

Lecture "Online Image Analysis Course (OIAC), Institute of Microbiology, Faculty of Biological Sciences" (FSU, SoSe 2021)

Homework assignment, 14.04.2021-15.04.2021, submission deadline 17:00, 15.04.2021. Maximum: 20 points (≥ 10 points required to pass)

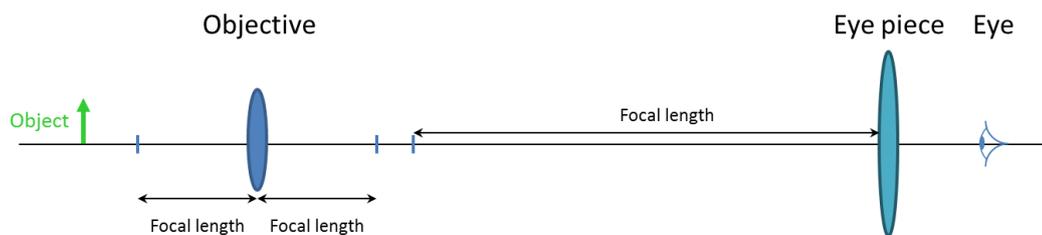
Prepare your answers in English and send them as a PDF file. Please ensure that your name and student ID are written on your submission. Please clearly indicate the question numbers.

Name: _____

Student ID: _____

Questions:

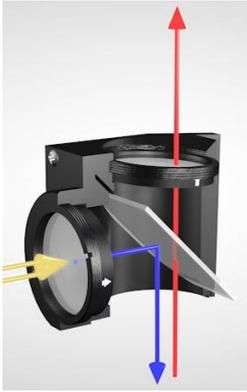
1. Sketch the image formation light paths of the following two-lens system, with the object being just outside the first focal point of the objective lens. Characterize the final image for orientation, real/imaginary character and magnification. You are welcome to prepare the drawing on a separate sheet of paper. (3 points)



2. Describe the meaning of the labels and the color bands on the side of these two objective lenses! What is the role of the metal collar on the lens on the right? (2 points)



3. Mark and describe the active optical elements of the dichroic cube in the image below. What do the yellow, blue and red lines and arrows symbolise in the image below? (2 points)



4. What would be the optimal pinhole size (in terms of best spatial resolution) of a confocal laser scanning microscope? Why is this pinhole condition difficult to achieve? How does Zeiss' AiryScan system approximate the results of using the optimal pinhole size? (4 points)
5. Sketch the Jablonski energy diagram for
 - a) single-photon excitation fluorescence
 - b) two-photon excitation fluorescence
 - c) phosphorescence
 - d) second-harmonic generation (4 points)
6. Design the excitation and emission filter settings for a biological sample containing the following three fluorescence proteins:
 - a) CFP (cyan fluorescence protein)
 - b) YFP (yellow fluorescence protein)
 - c) RFP (red fluorescence protein)
 Please find the absorption and emission spectra for these three proteins online and add them to your submitted answers! Describe in detail the control experiments that are necessary to examine the extent of crosstalk between the three labels! (5 points)

Please send us your answers as a single-file pdf document (manually filled out pages that are scanned or photographed and added to the pdf file are also accepted) before the submission deadline (15.04.2021, 17:00) via e-mail to thilo.figge@leibniz-hki.de, zoltan.cseresnyes@leibniz-hki.de and ruman.gerst@leibniz-hki.de. Earlier submissions are very welcome!