

## Finding the Structure: pieces of the puzzle

Record the specific contribution that each scientist made in the boxes provided.

<p>Friedrich Miescher <i>Miescher first isolated nuclein (DNA and its protein scaffold) from white blood (pus) cells.</i></p>
<p>Phoebus Levene <i>Levene understood that DNA has a regular, sugar-phosphate "backbone."</i></p>
<p>Oswald Avery <i>Avery and his colleagues identified that DNA is the "transforming principle," that can transfer particular traits between organisms. DNA must therefore carry the genes, and be the hereditary material.</i></p>

- Describe at least two ways that students who selected incorrect puzzle pieces would be able to recognize their mistakes.

- Having two pieces for the same spot in the puzzle.*
- Comparing the structure of the DNA segment represented by the puzzle with the model observed in [www.dnai.org](http://www.dnai.org) > Code > Finding the Structure > putting it together.*

- Describe why Watson and Crick knew that the triple helix model of DNA was incorrect.

*This model was based on three strands with unionized phosphate groups in the middle holding the molecule together. This didn't make sense because if the phosphate groups still had hydrogens, DNA would not be an acid . . . which it is.*

- Explain why it would not have been possible for Watson and Crick to develop their DNA model without the data from Rosalind Franklin.

*Franklin's x-ray crystallography work provided information including:*

- DNA's phosphate groups are on the outside of the molecule;*
- DNA could be a helical structure; and*
- DNA has a constant diameter along the length of the molecule.*

- What did Watson need to consider when he worked out the DNA base pairing?

- bond angles;*
- bond lengths;*
- the location of hydrogen atoms; and*
- Chargaff's pairs (although he didn't recognize this at the time).*

## Finding the Structure: pieces of the puzzle correlations

An (X) indicates an incorrect correlation.

### *Erwin Chargaff*

Chargaff determined that all species have the same numbers of A, T, C, and G. (X)

Chargaff used sperm from different species for his research.

Chargaff determined that the ratio of A:T and G:C is constant for an organism.

### *Linus Pauling*

Pauling's triple helix model acted as a catalyst for Watson and Crick.

Pauling worked with (Phoebus) Levene to develop a protein-based model of heredity. (X)

Pauling developed a three-chain model of DNA.

### *Rosalind Franklin*

Franklin's X-ray patterns showed Watson and Crick that DNA is helical.

Franklin's X-ray patterns showed that the diameter of DNA's helix is constant.

Franklin showed that DNA's phosphates must be on the outside.

Franklin crystallized white blood cells from pus. (X)

Franklin and (Maurice) Wilkins both obtained X-ray crystallographic patterns of DNA.

### *Maurice Wilkins*

Wilkins determined that DNA is crystalline.

Wilkins determined that protein carries the genetic code. (X)

### *James Watson and Francis Crick*

Watson and Crick determined how A and T, G and C, formed base pairs.

Watson and Crick flipped a coin to decide whose name went first (on the 1953 *Nature* paper).

Watson and Crick developed a triple helix model of DNA. (X)