



LEVEL 4

SEMESTER 2

MODULE CODE: SHSS4068

MODULE TITLE: THE SCIENCE OF NUTRITION

ASSESSMENT TYPE: ESSAY

ASSESSMENT/COMPONENT: 1

COMPONENT WEIGHTING: 100 %

WORD COUNT: 3000

MODULE TUTOR: David Gardner

SUBMISSION DETAILS: by 3.00 pm through turnitin

- Complete all 3 essays to be submitted through Turnitin UK via moodle.
- Each essay to be no more than 1000 words, excluding figures, tables and references.

By 28th February 2020

Describe the hormonal and enzyme regulation of the digestion process.

or

Describe the digestive process with particular reference to gut flora and bioavailability.

By 27th March 2020

Describe the mechanisms of cell signalling.

or

Describe the processes of gene expression.

By 1st May 2020

Describe the roles and importance of vitamins or minerals during energy catabolism.

or

With reference to a specific vitamin or mineral discuss the implications of deficiency and toxicity.

Assessment Criteria

Details relating to the specific requirements levels grading for the essays are provided in the generic level descriptor provided on moodle.

Specific details and an example session will be provided during lectures.

School of Sport, Health & Outdoor Education

Assessment Feedback Sheet

Student No./Name:

Module Code: SHSS4068

Module: The Science of Nutrition

Personal Evaluation – to support your academic progress please complete the section below BEFORE submitting your work.									
What do you consider to be the best aspects of this work?									
Which aspects do you consider could have been improved in this piece of work?									
What have you found most satisfying whilst undertaking this submission?									
ASSESSMENT CRITERIA	Learning Outcome	GRADE							
		Poor 0-25%	Unsatisfactory 26-39%	Satisfactory 40 – 49%	Good 50 – 59%	Very Good 60 – 69%	Excellent 70 – 85%	Exceptional 86– 100%	%
Theoretical explanation	1								70%
Use and appropriateness of references	2								20%
Structure and flow of answer	1								10%
It is expected that students will present work that is proof read, correctly referenced and adheres to the Assessment Checklist . Therefore a range of 0 – 10 marks will be deducted for non-completion of any of the points on the checklist below .									
TUTOR COMMENTS:									
Submission date: via Turnitin		Return date: (at least within 4 weeks)		Tutor:			Mark:		

Assignment Checklist

- ☐ Please complete the **Personal Evaluation** section of the Assessment Feedback sheet, add your name and details, and paste the whole of this assignment document into the front of your assignment
- ☐ Submission is a **single .pdf file, clearly labelled** with your name and module code
- ☐ Font style - Times New Roman, size -12 for text and 14 for headings
- ☐ Ink colour – black only
- ☐ Line spacing – 1.5 line spacing and 2cm- 2.5cm page margins
- ☐ Quotations more than three lines to be indented 1 line spacing
- ☐ One line space between paragraphs, paragraphs must be left aligned
- ☐ Pagination (your assignment should have **page numbers**)
- ☐ All tables and figures are internally referenced and have a title
- ☐ **Word count** checked and written at end of text (before references and any appendix)
- ☐ Assignment is within 10% of the word limit (excluding references and any appendices)
- ☐ **All** references in the text are included in the reference list
- ☐ **Correct referencing as described in UWTSD Harvard Referencing Handbook on the Library website** <https://www.uwtsd.ac.uk/media/uwtsd-website/content-assets/documents/library-and-learning-resources/infoskills/harvard-eng.PDF>
- ☐ Correct spelling and punctuation, using **UK English**
- ☐ Grammar and syntax correct- double check anything that has a green line under it
- ☐ I have read my assignment out loud to myself and it makes sense and is easy to read
- ☐ Somebody else has read my work and it makes sense to him or her!
- ☐ **I have checked and I have not plagiarised**

**Failure to follow these guidelines will
cost you marks!**

The Process of how gene expression functions

The fundamental role of gene expression is to provide the body with the correct protein when it is needed. It does this by following a very strict process in copying the gene and producing a new strand of synthesised material, which then allows for the material to be turned into protein ready for the body to use for its desired needs. In this essay the focus will be kept on the depth of how the mechanism of gene expression operates to produce new proteins.

Gene expression is the process of reading the genetic code of DNA and using it to assemble a protein molecule (Candotti, 2020). The first step in the process of gene expression is when the body detects the need for a new protein. Then epigenetics plays its part allowing for the specific code to be read so the next processes can occur (Cell biology, 2020).

This is followed by 2 main processes which are transcription and translation.

- Transcription is when the reading and copying of the gene occurs.
- Translation is when the copied code is used to combine amino acids into a new protein structure (Leicester, 2020).

Transcription is when the synthesis of a messenger ribonucleic acid (mRNA, RNA) occurs, this happens by using an enzyme called RNA polymerase.

Transcription factors help control the transfer of genetic information from DNA to mRNA (Istomine and Piccirillo, 2018). RNA polymerase binds to a promoter site which signals the beginning. The process begins and the gene is split into 2 strands,

- Antisense strand (DNA Strand)
- Sense strand (newly synthesised mRNA transcript)

RNA polymerase doesn't need a primer it initiates mRNA synthesis at start point moving down stream along the gene (Orphanides and Reinberg, 2002). This process is called elongation synthesising mRNA as it goes. The antisense strand is read from 3' to 5' and generating the mRNA from 5' to 3' attaching the RNA nucleotides to the 3' end as it goes. In mRNA the nucleotide thymine is changed with uracil as this is more biochemically stable (Uptain et al., 1997).

Once RNA polymerase reaches the end of the gene there is a terminator sequence that tells RNA polymerase to stop transcribing, enzyme detaches from the gene and DNA returned to the original state (Matsuzaki et al., 1994).

Now mRNA has been produced this will carry with it the information encoded within the gene. The mRNA will be edited and the parts which are kept are called exons and the parts which are edited out are called introns this process occurs so that the gene code can be altered into the correct format for the next stage to happen which is translation (Stuart and Panigrahi, 2002).

This is when the processed mRNA must be transferred from the nucleus to the cytoplasm before translation can begin, protein lined pores in the nucleus allow for the transfer of the mRNA to the cytoplasm (Reed and Hurt, 2002).

The mRNA then leaves the nucleus and finds itself a ribosome, this is where translation occurs, during Translation mRNA acts as a code for a specific protein (Ramakrishnan, 2002). Each set of 3 bases (codon) on mRNA will code for a specific anticodon which will be carried by a specific transfer RNA (tRNA) (Roll-Mecak et al., 2001). Each tRNA is attached to a specific amino acid. The arrangement of the nucleotide into these codons is called a reading frame, tRNA translates codons to amino acids (Buchan, 2006). Translation occurs inside a ribosome; the small ribosomal subunit binds to the mRNA and an initiator tRNA which adheres to the start codon, then the large ribosomal subunit joins to complete translation initiation complex (Dever, 2002).

The tRNA that corresponds to the next codon will enter ribosome, this will carry with it an amino acid which will be covalently bound to the methionine from the initiator tRNA. First tRNA detaches and leave the ribosome which has then shifted over making room for the next tRNA. The new amino acid links to the first 2, this process continues all the way down the mRNA (Leicester, 2020).

As tRNA's enter and exit the ribosomes in a sequence that is dictated by the codons on the mRNA a poly peptide chain will grow this continues till a stop codon is reached (Namy et al., 2001). At which point the completed poly peptide will swim away. Most likely entering one of the cell organelles for folding and modification.

In this process of gene expression DNA is transcribed into a mRNA. This mRNA is translated into a protein all simply by obeying the base pairing that occurs in nucleic acids and since every gene code for a specific protein and proteins make up for most of what you are, from muscle tissue to all of your receptors and enzymes. This is how DNA carries a code for a living organism. The complexity of gene expression is every going because of new information constantly being found. Researchers are trying to grasp every little piece of detail

regarding gene expression thus they are creating mass amounts of data which takes time to validate.

Word count 852

Reference

- Candotti, F., 2020. Gene Expression. [online] Genome.gov. Available at: <<https://www.genome.gov/genetics-glossary/Gene-Expression>> [Accessed 27 March 2020].
- Leicester, U., 2020. Gene Expression And Regulation — University Of Leicester. [online] Ww2.le.ac.uk. Available at: <<https://www2.le.ac.uk/projects/vgec/highereducation/topics/geneexpression-regulation>> [Accessed 27 March 2020].
- Istomine, R. and Piccirillo, C., 2018. Post-Transcriptional and Translational Mechanisms of Regulation of Gene Expression in T Cell Subsets. Gene Expression and Regulation in Mammalian Cells - Transcription From General Aspects, [online] pp.212-234. Available at: <<https://www.intechopen.com/books/gene-expression-and-regulation-in-mammalian-cells-transcription-from-general-aspects/post-transcriptional-and-translational-mechanisms-of-regulation-of-gene-expression-in-t-cell-subsets>> [Accessed 27 March 2020].
- Cell biology, B., 2020. Epigenetics – It’S Not Just Genes That Make Us | British Society For Cell Biology. [online] Bscb.org. Available at: <<https://bscb.org/learning-resources/softcell-e-learning/epigenetics-its-not-just-genes-that-make-us/>> [Accessed 27 March 2020].
- Orphanides, G. and Reinberg, D., 2002. A Unified Theory of Gene Expression. Cell, [online] 108(4), pp.439-451. Available at: <<https://www.sciencedirect.com/science/article/pii/S0092867402006554>> [Accessed 27 March 2020].
- Uptain, S., Kane, C. and Chamberlin, M., 1997. BASIC MECHANISMS OF TRANSCRIPT ELONGATION AND ITS REGULATION. Annual Review of Biochemistry, [online] 66(1), pp.117-172. Available at: <<https://www.annualreviews.org/doi/abs/10.1146/annurev.biochem.66.1.117>> [Accessed 27 March 2020].

Stuart, K. and Panigrahi, A., 2002. RNA editing: complexity and complications. *Molecular Microbiology*, [online] 45(3), pp.591-596. Available at:
<<https://www.ncbi.nlm.nih.gov/pubmed/12139607>> [Accessed 27 March 2020].

Matsuzaki, H., Kassavetis, G. and Geiduschek, E., 1994. Analysis of RNA Chain Elongation and Termination by *Saccharomyces cerevisiae* RNA Polymerase III. *Journal of Molecular Biology*, [online] 235(4), pp.1173-1192. Available at:
<<https://www.ncbi.nlm.nih.gov/pubmed/8308883>> [Accessed 27 March 2020].

Reed, R. and Hurt, E., 2002. A Conserved mRNA Export Machinery Coupled to pre-mRNA Splicing. *Cell*, [online] 108(4), pp.523-531. Available at:
<<https://www.sciencedirect.com/science/article/pii/S009286740200627X>> [Accessed 27 March 2020].

Ramakrishnan, V., 2002. Ribosome Structure and the Mechanism of Translation. *Cell*, [online] 108(4), pp.557-572. Available at:
<<https://www.sciencedirect.com/science/article/pii/S0092867402006190>> [Accessed 27 March 2020].

Dever, T., 2002. Gene-Specific Regulation by General Translation Factors. *Cell*, [online] 108(4), pp.545-556. Available at:
<<https://www.sciencedirect.com/science/article/pii/S0092867402006426>> [Accessed 27 March 2020].

Roll-Mecak, A., Shin, B., Dever, T. and Burley, S., 2001. Engaging the ribosome: universal IFs of translation. *Trends in Biochemical Sciences*, [online] 26(12), pp.705-709. Available at:
<<https://www.sciencedirect.com/science/article/abs/pii/S0968000401020242>> [Accessed 27 March 2020].

Buchan, J., 2006. tRNA properties help shape codon pair preferences in open reading frames. *Nucleic Acids Research*, [online] 34(3), pp.1015-1027. Available at:
<<https://www.ncbi.nlm.nih.gov/pmc/articles/PMC1363775/>> [Accessed 27 March 2020].

Namy, O., Hatin, I. and Rousset, J., 2001. Impact of the six nucleotides downstream of the stop codon on translation termination. EMBO reports, [online] 2(9), pp.787-793. Available at: <<https://www.ncbi.nlm.nih.gov/pmc/articles/PMC1084031/>> [Accessed 27 March 2020].