

## SPEC MODULE 6

### 6.1.1 - Cellular Control

(a) types of gene mutations and their possible effects on protein production and function. To include substitution, insertion or deletion of one or more nucleotides  
**AND** the possible effects of these gene mutations: (i.e. beneficial, neutral or harmful).

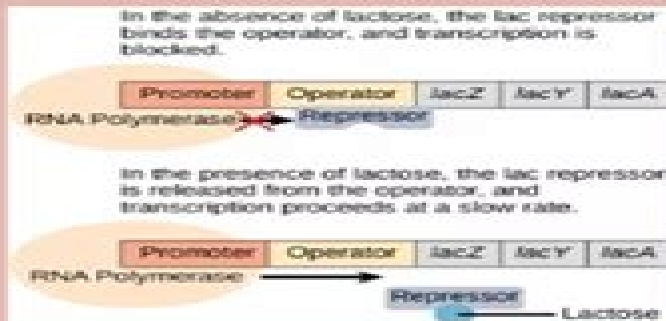
- **Nonsense mutation:** becomes a stop codon instead of coding for an AA
- **Missense mutation:** incorporation of the wrong AA

**Mutations:** Changes to base nucleotide sequence of DNA

- **Substitution:** 1 or more bases are swapped for another base
- **Deletion:** 1 or more bases are removed → causes frame-shift
- **Insertion:** 1 or more bases are added → causes frame-shift

**Effects of mutations:**

- **Silent:** no effect because genetic code is degenerate → may code for the same AA (1) sequence of AA is not altered (1)
- **Beneficial:** gives survival adv. (e.g antibiotic resistance)
- **Harmful:** reduces survival adv. (e.g CF)
- E.g insertion/ deletion causes frame-shift (1) → all triplets downstream will be different (1) different sequence of AAs (1) different tertiary structure of protein (1)



(b) the regulatory mechanisms that control gene expression at the transcriptional level, post-transcriptional level and post-translational level.

To include control at the transcriptional level: lac operon, and transcription factors in eukaryotes  
 post-transcriptional level: the editing of primary mRNA and the removal of introns to produce mature mRNA  
 post-translational level: the activation of proteins by cyclic AMP.

#### 1) TRANSCRIPTIONAL LEVEL

**Lac Operon:**

3 structural genes (lacZ, lacY, lacA) which code for specific enzymes + transcribed onto mRNA

**Regulatory gene** (lacI) codes for repressor

- 1) Repressor binds to the operator so that RNA polymerase can't bind to it, so no transcription
- 2) When lactose is present, it binds to the repressor, changing its shape (no longer complementary)
- So RNA polymerase can bind to promoter and transcribes
- 3) cAMP binds to cAMP receptor protein (CRP) to increase rate of transcription

**Transcription factors** (activator/ repressor) start or stop transcription

**Regulatory genes** code for TFs + controls expression of structural Gs

#### 2) POST-TRANSCRIPTIONAL LEVEL

- After transcription, mRNA is edited
- **Introns:** DON'T code for amino acids
- **Exons:** DO code for amino acids

**How gene expression is regulated after transcription. (3)**

- [Transcription creates the **primary mRNA** with introns and exons]
- Primary mRNA is modified (1) **Splicing:** introns are removed are to form mature mRNA (1)
- [Mature mRNA leaves the nucleus for translation]
- [mRNA may be edited by deletion/ insertion/ substitution → so range of proteins can be produced from a single mRNA]
- Alternative splicing produces different versions of mRNA (1)

# Ocr Biology Mark Schemes Jan 2013

**Iseb Iseb**



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*13+ Science Level 2 Biology Mark Scheme (Spring Term 2013)* Iseb Iseb,2012-12-01  
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**Ocr Biology 2** Richard

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