MRC Mitochondrial Biology Unit

UNIVERSITY OF CAMBRIDGE

DNA mutations: the bad, and the not-so-bad

What are DNA mutations?

- DNA mutations are changes to the sequence of bases (A, T, C and G)
- It is the sequence of bases in DNA that determines the sequence of amino acids in a protein!
- Several types of mutations can occur to DNA; these can cause serious problems, or no problems at all!
- The DNA sequence is 'read' in blocks of three bases; each block encodes for an amino acid
- Take the following sentence, which is made up of five, three letter words

THE CAT ATE THE RAT

Point mutations: one base is substituted for another

THY CAT ATE THE RAT

- The mutation may not affect the expression or function of a protein
- These types of missense mutations are *unlikely* to cause disease
- In this example, the **E** of **THE** has been replaced by a **Y**; however, we can still understand the meaning of the sentence

THE CAT ATE THE BAT

- The mutation may stop the protein from working properly
- These types of missense mutations *may* lead to disease
- In this example, the **R** of **RAT** has been replace by a **B;** the change has completely altered the meaning of the sentence

THE CAT ATE THE .

- The mutation may not code for an amino acid
- These types of nonsense mutations cause the cell to stop making the protein, therefore can be *severe*
- In this example, the **R** of **RAT** has been replace by a **FULL STOP**; the mutation has ended the sentence prematurely

Frameshift mutation: bases are either inserted or deleted

THE BCA TAT ETH ERA T

- An insertion causes a 'frame-shift'; the bases are +1 from where they should be. These mutations are usually *very severe*
- In this example, a **B** has been inserted into the sentence between **THE** and **CAT**
- The sentence no longer makes any sense!

THE ATA TET HER AT

- A deletion causes a 'frame-shift'; the bases are -1 from where they should be. These mutations are usually *very severe*
- In this example, the **C** of **CAT** has been deleted from the sentence
- The sentence no longer makes any sense!

CAT ATE THE RAT

- A deletion causes an 'in frame-shift'; all the bases are -3 from where they should be. These *may* or *may not* be serious
- In this example, **THE** has been deleted
- As the words are 'in-frame', we can still understand the sentence