The following Image, known popularly as Photo 51, was taken by Rosalind Franklin, and is probably the most famous photo in the field of Biology. Today, we can attempt to understand some properties of DNA through this image.

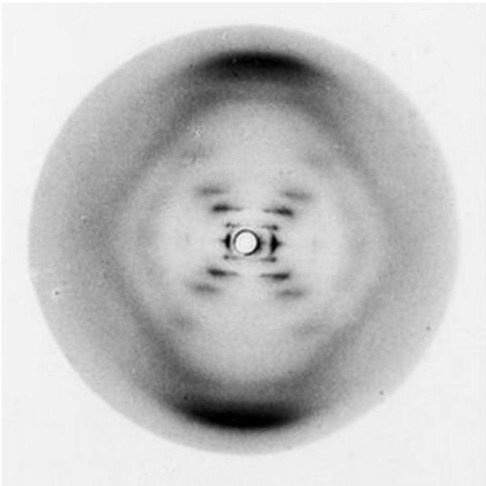
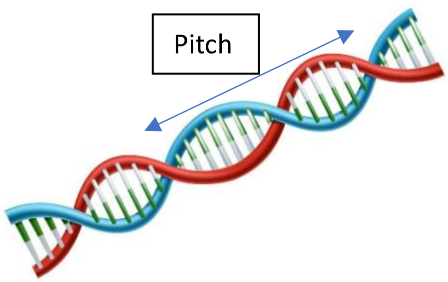


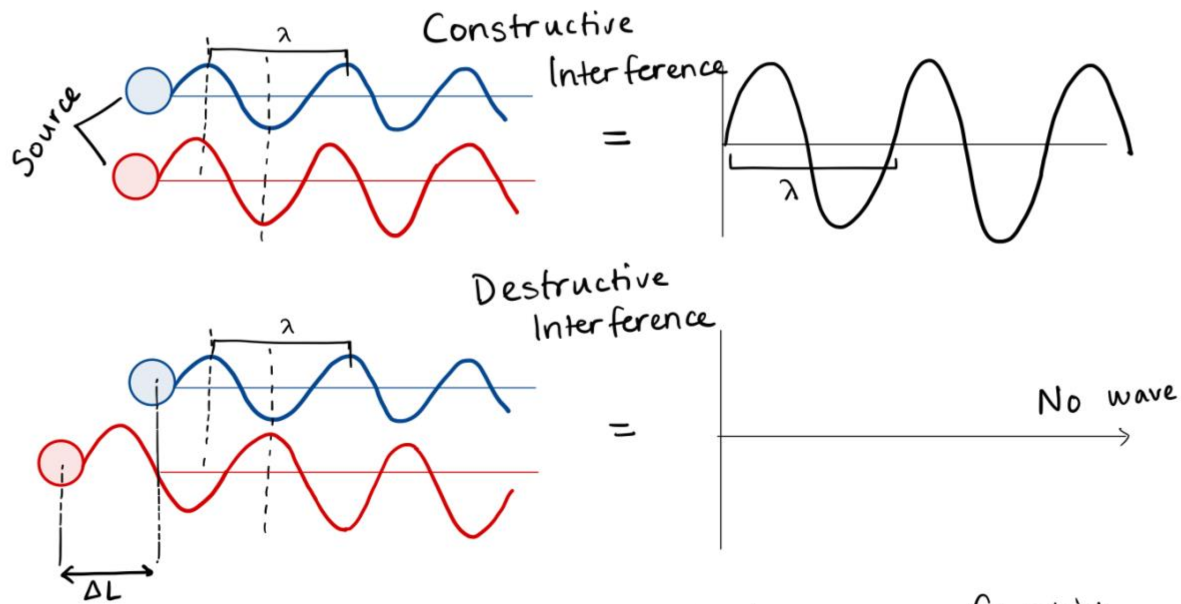
Fig 1: Photo 51. The photo was taken by Rosalind Franklin by shining X-Ray onto a sample of DNA. The details of this image can be found in this article https://www.livescience.com/2912-photo-51-changed-world.html, which you can go through later.

This photo has a signature X-shape, and today we will try to argue how that gives insight into the shape of DNA, along with the pitch of the DNA, which refers to the vertical height of each turn of DNA (or length of one turn of DNA strand.



Use the QR code to try out the **interference** simulation in Phet, or go to this link:
https://phet.colorado.edu/sims/html/wave-interference/latest/wave-interference_all.html

DIFFRACTION & INTERFERENCE:



ΔL is the distance between the two sources, for which we get a destructive interference.

For which values ΔL do we get a **constructive interference**, and for which values of ΔL do we get a **destructive interference** (write ΔL as a function of λ, and n where n =1,2,3,...)

A typical double slit/double source interference pattern will look like this: (You can play around with the Phet simulation a bit more if you are confused about how this works and ask the volunteers for help).

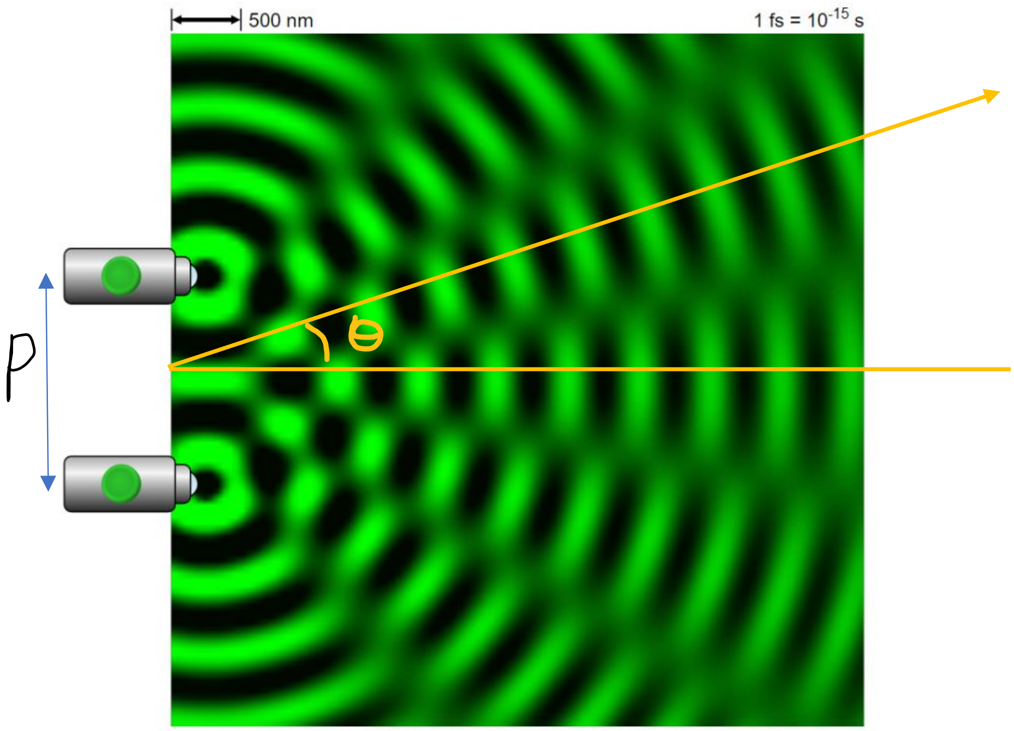


Fig 2: Shows the diffraction through a double slit. We will try to relate the distances between the two sources and the positions of the constructive interference.

You can simulate a double slit or double source experiment in the PhET simulation. There is also a measuring tape device in the simulation. By taking θ to be the angle between the center line and the constructive interference peaks, confirm that:

$$P\sin(\theta) = n\lambda, \text{ where n = 0,1,2...}$$

(Hint: Use some trigonometry and measure the relevant distances in PhET to see if the formula works)

Now, the diffraction pattern of DNA is going to be hard to derive from these, so instead we will try to relate it to the diffraction pattern through a spring.

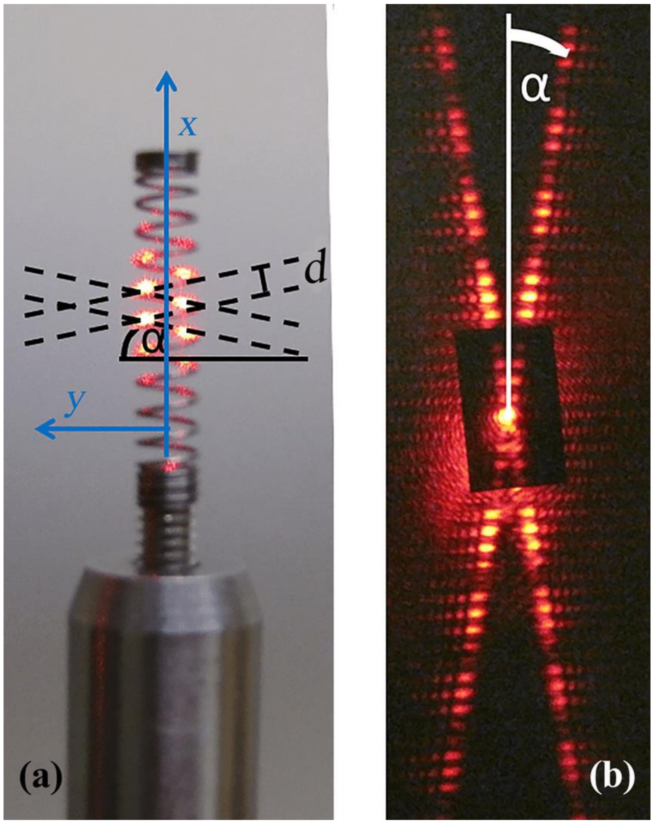


Fig 3: The figure shows a low frequency light source shining through a spring. The diffraction pattern is recorded on a wall on the opposite side.

Question: Discussing with your bench mates, try to find out the similarities and differences between the diffraction pattern of light through a spring, and in Photo 51, (page 1). Based on your knowledge of the DNA structure, what is the main difference between DNA structure and a spring (single helix). (Check your answers with the volunteers if you find it confusing!)

Question: The distance between the double slits/ double sources (labelled "P" in Fig 2) can be (roughly) thought of as the pitch of the DNA. Now based on the equation you confirmed in the previous page, $P\sin(\theta) = n\lambda$, where theta is roughly the spacing between interference peaks, if the pitch of the DNA was longer or shorter, what corresponding changes would you expect in Photo 51 (Fig 1).