



Enzymes

The Biological Catalysts.

(A catalyst alters the rate of a reaction without itself undergoing any permanent chemical change)



Enzyme Structure

- Globular Proteins.
- Specific 3D shape (tertiary/quaternary structure).
- Large size.
- Small active site.
 - This is the part that is the functional region.
 - The bit that binds to other molecules.



Enzyme Structure

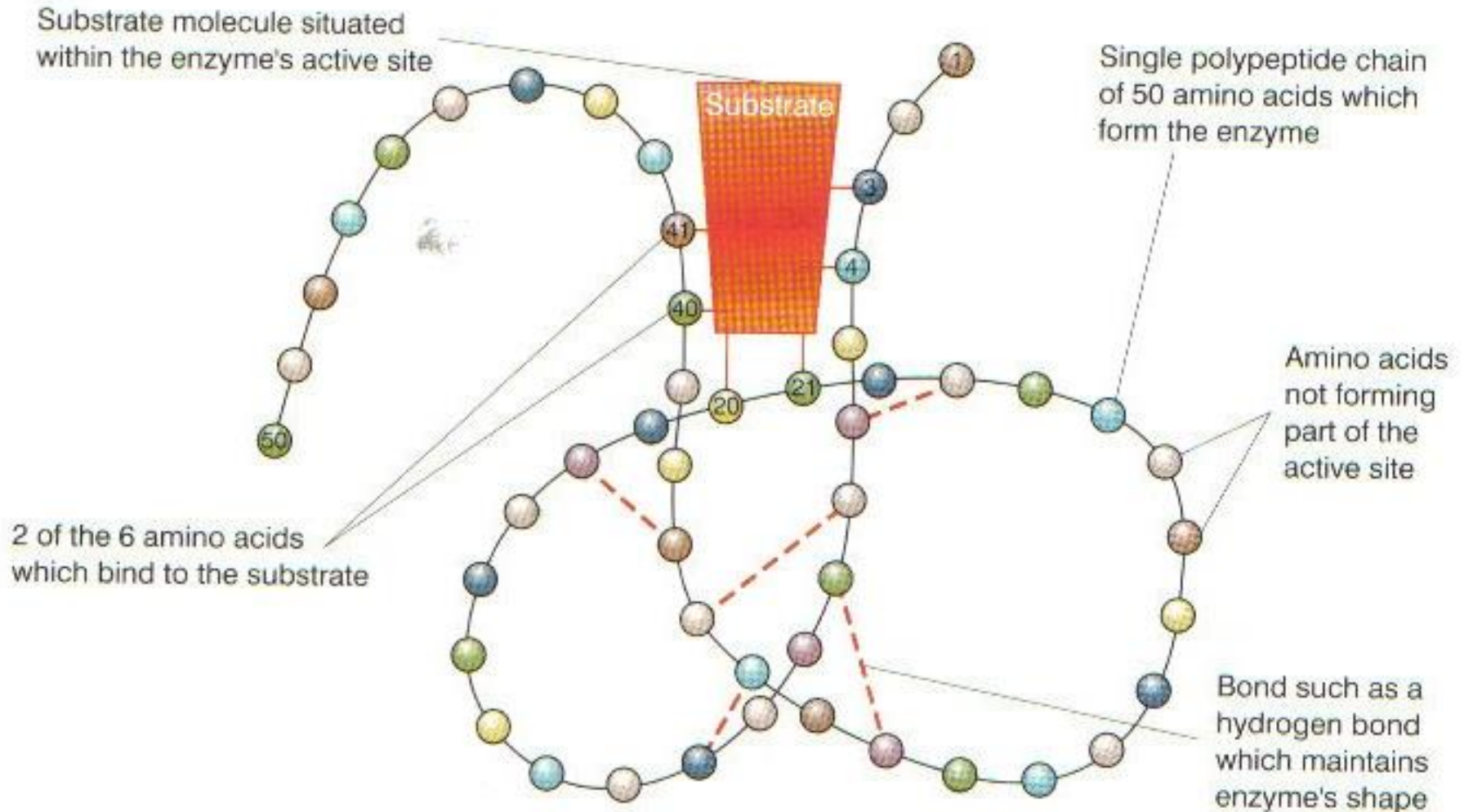
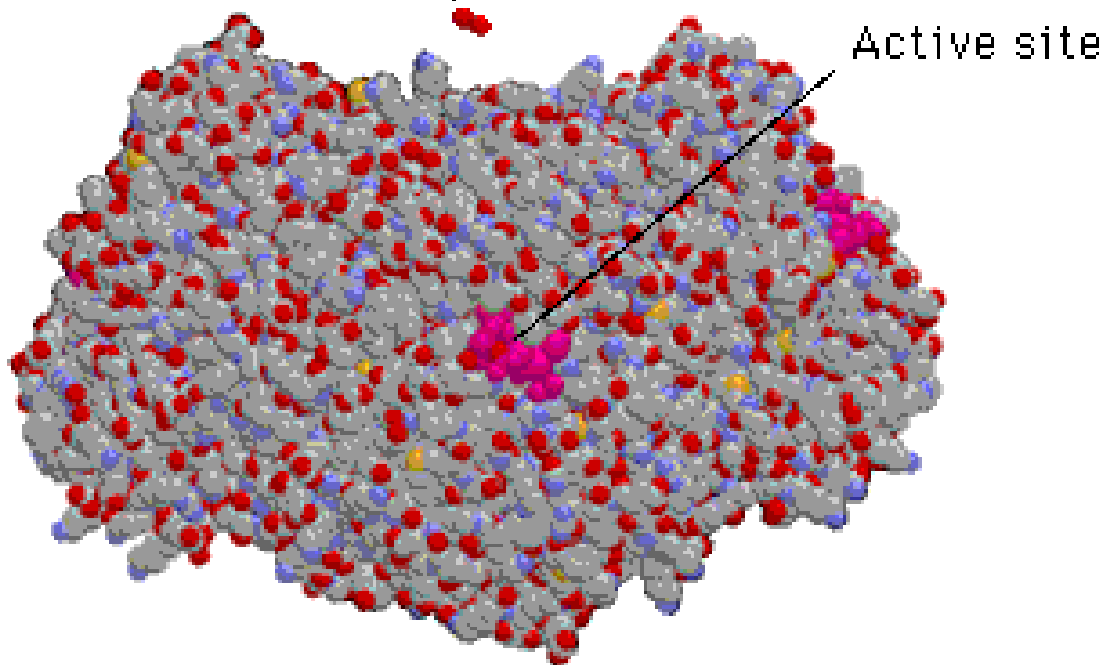


Fig 2.1 Enzyme-substrate complex showing the six out of 50 enzyme amino acids which form the active site



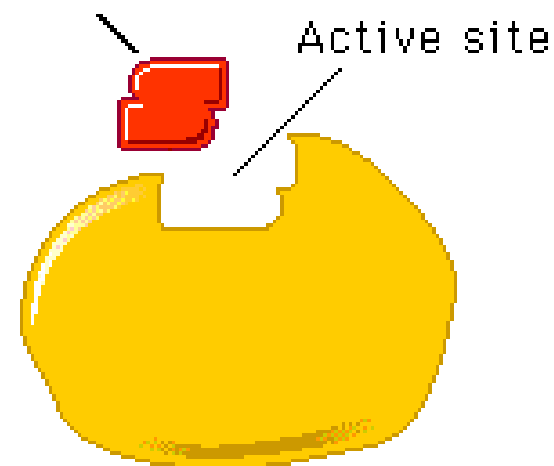
Enzyme Structure

Substrate = H_2O_2



Molecular model
of catalase

Substrate



Schematic model
of an enzyme



Activation Energy

- For any reaction to occur on its own the energy of the products must be less than that of the reactants.

Reactants \longrightarrow Products



High energy \longrightarrow Low energy



Activation Energy

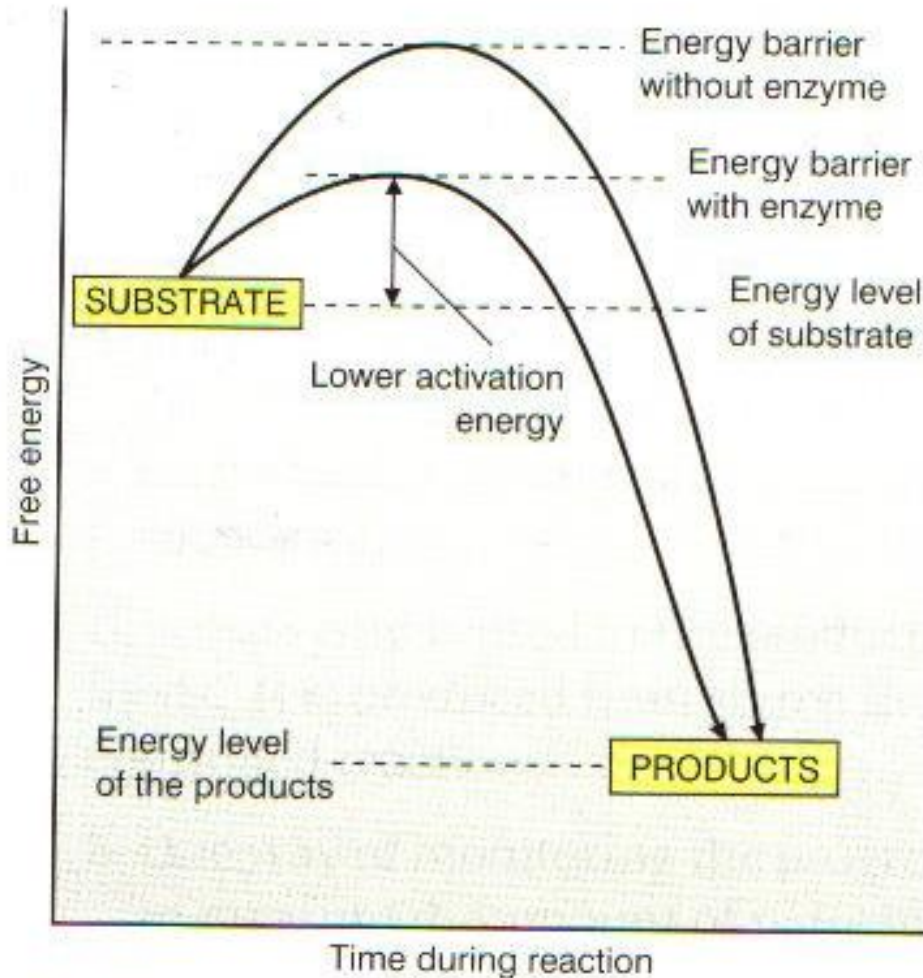


Fig 2.2 How enzymes lower the activation energy

- Reactions need a kick start.
 - An initial boost of energy.



How Enzymes Work

- Lock & Key Theory
 - Each lock has a specific shape that only accepts one key.
 - Each enzyme has a specific shape that only accepts one substrate.
 - The shape of the substrate exactly fits the active site of the enzyme.

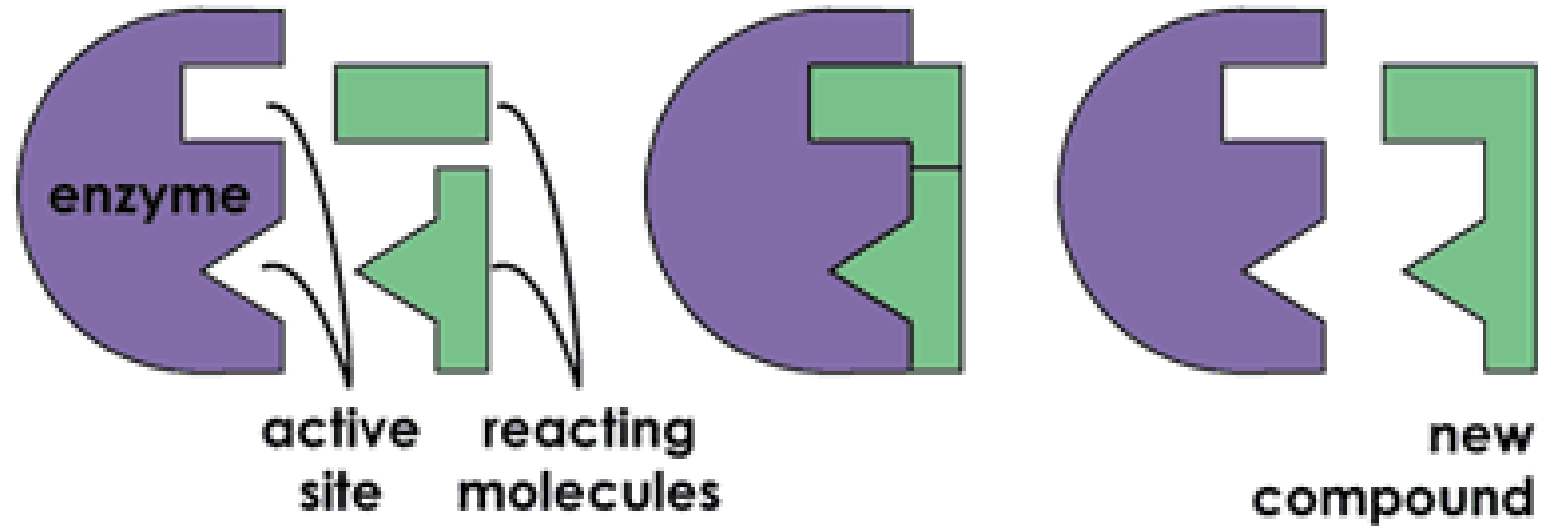


BEFORE REACTION

DURING REACTION

AFTER REACTION

SYNTHESIS ('building') REACTION

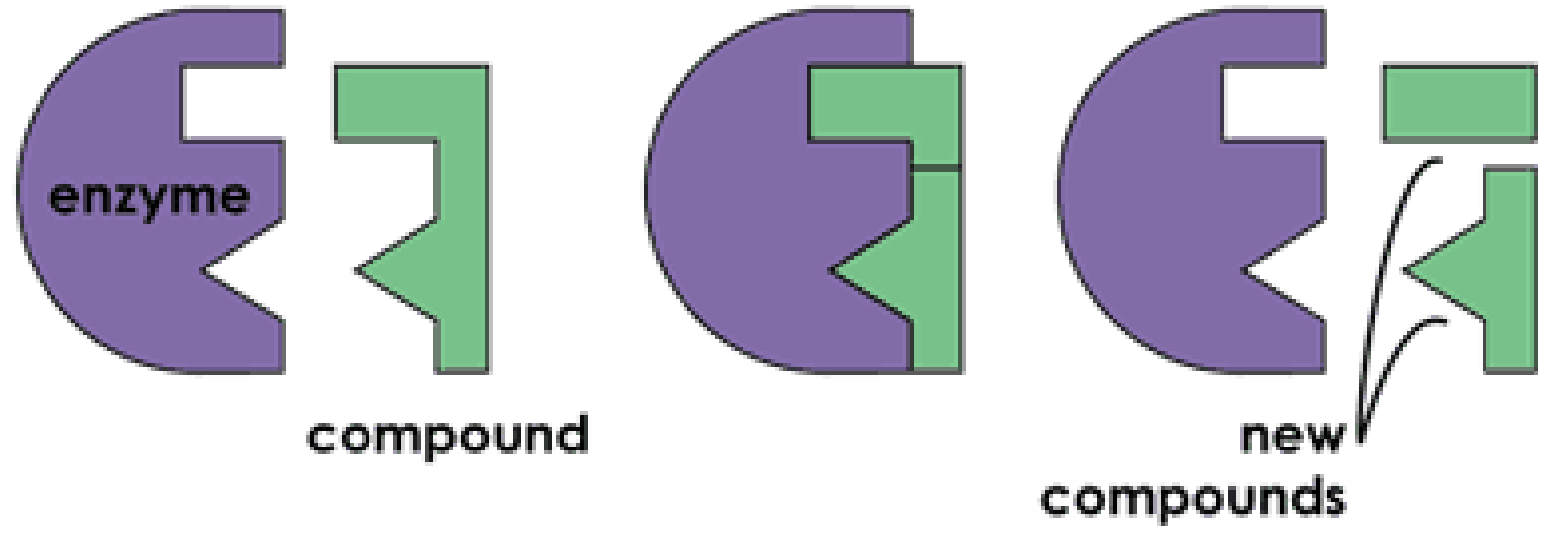


BEFORE REACTION

DURING REACTION

AFTER REACTION

BREAKDOWN REACTION



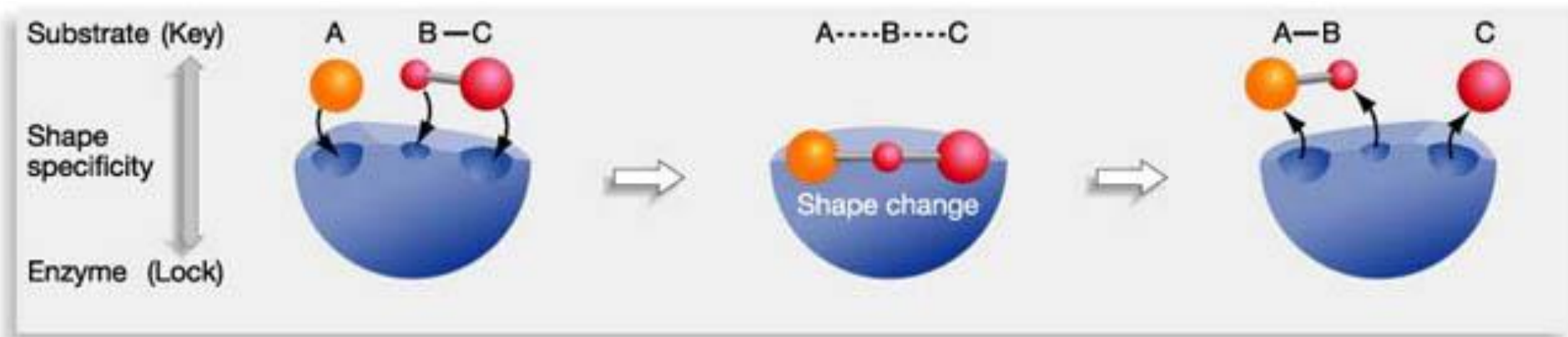


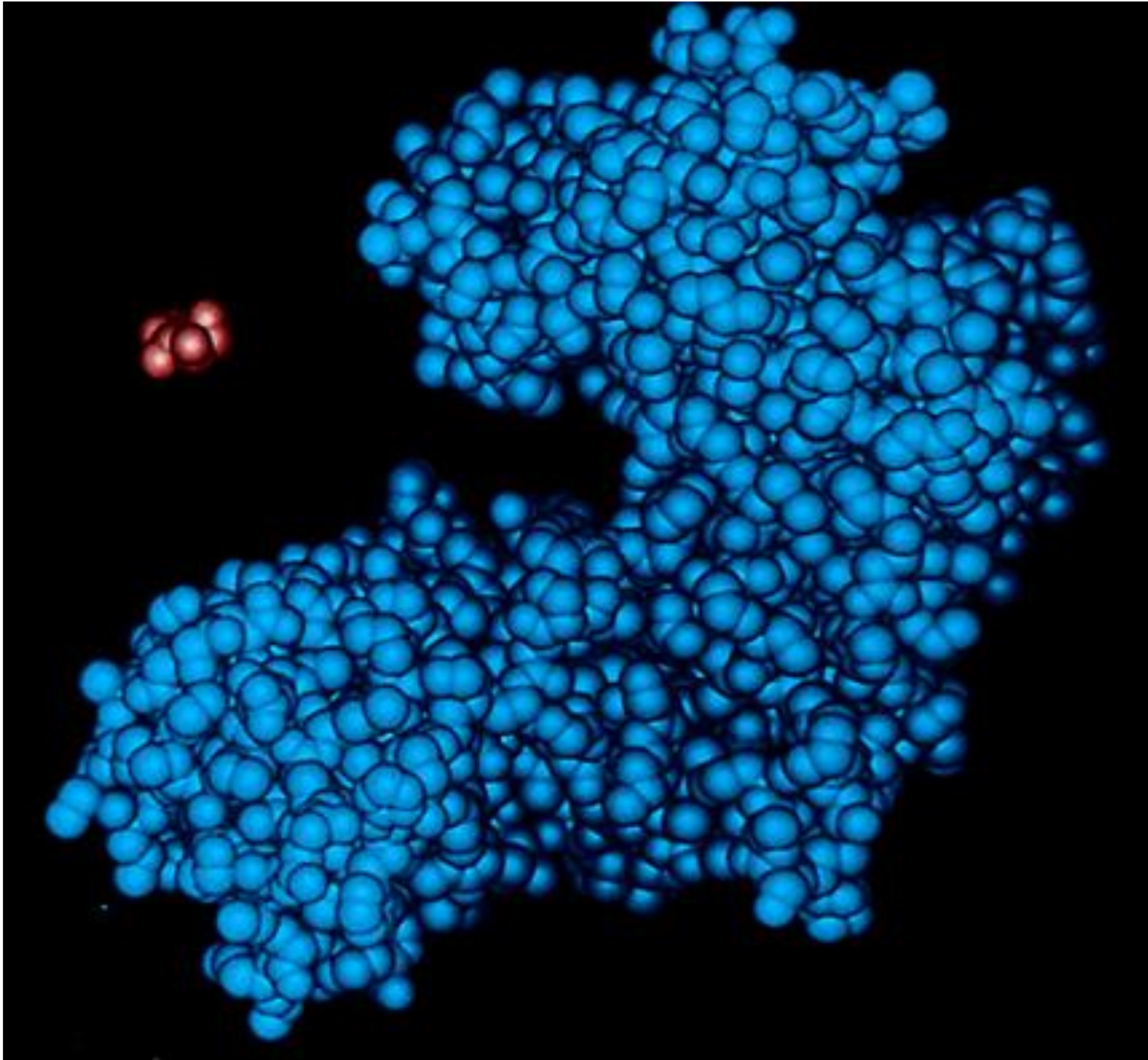
How Enzymes Work

- Induced Fit Theory
 - In reality, the enzyme may actually change shape slightly.
 - It may mould itself around the substrate like a glove moulds to the hand.
 - As it alters its shape it puts a strain on the substrate and lowers its activation energy.



Induced Fit Theory







Measuring Enzyme Reactions

- Measurements can be made in two ways:
 - Time-course
 - Measure the formation of products
 - Eg. Volume of gas produced, intensity of colour, etc.
 - Measure the disappearance of substrate
 - Eg. Fading colour, falling concentration, etc.
 - Rate of reaction
 - A snapshot of a particular set of conditions



Enzyme properties

- Enzyme activity can be affected by:
 - Temperature
 - pH
 - Substrate concentration
 - Enzyme concentration
 - Inhibitors