

Radiant Hope

Illuminating the Mechanisms and
Morality of Pediatric Cancer
Radiation Therapy



**“The whole concept of the
self-made man or woman
is a myth.”**

—Arnold Schwarzenegger

OUTLINE

01

**Mechanisms of Radiation
Therapy**

02

**Clinical Use of Radiation
Therapy**

03

**Radiation Therapy
Research**

04

Ethics

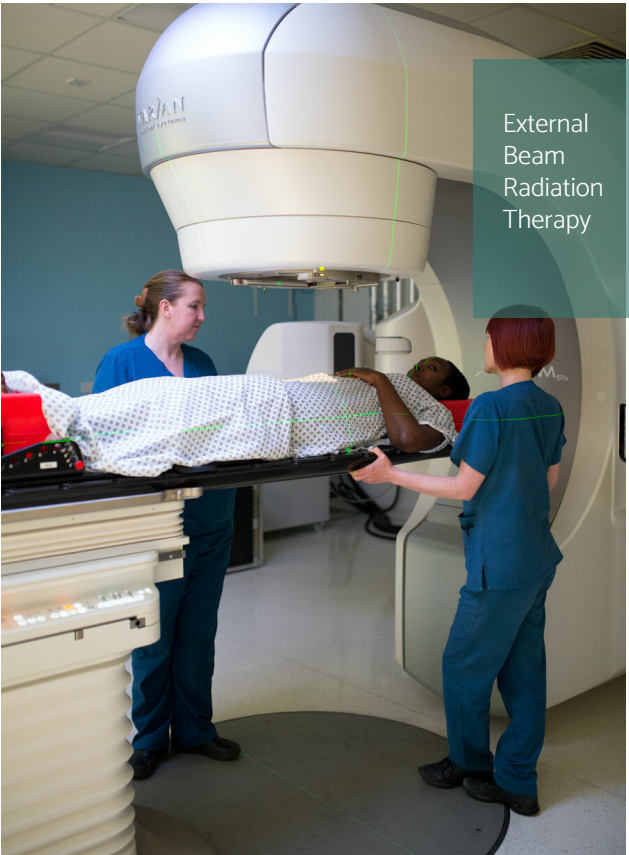
05

Personal Connections

WHAT IS RADIATION THERAPY?



Internal
Radiation
Therapy



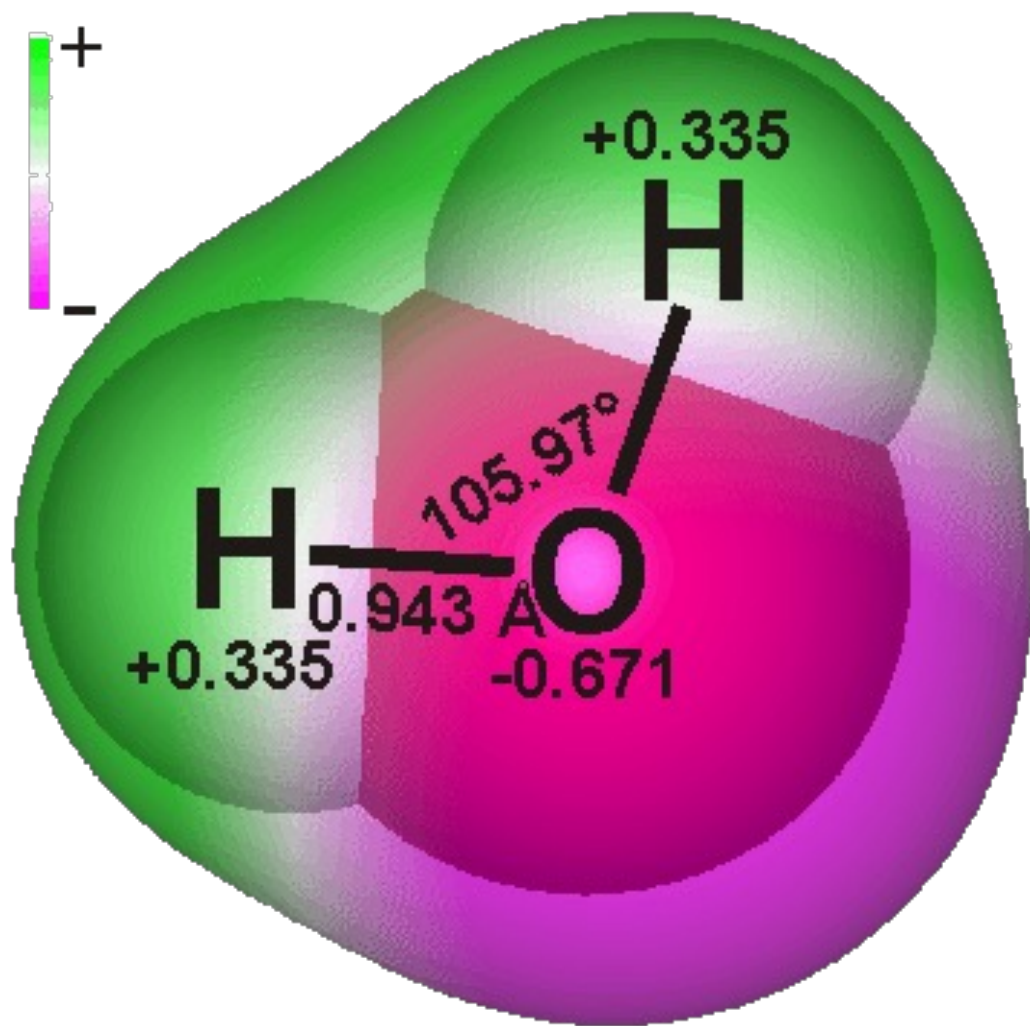
External
Beam
Radiation
Therapy

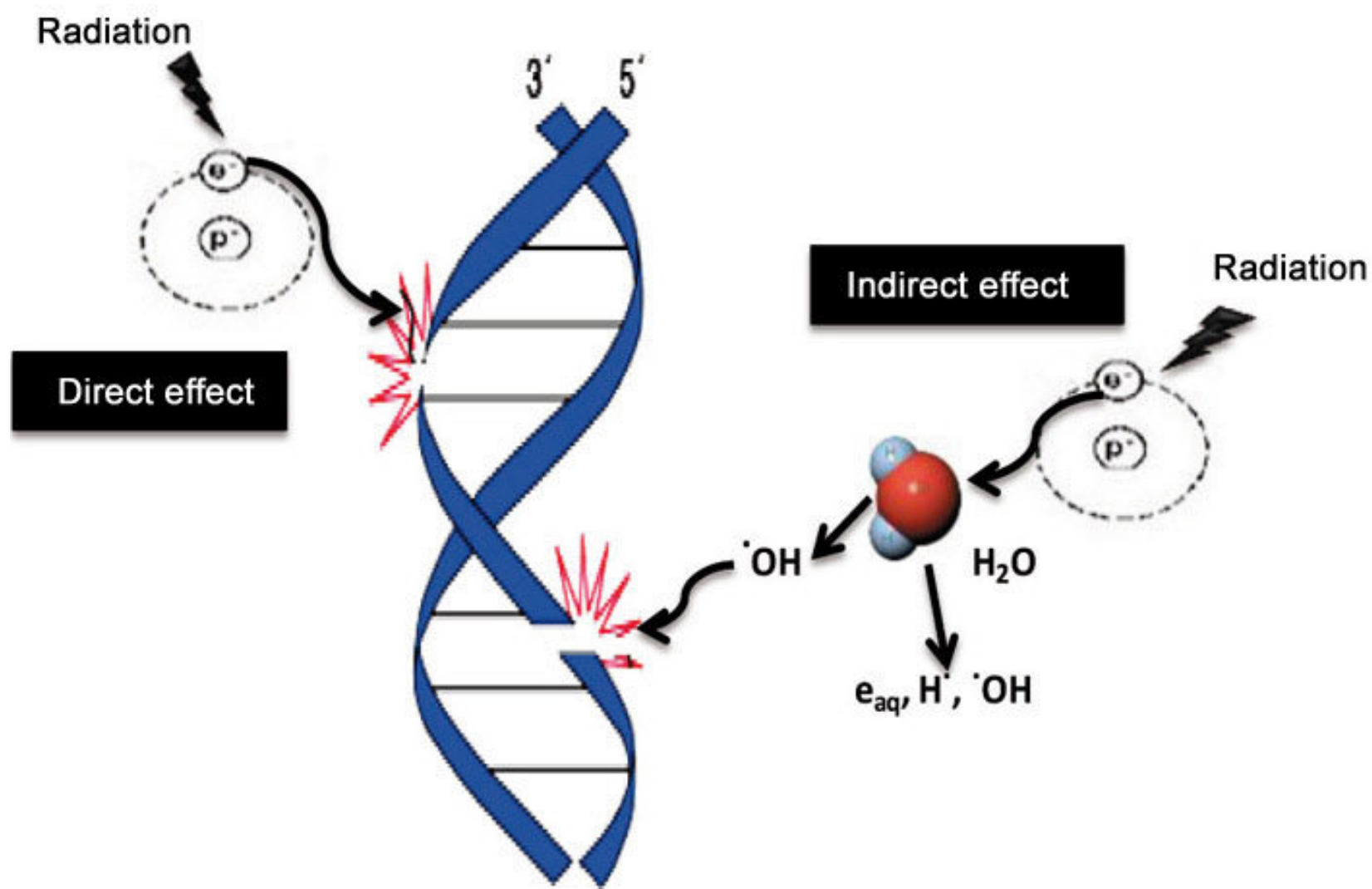
Radiation Therapy
vs.
Chemotherapy



MECHANISMS

01





INDIRECT DAMAGE

CAUSES

- Oxidation
- Dissociative
 - Azanide =
NH₂
- Reduction

EFFECTS

- Restitution
 - Fixed

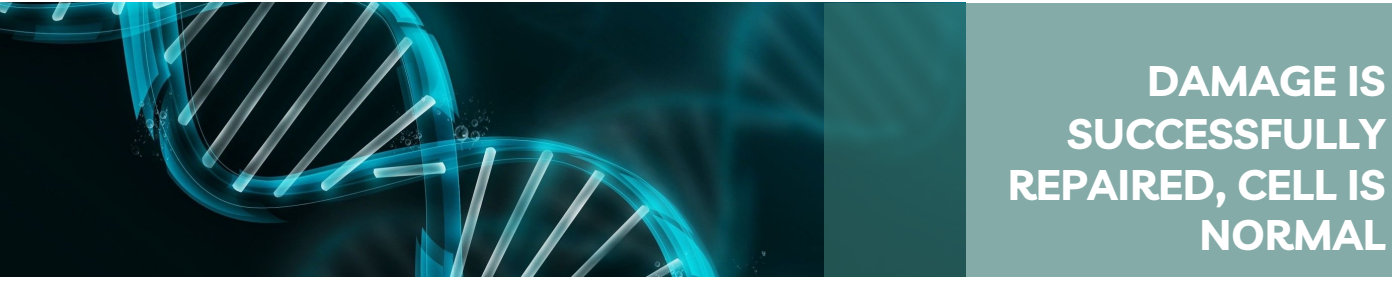
OUTCOMES OF DNA REPAIR



**REPAIR FAILS,
CELL DIES.**



**DAMAGE IS
INACCURATELY
REPAIRED,
MUTATION FORMS.**



**DAMAGE IS
SUCCESSFULLY
REPAIRED, CELL IS
NORMAL**

TYPES OF DNA BREAKS

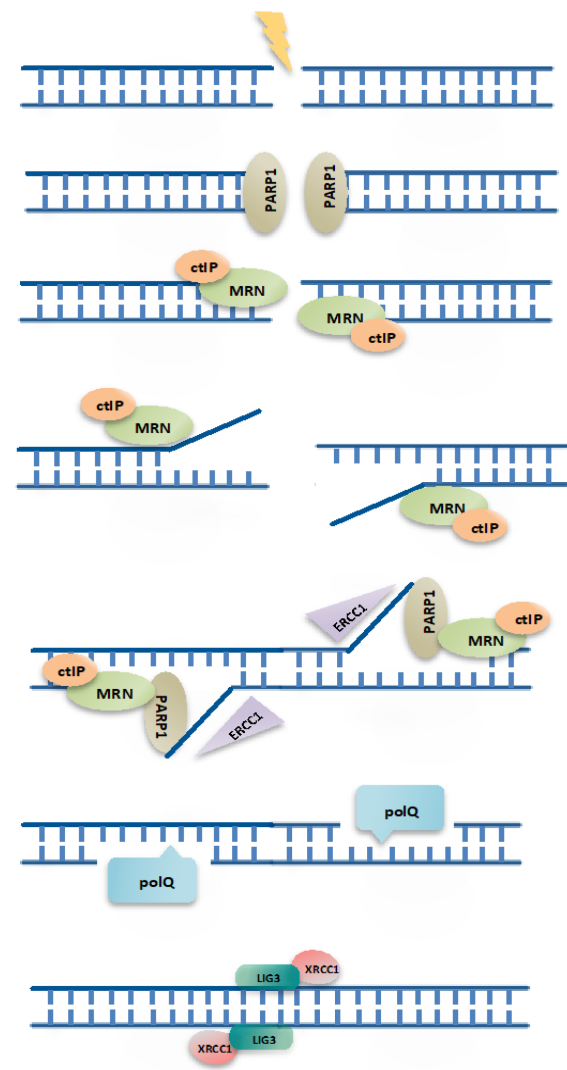
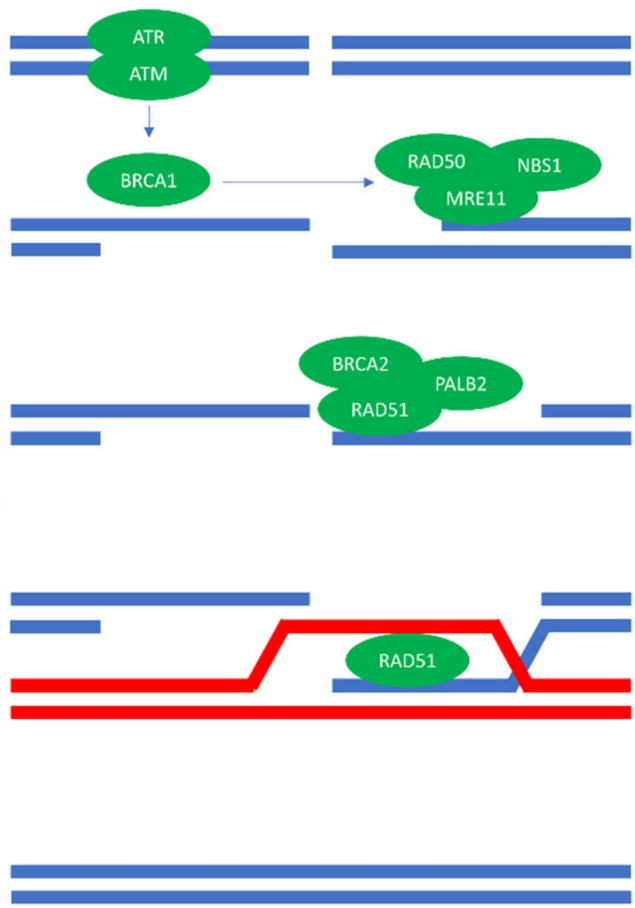
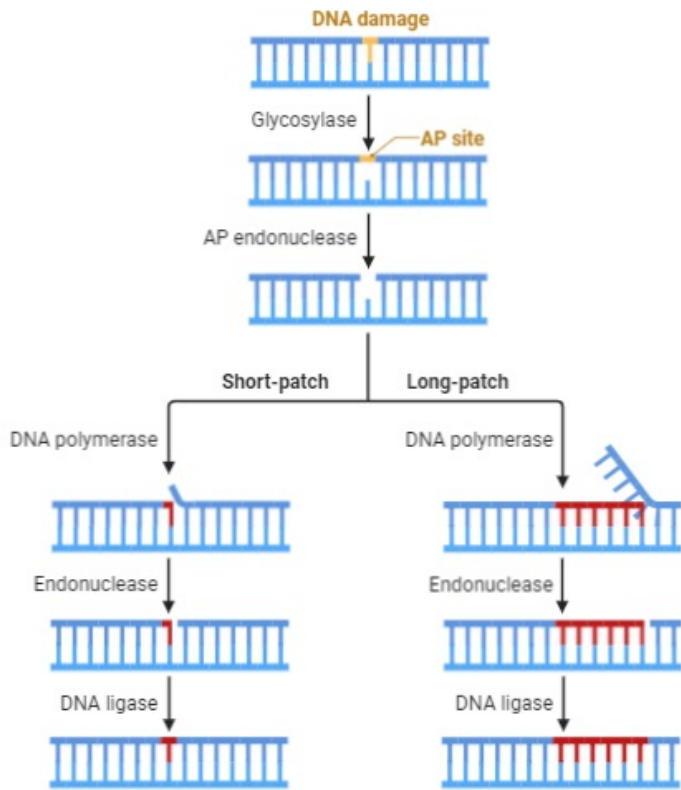
SINGLE STRAND BREAK (SSB)

- One missing nucleotide
- Easy to repair (require template)
- Less damaging in the long run
- Base Excision Repair

DOUBLE STRAND BREAK (DSB)

- Set of base pairs missing
- Difficult to repair (require cofactors and enzymes)
- Nonhomologous End-Joining or Homologous Recombination

Base Excision Repair



MUTATIONS



CLINICAL USE

02



The Discovery of the X-Ray

- Wilhelm Conrad Röntgen
 - November 8, 1895
 - “Röntgen’s Rays”

February 3, 1896



Professor Edwin Frost emits x-rays onto McCarthy's left fractured forearm. Dr. Gilman Frost and his wife watch as history is made in the field of radiation therapy.



3,000,000 Americans

SIDE EFFECTS

- Fatigue
- Nausea
- Vomiting
- Diarrhea
- Headaches
- Skin irritation
- Dry, itchy scalp
- Hair loss
- Mouth sores
- Pain when you swallow
- Reduced appetite
- A burning feeling in your throat or chest
- Pain or a burning sensation when you pee
- The need to pee frequently (often in small amounts)
- Abdominal bloating or cramps
- Sense of urgency to have a bowel movement

PEDIATRIC-SPECIFIC

- Late effects
- Location of Radiation
- Infertility
 - Delayed menstruation
 - Weakened sperm motility
- Anesthesia



“So, why is radiation therapy even used?”

—AN INTUITIVE LISTENER



RESEARCH

03

WHAT IS NEEDED FOR RESEARCH?

INCENTIVE

FUNDING

TIME

VOLUNTEERS

US FEDERAL SPENDING PRIORTIES



\$20,000,000,000

Plot Area

\$10,000,000,000

\$-

NASA
2020

SPACE FORCE
2021

3 SUBMARINES
2020

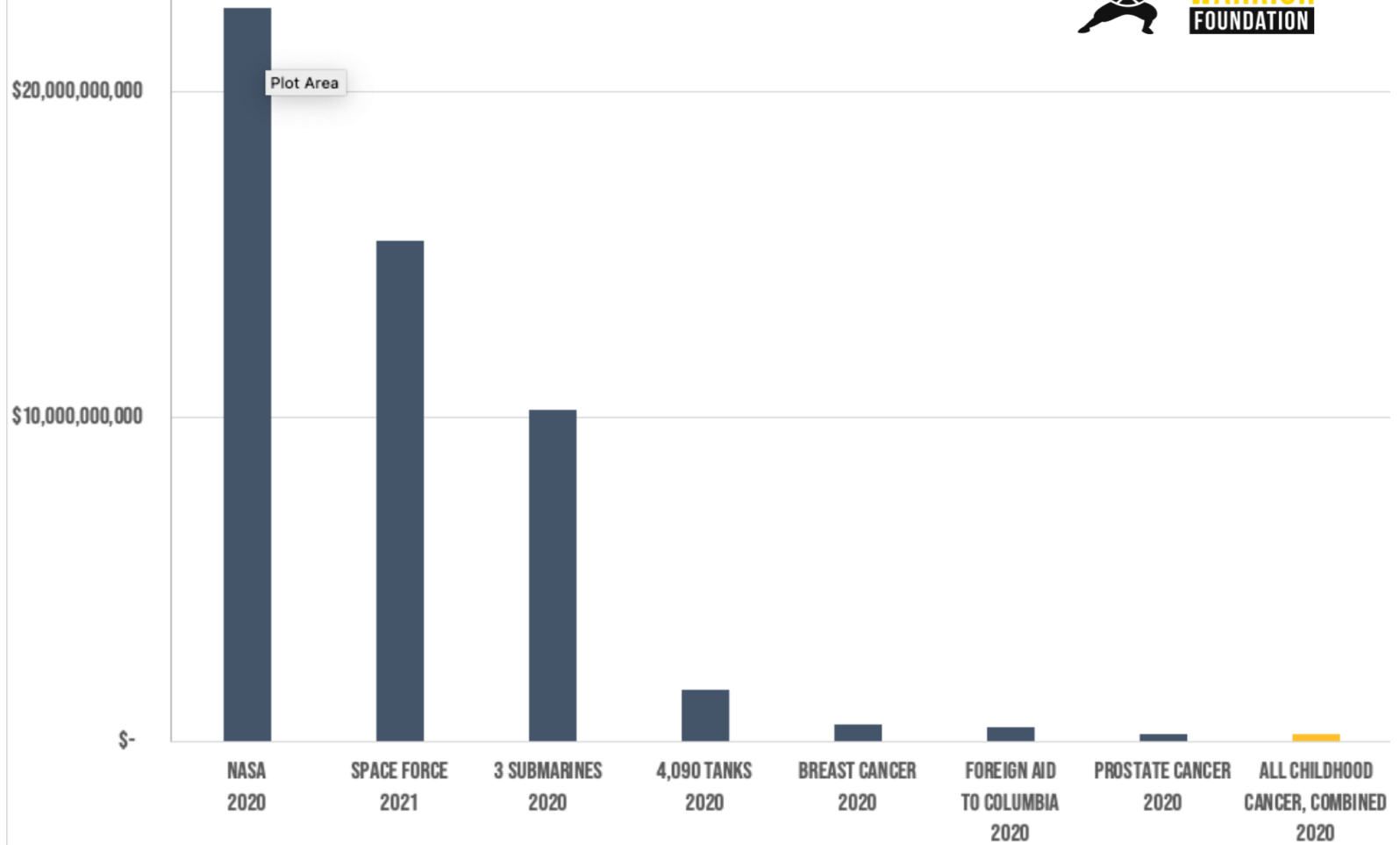
4,090 TANKS
2020

BREAST CANCER
2020

FOREIGN AID
TO COLUMBIA
2020

PROSTATE CANCER
2020

ALL CHILDHOOD
CANCER, COMBINED
2020



WHAT IS NEEDED FOR RESEARCH?

INCENTIVE

FUNDING

TIME

VOLUNTEERS



GOVERNMENT INVOLVEMENT

Incentives, #MoreThan4, more federal funding, advocacy by politicians

GLOBAL SHARING

e.g. U.S.'s National Cancer Institute's Childhood Cancer Data Initiative (CCDI)

ADVOCACY

You can do this!
e.g. The Caroline Symmes Children's Cancer Endowment

POTENTIAL SOLUTIONS

RISKS OF RESEARCH



THERAPEUTIC MISCONCEPTION

TREATMENT INTENTIONS



RESEARCH GOALS

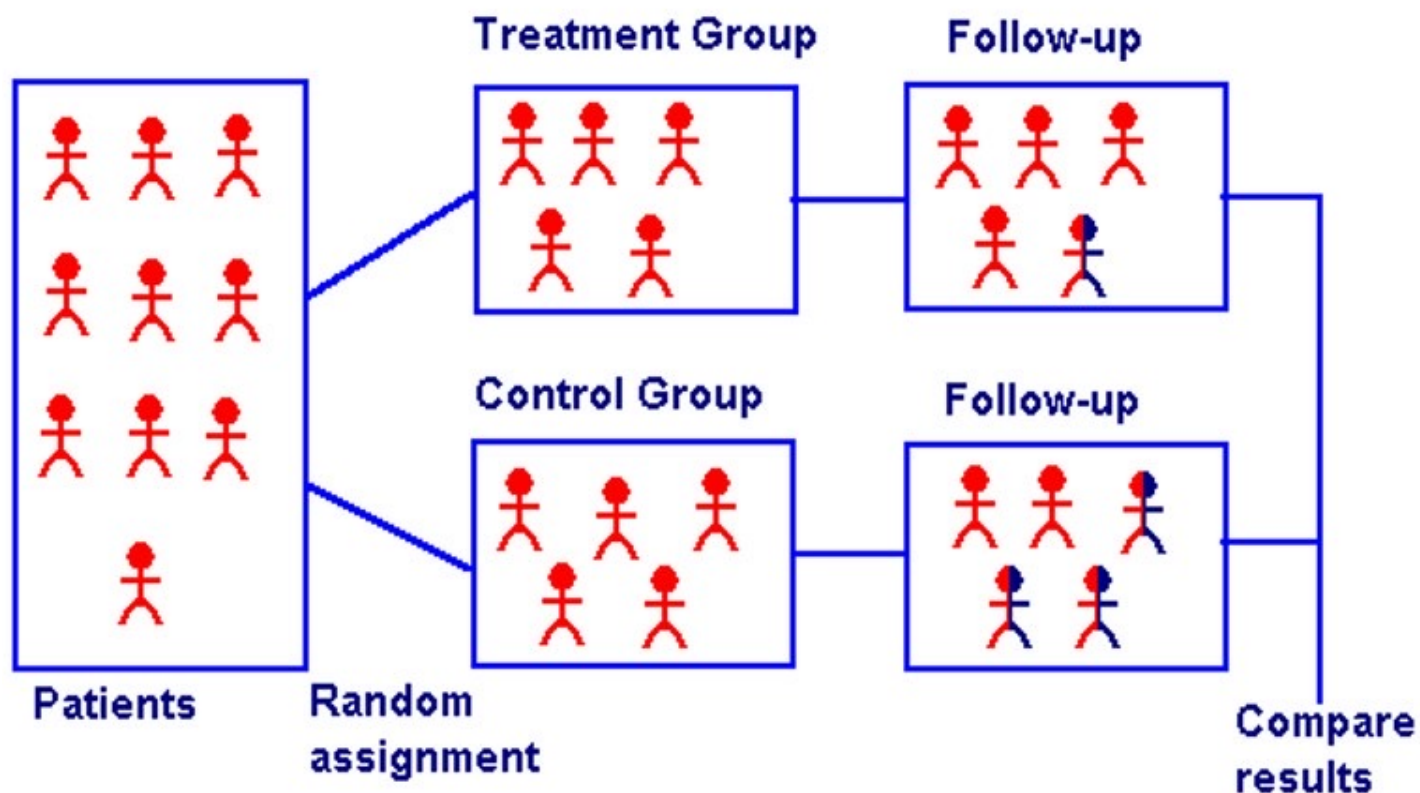
- Goals:
 - Seeking knowledge
 - Obtaining data
 - Receiving academic merit
- Therapeutic outcomes are secondary
- Unnecessary procedures
- Benefit is meant for broader society

TREATMENT GOALS



- Goals is to cure the individual patient
- Knowledge obtained is incidental
- More favorable amongst parents

Randomized Controlled Trials



ETHICS

04



IMMUNEL KANT

- 1724-1804
- Formulaic approach
- Reason and duty > everything else



CATEGORICAL IMPERATIVES

Universalizability Principle

“Act only by that maxim by which you can, at the same time, will that it be a universal law.”

Principle of Humanity

“So act as to treat humanity, whether in your own person or in that of any other, in every case as an end in itself, never as a means only.”



- Results of actions > intentions
- “Other-regarding”
- Focus on personal intuition

JEREMY BENTHAM

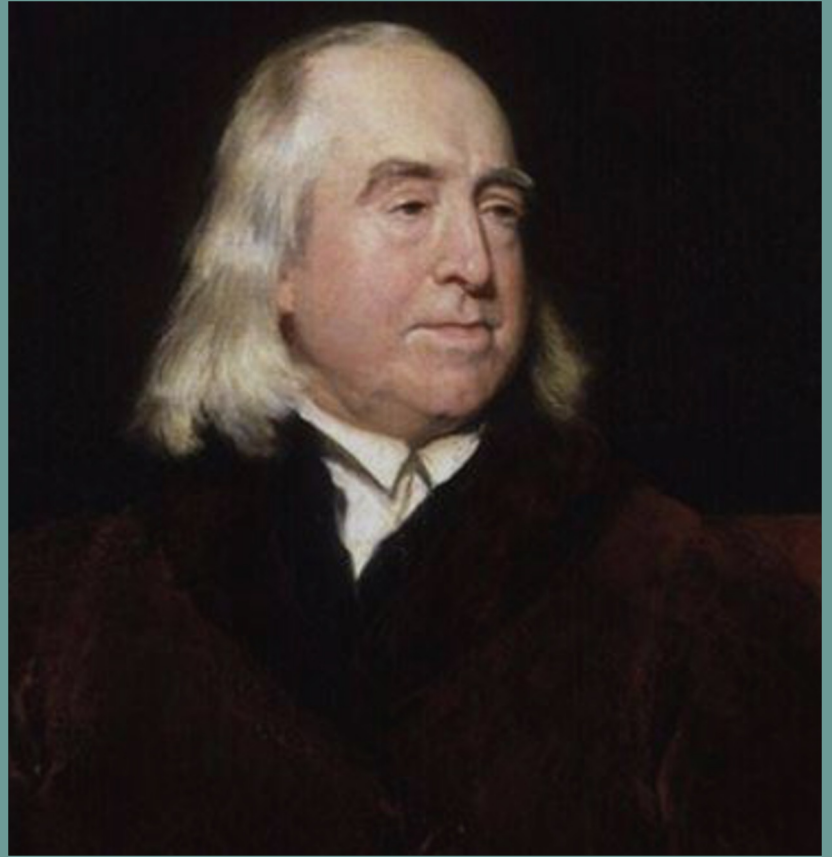
UTILITARIANISM BRANCHES

CLASSICAL

Principle of Utility:
“We should act
always so as to
produce the
greatest good for
the greatest
number.”

RULE

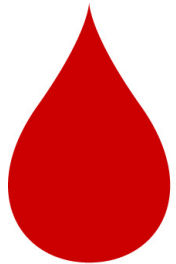
Supports actions
that *generally* and
likely produce the
greatest amount of
good for the
greatest number of
people.



An aerial photograph of a school campus. The image shows several large, grey-roofed buildings, a central courtyard, and parking lots. In the upper left, there is a baseball field with a red infield and a green outfield. A semi-transparent green rectangular box is overlaid on the top left portion of the image, containing the text 'PERSONAL CONNECTIONS' in white, bold, sans-serif capital letters.

PERSONAL CONNECTIONS

05



LEUKEMIA &
LYMPHOMA
SOCIETY®

5231

CAROLINE SYMMES CHILDREN'S CANCER ENDOWMENT

DAY OF HOPE

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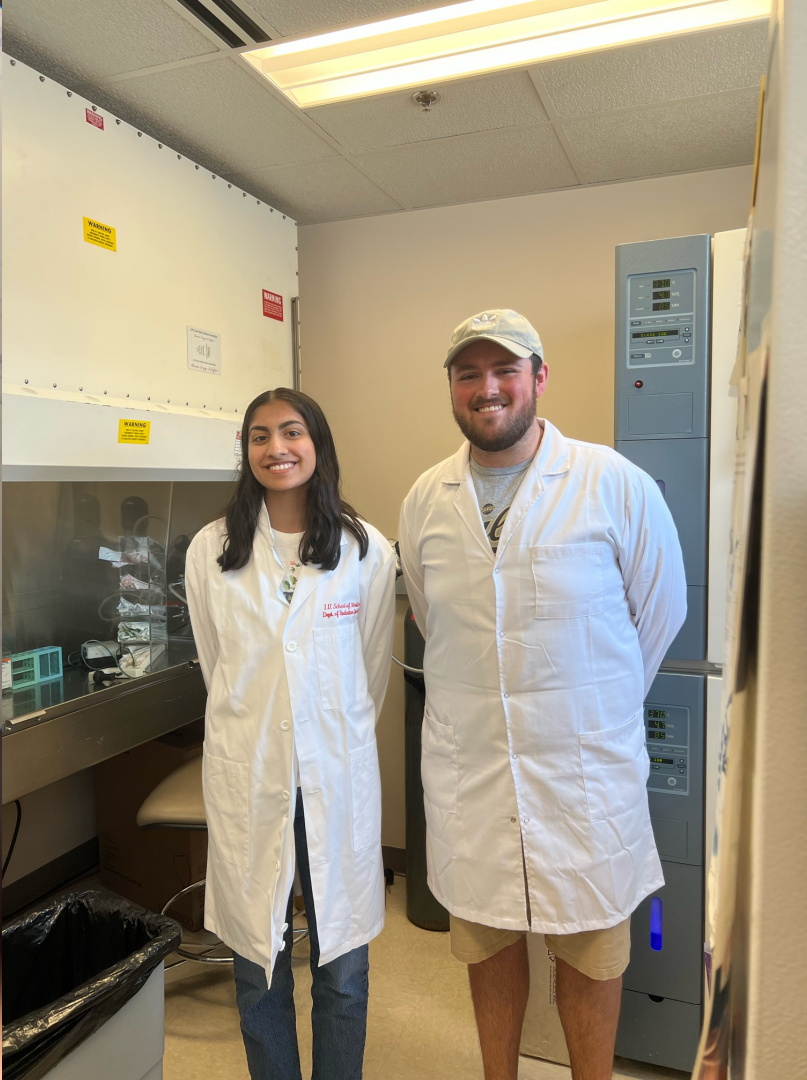
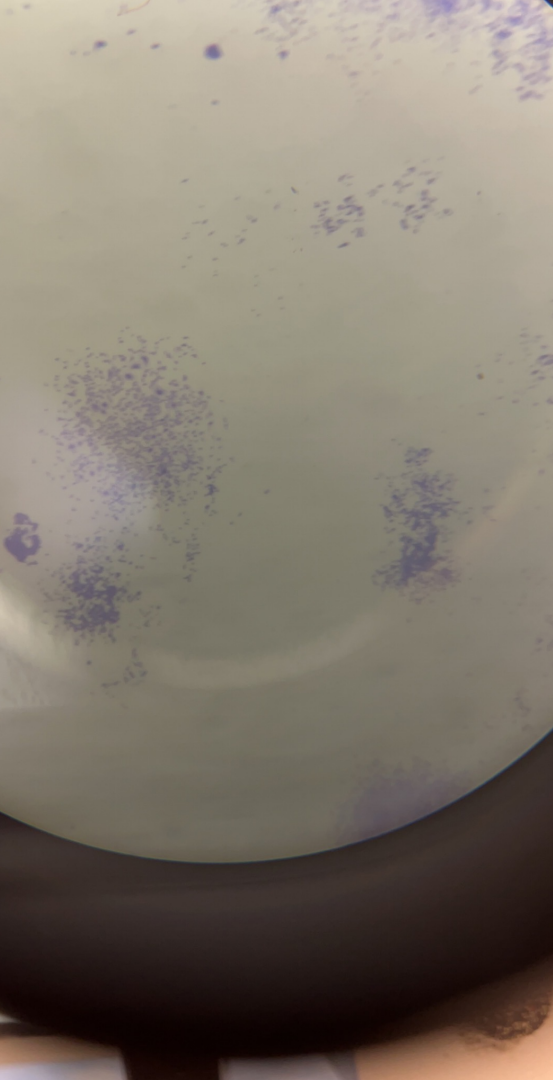


CAROLINE SYMMES CHILDREN'S CANCER ENDOWMENT

DAY OF HOPE

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DAY OF HOPE







“The highest attainable standard of health is a fundamental right of every human being.”

—**WORLD HEALTH ORGANIZATION**

QUESTIONS REMAINING

Can we cut down the costs of pediatric research?

What role, if any, will AI play in radiation therapy?

To what extent is pediatric radiation therapy treatment global, and what actions and measures can be taken to increase that?

To what extent do cultural nuances and religion impact beliefs towards the use of radiation therapy to treat pediatric cancer?

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