7.1.S1 Analysis of results of the Hershey and Chase experiment providing evidence that DNA is the genetic material.

Use one or more of the animations to learn about the Hersey-Chase experiment:

* [The Hershey-Chase experiment](http://nortonbooks.com/college/biology/animations/ch12a02.htm) by Norton books
* [Hershey and Chase experiment](http://highered.mheducation.com/olc/dl/120076/bio21.swf) by McGraw and Hill
* [The Hersey- Chase Experiment](http://bcs.whfreeman.com/webpub/Ektron/Hillis%20Principles%20of%20Life2e/Animated%20Tutorials/pol2e_at_0901_The_Hershey-Chase_Experiment/pol2e_at_0901_The_Hershey-Chase_Experiment.html) by BCS Freeman

1. Explain why was sulphur used in one experiment and phosphorus in the other.
2. Describe what the supernatant is.
3. In both experiments state what separates into the supernatant and the pellet and explain why.
4. Explain why most of the radioactive sulphur (35S) was found in the supernatant.
5. Explain why little of the radioactive phosphorous (32P) was found in the supernatant, i.e. most remained in the pellet.

7.1.A1 Rosalind Franklin’s and Maurice Wilkins’ investigation of DNA structure by X-ray diffraction.

When X-rays are directed at a material some is scattered by the material. This scattering is known as diffraction. For X-ray diffraction to work well the material ideally should be crystallised so that the repeating pattern causes diffraction to occur in a regular way. DNA cannot be crystallised but the molecules were arranged regularly enough for the technique to work.

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| -ray diffraction photo of DNA taken by Wilkins and Franklin which served as a key line of evidence in figuring out the structure of DNA |
| <http://undsci.berkeley.edu/images/us101/xray.jpg> |

1. Use the animation (<http://www.dnalc.org/view/15874-Franklin-s-X-ray.html>) to understand how to interpret the Rosalind Franklin’s and Maurice Wilkins’ X-ray diffraction photographs of DNA. To the right is an example of a X-ray diffraction photograph of DNA.

*Your answers to the questions below may well be helped by diagrams.*

* 1. What can be deduced from the X-shaped pattern?
  2. What deduction can be made about the regular nature of the pattern?
  3. The vertical distance between the horizontal bars is a measure of what feature of the DNA helix
  4. The distance from the middle of the image to the top measure what feature of the DNA molecule?
  5. What can be deduced given the answers to c and d?
  6. What can be deduced from the angle between the horizontal axis and the arms of X-shaped pattern?
  7. From their images what deduction did Franklin make about the positions of molecular units within the helical structure?

Nature of Science: Making careful observations—Rosalind Franklin’s X-ray diffraction provided crucial evidence that DNA is a double helix. (1.8)

*Rosalind Franklin’s careful observation and interpretation of the photographic evidence was crucial to Crick’s and Watson’s successful discovery of the structure of DNA. Her work and her calculations were shown to Crick and Watson without her permission and they subsequently published their model before she had an opportunity to publish her work. Her work is now is widely recognised as being as important to the discovery of DNA as Crick and Watson, but unfortunately, she has never shared in the Nobel prize awarded to Crick and Watson as Nobel prizes cannot be given posthumously (Franklin died in 1958 aged just 37).*

7.1.U2 DNA structure suggested a mechanism for DNA replication.

1. Mechanisms for DNA replication are implied by the presence of complementary base pairing in DNA. Explain why it is only possible for cytosine to pair with guanine and adenine to pair with thymine.

7.1.U1 Nucleosomes help to supercoil the DNA.

1. Explain why Prokaryotic DNA is described as being ‘naked’.
2. In the space below, draw and label the structure of a simplified nucleosome, including the H1 linker and octamer (which consists of two copies of four different types of histone proteins).
3. **Nucleosomes both protect DNA and allow it to be packaged**, this, in turn, allows DNA to be supercoiled.
   1. Outline how the H1 linker aids supercoiling beyond the nucleosome structure.
   2. Review 1.6.U2 and briefly outline why it is essential to supercoil chromosomes.
   3. Outline how nucleosomes help regulate transcription.
   4. State the part of the cell cycle in which the most DNA would be supercoiled.