

CHEM-E8120 Cell Biology, Essay writing

General instructions

- The essay writing accompanies studying of the course materials, and the final version of the essay results in a written synthesis of many (but not all) topics covered in the course.
 1. The correct integration of the topics into a coherent entity is a key factor in writing and evaluation. Note, that this also means that you must decide which aspects need to be left out because they are not relevant.
 2. The essay should be based on the contents of the course materials and the accompanying textbook. You do not need to search for any additional information nor go deeper into any of the topics as they are treated in the course materials.
- The topic of the essay is GLP-1 pathway of insulin production.
- While writing the essay, follow the structure below:
 1. Summary (max. 250 words)
 - Summary of the key topics.
 - Note that you won't need to write this first.
 2. Introduction
 - Write one short chapter describing what is insulin and why it is relevant for biotechnology. (max. 250 words)
 3. Biosynthesis of insulin
 - Covers all steps from genome organization to the synthesis of a polypeptide. (1000-1500 words)
 - This part is very generic, e.g., not dependent on the target gene (in this essay). You won't need to look for any additional literature on that.
 4. Processing and secretion of insulin
 - Describe how the formed polypeptide folds into a functional protein and reaches the cytoplasmic membrane. (1000-1500 words)
 5. Regulation of insulin synthesis
 - Describe how the extracellular signal is perceived and how this signal reaches the nucleus and turns on gene expression. Here you must think well where this part fits into the story of the essay. Only use the figure provided below and the learnings from this course. Do **not** read additional literature on this topic for this essay! (1000-1500 words)
 6. Bonus question: why GLP-1 agonists are such a hot topic now?
 - For this one, you will need to search for some additional information. Note that this is not a compulsory part but a change to get few extra points. (Max 100 words)
- The total length of the essay should be approximately 4000-5000 words (10-12 pages).
- Be aware that you might need to go back to already written parts of the essay as you learn new elements.

- Consider the essay as an applied learning diary. The goal is for you to reflect what you have learned on a semi-realistic example. During the course, you read about new elements (biological processes and molecules) which you must integrate step-by-step into the essay.
- The story described below serves as a scaffold for the essay, you must build your essay onto the given scaffold and not just write an unrelated summary.

Group work

- Set-up a starting meeting
- Decide how you will share the workload. Each one will select one of the articles for assignment II and working for the related part of the essay is recommended.
 - Preferred to work together and at least review parts that others have written.
- Decide when and where you will meet to discuss.
- Time for discussion about the group work on lectures 2, 7, and 11 (+ you can ask for advice).

Set-up of the story for the essay

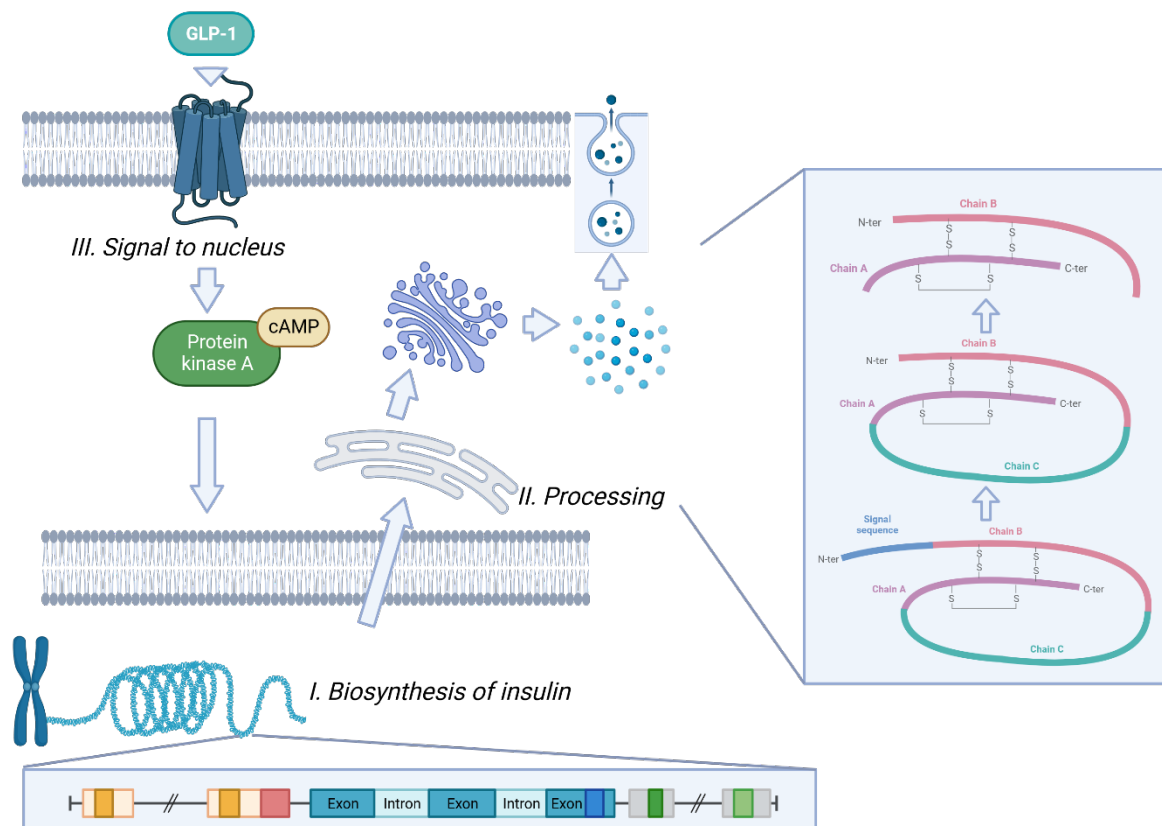
Insulin is a small protein that is essential for the regulation of blood sugar levels. In addition to being essential for human cell biology, insulin is one of the most influential examples of biotechnological innovations.

One of the pathways to regulate insulin secretion is via a GLP-1 pathway. Glucagon like peptide 1 (GLP-1) is a peptide hormone participating in regulation of blood sugar levels by enhancing the secretion of insulin. It is released as a response to food being present in the gastrointestinal track. In addition to being essential for human, GLP-1 receptor agonists have been an important target for diabetes and drug research.

The presence of GLP-1 peptides stimulates a plasma membrane localized G-protein coupled receptor (GPCR). GLP-1 peptide targets GLP-1 receptor, which is a G-protein coupled receptor. After activation of the GPCR, the signal is conveyed through a PKA mediated signaling cascade to the nucleus. When the signal reaches the nucleus, the transcription of the gene encoding the transporter and the gene that encodes preproinsulin is induced.

Preproinsulin is synthesized on ER, where it is folded and its disulfide bonds are oxidized, and the signal peptide cleaved, prior to being transported to the Golgi apparatus. At Golgi, proinsulin is packaged into secretory vesicles, and processed by proteases to form mature insulin (see sketch below). Insulin is stored in granules and secreted upon a signal (an increase in intracellular calcium levels). Activated PKA also induces Ca^{2+} influx via several steps. Increase in the intracellular Ca^{2+} level leads into exocytosis of the insulin granules.

Please note that this is a radically simplified scheme and does not fully reflect the real process!



Deliverables:

Draft I -> 1000 to 1500 words (Part I) -> online text submission

Draft II -> 2500 to 3000 words (Part I & II) -> online text submission, mark new part(s) with altered font / font color (you may use track changes).

Final version -> 5000 words (Part I, II & III) starting with **a summary paragraph** (max 250 words) -> submitted as a PDF file. 5000 words correspond to 10 to 12 pages of text.

Please use Times New Roman (or similar), font size 12, line spacing 1.15.

Evaluation criteria

- Contributes 30% to the final grade
- Both **draft versions** submitted with sufficient amount of text and covering the relevant topics. There can be gaps / text not polished (2 x 10 points).
- **Final version** (80 points)
 1. Text forms a logic and coherent entity (20 points)
 2. The essential biological processes and molecules that are relevant to the story have been recognized and integrated correctly into the story. This also means that irrelevant processes are left out. (20 points)
 - Integrating new parts might require reconsidering the structure of a draft version.
 3. All elements present and included in a balanced manner. (20 points)
 - You cannot focus on a particular element, for example transcription and describe it with many details, while neglecting others.
 4. Correct use of terminology (20 points)
 5. Bonus question: +5 points