

## Correction Exam October 2021

1.

1. reticulum endoplasmic
  2. ribosome
  3. Golgi apparatus
  4. nucleus
  5. membrane
  6. microtubules/cytoskeleton
  7. Mitochondria
  8. synapse
  9. axon
  10. myelin
  11. dendrite
- /2.25

2. Ace[R] is recessive, Ace[S] is dominant  
/0.5

3. Red population: no difference in survival until adulthood between AceR/AceR and AceS/AceS mosquitoes  
Green and orange populations: survival of the AceR/AceR individuals is lower than the AceS/AceS individuals from embryo to 2nd instar stage and also from 2nd instar to adult stage  
/1.5

4. Polymerase chain reaction  
/0.5  
biochemical reaction used to amplify a specific DNA fragment  
/0.5  
DNA, nucleotides, Taq polymerase, buffer (MgCl<sub>2</sub>, etc.), water  
/1.25  
denaturation  
hybridization  
elongation  
(...)  
/1.5

5. Point mutation, non synonymous, SNP, position 119, GGC to AGC, Glycine to Serine  
/1  
synonymous  
/0.25

6. No Ace protein = negative control, no enzymatic activity  
wild-type Ace: no effect of propoxur at very low concentrations, inhibits Ace activity at 10<sup>-6</sup> and higher concentrations  
resistant Ace (with a single amino acid change): no effect of propoxur at low and high concentrations, the enzyme is still active  
<https://www.nature.com/articles/423136b/figures/1>  
/1.5

7. collect mosquitoes at various places, extract DNA, PCR, (electrophoresis gel), sequencing the PCR fragments, calculating the frequencies at various locations  
/2

selection in the treated zone for resistant alleles + migration of the resistant individuals to the non treated zone  
/1

the allele conferring resistance is not present at 100% in these mosquito populations because the resistant allele decreases survival compared to the sensitive allele (question 3, figure 1).  
/0.5

8. The new AceD mutation does not confer better insecticide resistance than the AceR allele, but it has spread through the populations. Therefore, it probably improves developmental survival from embryo to adult stage compared to the AceR allele.  
The duplication probably increases the overall activity of the enzyme and thus leads to better survival from embryo to adult stage than the AceR allele.  
However, the AceD allele does not invade untreated areas, so it must still confer a disadvantage over AceS in absence of insecticide, although not as great a disadvantage as the AceR resistance allele.

La nouvelle mutation AceD ne confère pas une meilleure résistance à l'insecticide que l'allèle AceR mais elle s'est répandue dans les populations. Elle doit donc améliorer la survie au cours du développement, entre le stade embryonnaire et le stade adulte, par rapport à l'allèle AceR.  
La duplication permet sans doute d'augmenter l'activité globale de l'enzyme et ainsi réduire la baisse de survie qu'occasionnait AceR.  
Cependant, AceD n'envahit pas les zones non traitées, il doit donc conserver un désavantage par rapport à AceS en l'absence d'insecticide, bien que moins grand que l'allèle de résistance AceR.