

Proton Therapy Workshop - Treatment Planning Game

For this activity, the students can either work independently, in pairs/groups or as a class. Pairs or small groups (2-4) are recommended if possible.

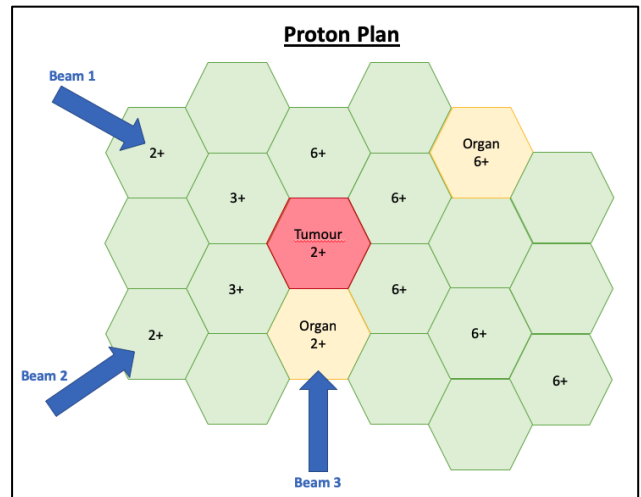
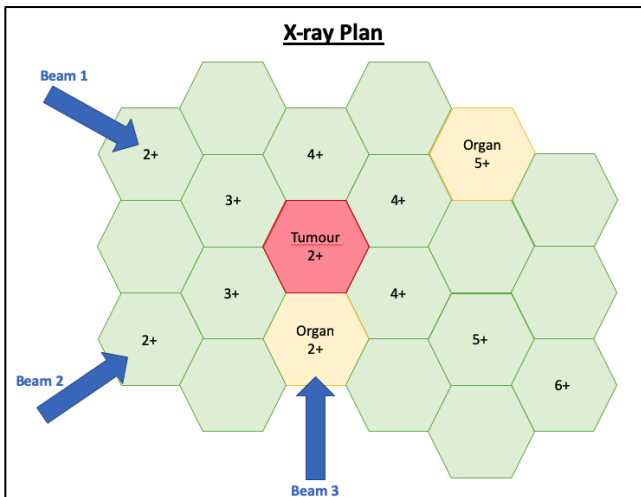
Aim of activity: to simulate a radiotherapy treatment using 'dice roll' statistics, using either an X-ray or proton treatment plan.

Objectives:

- Understand how the difference in X-ray and proton energy deposition and influences treatment outcome
- Understand some of the compromises made during treatment planning to kill the tumour while sparing normal tissue.

Resources:

1. X-ray and proton activity sheets:



2. Score card:

Proton or X-ray Plan:

	Round 1	Round 2	Round 3	Round 4	Round 5	Round 6	Round 7	Round 8
Beam path chosen (1, 2, or 3)								
Damage in the tumour? (Y/N)								
No. of damaged normal cells (x1 for each)								
No. of damaged organ cells (x3 for each)								
Round score:								

Tumour kill? Yes No

Total score:
(lowest score wins)

FOR TEACHER:

- If students are working **independently** or in **pairs/small groups**:
 - Recommended group sizes of between 2 and 4.
 - I would suggest half the class use the X-ray plan while the other half use the proton plan.
 - **Each group will need:**
 - 1x either activity sheet
 - 1x score card
 - 1x dice
 - 1x set of counters (about 25) OR a pen
- If the activity is done **as a class** or in **large groups** (e.g. more than 6), you can do the X-ray plan first then the proton one.
 - **You will need:**
 - 1x proton activity sheet AND 1x X-ray activity sheet
 - 2x score card (one for each game)
 - 1x dice
 - 1x set of counters (about 25) OR a pen
- It's recommended that the activity sheets are printed out (**A4 or larger**) for each group to allow them to be drawn on, and the score cards (any readable size) to write scores down on.
 - If you'd prefer to do the activity on screen, you will need some way of marking on the documents (e.g. using PDF annotation).
- The activity should take approximately 5-10 minutes depending on group sizes and how many games played.

FOR STUDENT:

Instructions:

(See video for instructions with example gameplay)

1. Pick a beam direction (beam 1, 2 or 3 shown on the activity sheet)
2. Starting from the 1st cell on that path, roll the dice:
 - If the number you roll is equal to or greater than the number on the cell, place a damage counter on the cell or draw a small cross.
 - If the number rolled is less than the number on the cell, move on.
3. Move to the next cell along the path and roll again.
4. Repeat until you reach the end of the beam path, marking damage as you go. Complete the scorecard, noting:
 - Whether or not you damaged the tumour
 - How many normal (green) cells you damaged
 - How many organ (yellow) cells you damaged
5. Count up your score for that round and add to the scorecard:
 - +1** for every normal tissue (green) cell damaged
 - +3** for every organ cell (yellow) damaged

(That's one round)

6. Repeat steps 1-5, using the same or different beam paths until:
 1. There are **5** damage marks in the tumour cell
(well done, you've eradicated the tumour!)
 2. There are **3** damage marks in any normal tissue cell or **2** in any organ cell
(Sorry you lose – you can't risk killing a healthy cell!)

 7. If you managed to kill the tumour, add up your total score across **all** the rounds – the lowest score wins!
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Links to additional resources:

(Mentioned at end of video)

Proton Therapy at The Christie:

<https://www.christie.nhs.uk/patients-and-visitors/services/protons/proton-beam-therapy-at-the-christie>

- Information aimed at patients
- Video showing how proton therapy treatment procedure works
- Video to see inside the proton centre at The Christie
- 'Meet the team' information showing different jobs involved in proton therapy

Cancer Research UK Website:

<https://www.cancerresearchuk.org/about-cancer/cancer-in-general/treatment/radiotherapy/external/types/proton-beam-therapy>

- Information mostly aimed at patients.
- Links to general cancer and treatment information

Proton therapy research at University of Manchester (Precise Group):

<https://www.bmh.manchester.ac.uk/research/domains/cancer/proton/>

- Overview of proton therapy research at the University of Manchester
- Information on research areas and people involved