The Evolution of Cancer Therapy

ELEANOR STRIDE

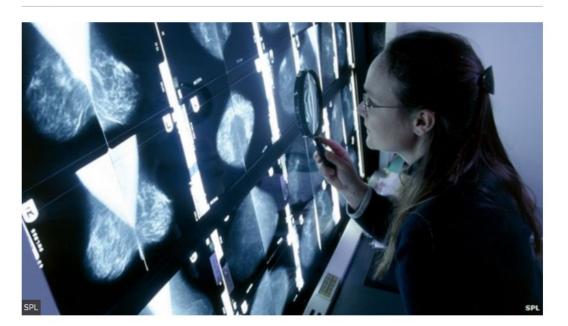


Cancer

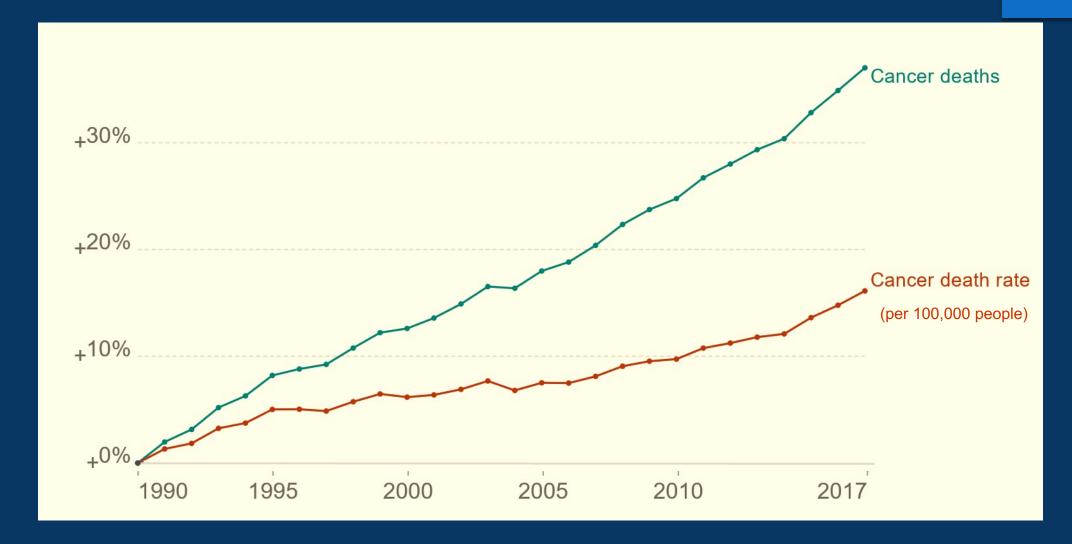
THE PRICE OF LONGEVITY?

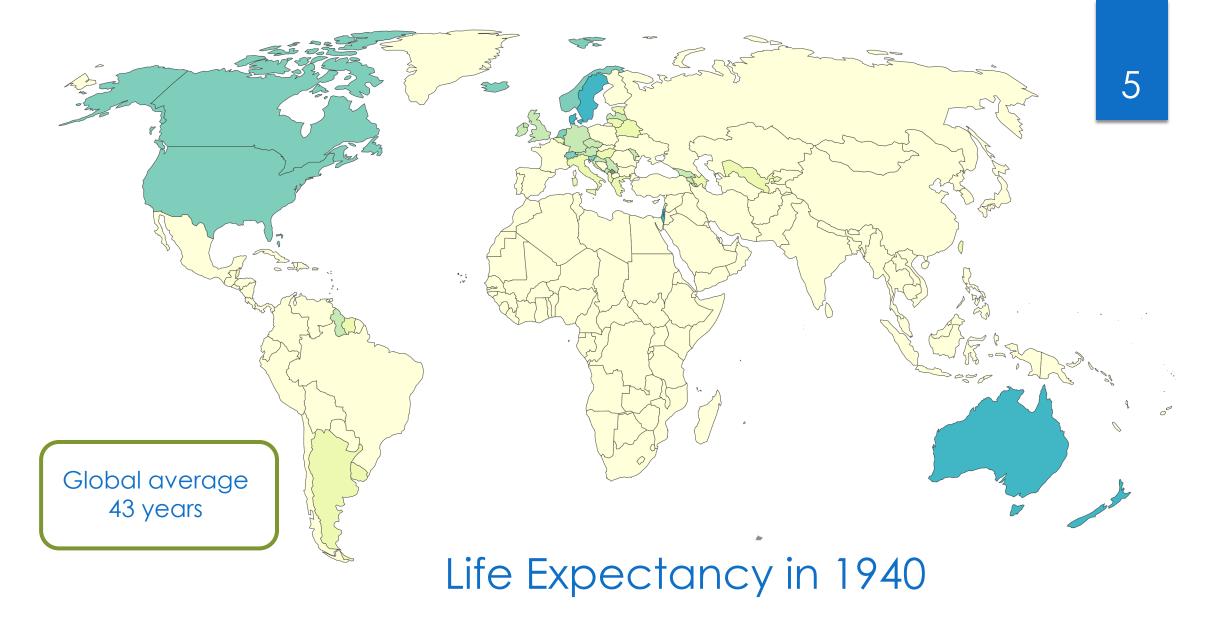






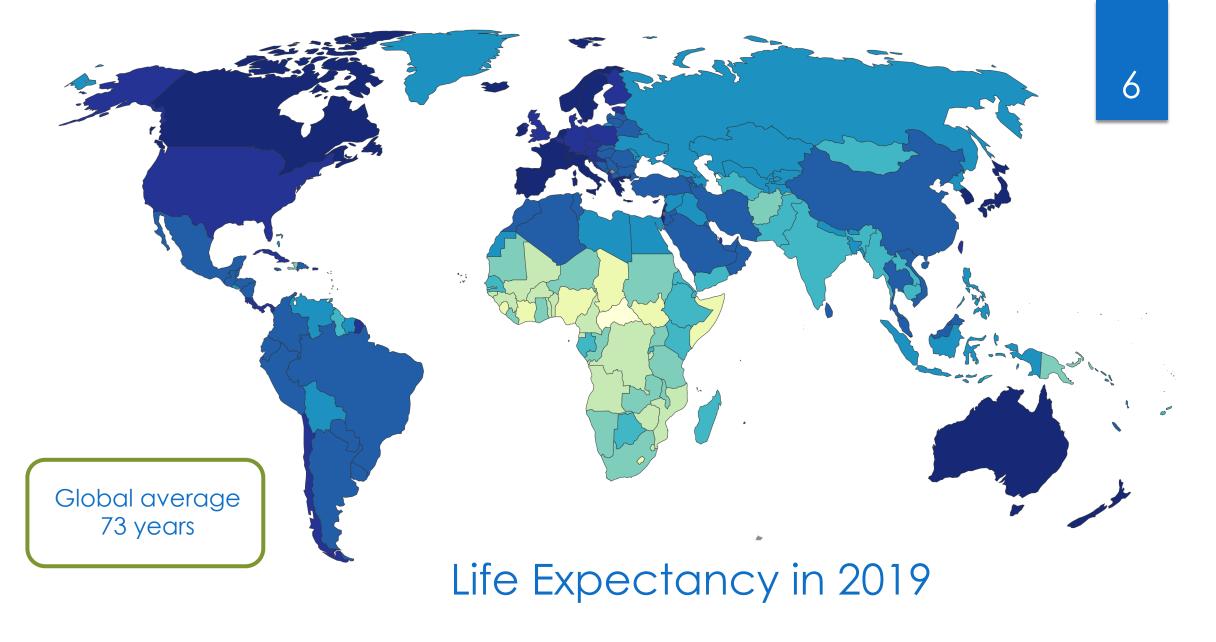
One in two people in the UK will be diagnosed with cancer at some point in their lives, analysis suggests.





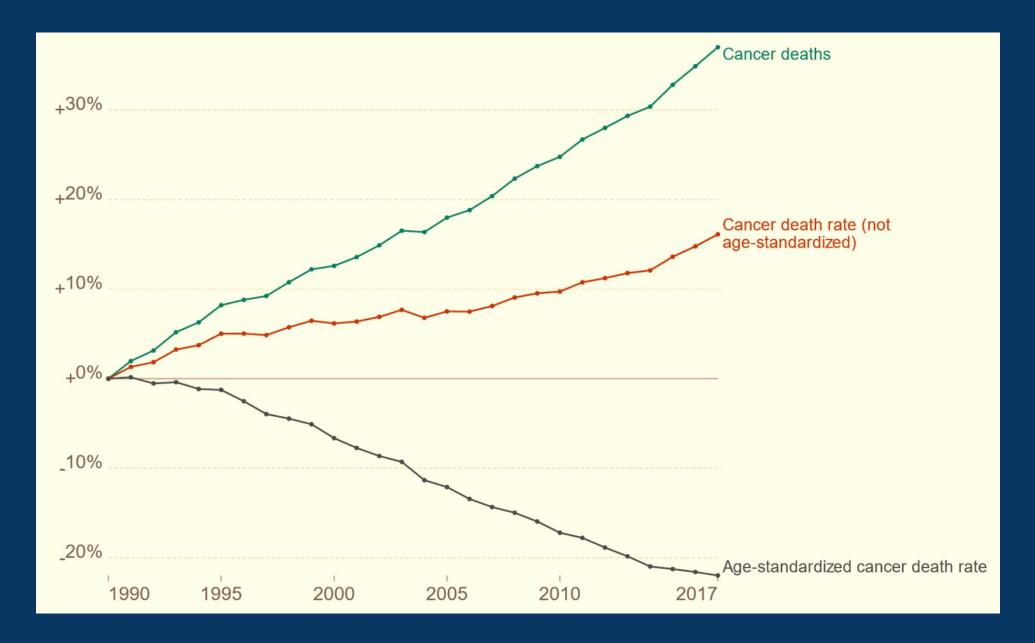
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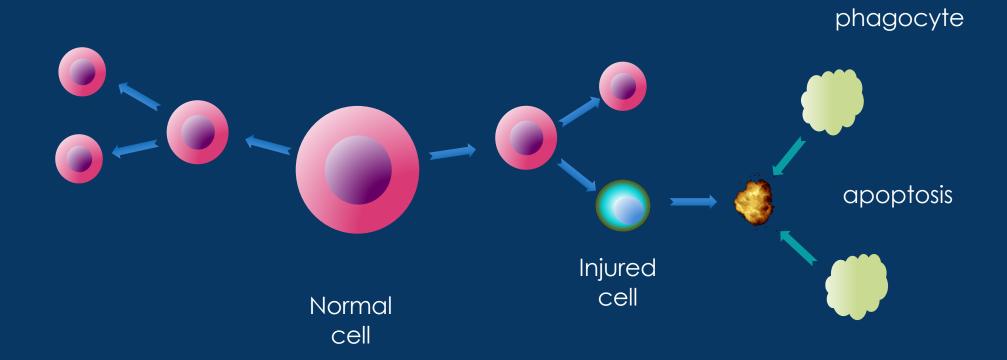
54 years 58 years 62 years 66 years 70 years 74 years 78 years 82 years 86 years 90 years

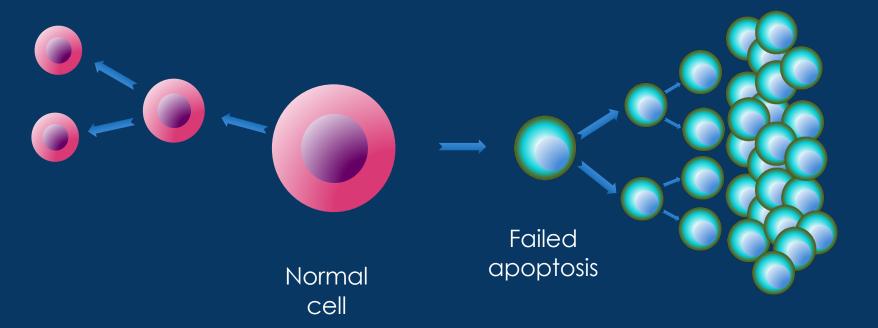


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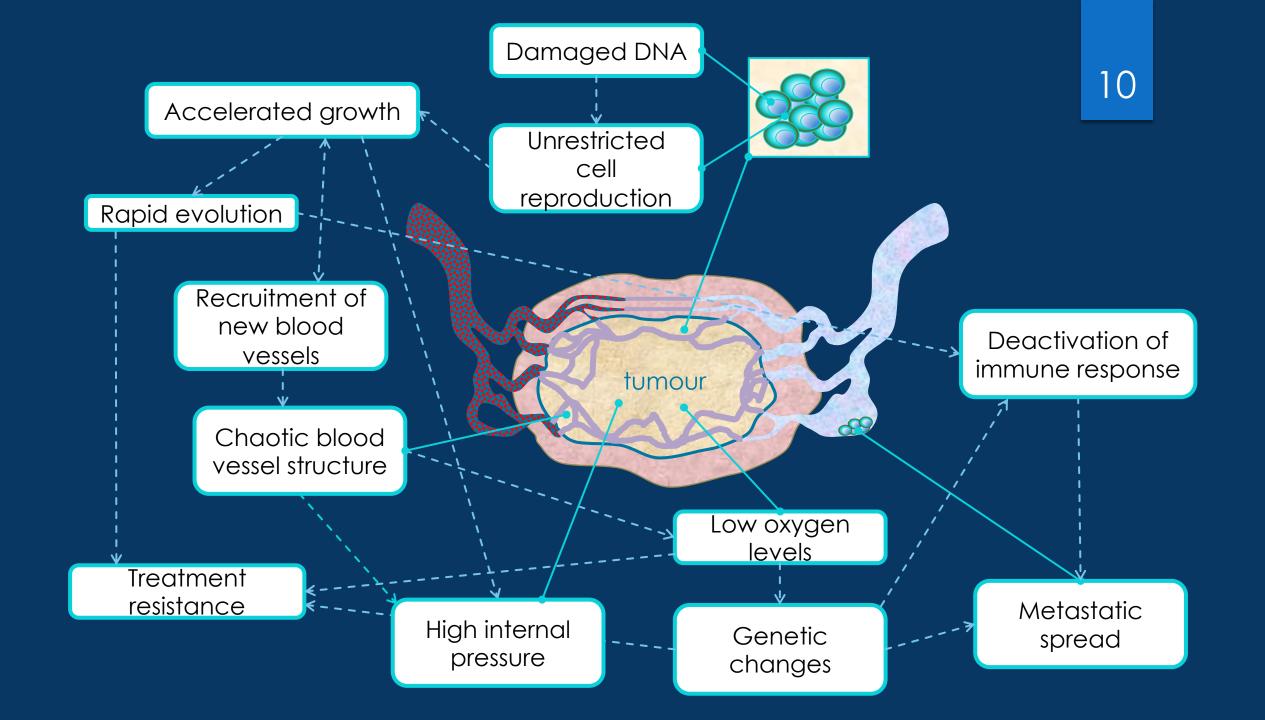
54 years 58 years 62 years 66 years 70 years 74 years 78 years 82 years 86 years 90 years

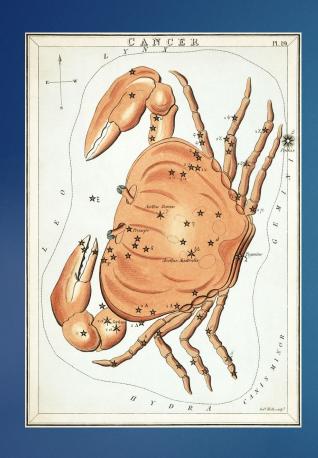






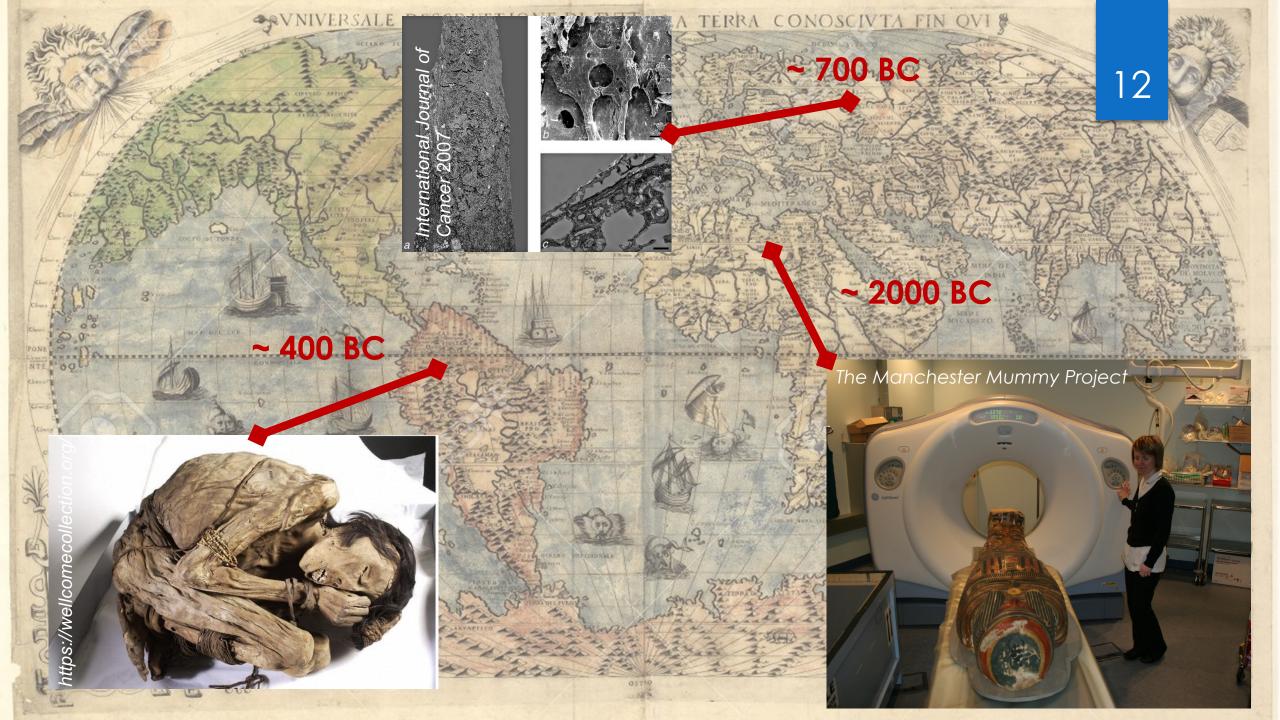
Uncontrolled growth

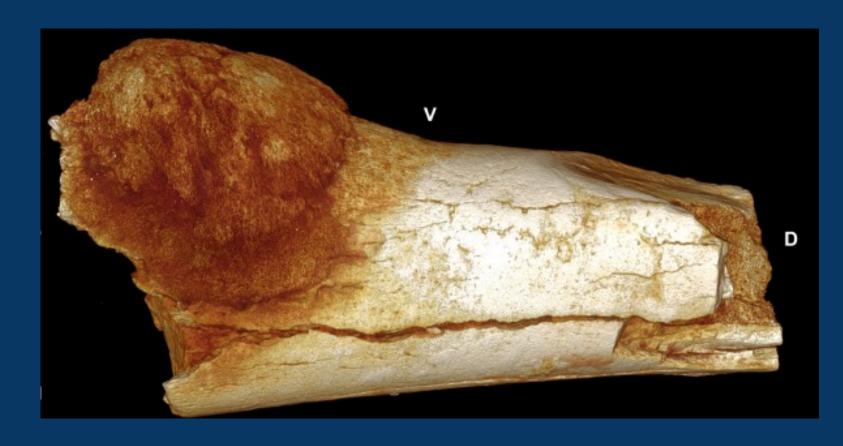


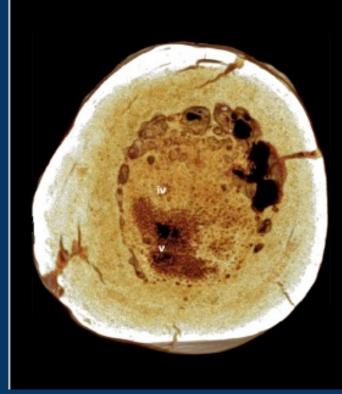


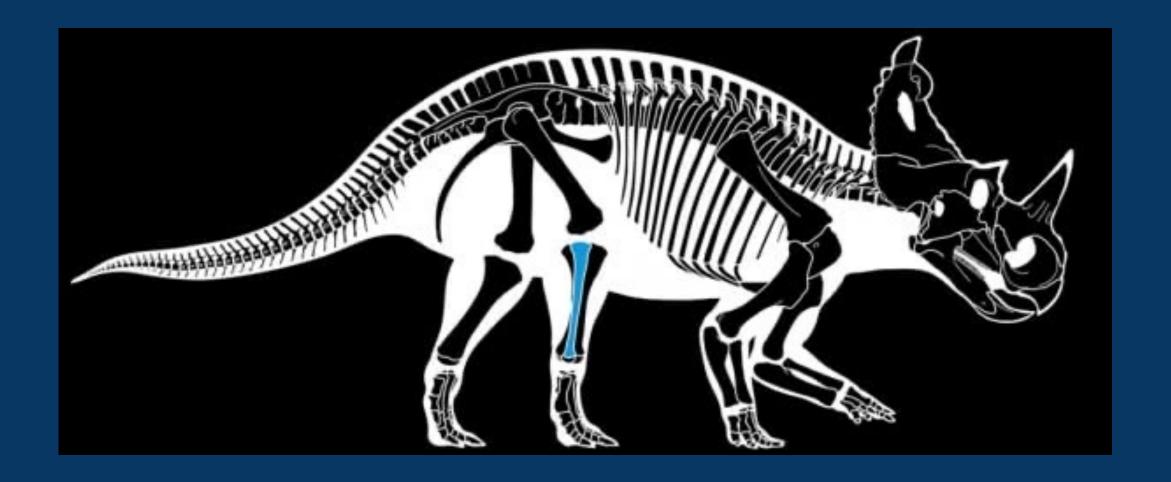
Black Humour

FROM THE ANCIENT WORLD
TO THE INDUSTRIAL
REVOLUTION





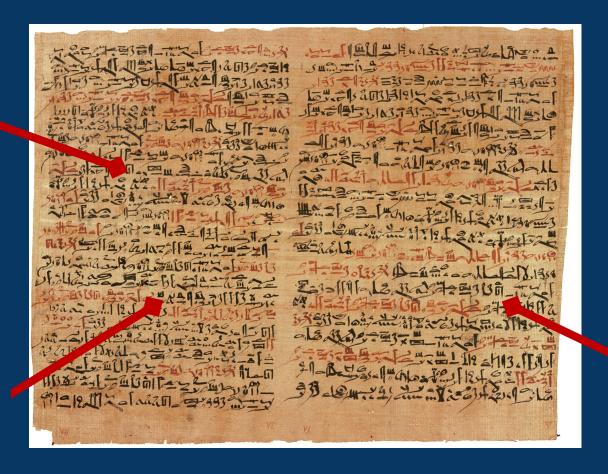




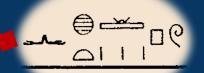
Cancer rates in medieval Britain were around ten times higher than previously thought, study suggests





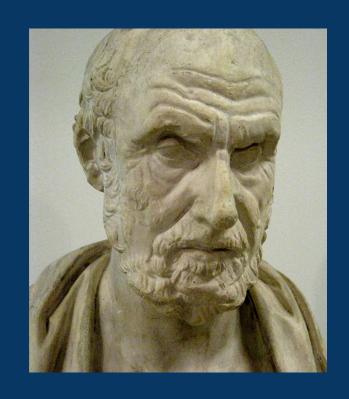


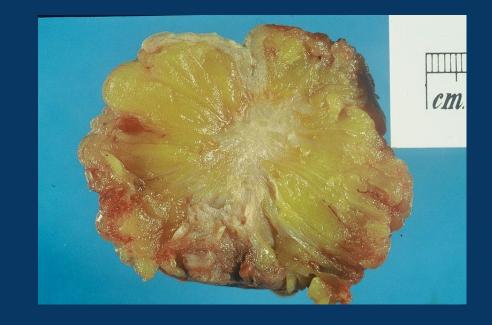
"If thou examinest a man having bulging tumors on his breast ... that have spread over the breast ... [and] thou findest them very cool"

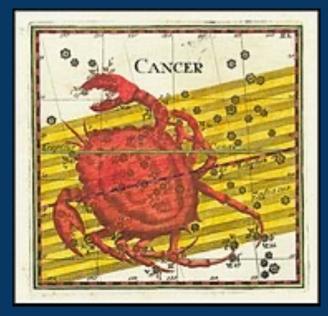


The Edwin Smith Papyrus

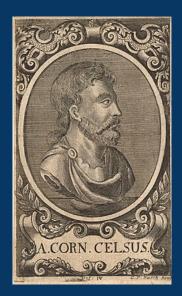
"There is nothing"



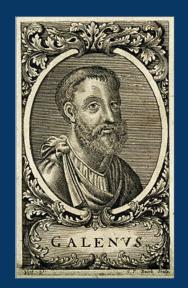




Hippocrates (460-370 BC)

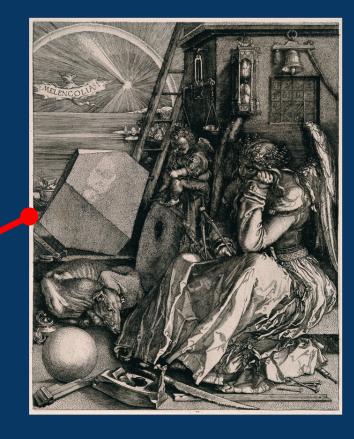


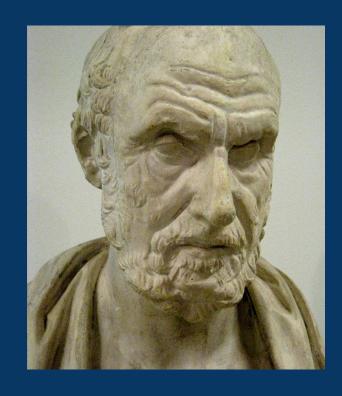
Celsus c.25 BC-50 AD



Galen c.130-200 AD







"Occult cancers should not be molested. Attempting to treat them, they quickly become fatal. When unmolested, they remain in a dormant state for a length of time"

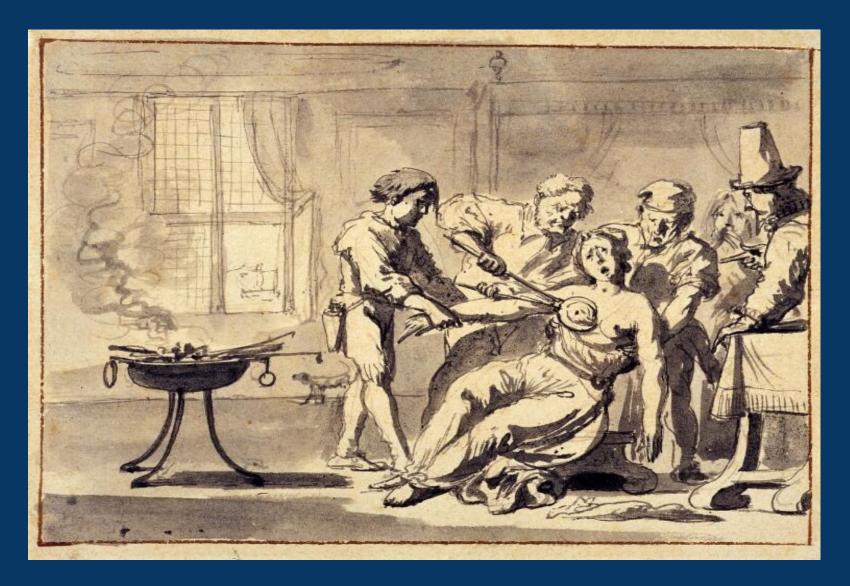
Hippocrates (460-370 BC)











Z b / 9+0

DICTIONARY

237

PRACTICAL SURGERY

317

VARIOUS BRITISH HOSPITAL SURGEONS

EDITED BY

CHRISTOPHER HEATH, F.R.C.S.

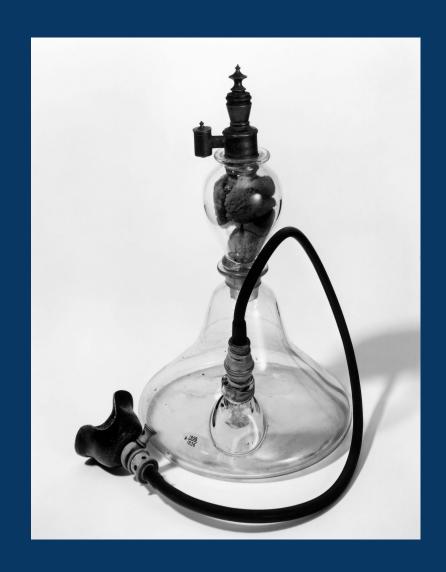
NOLME PROPESSOR OF CLINICAL SCHOOLSY EX UNIVERSITY COLLEGE, LONDON STREETS TO UNIVERSITY CULLINGS RESSITAT; MEMBER OF THE CHINCEL AND COURT OF REALINESS OF ENGLISH COLLEGE OF SUDGLOSS OF ENGLISH

VOLUME II.

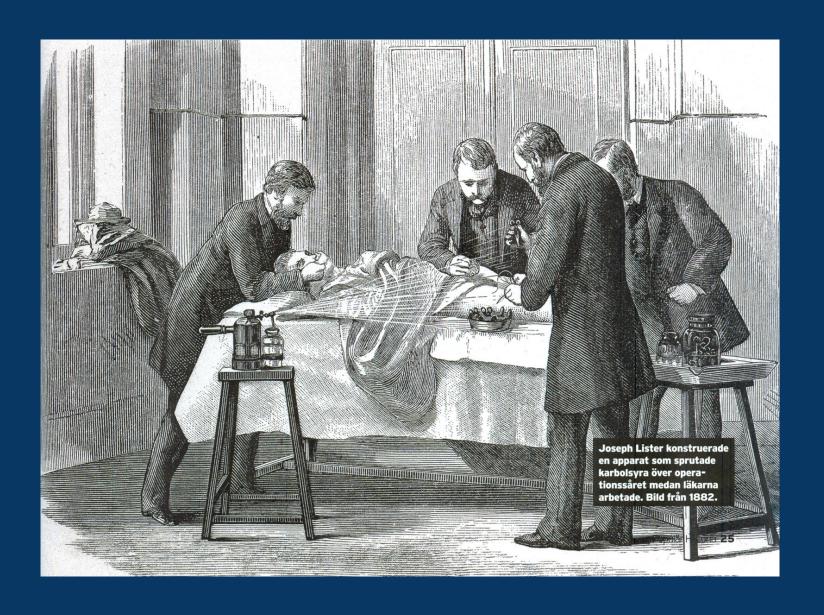
SUBSCRIPTION EDITION

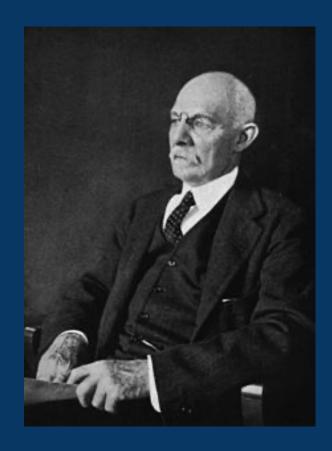
"In treating of cancer, we shall remark that little or no confidence should be placed either in internal remedies and that there is nothing except the total separation of the part affected"

Dictionary of Practical Surgery 1836



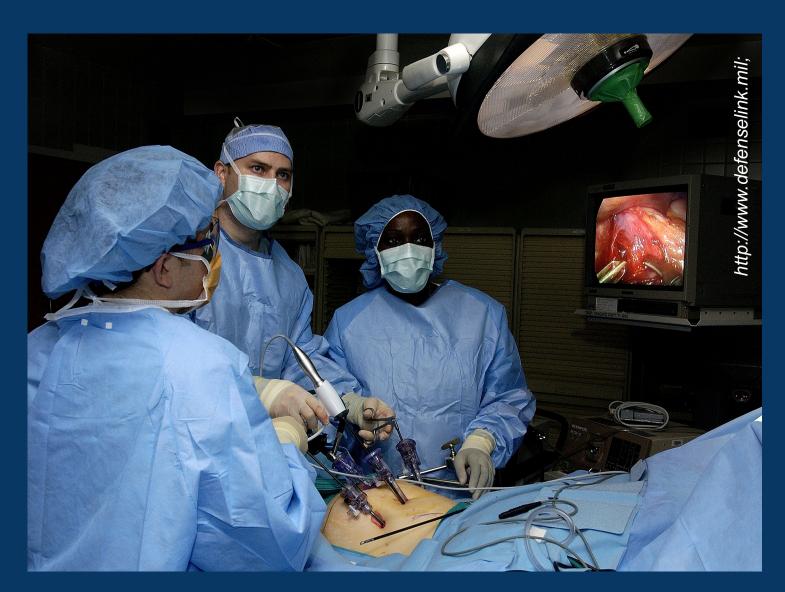




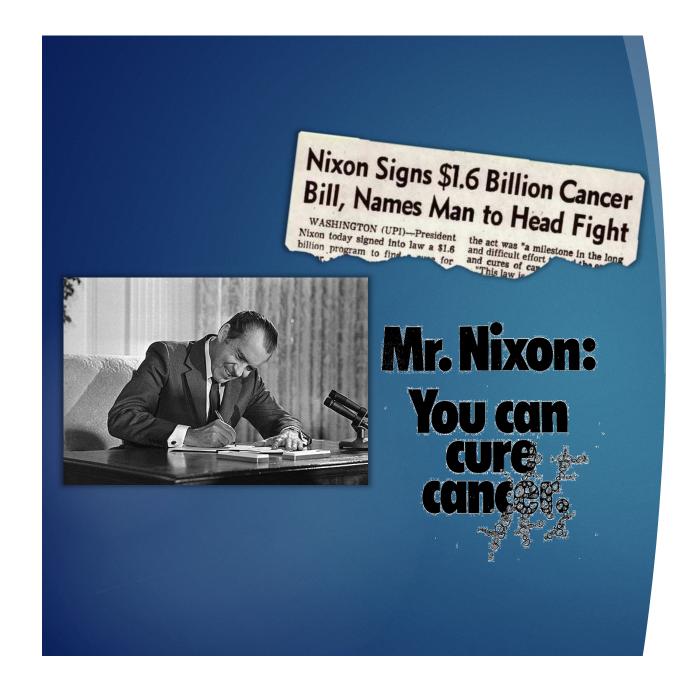


William Halsted 1852 – 1922





45% cancer patients receive surgery



The War on Cancer

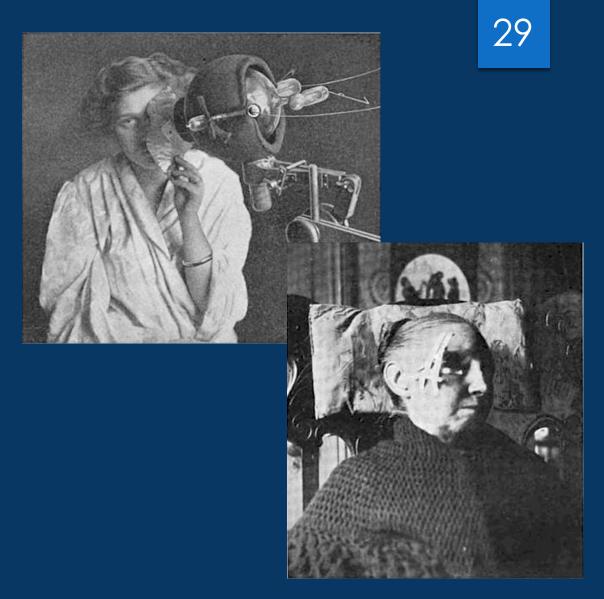
THE MODERN ERA

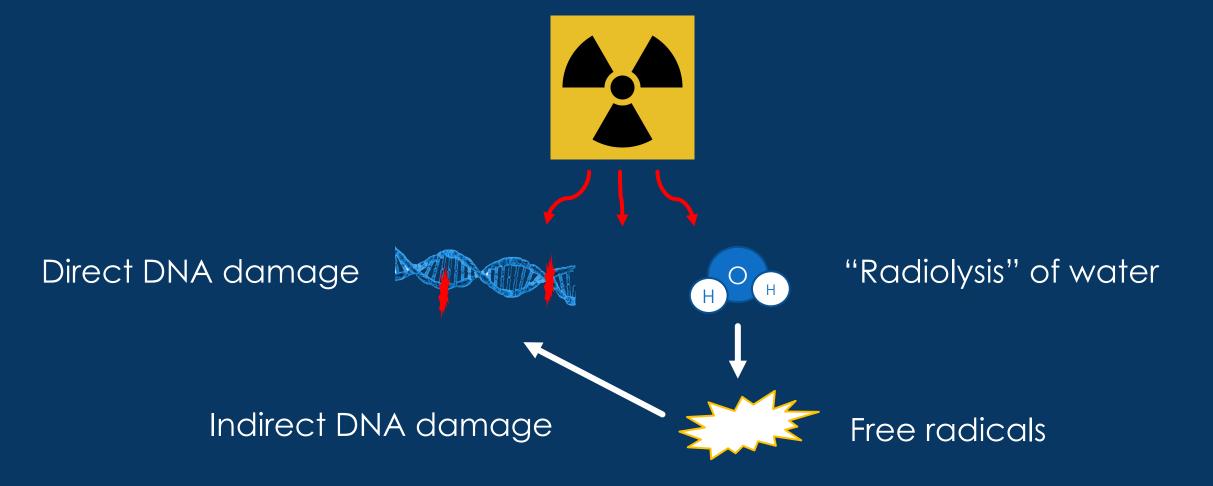


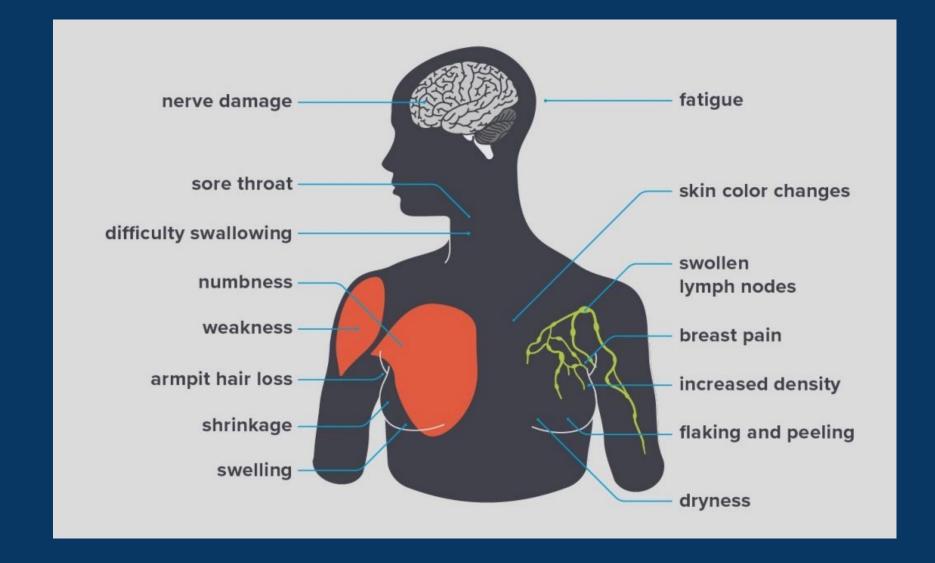
"An absolute cure for all forms of cancer"

cancer physician, 1901





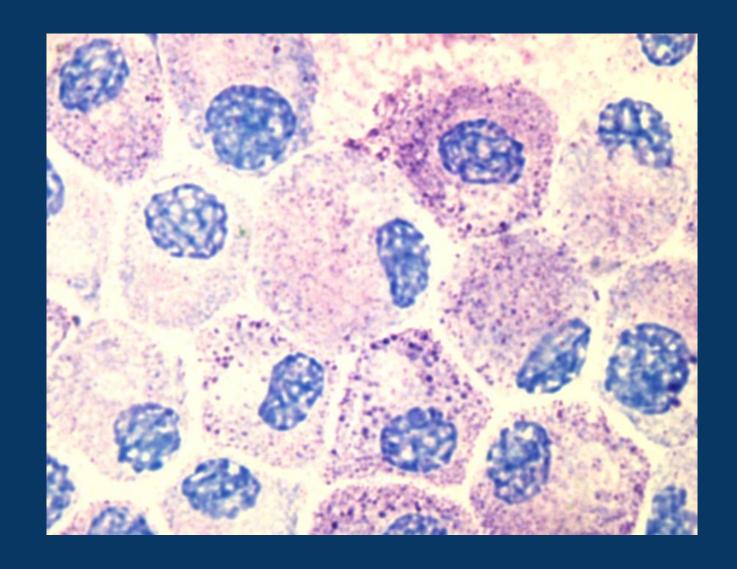


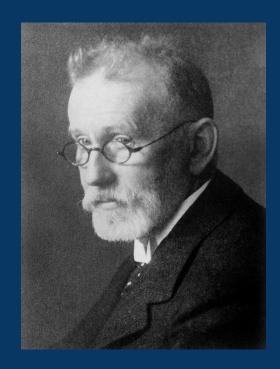






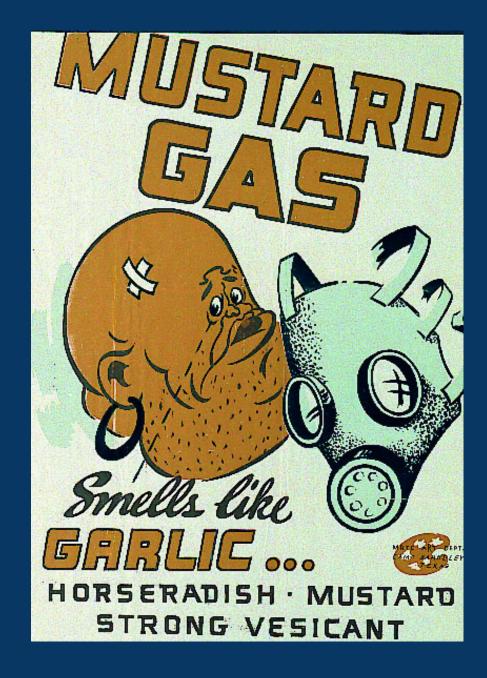
27% cancer patients receive radiotherapy

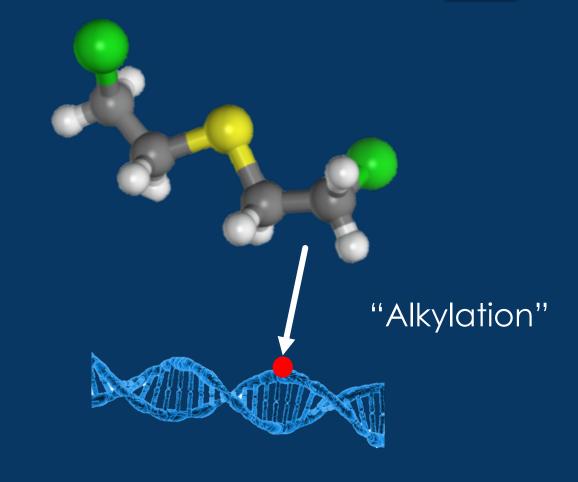


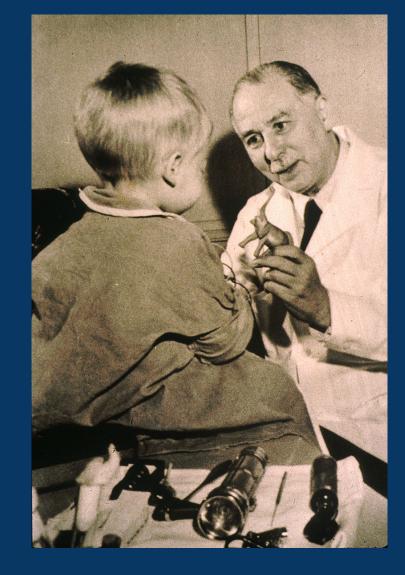


Paul Ehrlich 1854 -1915

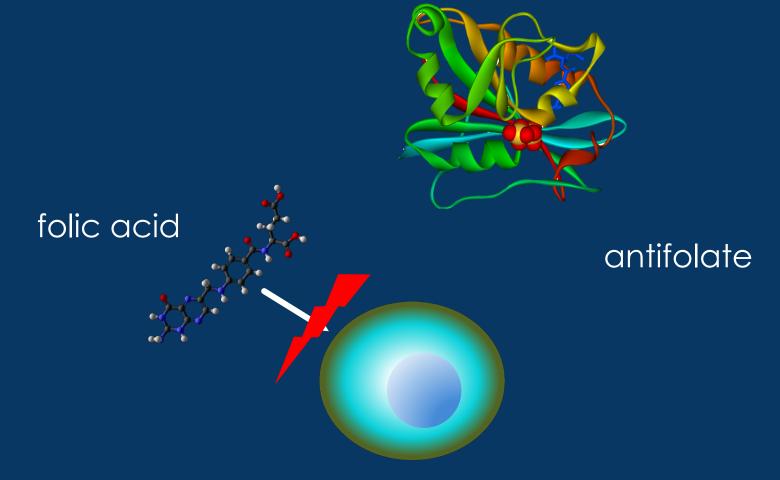








Sidney Farber 1903 -1973



Alkylating agents

Antimetabolites

Tubulin interactive agents

Taxanes

Platinum complexes

Topoisomerase inhibitors

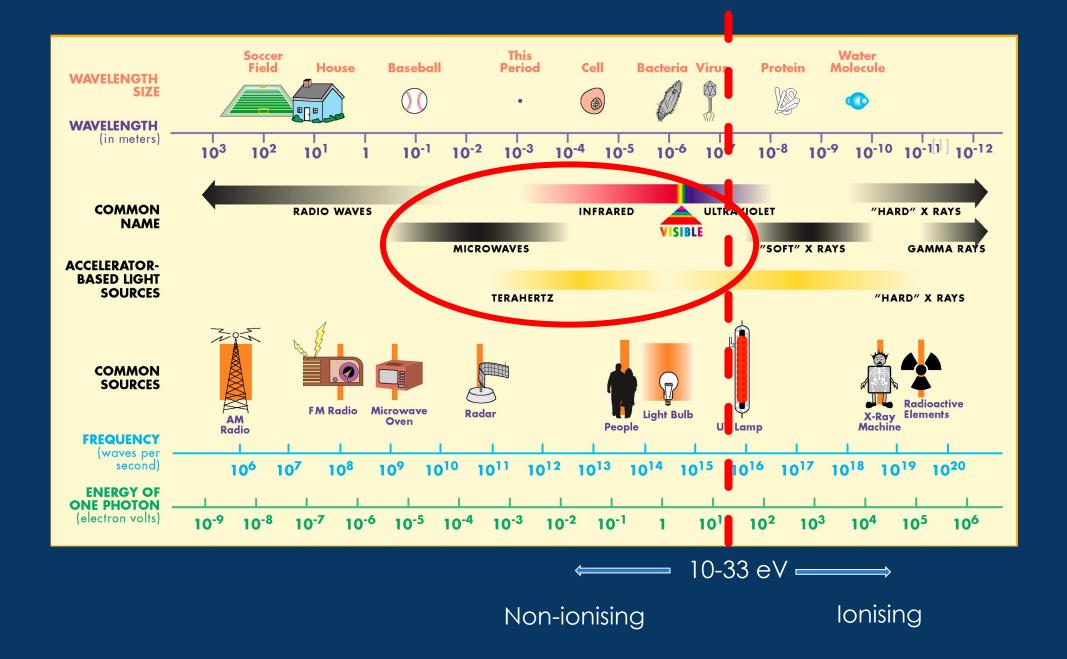
Anthracyclines





28% cancer patients receive chemotherapy







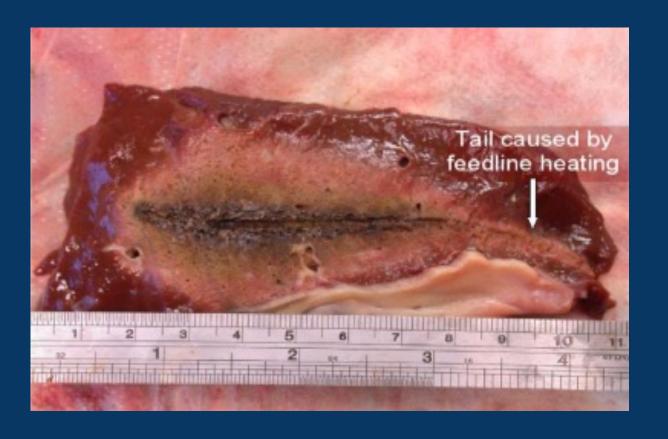
Microwave ablation



Laser ablation



Radiofrequency ablation





High intensity focused ultrasound

BLOOD-BRAIN BARRIER OPENED NON-INVASIVELY WITH FOCUSED ULTRASOUND FOR THE FIRST TIME

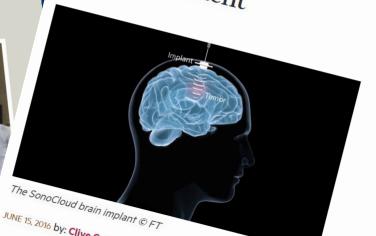
Charlottesville, VA – November 9, 2015 – The blood-brain barrier has been non-invasively opened in a patient for O Published: November 9, 2015 the first time. A team at Sunnybrook Health Sciences Centre in Toronto used focused ultrasound to enable temporary and targeted opening of the blood-brain barrier (BBB), allowing the more effective delivery of chemotherapy into a patient's malignant brain tumor.

The team, led by neurosurgeon Todd Mainprize, MD, and physicist Kullervo Hynynen, PhD, infused the chemotherapy agent doxorubicin. along with tiny gas-filled bubbles, into the bloodstream of a patient with a brain tumor. They then applied focused ultrasound to areas in the tumor and surrounding brain, causing

tight junctions of the cells comprising the blood-brain barrier and allowing high concentrations of t chemotherapy to enter targeted tissues.

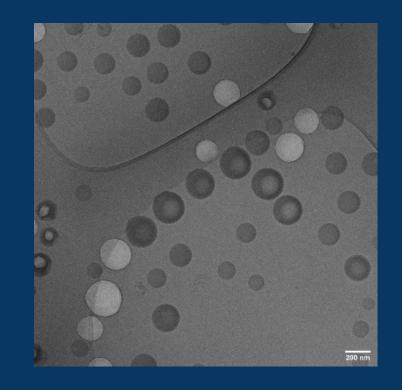


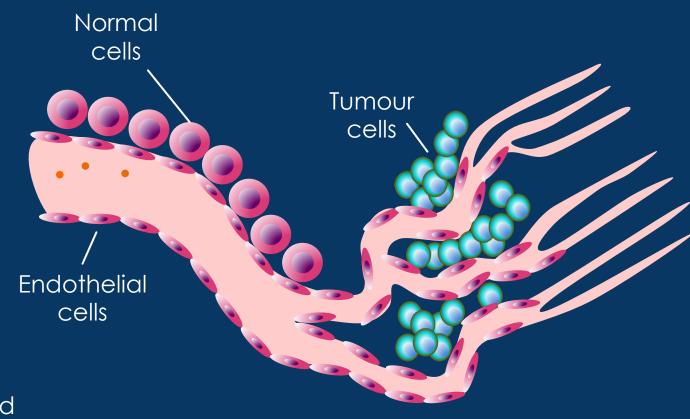
Ultrasound used to breach blood-brain barrier in cancer treatment

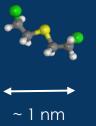


JUNE 15, 2016 by: Clive Cookson, Science Editor

French scientists have carried out the first human trial of an ultrasound device that pushes drugs through the "blood-brain barrier", potentially clearing a big obstacle to using chemotherapy on brain tumours.









Drug loaded nanoparticle

$$+ \qquad = \qquad \stackrel{\text{OH}^{-} \cdot \text{OH}}{\underset{\text{IO}_{2}}{\text{OH}}}$$

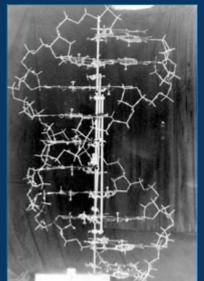
Inactive drug

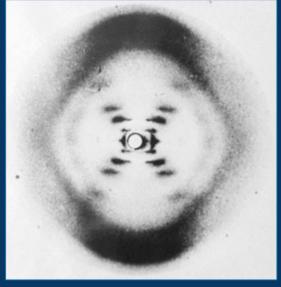
Reactive oxygen species



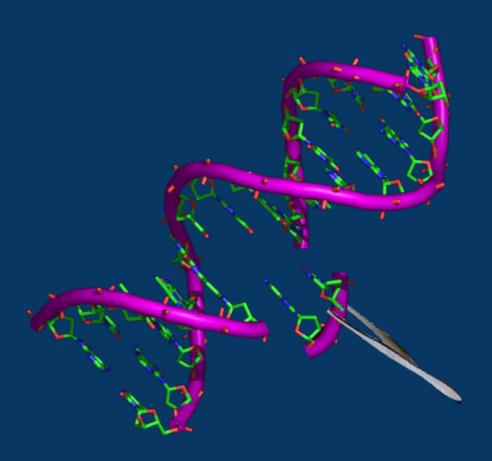


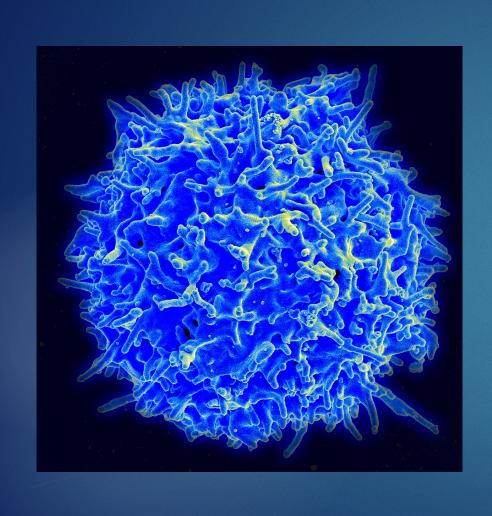






Cold Spring Harbor Laboratory Library





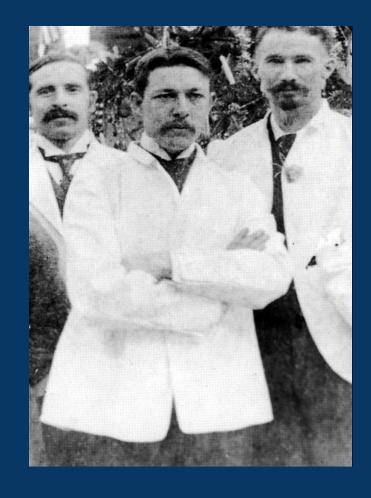
Curing cancer from within

THE RISE OF IMMUNOTHERAPY



Saint Peregrine Laziosi

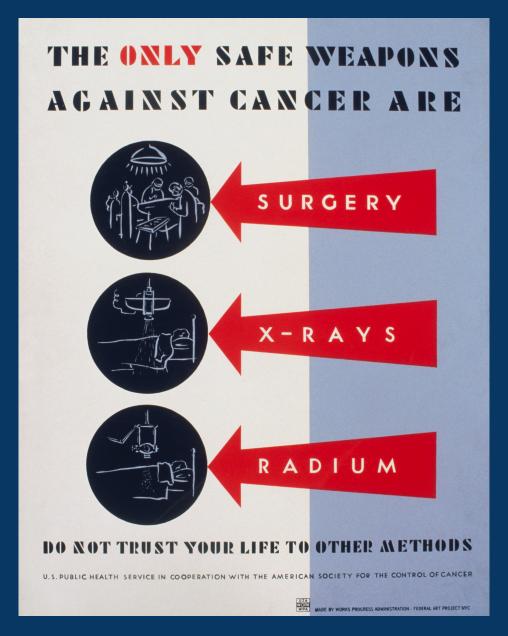
1265-1345

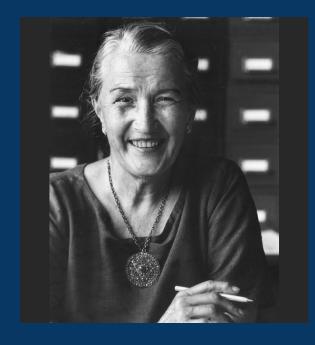


William Coley 1862-1936

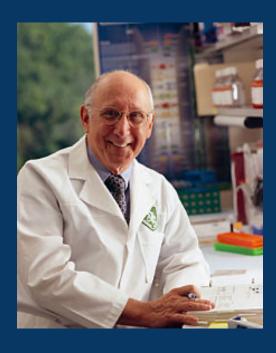


Streptococcus pyogenes

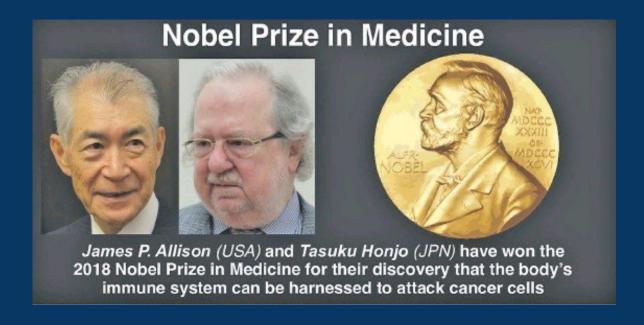


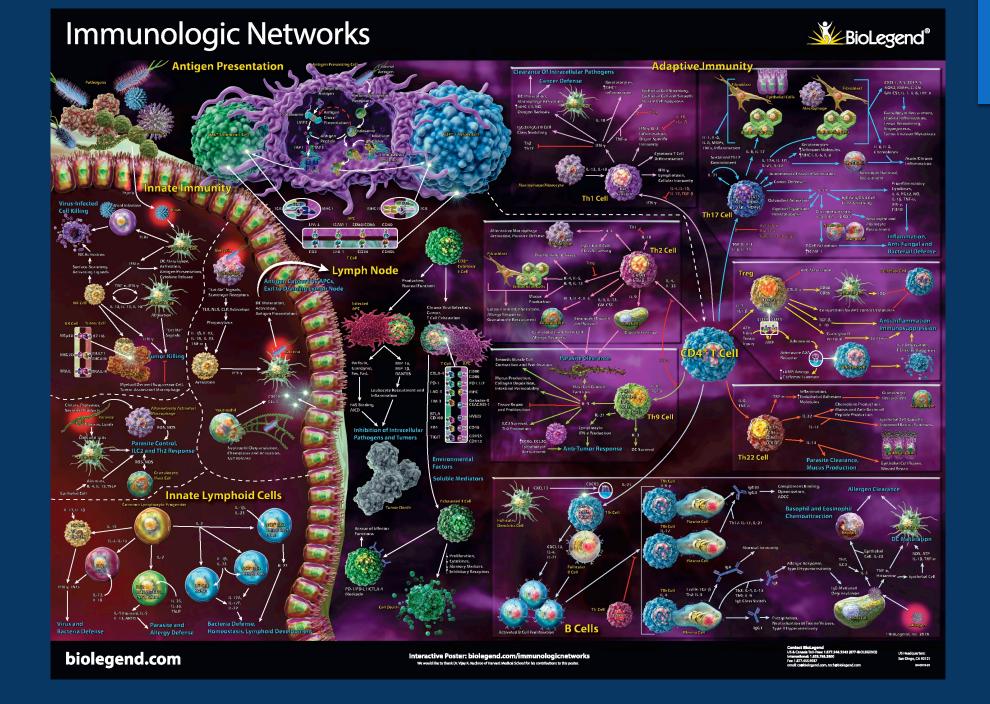


Helen Coley Nauts 1907-2001

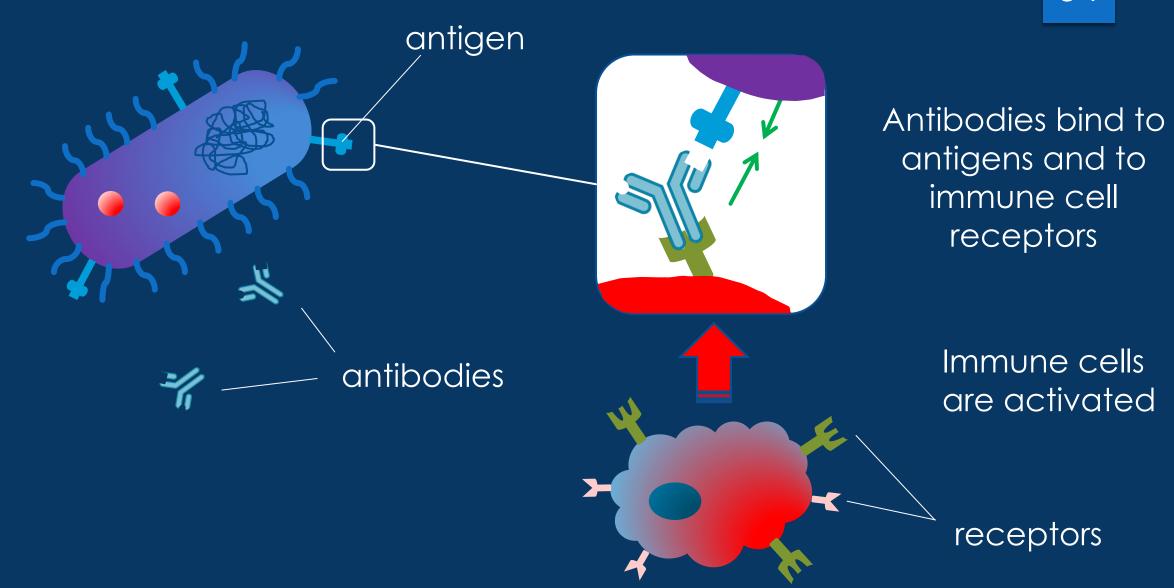


Steve Rosenberg 1940 -

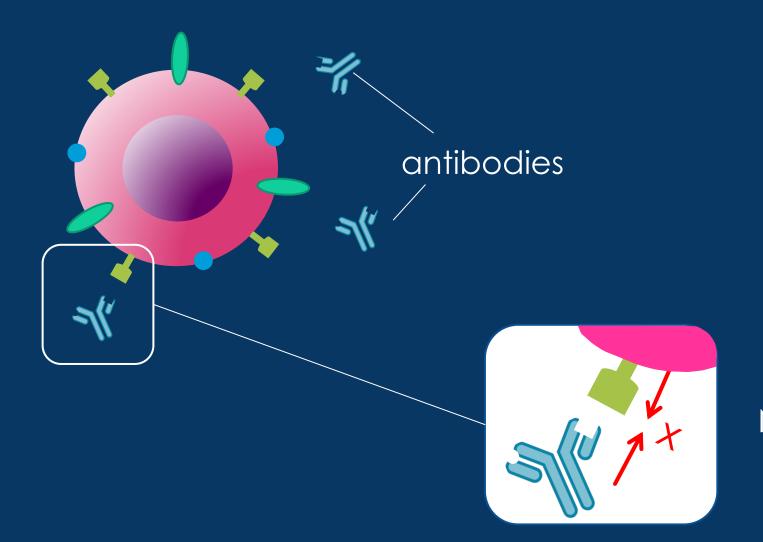




"Foreign" cell



Normal healthy cell



No antibody binding

Tumour cell

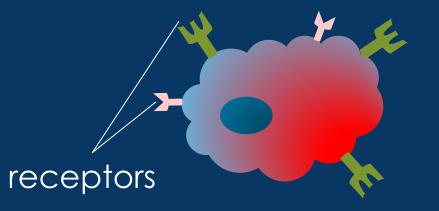
antibodies |



Antibodies bind



Immune cells are activated



antigen



Check point activation



Immune response is shut down



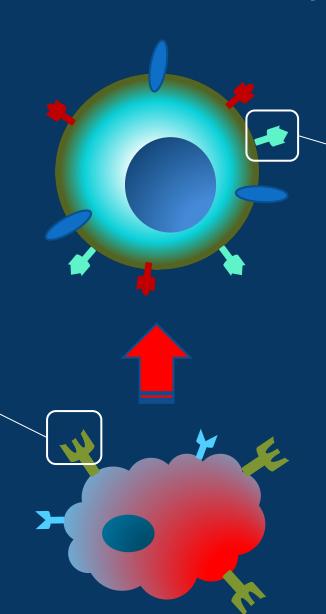
Immunotherapy



Antibodies bind



Immune cells are activated

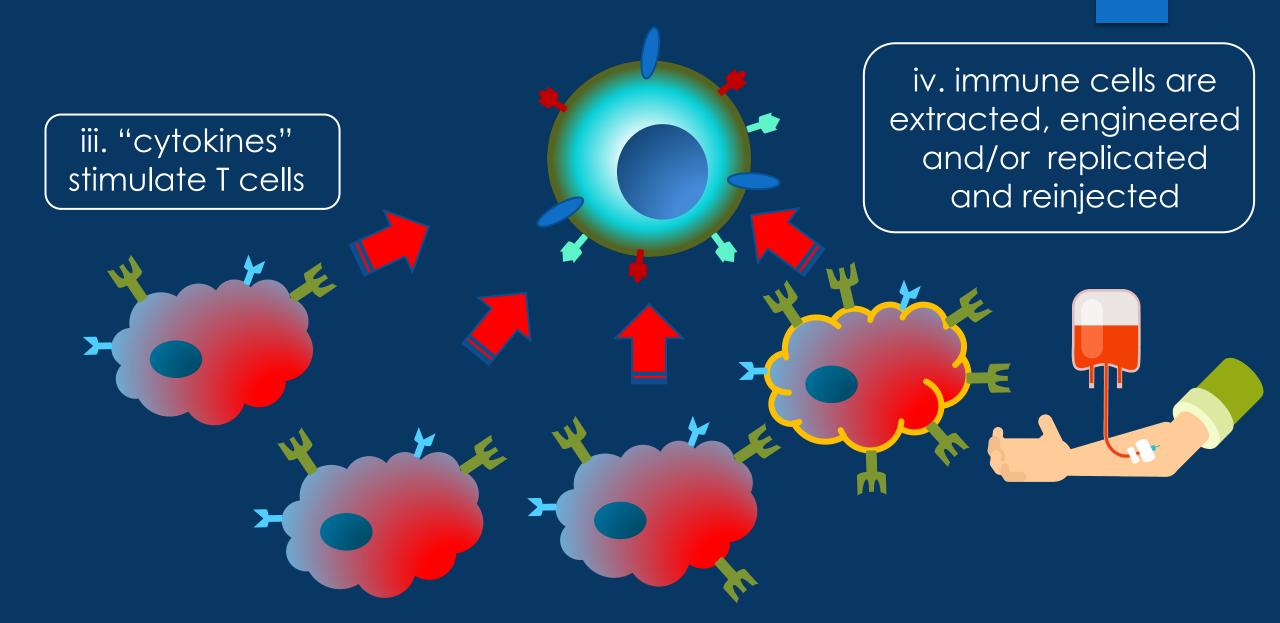


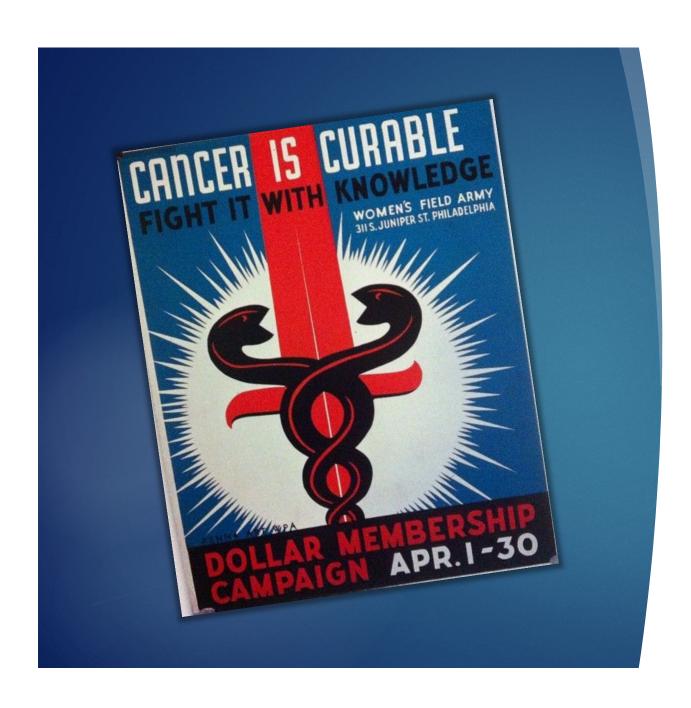


ii. Check point inhibitor

Immune response remains active

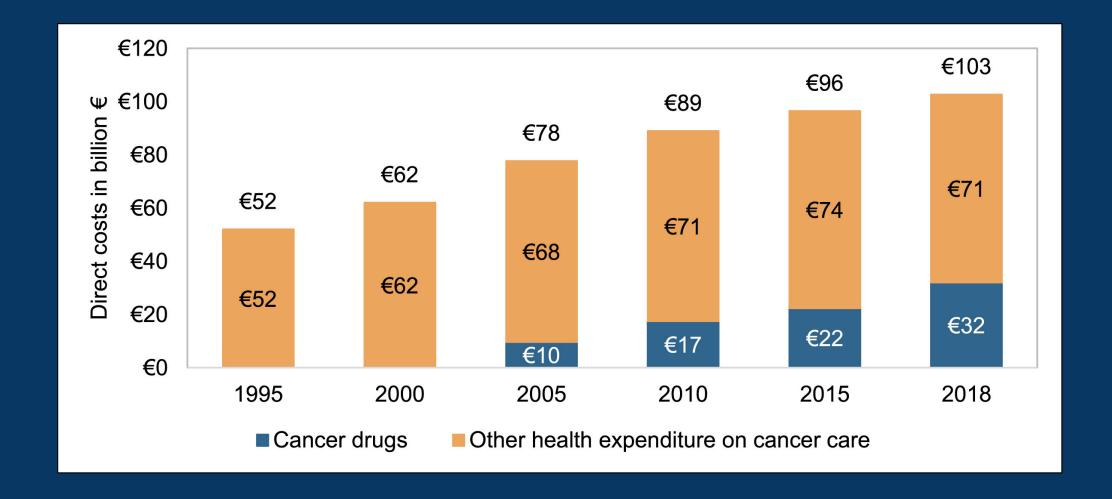
Immunotherapy cont.

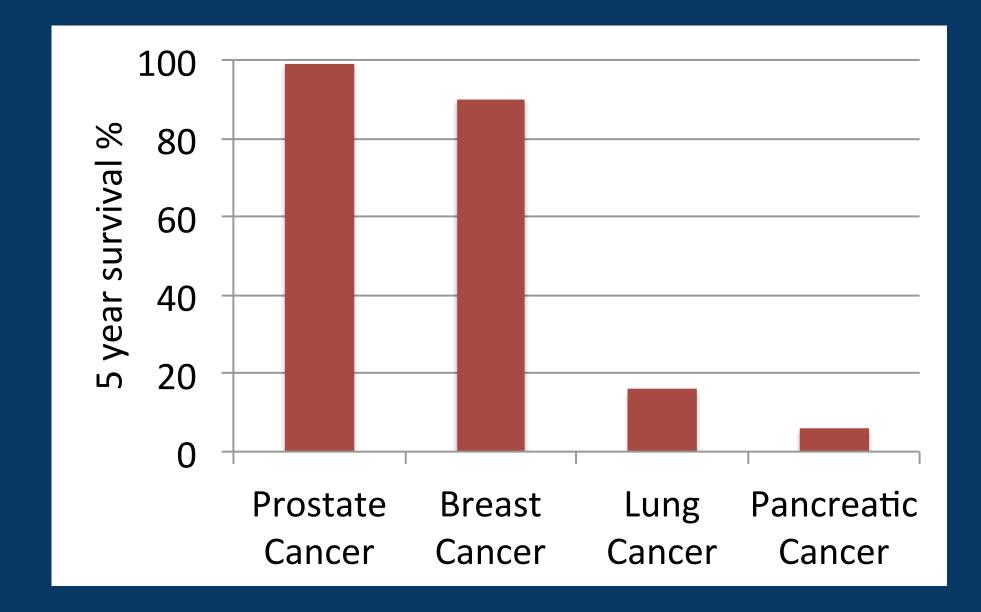




The Future?

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Scientific & Technical

- How does DNA damage leads to cancer?
- What are the genetic and environmental risk factors?
- What causes cancer drug resistance?
- How do tumours evade the immune system?
- Why do some tumours metastasize?
- How can we accurately target therapy?
- Why do only some patients respond to therapy?

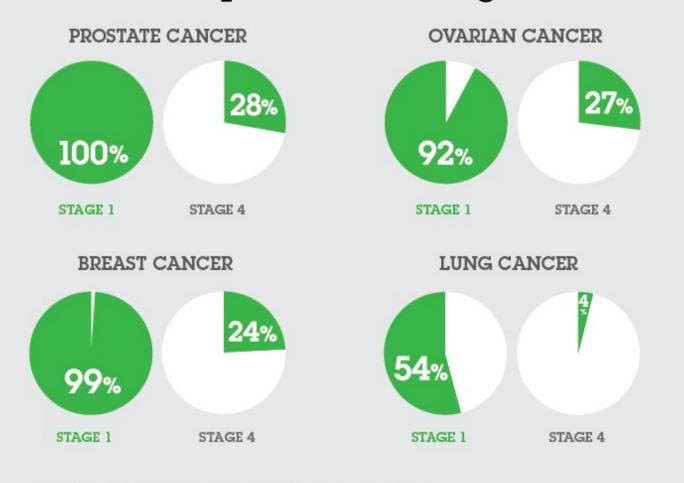
Economic

- Cost of drug development
- Cost & duration of regulatory approval processes
- Cost of manufacturing
- Cost to healthcare providers
- Complexity of reimbursement mechanisms

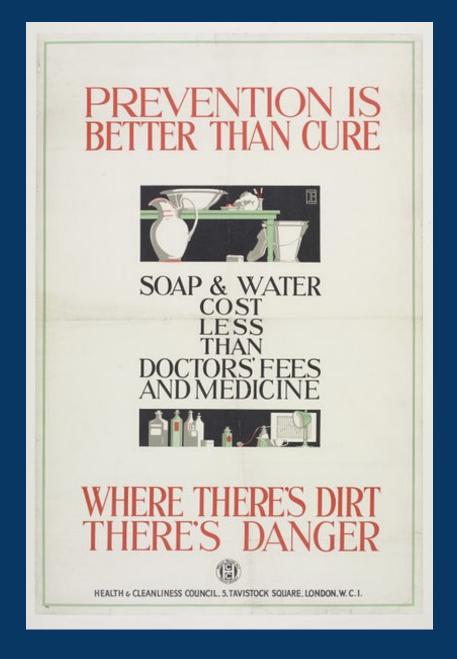
Ethical & Political

- Should patients have the "right to try" new drugs?
- How tightly should we regulate genetic engineering?
- Should we nationalise drug development?
- Should we mandate cancer vaccines?
- Should we ban alcohol?

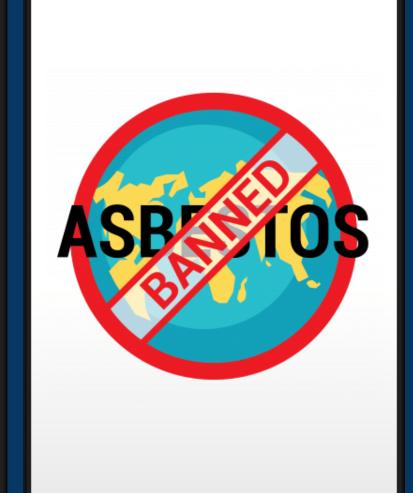
5-year survival rate, depending on **early** or **late** diagnosis:



Source: SEER Cancer Statistics, National Cancer Institute, 2013









Changes in post-vaccination HPV prevalence in England: 16-18 year old females

