

Mitochondrial diseases

For this activity, students view the animation before applying their knowledge of cellular respiration to mitochondrial diseases. The 'talking heads' give background information about Leigh's disease, and the animation shows the events on the mitochondrial inner membrane.

Answers

- 1 a) Tiredness, weak muscles, problems with balance and coordination;
b) Muscles and nerves;
- 2 Muscle and brain tissue are highly active, consuming a large amount of oxygen in respiration. Because of the high energy demands of these tissues, mitochondrial diseases lead to weakness and wasting of nerves and muscles before other tissues. Many of the symptoms of Leigh's disease are due to degeneration of nerve and muscle tissue due to insufficient ATP production.
- 3 Free radicals can cause damage to cell components. This damage has been implicated in some cancers, heart disease and ageing.
- 4 a) Free radicals can cause mutations in mitochondrial DNA. This can increase the likelihood of developing Alzheimer's disease. Curcumin in turmeric is widely consumed in India and neutralises free radicals. This may account for the low incidence of Alzheimer's disease in the ageing population of India, compared to the West.
b) If Georgina has high levels of free radicals in her cells, it may help to have a diet high in antioxidants such as vitamin C, beta-carotene and vitamin E. These are found in fresh fruit and vegetables.
- 5 To help with annotation of the diagram of the inner mitochondrial membrane students can use the animation and student book for information. This should draw together the sequence of events involved in ATP synthesis. Possible annotations are shown below.
- 6 The disruption of the electron transport chain will not affect glycolysis, the anaerobic stages of cellular respiration producing pyruvate. Reduced coenzyme produced in glycolysis can't be oxidised via the electron transport chain, so pyruvate will be reduced to lactate in anaerobic respiration.

