Examenvragen 1ste Master Biochemie & Biotechnologie – Semester 2

Beste student, *dit document bevat alle examenvragen die bijgehouden zijn doorheen de voorbije jaren. Hou er rekening mee dat sommige onvolledig zijn en dat er een hele hoop ontbreken. We hebben ervoor gekozen ze te ordenen van recent naar oud zodat de meest relevante vragen vanboven komen te staan. Sommige examenvragen dateren van lang geleden (2005-2006 of ouder) en zijn vaak niet erg relevant meer. De reden dat we deze alsnog behouden is omdat ze meestal nog steeds de essentie, belangrijke onderwerpen van de vakken weergeven.*

Wil je bijdragen aan ons archief? *Via de onderstaande Google Forms link kan je je examenvragen snel en eenvoudig deponeren!*

https://forms.gle/mCu6rZ4Cwm7Gon779

Voor de masters is het belangrijk om Ufora in het oog te houden. De meeste professoren geven daar duidelijke voorbeeldvragen en documenten die benadrukken welke leerstof belangrijk is en welke niet.

Inhoudstafel

Comparative Genomics (BIS):

- Compare COG and InParanoid.
- Given an influx grid. Which species are shown on the right and on top? What can you say about the grid? Write down in bullet points how this grid was made
- Given a gene tree and phylogenetic tree, decide for certain gene pairs if they are outparalogs, inparalogs or orthologs
- Explain three entries in a H2O2 response matrix
- Explain & compare COG & InParanoid methods and define all terms you use in your explanation? Which principles are used in both methods and what extra features are used by InParanoid? Give the formula to calculate confidence values. (5p)
- Influx grid is given; explain what it is, how it is made; what the species names on left & top sides represent and how to interpret it (5p)
- 3 True/false questions: (4p)
    o Deletion of an outparalog can lead to orthologs.
    o Syntenic regions cannot be detected by diagonals in a Gene homology matrix.
    o Phylogenetic foorprinting on closely related species can be used to find functionally constraint sequences.
- Exercise on in- and outparalogs and orthologs (3p)
- 3 cells are marked in the H2O2 response matrix (0,5 ; 0,0 & an empty cell). Explain what they mean (3p)

Algorithms (BIS):

- Exam consisted of three algorithms that you should explain:
    o ReversalSort
    o EulerianCycle
    o MajorityElement (+ explain what Divide & Conquer algorithms are)

Transgenics (BIB):

- Part prof. Libert:
  - DNA injection in zygotes: what are the problems and how can you solve them
  - Reduce off target activity of CRISPR
  - How can you perform place or time specific expression with Cre and how can you check this?
- Part prof. Vleminckx:
  - Exercise on Xenopus (only transient so you can't make transgenic animals) (8p)
  - Which organism is best to study aging (Drosophila or C. elegans), explain. (1p)
  - Which organism is better to maintain a recessive lethal mutation? Explain. (Drosophila or C. elegans) (1p)

The Plant Cell (PLB):

- Part prof. De Veylder:
    - Page 33-34 (Salt stress induced proteolysis of SPR1 is required for salt tolerance)
    - Page 109-113 (epidermal cell shape, ROP2/4 RIC4 RIC1)
    - Page 240-242 (ODR and NDR)
    - Slide 240 & 241 (Chapter 5) about interplay between organelle & nuclear genome replication

- Part prof. Van Damme:
    - Name & briefly explain 4 fluorescent dyes and what are they used for? (40%)
    - 6 yes/no questions with a short explanation (60%)

Plant Growth & Development (PLB):

- Explain the molecular mechanisms of RAM and SAM. Are they similar? Explain. (5p)
- Auxin displays morphogen-like features within the RAM, explain. (3p)
- Briefly explain: (3x 2p)
    - Dexamethasone inducible system
    - Pollen tube overgrowth phenotype
    - Endothelium
- What is the difference between regular secondary growth in gymnosperms and dicotyledonous angiosperms compared with the anomalous secondary growth (order Asparagales) (2p)
- Chose 1 transcription factor that is important for secondary growth, explain the phenotype and how this is studied. (2p)
- The task of the "excursion" (2p)
- Discuss the LEC1 and PKL mutants and their role in phase changes. You should mention in which phase change they are active, what the phenotype of these mutants is, and what the molecular interaction between these factors is. (5p)
- Explain: The RAM stem cell niche is dependent on counteracting TF gradients. (3 points)
- Explain the following terms:
    - Megasporogenesis (2 points)
    - StrigAway maize technology (2 points)
    - MDIS1 (2 points)
- Choose one phytohormone and discuss its functions in secondary growth (2 points)
- Which stem cell niche is responsible for secondary growth, and what tissues does it generate? (2 points)

Plant growth and development - **Prof Beeckman/Vanneste/Nowack**
Version 1:
-endosperm: what where how and compare monocots & dicots + give biotechnological application (5)
-2 strategies voor monocot growth of stem that lost sec growth (2)
-give one phytohormone + exp that plays a role in cambium formation (2)
-wox5: role, how primary transcripts were discovered and model of application (3)
-words (2 each): megasporogenesis vs megagametogenesis, after-ripening, glossy15
-figure from course, situate and explain briefly: MDIS/MIK is species specific (2)
Version 2:
-phase change, explain
-give 4 stem cell niches in plants, give characteristics of stem cells and which are involved in sec growth
-arabidopsis as a model for sec growth?
-scr, shr and jkd complexes, explain. Explain fret.
-3 words: polygonum type, leafy cotyledon 1 and pollen tube overgrowth mutant
-picture from course: wox5 LOF complements with wsh and vice versa

Bio-informatics 2 - **Prof Yves Van De Peer**
-frog closer related to human or fish? Explain
-UPGMA, why rooted? Combinatoral explosion or not?
-subst rate plot, have to make a tree based on this, how would you do that?
-Ks and explain what you can conclude from that?
-dotplot from chr 5 and 7 of poplar, what can you conclude?
-trace plot and burn-in fase, explain.

Microbial ecology - **Prof Marie Joossens**
-ARISA and SIP, explain + added value?
-metaproteomics and microarray, explain + added value?
-driving factors that influence skin microbiota
-key stone pathogen concept + systemic health -enterotypes, explain. Where on body also this concept?
-probiotic for kidney disease, what would prodigest analyse + give 2 adv and 2 disadv
-type of fungi and bacteria in house dust influenced by other things, what and how discovered?
-functional gene seq is more challenging than 16S rRNA (Prof Anne Willems)
-plant wear there guts on the outside, explain. (Prof Aurelien Carlier)

Probable exam questions as discussed during the last lecture
-two questions about Two different techniques and ask to describe both techniques with advantages and disadvantages and ask how they are complementary. Sometimes they are not complementary! They have no added value. Fish, other proteomics and the added value. Very important to answer each part of that question.
-The questions on the exam are related to the size of the course chapters. (~ 1.50 points/class) Use schemes to summarise!
-Second part => about the different human-associated MO's

-Questions on the Antarctic, on plant and different human-associated microbiomes.
-Part of the human microbiota. Know the big things, do not know the different parts of the small intestine, only of the colon. Need to know the succession of the different parts.
- How does the environment determine the different MO's found. Very important concerning the bacteria you find back, different types of fermentation.
-Role of the intestinal microbiota (175) => ask to give 3 of them and explain them a bit.
-Main bacteria found on different places in your body, insight on what the difference is between the different body parts. What are the main groups and which are the leading players within these groups?
Critical insights on what we know about the microbial compositions in and out our body.
-Enterotypes, way of stratifying your data. So many different bacteria that comprise a microbiome, by looking for distinct groups. Looking for similarities between different patterns, able to say something more informative about the disease, eating habits,...
-(198) Modification of the intestinal microbiota. Expected to say something about how you can modify it and explain it in more detail.
-What is the difference between saliva and stool? Why this difference? (261)
-Tend to ask about the main phyla/genera that are present in different MO communities in and out our body.
-Question about the model for periodontitis.
-Explain the keystone pathogens and how it leads to the propagation of different things that are happening and how it leads to damage.
-(290) Do ask about the different hypothesis about how periodontal disease leads to different miscarriages.
-(297) Ask about the possible mechanism of how the oral microbial community might be linked to obesity.
-(298) link to periodontitis to other diseases.
-301 clue about general vaginal concepts.
-303 What is the function of the vaginal microbiota and what is the impact of the composition of the microbiota concerning diseases.
-(307). A clue about the different vaginal types.
-311 vaginal microbiota in both health and disease,
-312 have to know that there are much more temporal changes in vaginal microbiota compared to the intestinal microbiota.
-Skin (319) got to have some clue about the different layers and how they affect the bacteria found.
-What is the skin microbiome? Which factors contribute to the variation of the microbiota.
-Why is the microbiota different on two hands. (323 is the answer).
-Prodigest => How to set up and experiment. What type of SHIME should In use, and why?
-CSI=> Potential role of MME in forensics (341). Critically discuss why it makes sense or why they.
-Methods: 2Q for 5 points.
-Nine points for all the human-associated microbiota: 2 p oral microbiota, 1.5 Q about compositions, 2p microbial community, 1.5 Prodigest, 2p forensics, 1.5 Willems & 1.5 Carlier

Host-bacterial interactions
Prof Sofie Goormachtig
-give 2 functions of effectors (2,5)

-guard model, explain + example (2,5)
Prof Marie Joossens
-functional mutations of TLR and link in inflammatory bowel disease (3)
-scheme of IFN signalling, what is different if you give synthetic IFN? (2)
Prof Aurelien Carlier
-explain tir effector in pedestal structure making (2)
-what do eukaryotes do to interfere with quorum sensing (2)
-interpret figures from a given article (6)

Example exam questions:
The exam will consist of 5-6 open questions, plus one exercise where you will be asked to interpret experimental data taken from a recent article.
Examples of open questions:
-Using the human gut as an example, outline the various ways pathogens use to circumvent host defenses/barriers
-Compare and contrast the T2SS and T4SS of gram-negative bacteria. Discuss the components of the secretion systems, the nature of the cargo proteins and give some examples in the frame of pathogenic and/or symbiotic interactions.
-Effector proteins modulate the host's immunity. Explain this concept using an example discussed during the course.
-Do effectors play a role during the establishment of mutualistic interactions? Explain your answer.
-What are the cues sensed by EHEC in the intestine and how are virulence genes regulated in response?

The Plant Cell - Prof Lieven De Veylder
Version 1:
Describe the following slides:
-page 50
-page 165
-page 168
-page 230
-page 268
-page 270
Fluorescence:
1. Explain the difference between the two images on pt 2 slide 46. How did the image on the right get achieved?
2. Explain the effect of using two different wavelengths to excite a flurophore.
3. (Cannot recall specific questions. Study all techniques, essentially.)
4. Explain the concept of acceptor bleaching to understand protein interactions.
Version 2:
De Veylder
-MAPs + bending
-RDH2 ko
-ODR & NDR
-E2Fs
Vandamme

-stromuli -time-gating
-FAST, XRAY-fluo, confocal, can you see polyploidy in microscopy, maturation time of fluorophore
-induced delocalization

Biotic interactions in plants - Prof Sofie Goormachtig
-AVR3a from P infestans, what is its role in interaction between plant and oomycete?
-what is microbiome, how study it and what is its role? (-> excursion Keulen)
-What is nodulation and why does a particular rhizobia only infects a particular plant?
-victorin: explain (picture experiments Col4 & LOV given)
-what does lignin do in plant microbe interaction (pathway of lignin and penetration graph of KO of lignin pathway enzymes)

Biostatistics – De Tender
-response variables (3 species of fish that have different numbers), model + explain every parameter, explain diagnostic plots.
-experiment: give biological & technical replicates and give levels of biological & technical variation and give design.
-give 2 influencing factors of plants grown in field with water and in greenhouse without water. Marchal
-clustering question (kmeans and correlation) as in exercises
-PCA question as in exercises

Comparative Genomics - Prof Klaas Vandepoele
-(5pt) Describe the differences and similarities between TribeMCL and OrthoMCL. Show the different steps for each.
-(5pt) A researcher wants to use comparative expression analysis experiments to identify genes with an early response to heat stress.
i) What type of experiment will you use to get transcriptional data? How many and what types of samples and controls will there be?
ii) What type of comparative expression analysis will you use?
iii) Show the bioinformatics analysis workflow (feel free to use diagrams to help illustrate your answer).
-True/False + short explanation
(1pt) When comparing sequences from two closely related species using phylogenetic footprinting, you can expect a high amount of functional constraint.
(1pt) When using DOLLO Parsimony, as many gain and loss reversions are used as necessary to form the tree.
(1pt) An outparalog may lead to the creation of an ortholog.
-(2pt) You are given two graphs of BLS information, showing lines for real, control, and confidence.
Which of the graphs utilized distantly related species? Mark on this graph how many ortho groups you have at 80% confidence.
-(2pt) Figure depicting a comparative expression matrix titled phosphorylation 6, between *C. albicans* vs *S. cerevisiae*. (See lecture 9: expression II, slide 14)
What type of genes are depicted in the figure? What can we infer from the information in the matrix?

-(3pt) A phylogenetic tree shows distribution of plant species (*A. thaliana*, Rice, etc.). A second phylogenetic tree shows many genes from different plant species (detailed with short species code, i.e. ath = *A. thaliana*). 6 different gene pairs are presented and you must check whether the gene paralogs are orthologs, inparalogs, or outparalogs, 1 pt each.

Transgenetica

Claude Libert
- Hprt locus
- How to improve HDR
- Cell ablation
- How creating a mutant mouse with turner syndrome (XO)? Problems and how solve it

Kris Vlemincks
- Balancer chromosome
- How miRNA is analysed in zebrafish or xenopus
- Exercise like in workcollege (how to investigate where and when expression of a protein? Protein influence on miRNA expression? Investigate if protein has interaction with another protein? Timeframe of protein expression…)

Bio Informatic Algorithms
- Give the rabinkarpe algorithm
- Explain how the superstring can be obtained from its spectrum using an eularian graph.
- Manhatten distance problem:
  - Give the algorithm to solve the Manhatten distance problem in a regular grid.
  - What if the graph is not a regular grid?