**Mutagenesis Agent**

**Question 2: Describe and discuss the mode of function of a mutagenesis agent**

The deoxyribonucleic acid (DNA), ribonucleic acid (RNA), and their supportive protein molecules form the biochemical basis of human genetics. The four nitrogenous bases that form nucleotides in DNA molecules are guanine, cytosine, adenine, and thymine. Three sets of these bases form a codon within the DNA and a sequence of codons controls production of proteins in the nucleus. Moreover, the double helix DNA strand should separate during DNA replication. A mutation is the alteration of the DNA sequences leading to a permanent change in the genetic composition of the cell.1 The types of mutations include inversion, substitution, duplication, insertions, and deletions that can be either consequential or inconsequential.2 Insertions involve inclusion of a new nucleotide while deletion involves removal of an already existing nucleotide in the codon sequence. The codon can undergo inversion where the sequence is rotated horizontally while substitution means exchange of a given nucleotide base with another. For example a thymine base can exchange with guanine leading to a different protein. Even though somatic mutations are not inheritable, 3 germline mutations are inheritable because they occur in sperms and ova that form the next offspring.4 On the other hand, transversion occurs when a pyrimidine replaces a purine. Overall, mutations result to an alteration of the codon sequence leading to a change in the type of protein produced from the codon.

Aflatoxin B is a potential mutagenesis agent that can alter the genetic composition of a human cell leading to subsequent carcinogenesis. Aflatoxin B is a naturally occurring mutagenesis agent that comes as a product from a mold called Aspergillus.5, 6, 7 The mode of action of this agent relates to its ability to penetrate the cells to reach the DNA. Once inside the cells, aflatoxin B causes transversion in codon number 249 that leads to substitution of arginine with serine.5 Currently, 30-60% of liver cancers in South East Asian countries, including Australia, result from exposure to aflatoxin B.8 The potential consequences of aflatoxin are mutagenesis leading to carcinogenesis. Once the cell undergoes mutagenesis, it becomes vulnerable to cumulative mutations and promotions that would lead to development of cancer.9 Moreover, this mutagenesis agent causes loss of function mutation of *p53* protein leading to enhanced cell immortality.5 The most interesting area about aflatoxin is the current research completed on its detection and diagnosis. Currently, scientists and health care providers can use nanotechnology, through bioanalytic devices, to detect the level of the aflatoxins in food and body.10 Therefore, the health care providers and food suppliers are able to detect aflatoxins before food reaches the consumers.

**References**

Ahmed N. Clinical biochemistry. Great Clarendon Street: Oxford University Press: 2016.

Kasper D, Fauci A, Hauser S, Longo D, Jameson J, Loscalzo J. Harrison's principles of internal medicine. Penny, PA: McGraw-Hill Professional: 2016.

Talwar GP. Textbook of biochemistry, biotechnology, allied and molecular medicine. Delhi: PHI Learning Pvt. Ltd.: 2015.

Tung N, Lin NU, Kidd J, Allen BA, Singh N, Wenstrup RJ, Hartman AR, Winer EP, Garber JE. Frequency of germline mutations in 25 cancer susceptibility genes in a sequential series of patients with breast cancer. *Journal of Clinical Oncology*. 2016: 34(13):1460-1468. Available from doi: 10.1200/JCO.2015.65.0747.

Kumar V, Abbas AK, Aster JC. Robbins Basic Pathology. Philadelphia, PA: Elsevier Health Sciences: 2017.

Medina A, Rodríguez A, Sultan Y, Magan N. Climate change factors and Aspergillus flavus: effects on gene expression, growth and aflatoxin production. *World Mycotoxin Journal.* 2014: 8(2):171-9. Available from doi: 10.3920/WMJ2014.1726

Temba BA, Fletcher MT, Fox GP, Harvey JJ, Sultanbawa Y. Inactivation of Aspergillus flavus spores by curcumin-mediated photosensitization. *Food Control.* 2016: 1(59): 708-13. Available at doi: 10.1016/j.foodcont.2015.06.045.

Zhu RX, Seto WK, Lai CL, Yuen MF. Epidemiology of hepatocellular carcinoma in the Asia-Pacific region. *Gut and Liver*. 2016: 10(3): 332-339. Availabel from doi:  10.5009/gnl15257.

Walker BR, Colledge NR. Davidson's Principles and Practice of Medicine. Sydney, AU: Elsevier Health Sciences; 2013.

Reverté L, Prieto-Simón B, Campàs M. New advances in electrochemical biosensors for the detection of toxins: Nanomaterials, magnetic beads and microfluidics systems. A review. *Analytica Chimica Acta*. 2016: 18(908): 8-21. Available from doi: 10.1016/j.aca.2015.11.050.