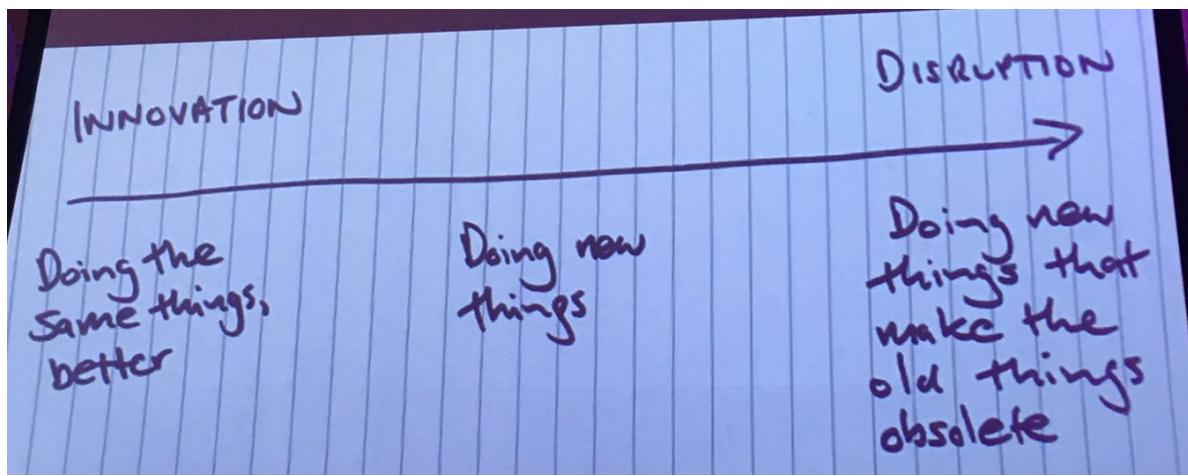
Get the latest news from TechCrunch straight to your inbox.

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12:01:16 | 5:13 PM Illumina spinout Grail is seeking to raise \$1.7 billion for large-scale clinical trial: sources

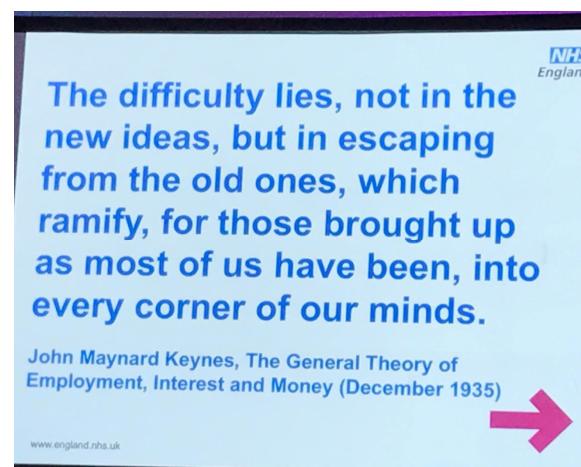
Grail, a spinout company of the DNA-sequencing giant Illumina, has a very bold mission: to develop a blood-based screening test for cancer.

Disruption – mange definitioner



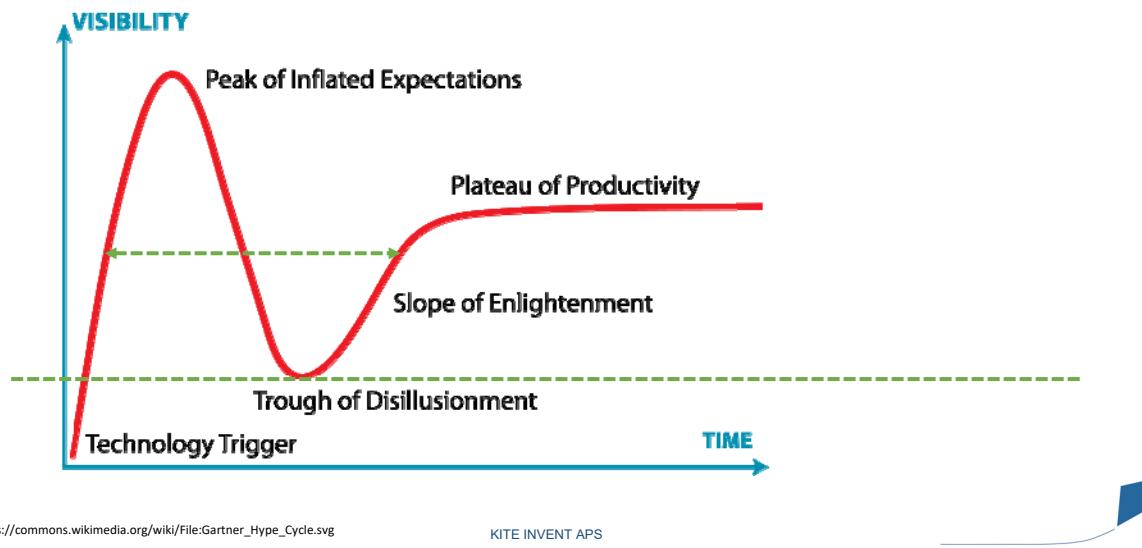
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Udfordringer med disruptive ideer



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Gartner's hype cycle

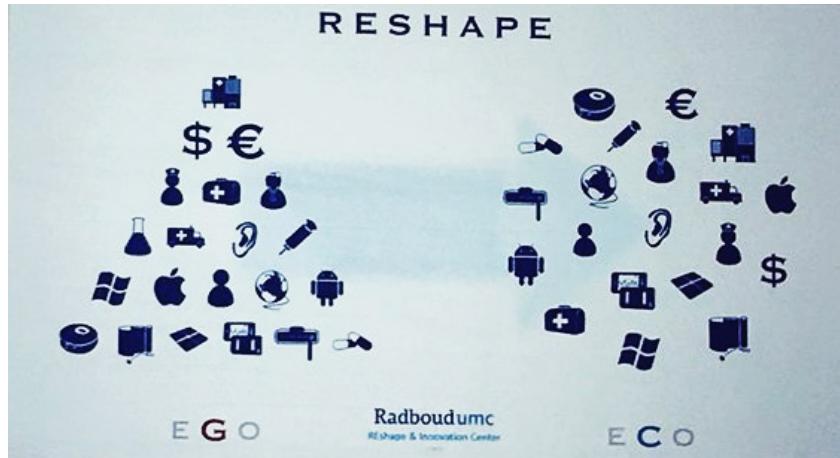


Fra sygdom til sundhed I

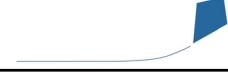
**Sundhedsteknologi
flytter ud
af hospitalerne**



Fra Ego til Eco: Lucian Engelen



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Apps og selvmonitorering: Apple Health – til patienten



Activity

The Health app makes you motivated by showing you how much you move. It combines activity data from iPhone — like your steps and distance travelled — with metrics from third-party fitness apps. And Apple Watch automatically records simple but meaningful kinds of movement. All that, when you stand, how much you exercise, and your all-day calorie burn.

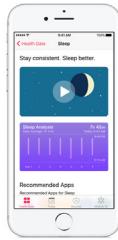
[Watch the Activity film](#)



Mindfulness

Finding a moment to take a few deep breaths and quiet your mind is a great way to relieve stress, or improve your overall health. That's what mindfulness is all about. Many apps on the iPhone, as well as Apple Watch, let you do just that. They help you focus and stay centered throughout the day. Whatever apps you choose, Health adds up the numbers to show you how much time you've spent being mindful.

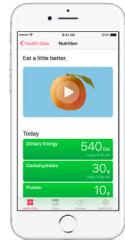
[Watch the Mindfulness film](#)



Sleep

Getting a good night's sleep helps restore and repair your body. So going to bed at the same time every night and getting the right amount of rest can improve how you feel. The new Bedtime tab in the Clock app helps you get the most out of your sleep. It tracks your sleep patterns, wakes you gently, and also lets you visualize your sleep patterns. It then feeds the information into Health — along with data from your third-party sleep apps — so you can get into a healthier sleep routine.

[Watch the Sleep film](#)



Nutrition

whether you're counting carbs, calories, caffeine, or a host of other important nutritional metrics, the Health app makes it easier to manage your goals and watch exactly what you eat. Third-party apps can help you keep a closer eye on what you eat, and since all the data is displayed in Health, you'll always know if you're getting the nourishment you need.

[Watch the Nutrition film](#)

Track other important data, too.

Health makes it easy to keep tabs on a wide array of data that matters to you — from measurements of your blood pressure and blood glucose to records for your weight and reproductive health.



Body Measurements



Reproductive Health



Results



Vitals

Apple acquired Glimpse, a personal health data startup

Posted June 20, 2014 by Jordan Crook | [appleinsider.com](#)

Why Apple Is The Most Important Health Company In The World

 **Unity Stokes, CONTRIBUTOR**
Lower global health innovation and the reimagining of healthcare. [FULL BIO ▾](#)



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Social Media og mental sundhed



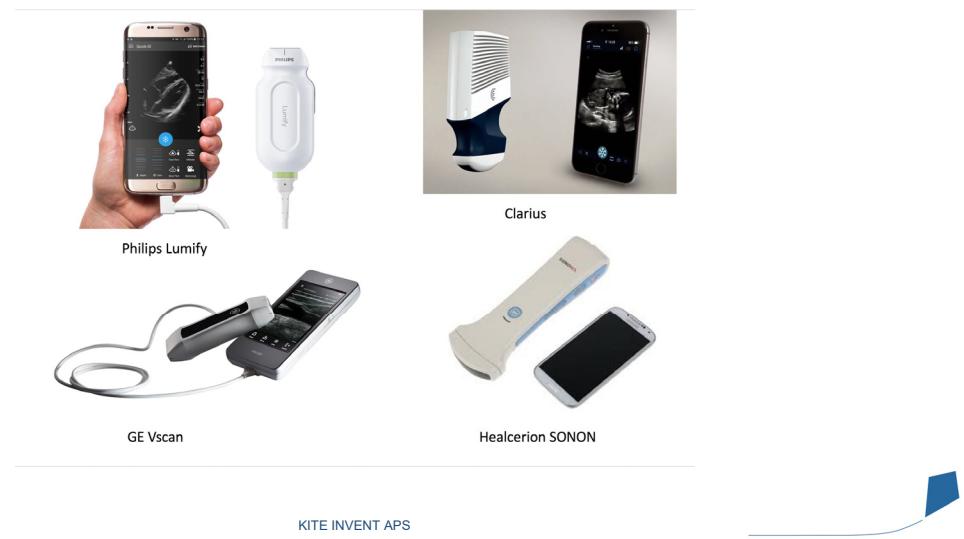
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Telemedicin: FDA godkendt måleudstyr

<h2>Start measuring your stats in real time</h2> <p>Our range of connected health devices automatically sync to the free Philips HealthSuite Health App on your smartphone, so you can monitor your data over time and see how you're progressing towards your goals.</p>	
	
Health watch Gain insight into your overall condition through tracking your heart rate and heart rate zones.	Wrist blood pressure monitor Instantly check your readings against World Health Organization classifications.
	
Upper arm blood pressure monitor Instantly check your readings against World Health Organization classifications.	Body analysis scale Track your weight, body mass index and body fat percentage.
	
Ear thermometer Accurate in-ear temperature measurement in just two seconds.	

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Nye light-weight dianostikapparater



Sædkvalitetsanalyse på mobilen



Qualcomm Tricorder XPRIZE

Krævede diagnoser(10): Blodmangel, Atrieflimre, KOL, Diabetes, Leucytosis, lungebetændelse, akut mellemørebetændelse, søvnnapnø, Urinvejsinfektion, Absence of condition

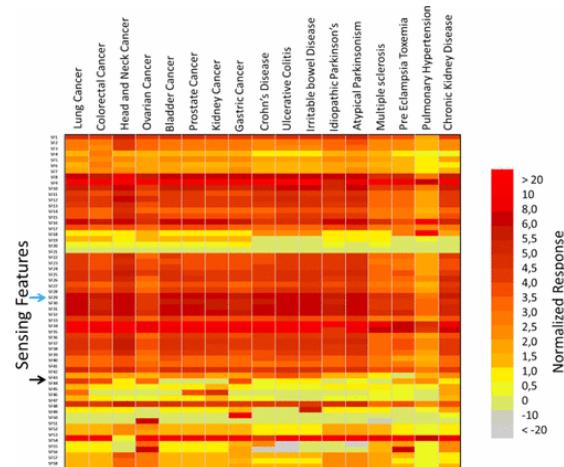
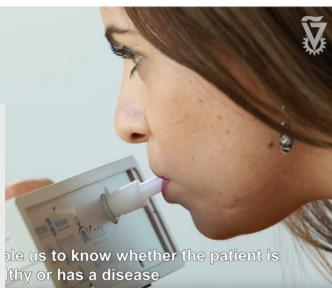
Valgfri diagnoser (Valg af 3): Kolesterol screening, madforgiftning, HIV screening, Hypertension, Hypothyroidism/Hyperthyroidism, melanom, Kyssesyge, kighoste, helvedesild, Streptokokhalsinfektion

Krævede vitalværdier (5): Blodtryk, puls, iltmætning, temperatur, respirationsfrekvens.



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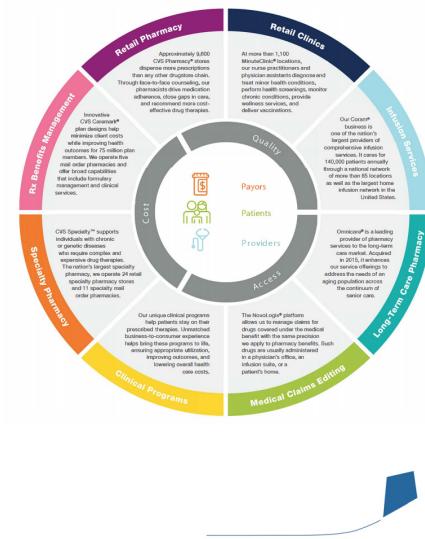
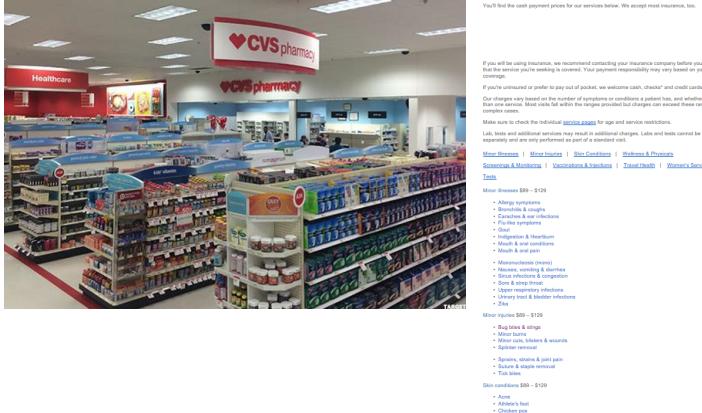
SniffPhone - volatile organic compounds



<http://pubs.acs.org/doi/full/10.1021/acsnano.6b04930>

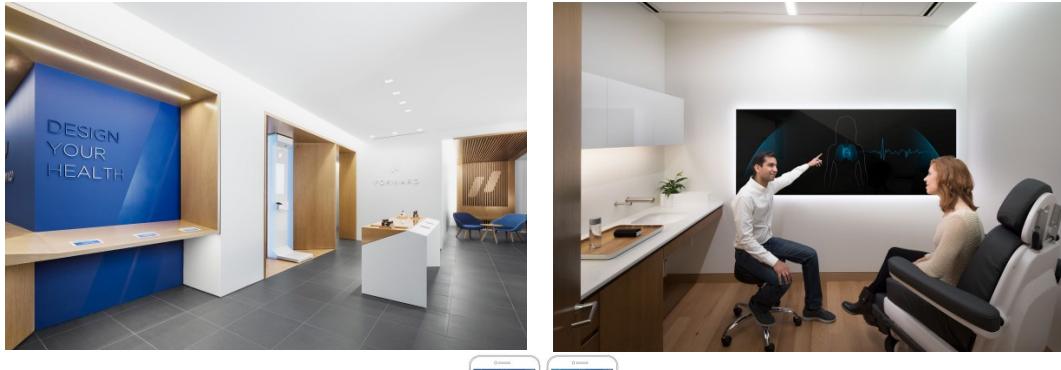
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Nye sundhedsspillere: CVS og Walgreen



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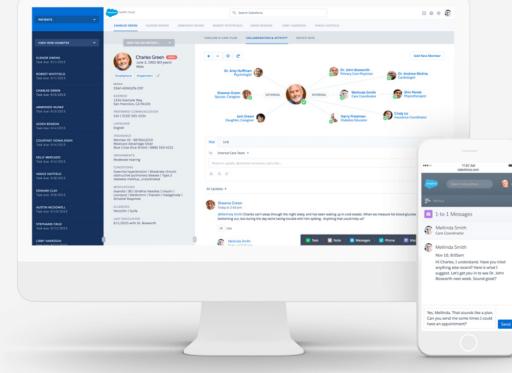
Forward – alternativ forebyggelse/lægepraksis



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Nye teknologiske spillere: SalesForce

Empower healthcare professionals to deliver more personal, targeted care.



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Uddanne læger til den nye verden

		Leading EDGE Four-Year Curriculum												
		JUL	AUG	SEP	OCT	NOV	DEC	JAN	FEB	MAR	APR	MAY	JUN	
YEAR 1 – ESSENTIALS	MOLECULES AND CELLS	STRUCTURE AND FUNCTION		BRAIN AND BEHAVIOR			BREAK	FOUNDATIONS OF DISEASE		MECHANISMS OF DISEASE				
	INTERPROFESSIONAL EDUCATION			INTERPROFESSIONAL EDUCATION			INTERPROFESSIONAL EDUCATION			INTERPROFESSIONAL EDUCATION				
	DEVELOPING OUTSTANDING CLINICAL SKILLS (DOCS)			DEVELOPING OUTSTANDING CLINICAL SKILLS (DOCS)			LEADERSHIP			LEADERSHIP				
YEAR 2 – DISCOVERY	INTERNAL MEDICINE	PSYCHIATRY/NEUROLOGY	WOMEN'S HEALTH		PEDIATRICS	SURGERY	MULTIDISCIPLINARY							
	PRIMARY CARE, FAMILY AND COMMUNITY MEDICINE			PRIMARY CARE, FAMILY AND COMMUNITY MEDICINE			INTERPROFESSIONAL EDUCATION			INTERPROFESSIONAL EDUCATION				
	INTERPROFESSIONAL EDUCATION			INTERPROFESSIONAL EDUCATION			DEVELOPING OUTSTANDING CLINICAL SKILLS (DOCS)			DEVELOPING OUTSTANDING CLINICAL SKILLS (DOCS)				
YEAR 3 – GROWTH	DEVELOPING OUTSTANDING CLINICAL SKILLS (DOCS)			LEADERSHIP			LEADERSHIP			LEADERSHIP				
	URINAL STEP 1 PREP	OPTIONAL CLINICAL ELECTIVES OR VACATION	INNOVATION, LEADERSHIP AND DISCOVERY				BREAK	INNOVATION, LEADERSHIP AND DISCOVERY		OPTIONAL CLINICAL ELECTIVES OR VACATION				
	PRIMARY CARE, FAMILY AND COMMUNITY MEDICINE			PRIMARY CARE, FAMILY AND COMMUNITY MEDICINE			INTERPROFESSIONAL EDUCATION			INTERPROFESSIONAL EDUCATION				
YEAR 4 – MASTERY	INTERPROFESSIONAL EDUCATION			INTERPROFESSIONAL EDUCATION			DEVELOPING OUTSTANDING CLINICAL SKILLS (DOCS)			DEVELOPING OUTSTANDING CLINICAL SKILLS (DOCS)				
	DEVELOPING OUTSTANDING CLINICAL SKILLS (DOCS)			LEADERSHIP			LEADERSHIP			LEADERSHIP				
	ACTING INTERNSHIP	Critical Care	Emergency Medicine	Acting Internship	Interviews		BREAK	ELECTIVES		INTERPROFESSIONAL EDUCATION		INTERPROFESSIONAL EDUCATION		
		INTERPROFESSIONAL EDUCATION		DEVELOPING OUTSTANDING CLINICAL SKILLS (DOCS)			DEVELOPING OUTSTANDING CLINICAL SKILLS (DOCS)			LEADERSHIP		LEADERSHIP		

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Disruption: Sundhed flytter ud af hospitalerne



Sundhedsdata er ikke længere sygehusets, lægen, EPJ-systemer eller det offentlige. Det er et økosystem, hvor nye løsninger og spillere vil komme.



Borgeren og patienten vil få en langt mere aktiv rolle i koordineringen og der vil komme nye services til at støtte alle borgere i denne transformation.



Tung hardware baseret hospitalsinfrastruktur vil blive erstattet af lettere løsninger med software services



Screening – nye sensor gør screening og diagnostik mindre invasiv. Dette kan åbne op for yderligere screening af patienter

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Fra sygdom til sundhed II

Organiser omkring sundhed



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Forebyggelse

Healthy Living Is the Best Revenge

Findings From the European Prospective Investigation Into Cancer and Nutrition–Potsdam Study

Earl S. Ford, MD, MPH; Manuela M. Bergmann, PhD; Janine Kroger; Anja Schienkiewitz, PhD, MPH; Cornelia Weikert, MD, MPH; Heiner Boeing, PhD, MPH

Background: Our objective was to describe the reduction in relative risk of developing major chronic diseases such as cardiovascular disease, diabetes, and cancer associated with 4 healthy lifestyle factors among German adults.

Methods: We used data from 23 153 German participants aged 35 to 65 years from the European Prospective Investigation Into Cancer and Nutrition–Potsdam study. End points included confirmed incident type 2 diabetes mellitus, myocardial infarction, stroke, and cancer. Of 4 factors, were never smokers, having a body mass index lower than 30 (calculated as weight in kilograms divided by height in meters squared), performing 3.5 h/wk or more of physical activity, and adhering to healthy dietary principles (high intake of fruits, vegetables, and whole-grain bread and low meat consumption). The 4 factors (healthy, 1 point; unhealthy, 0 points) were summed to form an index that ranged from 0 to 4.

Results: During a mean follow-up of 7.8 years, 2006 participants developed new-onset diabetes (3.7%), myocardial infarction (0.9%), stroke (0.8%), or cancer (3.8%). Fewer than 4% of participants had zero healthy factors, most had 1 to 3 healthy factors, and approximately 9% had all 4 healthy factors. After adjustment for age, sex, smoking status, and occupational status, the hazard ratio for developing a chronic disease decreased progressively as the number of healthy factors increased. Participants with all 4 factors at baseline had a 78% (95% confidence interval [CI], 72% to 83%) lower risk of developing a chronic disease compared with 93% (95% CI, 89% to 95%), myocardial infarction, 81% (95% CI, 79% to 93%), stroke, 50% (95% CI, -18% to 79%), and cancer, 36% (95% CI, 5% to 57%) than participants without a healthy factor.

Conclusion: Adhering to 4 simple healthy lifestyle factors can have a strong impact on the prevention of chronic diseases.

Arch Intern Med. 2009;169(15):1355-1362

Fire Interventioner

1. BMI<30
2. Ingen rygning
3. Mindst 3,5 timers motion om ugen
4. Spise sundt

Effekt

78 % lavere risiko for kroniske sygdomme

93 % diabetes

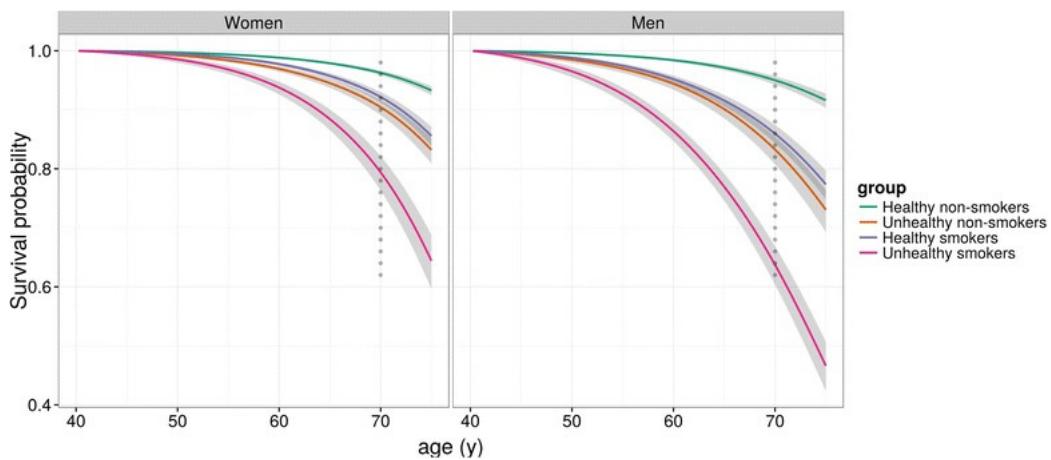
81 % Blodprop i hjertet

50 % Slagtilfælde

36 % cancer

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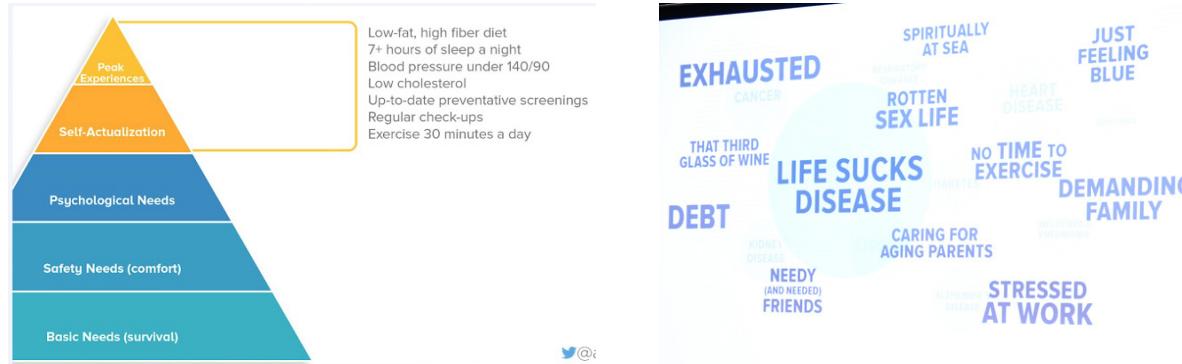
Effekten af rygning og sund livsstil



<https://www.ncbi.nlm.nih.gov/pmc/articles/PMC4907105/>

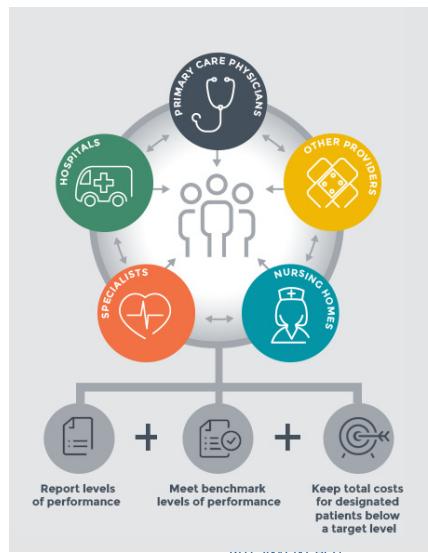
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Forebyggelse: Alexandra Drane (Eliza Corp)



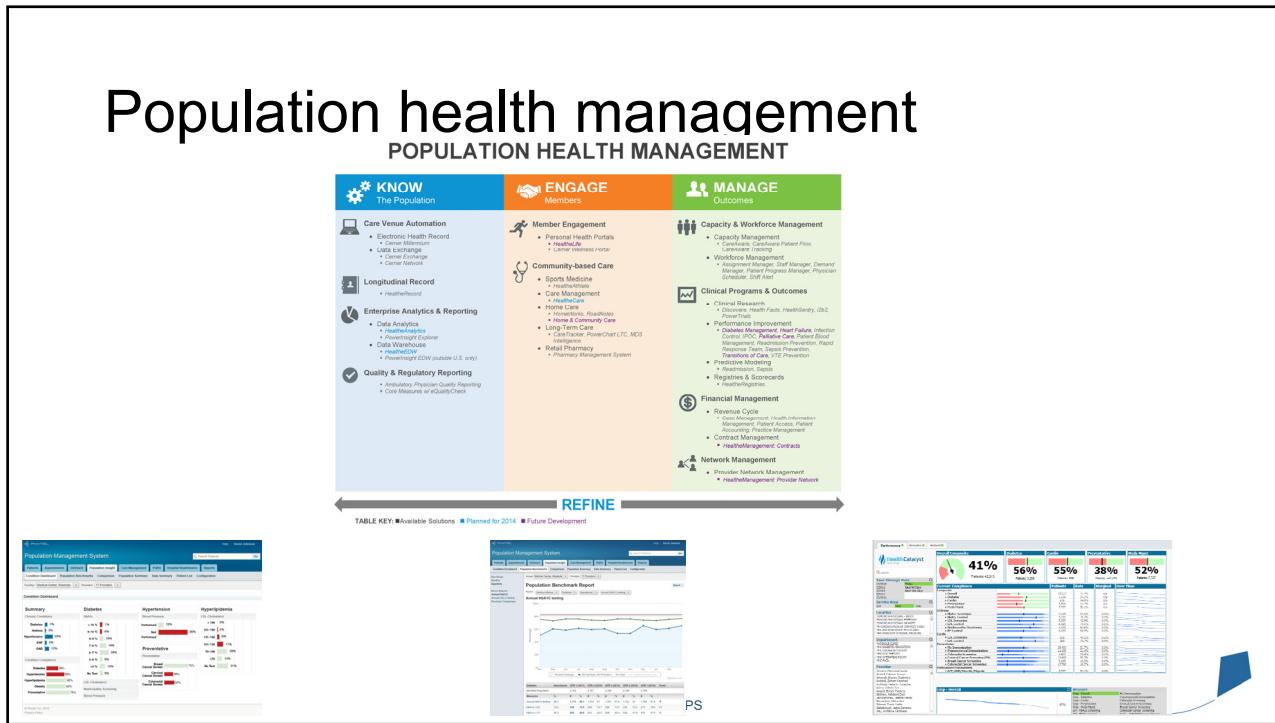
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Affordable care organizations



Population health management

POPULATION HEALTH MANAGEMENT



Eksempel: Arivale – Scientific wellness

Livsstilsændring + data

Programmer

Tabe sig

Optimeret aldring

Bedre fysisk form

Reduktion af stress

- ✓ Personal Arivale Coach

Throughout the program, you'll work directly with a personal Arivale Coach who will help translate your data and hold you accountable to making lasting changes. Our coaching team is made up of expert clinicians and behavior change specialists—including Registered Dietitian Nutritionists, Certified Nutritionists, and Registered Nurses—all of whom have a solid foundation in functional nutrition and a systems approach to wellness.
- ✓ Genetic Analysis

With your Arivale Coach, explore genes related to weight management, fitness and wellness—and integrate them with your blood and saliva measurements.
- ✓ 2 Blood Analyses

With your Arivale Coach, deep dive into 80+ blood measurements and integrate them with your saliva, genetics and lifestyle data. Blood analyses are conducted at the beginning of the program and again after six months.
- ✓ 1 Saliva Analysis

Track your cortisol and DHEA levels—important hormones secreted by the adrenal glands that can help show how your body responds to stress.
- ✓ 1 Gut Microbiome Analysis

Your gut microbiome is a fascinating, emerging area of science and wellness. Talk with your Arivale Coach about the diversity of bacteria in your gut and how it might relate to your overall wellness.
- ✓ 1 Fitbit Activity Tracker

Gain insights into your lifestyle through activity, heart rate, and sleep tracking—all of which links to your Arivale Dashboard.
- ✓ Personalized Wellness Dashboard

From your Arivale Dashboard, explore your body's key systems that relate to wellness through six health dimensions: Heart Health, Diabetes Risk, Inflammation, Optimal Nutrition, Healthy Aging, and Stress Management. Dive into the Arivale dashboard here.
- ✓ Monthly Calls (or More) and Unlimited Text/Email Check-ins with Arivale Coach

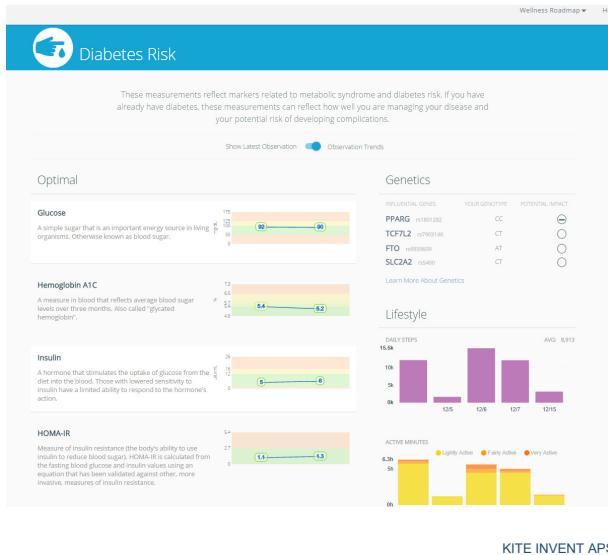
Your Arivale Coach is with you every step of the way.
- ✓ Concierge Service

Throughout your journey, you'll have access to a concierge service to answer any questions, help set up blood draws, etc.



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Eksempel: Arivale



The one-time plan is \$3,499
(24.000 kr – 1 år).

Disruption: Organisering omkring sundhed



En yderligere styrkelse af den tværfaglige tilgang til sundhed bl.a. i kommunerne koblet til understøttelse af den enkeltes sociale helhedssituation.



Nye samarbejdskonstellationer mellem traditionelle sundhedsaktører og bløde livsstilsaktører.



Nye afregningsmodeller for forebyggelse og nye services som følge heraf.



Nye værktøjer til borgere og patienter til at forstå og understøtte sund livsstil og livsstilsændringer.

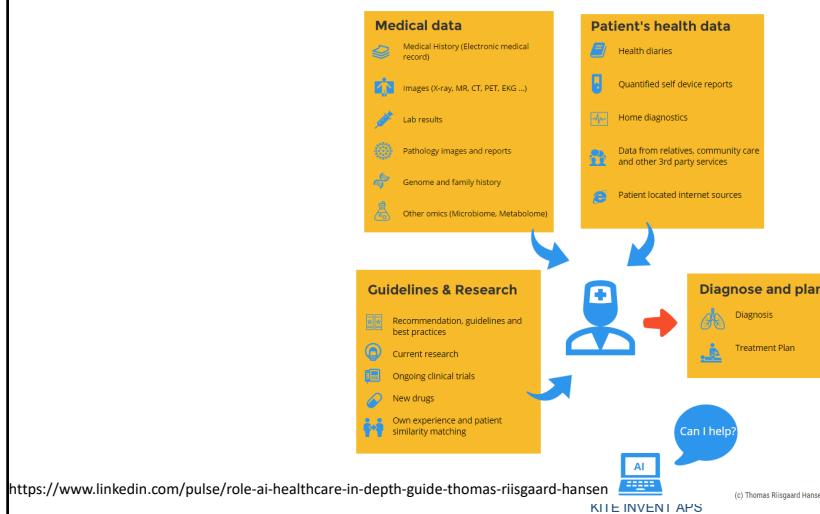
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Algoritmer, kunstig intelligens og big data

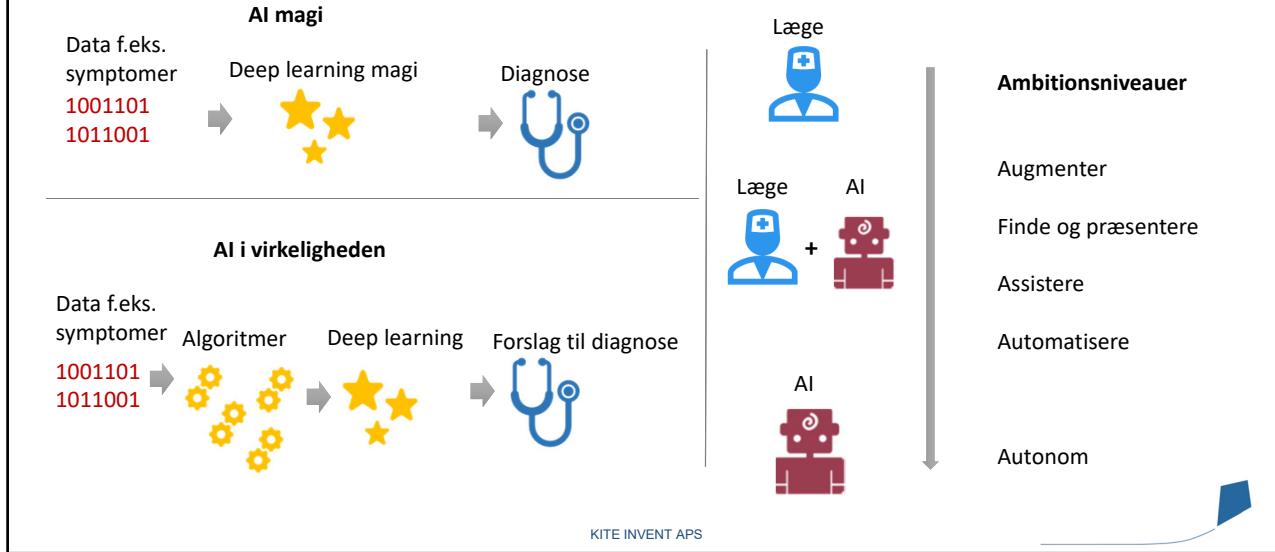


Big data og kunstig intelligens

The need for AI in Healthcare



AI – ikke magi men hårdt arbejde



IBM Watson Oncology

Clinical Information for: Stage IIB neoadjuvant with Case Notes

Summary All Attributes Notes

Disease Status

- M Stage: M0 - No clinical or radiographic evidence
- name: 400000200 AdditionalNote: 9/29/2015
- ... usual woman from New York, accompanied by her daughter today to discuss neoadjuvant therapy for her stage IIB breast cancer.

Staging characteristics

- cT Stage: T3 - Tumor greater than 5 cm in Primary tumor size: 7.4
- Derived
- Cancer stage: IIB
- name: 400000200 AdditionalNote: 9/29/2015
- ... usual woman from New York, accompanied by her daughter today to discuss neoadjuvant therapy for her stage IIB breast cancer.

Primary tumor pathologic findings

- Histology: Lobular
- name: 400000200 AdditionalNote: 9/29/2015
- ... he then underwent an ultrasound-guided core biopsy that revealed moderately differentiated invasive lobular carcinoma. HER2 1+ by IHC. LVI was present.
- Tumor grade: Intermediate - moderately differentiated
- name: 400000200 AdditionalNote: 9/29/2015

Comorbidities

Please Verify: Attributes below correctly reflect the patient's condition.

Patient characteristics

Gender: Female

NYHA Cardiac disease grade: Required

Specify the severity of any comorbidities present:

Neuropathy grade: Required

AdditionalNote: 9/29/2015

2013 INITIAL CONSULTATION CHECKLIST: The patient is in good overall health. She has no known allergies. She is currently taking metformin 1000 mg/day and lisinopril 10 mg/day. She has a history of hypertension and diabetes mellitus. She has a history of breast cancer. She has a history of smoking 1 pack per day for 20 years. She has a history of alcohol abuse. She has a history of depression. She has a history of anxiety. She has a history of hypertension. She has a history of diabetes mellitus. She has a history of breast cancer. She has a history of smoking 1 pack per day for 20 years. She has a history of alcohol abuse. She has a history of depression. She has a history of anxiety.

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<https://www.youtube.com/watch?v=qG6jfHI4ucw>

IBM Watson Oncology

The screenshot shows the IBM Watson For Oncology interface. At the top, it says "Introducing IBM Watson For Oncology - Manipal Hospitals" and "Chemotherapy followed by surgery followed by endocrine therapy and radiation therapy". There is a "SUBSCRIBE NOW!" button.

Below this, there is a timeline for treatment plan (in years) from 0 to 10. The timeline shows "Chemotherapy" (blue bar), "Surgery" (orange bar), "Endocrine (Radiation)" (yellow bar), and "Radiation" (purple bar).

The "Treatment Options" section shows a grid of chemotherapy regimens:

- Dose-dense AC (Doxorubicin / Cyclophosphamide) followed by T (Paclitaxel)
- TAC (Docetaxel / Doxorubicin / Cyclophosphamide)
- AC (Doxorubicin / Cyclophosphamide) followed by Docetaxel
- EC (Epirubicin / Cyclophosphamide) followed by T (Paclitaxel)
- Referral to surgery
- Letrozole at 5 years
- Anastrozole at 5 years
- Temozol

Each regimen has a "View more" link. To the right, there is a detailed view of the "Dose-dense AC (Doxorubicin / Cyclophosphamide) followed by T (Paclitaxel)" treatment plan, which includes sections for Overview, Additional Publications, Administration, Drug Information, and Experimental Feature: "Additional publications Watson has identified as potentially relevant to this case".

<https://www.youtube.com/watch?v=qG6jfHl4ucw>

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Behovet for Data

Strategier for at få adgang til data

Købe data (IBM and Merge)

Adgang gennem partnerskaber (IBM and Epic)

Data udvekslingsplatforme (CancerLinq, AACR Project GENIE, Foundation Medicine's PatientMatch)

Offentlige drevne databaser

Udfordring for Danmark

Hvem ejer data?

Hvordan slipper vi vores data fri?

Hvordan muliggør vi nye samarbejdsformer?

Hvordan får vi gentænkt privat og offentlig sammenspil

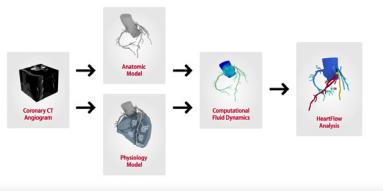
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EPJ åbner op

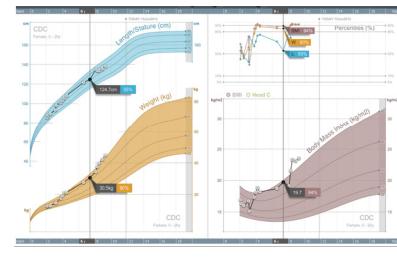
EPJ API'er



Analyser i skyen - Heartflow



App's i EPJ'en - SmartOnFHIR



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Blockchain – har det en rolle i sundhed?

Problemstillinger

Integration

Sikkerhed

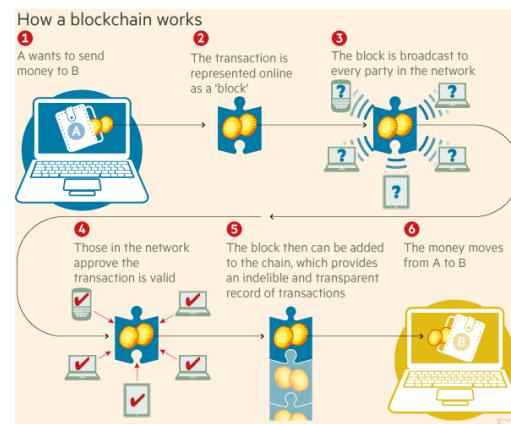
Unik ID

Innovation

Er blockchain løsningen?

På det store problem?

På en del af problemet?



<https://www.weforum.org/agenda/2015/11/how-will-blockchain-technology-transform-financial-services/>

KITE INVENT APS

Disruption: Algoritmer, big data og AI



Lægen – lægen kan blive ekspert i at anvende værktøjer - ikke kende detaljer



Patienten – nye typer værktøjer kan hjælpe til selvdagnostik og selvmonitorering

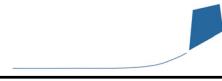


Sundhedspersonale – nye former for beslutningsstøtte kan flytte kompetencekrav og opgaver mellem grupper.



Bedre og mere ensartede behandlinger

KITE INVENT APS



Præcisionsmedicin I Personlig medicin



Personlig medicin

"Personlig Medicin dækker over en udvikling i sundhedsvæsenet, hvor bl.a. forebyggelse og behandling i højere grad **tilpasses den enkelte patients individuelle biologi og fysiologi**. Det kan være, at en analyse af generne kan hjælpe til at forstå, hvorfor patienten er blevet syg og dermed, hvordan patienten bedst kan behandles."



INDUSTRY NEWS > TECHNOLOGY

Cerner Health Conference: Genomics is the 'next great frontier'

Nov 17, 2016, 10:14am CST

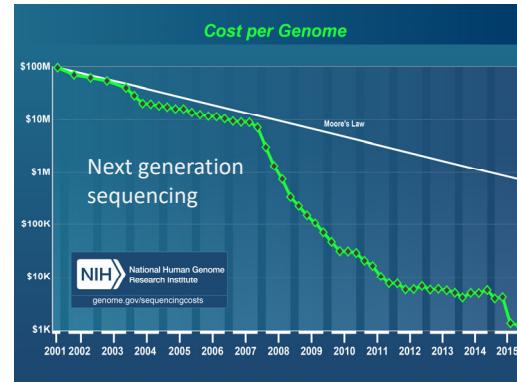
INDUSTRIES & TAGS Technology, Health Care, Biotech, Bioscience

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Genomanalyse

DNA

3 milliarder basepar
20.500 proteinkodende gener



<http://www.nature.com/nrg/journal/v17/n6/full/nrg.2016.49.htm>

KITE INVENT APS

Genanalyse: Arvelige sygdomme

Nuværende praksis

Præimplantations genetisk diagnostik
(Ægselektion)

Tidlig screening f.eks. for down syndrome

Ved fund i familien - tilbyde at undersøge andre i familien

Voksende muligheder

Risikoanalyse

Disorder	Prevalence	Chromosome or gene involved
Chromosomal conditions		
Down syndrome	1:600	Chromosome 21
Klinefelter syndrome	1:500–1000 males	Additional X chromosome
Turner syndrome	1:2000 females	Loss of X chromosome
Sickle cell anemia	1 in 50 births in parts of Africa; rarer elsewhere ^[71]	β -globin (on chromosome 11)
Cancers		
Breast/Ovarian cancer (susceptibility)	~5% of cases of these cancer types	BRCA1, BRCA2
FAP (hereditary nonpolyposis coli)	1:3500	APC
Lynch syndrome	5–10% of all cases of bowel cancer	MLH1, MSH2, MSH6, PMS2
Neurological conditions		
Huntington disease	1:20000	Huntingtin
Alzheimer disease - early onset	1:2500	PS1, PS2, APP
Other conditions		
Cystic fibrosis	1:2500	CFTR
Duchenne muscular dystrophy	1:3500 boys	Dystrophin

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Genanalyse: 23andMe og Origin

The screenshot shows the 23andMe Health Overview page. Under 'Genetic Risk Factors', it lists variants for Alzheimer's Disease, Factor XI Deficiency, Inherited Thrombophilia, and Parkinson's Disease. Under 'Inherited Conditions', it lists variants for Bloom Syndrome, Cystic Fibrosis, Sickle Cell Anemia, and Tay-Sachs Disease. A link to 'See All Genetic Risk Factor Reports' is available.

REPORT	RESULT	REPORT	RESULT
Alzheimer's Disease	Variant Present, Higher Risk	Bloom Syndrome	Variant Present
Factor XI Deficiency	Variant Absent, Typical Risk	Cystic Fibrosis	Variant Absent
Inherited Thrombophilia	Variant Absent, Typical Risk	Sickle Cell Anemia	Variant Absent
Parkinson's Disease	Variant Absent, Typical Risk	Tay-Sachs Disease	Variant Absent

[See All Genetic Risk Factor Reports](#)

REPORT	RESULT	REPORT	RESULT
Bitter Taste Perception	Unlike to Taste	Clopidogrel (Plavix®) Efficacy	Reduced
Eye Color	Likely Brown	Proton Pump Inhibitor (PPI) Metabolism	Reduced
Lactose Intolerance	Like Tolerant	Mefenamic Acid (Causamin®) Sensitivity	Typical

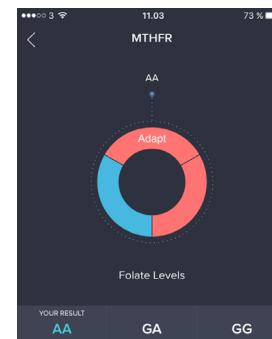
[See All Inherited Condition Reports](#)



People like you have an increased susceptibility to risk seeking behavior. You are more likely to be an extrovert and may seek out novel and thrilling experiences.

Comments

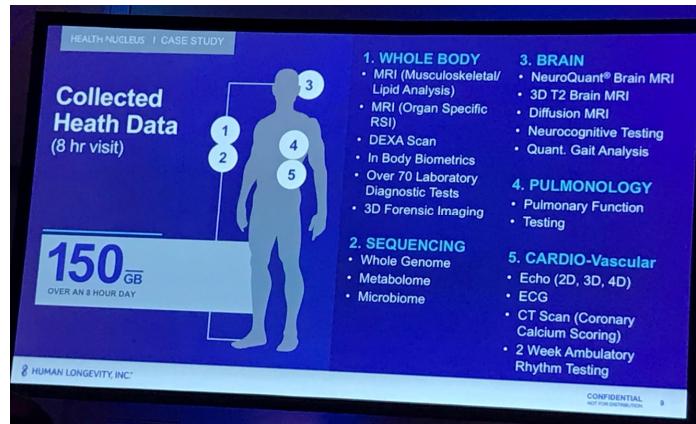
Are you an extrovert? Scientists have studied aspects of human behavior such as how outgoing and impulsive you are and how motivated you are to seek novel experiences. These behaviors seem to go together and the brain.



This is the rare result found in 10% of the population. You have much reduced levels of the enzyme (30% of normal). This will give you lower levels of folate, Vitamin B12, and gamma-glutamylcysteine. Therefore, you should actively seek food such as lentil beans, asparagus, spinach, turnip greens, broccoli, and beets that are rich in folate and may consider an additional folate supplement, as needed and discussed with your doctor.

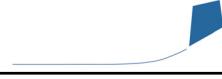
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Genanalyse: Health Nucleous

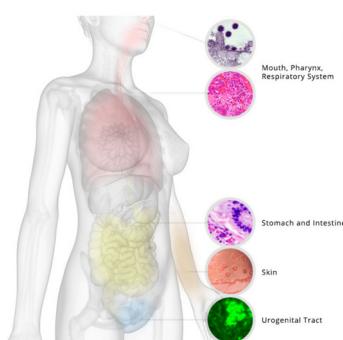


Pris: 175.000-350.000 kroner

KITE INVENT APS



Mikrobiomet



Microbes can play games with the mind

The bacteria in our guts may help decide who gets anxiety and depression

By LAURA SANZOS | 20 MAR 16, 2016

How Gut Bacteria Are Shaking Up Cancer Research

By Makiko Kitamura

14. marts 2016 06:00 CET

- Roche says it plans to study role of microbiome in cancer
- Vedanta expects more drug companies to enter the field

Top scientists at Roche Holding AG and AstraZeneca Plc are sizing up potential allies in the fight against cancer: the trillions of bacteria that live in the human body.

"Five years ago, if you had asked me about bacteria in your gut playing an important role in your systemic immune response, I probably would have laughed it off," Daniel Chen, head of cancer immunotherapy research at Roche's Genentech division, said in a phone interview. "Most of us immunologists now believe that there really is an important interaction there."

New Online Views 31,685 Citations 0 [Download](#) 367

Viewpoint

December 22, 2016

The Microbiome and Risk for Obesity and Diabetes

Anthony L Komaroff, MD¹

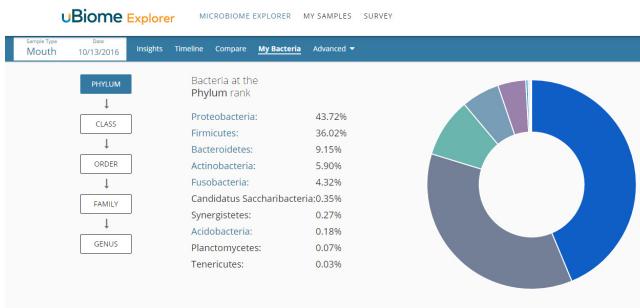
> Author Affiliations | Article Information

JAMA. Published online December 22, 2016. doi:10.1001/jama.2016.20099

<http://www.nature.com/nrmicro/journal/v10/n11/full/nrmicro2876.html>
<http://www.nature.com/neuro/journal/vaop/ncurrent/full/nn.4476.html>

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Mikrobiomet - uBiome



uBiome finds out how many bacterial friends you have using 16S-sequencing on the Illumina Next Generation Sequencing platform. 16S is a ribosomal gene present in bacterial DNA, which makes it possible for us to classify bacteria all the way down to the genus level while filtering out any human genetic material.

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Interventioner baseret på mikrobiomet



nature International weekly journal of science

Home | News & Comment | Research | Careers & Jobs | Current Issue | Archive | Audio & Video | For Authors

News & Comment > News > 2017 > January > Article

NATURE | NEWS

Scientists swab C-section babies with mothers' microbes

Newborns were exposed experimentally to vaginal microbes to restore the microbiomes they missed.

Ewen Callaway

01 February 2016



<http://www.eliminatedengue.com>

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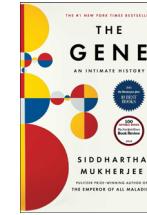
Disruption: Personlig risikovægtet behandling



Fra ens behandling af alle til personlig risikovægtet behandling baseret på genetisk information hos kommunen, praktiserende læge og på hospitalet



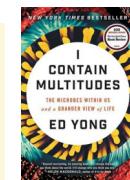
Borgeren – hvad betyder det at kende sin risiko? Hvordan håndtere borgerne det?



Samfundet - Bør alle få lavet en DNA-analyse ved fødslen?



Mikrobiomet - nye forståelser af en række sygdomme og mulige forebyggelse og behandlingsmuligheder.

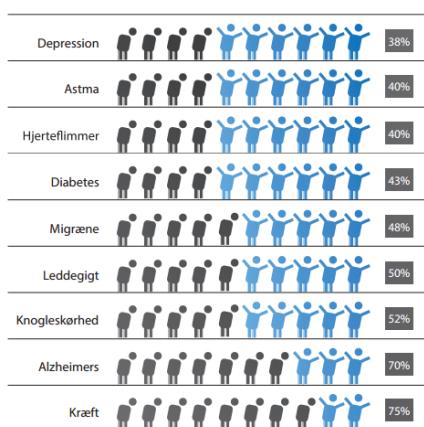


KITE INVENT APS



Pharmacogenomics

Andelen af patienter, som ikke har gavn af medicinen



Pharmacogenomics er studiet af hvordan gener påvirker persons medicinrespons

Rigtige medicin til rigtige patient

Færre bivirkninger

Bedre behandling

Reducere udgifter til medicin

Kilde: FDA "Paving the Way for Personalized Medicine", oktober 2013

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Pharmacogenomics: Eksempel

pro.medicin
INFORMATION TIL SUNDHEDSFAGLIGE

Information til patienten om Marevan Indlægssedler for Marevan

Marevan

Warfarin B01AA03

Amning | Andre anvendelsesområder | Anvendelsesområder | Bivirkninger | Bloddonor | Dispenseringiform | Doping | Doseringsofslag | Egenskaber, håndtering og holdbarhed | Farmakodynamik | Farmakokinetik | Firma | Forgiftning | Forsigtighedsregler | Foto og identifikation | Graviditet | Hjælpestoffer | Indholdsstoffer | Instruktioner | Interaktioner | Kontraindikationer | Pakninger, priser, tilskud og udlevering | Patientsikkerhed | Schengen-attest (pillepas) | Substitution | Tilskud | Trafik

Coumarinderivat. Indirekte virkende antikoagulans.

Anvendelsesområder

Forebyggelse og behandling af **dyb tromboflebit** og tromboemboliske komplikationer.
Se endvidere:
Vitamin K-antagonister

Induktører af CYP2C9 eller CYP3A4 kan ned sætte den antikoagulerende virkning, mens hæmmere af CYP2C9 og CYP3A4 eller konkurrerende substrater for disse isoenzymer kan forstærke den antikoagulerende virkning. Se endvidt tabel 2 i **Elimination og cytrom P450-systemet.**

Gene	Important Variant	Variation	Consequence of Variation	Effect on Enzyme Activity	Selected Medication Substrates
CYP2D6	CYP2D6*3	2549 del A (rs4986774)	Frameshift mutation, premature stop	Absent activity	Amitriptyline, atenoxetine, carvedilol, chlorpheniramine, chlorpromazine, citalopram, clomipramine, clozapine, codeine, debrisoquine, desipramine, dextromethorphan, doxepin, fexofenadine, fluoxetine, fluvoxamine, gefitinib, haloperidol, imipramine, maprotiline, metoprolol, mescaline, mianserin, morphine, nortriptyline, prostetene, risperidone, theophylline , quinidine, sumatriptan, tolterodine, tramadol
CYP2D6*4	1846G>A (rs3892097)		Splicing defect	Absent activity	
CYP2D6*5	n/a		Whole gene deletion	Absent activity	
CYP2D6*6	1707 del T (rs503655)		Frameshift mutation	Absent activity	
CYP2D6*9	2615_2617delAAQ (rs3039656)		Deletion of lys ²⁶¹ -ser ²⁶²	Reduced activity	
CYP2D6*10	100C>T (rs1065832)		pro ³⁴ -ser	Reduced activity	
CYP2D6*17	1023C>T (rs23371706)		thr ¹⁰⁷ ile	Reduced activity ⁻²	
CYP2D6*29	3183G>A (rs59421388) and 4180G>C (rs61736512)		val ³³⁵ met and ser ⁴⁸⁶ thr	Reduced activity	
CYP2D6*41	29880>A (rs23371725)		Splicing defect	Reduced activity	
CYP2D6*4M	n/a		Additional functional copies (2-13) of gene	Increased activity	

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Pharmacogenomics: GeneDose

Corell GeneDose Live

PatientA
Scott Megill

- Home
- Genetics
- Demographics
- Lifestyle
- Indications
- Regimen
- Report
- Alternatives

Baseline medication

Medication	Genetic	Contraindication	Drug interaction	Anticholinergic burden	Lifestyle	ADR (Black box)	Beers criteria
Simcor	~5	~5	~5	~5	~5	~5	~5
Tarka	~10	~10	~10	~10	~10	~10	~10
Invokana	~30	~30	~30	~30	~30	~30	~30
Tenormin	~5	~5	~5	~5	~5	~5	~5
Omeprazole	~10	~10	~10	~10	~10	~10	~10
Lantus	~10	~10	~10	~10	~10	~10	~10
NovoLog	~10	~10	~10	~10	~10	~10	~10
Clarinex	~10	~10	~10	~10	~10	~10	~10

Alternate medication

Medication	Genetic	Contraindication	Drug interaction	Anticholinergic burden	Lifestyle	ADR (Black box)	Beers criteria
Invokana	~5	~5	~5	~5	~5	~5	~5
Omeprazole	~10	~10	~10	~10	~10	~10	~10
Tenormin	~5	~5	~5	~5	~5	~5	~5
Lantus	~5	~5	~5	~5	~5	~5	~5
NovoLog	~5	~5	~5	~5	~5	~5	~5
Crestor	~5	~5	~5	~5	~5	~5	~5
Clarinex	~5	~5	~5	~5	~5	~5	~5
Alisikren	~5	~5	~5	~5	~5	~5	~5

Drug alternative modeler

Selected	Name
<input checked="" type="checkbox"/>	Add alternative ▾ Clarinex
<input checked="" type="checkbox"/>	Add alternative ▾ Invokana
<input checked="" type="checkbox"/>	Add alternative ▾ Lantus
<input checked="" type="checkbox"/>	Add alternative ▾ NovoLog
<input checked="" type="checkbox"/>	Add alternative ▾ Omeprazole
<input checked="" type="checkbox"/>	Add alternative ▾ Simcor
<input type="checkbox"/>	Add alternative ▾ Crestor

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Disruption: Pharmacogenomics



Patienten - Bedre behandlinger med målrettet medicin med færre bivirkninger



Sundhedsvæsenet – færre udgifter til nytteløst medicin



Medicinalindustrien – øget krav til dokumentation for genetisk indflydelse. Potentiale for at ældre lægemidler, der ikke virkede på den brede befolkning kan genintroduceres baseret på genetisk information

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Præcisionsmedicin II Geneditering



Genterapi



"Behandling af genetisk bestemte sygdomme, hvor der overføres DNA til kroppens celler eller indsætter celler med raske gener som erstatning for eller supplement til celler med syge gener."

Baggrund

Startede omkring 1990
 Har haft omkring 2,300 kliniske forsøg
 En del fejslagne forsøg (cancer og dødsfald)

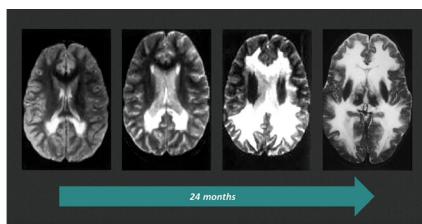
Godkendte behandlinger

2012 Glybera er det første godkendte medicin (lipoprotein lipase deficiency)
 2016 Strimvelis til behandling af Bobble boy - ADA-SCID

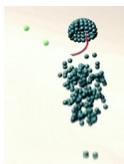
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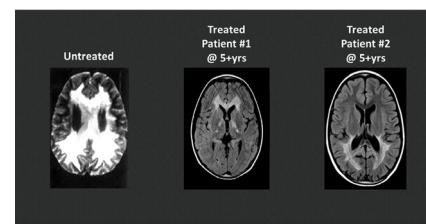
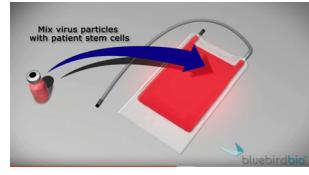
Eksempel: Adrenoleukodystrofi (ALD) lenti-D genterapi



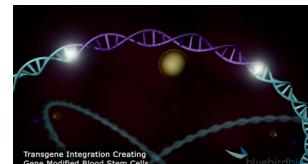
1. Design genændring og virus



2. Tag stamceller og genmodificerer dem



3. Genmodificerede stamceller sendes tilbage i kroppen



4. Stamcellerne laver nye modificerede celler



KITE INVENT APS <https://www.youtube.com/watch?v=EzS60GnkSrE>

Priser

Strimvelis

4.4 millioner kroner

Penge tilbage garanti

14 tilfælde i Europa

Biomedicine

The World's Most Expensive Medicine Is a Bust

The first gene therapy approved in the Western world costs \$1 million and has been used just once. The doctor who tried it says the price is "absolutely too high."

by Antonio Regalado May 4, 2016

Glybera

7.5 millioner kroner

Solgt en enkelt gang

Rewriting Life

The World's Most Expensive Medicine Is Being Pulled from the Market

The maker of the gene therapy Glybera says it doesn't have enough customers.

by Emily Mullin April 21, 2017

KITE INVENT APS

Fremtiden for genterapi

Sjældne sygdomme

Findes i dag omkring 5000 identificerede sjældne sygdomme der skyldes isolerede genmutationer

I Danmark er det måske 30.000–50.000 mennesker og typisk er der ofte 500-1000 eller færre patienter der karakteriseres som sjældne



Nye former for genterapi

Virus

CRISPR-CAS9

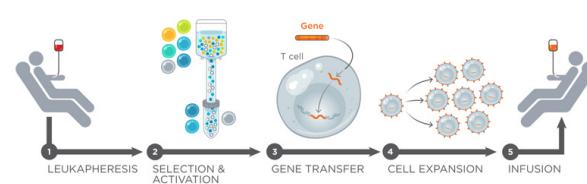
Varianter baseret på nanoteknologi



De almindelige sygdomme

Cancer

Diabetes



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Disruption: Geneditering



Behandling - Helbrede genetiske sygdomme



Behandling - Nye behandlingsmuligheder for kræft,
andre sygdomme og måske diabetes?



Dilemma – hvad må en behandling koste? Hvordan sikrer
vi udvikling og behandling af sjældne sygdomme?

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Mennesket 2.0



Syntetisk biologi

After 20 Year Quest, Biologists Create Synthetic Bacteria With No Extra Genes

Trade-in any qPCR instrument

RESEARCH ARTICLE
Design and synthesis of a minimal bacterial genome

David A. Relman^{1,2}, Guy N. Chang^{1,2}, Vladimir N. Husev¹, Marcy Ausubel-Garcia¹, Thomas J. Dervinick¹, Mark H. Ellington¹, John Giff¹, Kristina Kanaev¹, Bogdan J. Karajc¹, Li Ma¹, James F. Pellegrini^{1,2}, Zhi-Qing Qi¹, R. Alexander Richter¹, Elizabeth A. Strycharski¹, Liye Su^{1,2}, Yo Suzuki¹, Elliyana Tsvetkova¹, Kim S. Wise¹, Hamilton O. Smith^{1,2}, John I. Glass¹, Chuck Marryman¹, Daniel G. Gibson^{1,2}, and Craig Venter^{1,2}

¹ Corresponding author. E-mail: cbu@jhu.edu (C.V.)
² Present address: The Institute for Personalized Medicine, Johns Hopkins University School of Medicine, Baltimore, MD 21201, USA.
³ Present address: Center for Bits and Atoms, Massachusetts Institute of Technology, Room 325-401, 20 Ames Street, Cambridge, MA 02139, USA.
⁴ Present address: C3RTT, 1275 Sorrento Valley Road, Suite 204, San Diego, CA 92121, USA.

Received 09 Jan 2012; revised 09 Mar 2012; accepted 09 Mar 2012; published online 09 Apr 2012.
DOI: 10.1126/science.120200

The Genome Project-Write
Jeff D. Boeke, George Church, Andrew Hessel, Nancy J. Kelley, Adam Arkin, Yahi Cal, Rob Carlson, Aravinda Chakravarti, Virginia M. Colletta, Linda Hall, Ferenc J. Izsak, Todd Kalan, Marc Lajoie, Tracy Lesser, Michael Leshem, David Lieber, Timothy Loh, Michael Lohr, Roger Llobera, Dennis Rosen, Neville E. Sangama, Pamela A. Silver, David Stell, Harris Wang, Jeffrey C. Way, Leimin Yang

Author Affiliations
A complete list of acknowledgments is available in the full-text online edition of this article.
Published online April 6, 2012; doi:10.1126/science.120200

Science 336, 120200 (2012); DOI: 10.1126/science.120200

Published online April 6, 2012; doi:10.1126/science.120200

Human chromosomes and nucleus as visualized by scanning electron microscopy. *Photo courtesy of David Lajoie.*

The Human Genome Project ("HGP") was completed in 2004, aimed to sequence the human genome and to improve the technology, cost, and quality of DNA sequencing (1,2). It was biology's first genome-scale project and at the time was considered controversial by some.

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THE FUTURE OF MAKING THINGS

We are on the cusp of a revolution where the same design principles applied to the built environment can be applied to biology and nanotechnology. The Bio+ Nanotech group at Autodesk aims to create the best design software for scientists to design and build at the nanoscale.

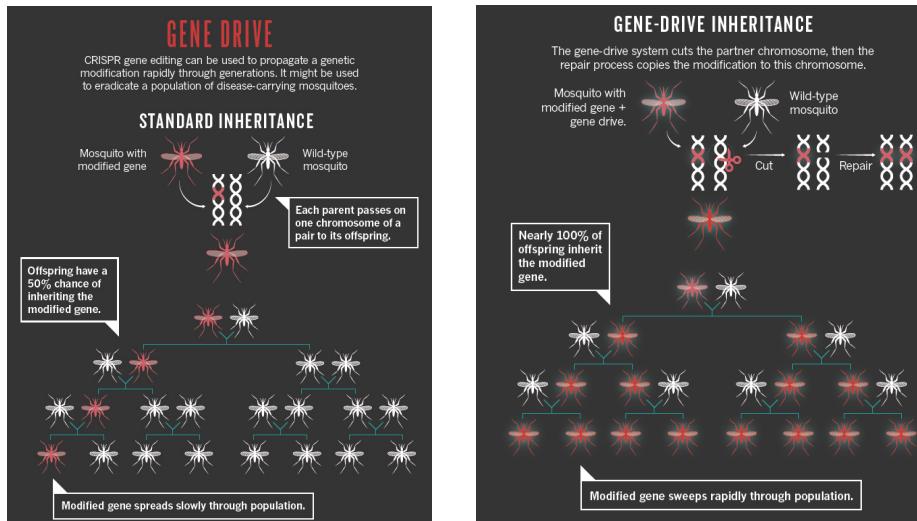
Creating the best design software for biology is a long journey and a team effort. We are committed to creating an open-source platform and we encourage you to fork, modify, re-use, and extend our work. Make it yours!

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Gene drives



<http://www.nature.com/news/crispr-the-disruptor-1.17673> KITE INVENT APS

Gene drives

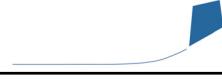


Oxitec's Guilherme Trivellato on Deploying Friendly™ Aedes Solution in Brazil

December 15, 2016

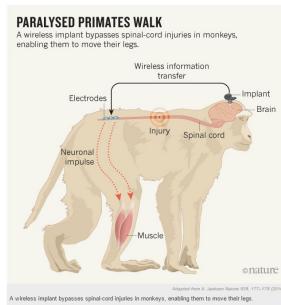
Oxitec has developed the Friendly™ Aedes solution, genetically engineered male mosquitoes used in Brazil today to combat the spread of...

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Brain interfaces #1

Paralyserede aber går igen



nature International journal of science

Brain implants allow paralysed monkeys to walk

Swiss researchers travel to China to conduct pioneering experiment.

David Cyranoski
20 November 2015

Alpha & Omega

Brain implants bypass spinal-cord injuries in monkeys to enable movement of paralyzed messages

MIT Technology Review

Synthetic RNA CRISPR Kits TRY FREE

This Paralyzed Man Is Using a Neuroprosthetic to Move His Arm for the First Time in Years

To reverse paralysis, scientists wired a man's brain to his muscles using nanowires.

by Emily Mullin March 28, 2017

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<http://www.nature.com/news/brain-implants-allow-paralysed-monkeys-to-walk-1.20967>

<https://www.technologyreview.com/s/603993/this-paralyzed-man-is-using-a-neuroprosthetic-to-move-his-arm-for-the-first-time-in-years/>

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Brain interfaces #2

RetroSense Therapeutics

Optogenetics without the genetics

Posted on March 02, 2017 by Kwok-Jing Li at the Beach



An optic fiber beams pulses of light into the brain of a genetically modified mouse.

TECH
Elon Musk Launches Neuralink to Connect Brains With Computers

Startup from CEO of Tesla and SpaceX aims to implant tiny electrodes in human brains

By ROLFE WINKLER

March 27, 2017 3:24 p.m. ET

Building a mass-market electric vehicle and colonizing Mars aren't ambitious enough for Elon Musk. The billionaire entrepreneur now wants to merge computers with human

Ray Kurzweil: Human brains could be connected to the cloud by 2030



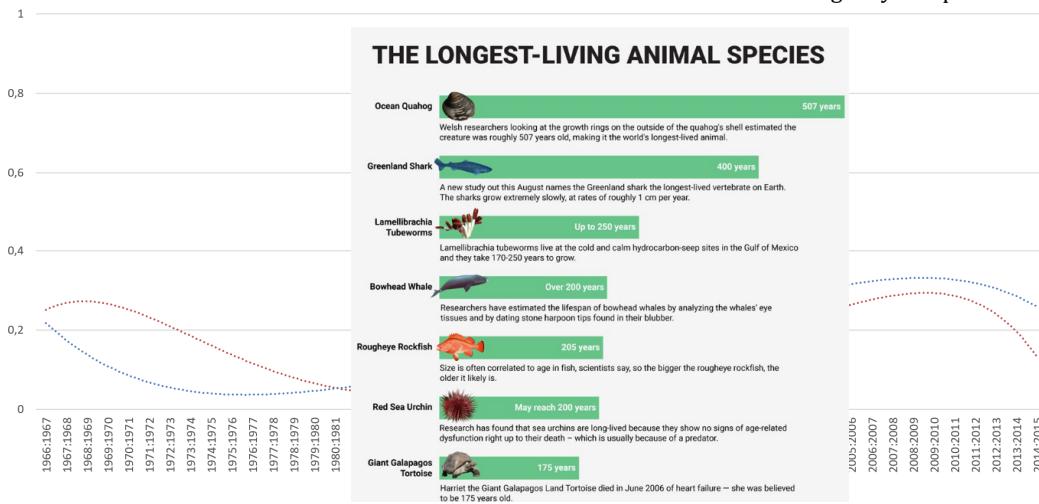
By Anthony Cuthbertson
June 4, 2015 12:14 BST



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Hvad viser denne graf?

Longevity escape velocity



Disruption: Human 2.0



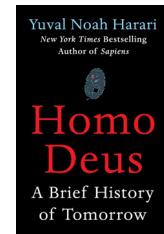
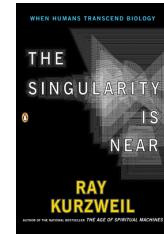
Hvor går grænsen mellem behandling og forbedring?



Hvordan sikrer vi lige vilkår for alle i en verden, hvor de rigeste har adgang til helt nye augmenterende behandlinger



Hvis vi kan, vil vi så tillade og designe human 2.0? Kan vi lade være? Vil det komme løbende? Hvad vil det sige at være menneskelig?



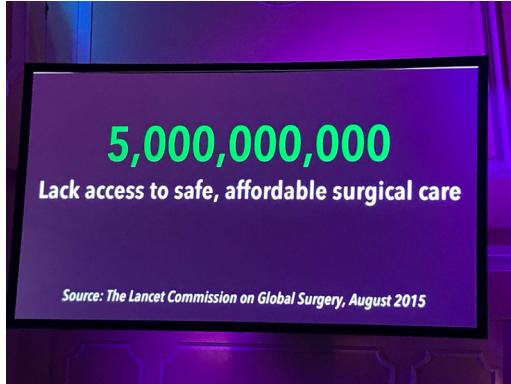
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Sundhed for alle



Akut mangel på sundhedstilbud



Health Crisis

India short of 500,000 doctors, bodies on shoulders reminder of health crisis

India is short of nearly 500,000 doctors, based on the WHO norm of 1:1,000 population, according to an IndiaSpend analysis of government data.

IANS | Thursday, September 01, 2016 - 17:21

A photograph showing a group of medical professionals in blue scrubs and caps performing surgery on a patient. They are focused on the procedure, with various medical instruments visible on the table in front of them.

Representative Image by Charanpal Saini / Joseph Calabrese / Public domain, via Wikimedia Commons

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Løsninger - Kina



Sample conversation from 'Melody the Medical Assistant' app, translated into English from Chinese. Image: Baidu

Baidu – AI

https://motherboard.vice.com/en_us/article/baidu-made-a-bot-to-help-you-when-youre-sick

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BeneVision N22/N19 Patient Monitor
See more. With ease.

Two large computer monitors side-by-side, each showing multiple ECG leads and other vital sign data. Below the monitors are smaller images of a mobile device and a laptop.

MEDLAB ASIA PACIFIC Apr 3-5, 2017 Singapore

Resona 7 Premium Ultrasound System

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Mindray – kinesisk medical device virksomhed med *
øget kvalitet i løsninger

<http://www.mindray.com/en/index.html>

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Løsninger - WhatsApp

Here's how WhatsApp could disrupt healthcare

BI Intelligence  Aug. 31, 2016, 8:30 PM 12,408



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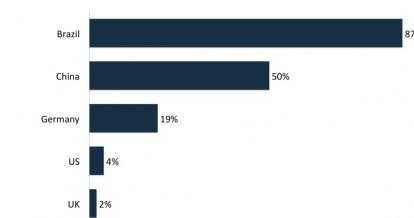
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WhatsApp's global cross-platform rollout of end-to-end encryption could incentivize more US doctors to use the messaging service to communicate with patients or colleagues, according to Cello Health Insight (cited by Fortune).

This could vastly improve the reach and speed of communication between doctors and patients.

Just 4% of doctors in the US use the chat app to communicate with other doctors or patients. The low adoption rate is mostly out of concern about violating Health Insurance Portability and Accountability Act (HIPAA) privacy regulations. In other markets where regulations aren't as severe, such as Brazil and China, the use of WhatsApp among doctors is much more prevalent. In Brazil, roughly 90% of doctors use the app

Share Of Doctors Using WhatsApp To Talk To Patients, By Country 2016



BI INTELLIGENCE

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Løsninger – Emerging world



Et eksempel på en inkubator, der er designet baseret på eksisterende komponenter i 3. verdens lande og dermed lettere at reparerer og holde ved lige.

<https://www.linkedin.com/pulse/how-we-can-improve-our-healthcare-system-designing-countries-hansen>



Billig hånddrevne blodcentrifuge

<http://www.nature.com/articles/s41551-016-0009>



Mobile Apps inklusiv billige sensorer, der bliver koblet på mobilen. Her er et eksempel på en app til at støtte fødsler, der bl.a. er danskudviklet til den 3. verdens lande.

<http://maternity.dk/the-safe-delivery-app/>

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Løsninger - Roboter



Intuitive Surgical er de største indenfor højt specialiserede robotter og er også blevet testet af i Danmark.

<https://www.intuitivesurgical.com/>

InTouch health er et eksempel på hvordan en robot og videolink kan understøtte tele-tilstædeværelse. Har prøvet deres løsning og kvaliteten er rigtig god. Interessant teknologi til at bringe læger derhen hvor der er behov f.eks. til udkantsområder eller til sygehusene på skæve tider af døgnet.

<http://www.intouchhealth.com/>



Derudover findes der en del projekter i Japan med at understøtte pleje, jeg ikke har set så meget nærmere på.

For yderligere om robotter anbefales nogle af artiklerne her:
<http://medicalfuturist.com/category/blog/technological-change/robotics/>

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Disruption: Sundhed for alle



Traditionel disruption af eksisterende virksomhed ved at komme med et billigt alternativ



Reelle innovative løsninger, da udgangsproblemstillingen er markant anderledes end i vesten.



Robotteknologi vil på sigt kunne transformere en række sundhedsfaglige og plejejobs.

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De fire disruptive trends



Fra sygdom til sundhed



Mod præcisionsbehandling



Menneske 2.0



Sundhed for alle

Disruption

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Er vi med i Danmark?

Personlig medicin

2017: 10 mio. kr.
2017-2020: 100 mio. kr.

Venture fonde

817 millioner investeret i danske firmaer (2013)

Period tracking app Clue pulls in \$20 million Series B from Nokia Growth Partners



GRAND ROUNDS

Overview

Total Equity Funding
\$106M in 4 Rounds from 5 Investors
Most Recent Funding
\$55M Series C on August 20, 2015

2.945

In 2016, the Novo Nordisk Foundation awarded a grant of DKK 2.945 billion (€396 million) to the Capital Region of Denmark to establish and operate the Steno Diabetes Center Copenhagen.

Novo Nordisk forskningsbudget

ca. 10 milliarder (årligt)

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Spørgsmål og interager

Web

www.kiteinvent.com

LinkedIn – connect eller follow!

www.linkedin.com/thomasr

Twitter – links til healthcare nyt

@thomasrdk

E-mail – skriv gerne

thomas@kiteinvent.com



Trends der ikke kom med ...

- Syntetisk RNA
- Mitochondrial transplantation
- Nye genetiske bogstaver
- Stamcelle behandling af hjernedøde
- 3d printning
- Dyrkning af organer
- Fosteroperationer
- Nanoteknologiske diagnostikplattorme
- Psykiatrisk diagnostik
- Internet of things
- IT-sikkerhed
- Nanoroboter
- Liquid biopsier
- Innovationsmodeller
- ...

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