BIMA52 HT 2014 **Re-exam Developmental Biology**	**2014-11-25**
number	**passed** ☐ **not passed** ☐
time when left back:	**Points:** ***(Erasmus grading:)***

You can write your answers either in English or Swedish.
IMPORTANT: write your number on the bottom of each side.

Short questions:
Answer these questions using words only or a short sentence.

1a) At which cell cycle stage does fertilization of the human oocyte occur? (2p)

1b) Name two characteristics how sea urchins sperms differ from those in mammals? (2p)

1c) How many cells constitute a mouse blastocyst, and how is the cavity within called? (2p)

1d) At which cell-stage is the dorsal-ventral axis of *C. elegans* established? (2p)

2a) Indicate the region of origin of the germlayers in a Drosophila blastoderm embryo. In other words: Draw a Drosophila blastoderm fate map. (2p)

2b) Briefly outline formation of a Drosophila egg chamber from germline and somatic stem cells. (2p)

2c) In the microscope you see a Drosophila blastoderm embryo in which mRNA of the hunchback gene is evenly distributed throughout the embryo. Which gene could be homozygous mutant in this embryo? Briefly motivate your answer. (2p)

2d) Briefly outline specification of the terminal ends of the Drosophila syncytial blastoderm embryo. (2p)

3a) Briefly outline how mesoderm is established in the amphibian embryo. (2p)

3b) Briefly outline the mechanism of signal transduction by the TGFbeta signaling pathway. (2p)

3c) Describe briefly an experiment that demonstrates that cells along the anterior-posterior axis of the amphibian gastrula are regionally specified i.e. cells know which region along the anterior – posterior axis they belong to. (2p)

3d) Briefly outline the cell movements that lead to elongation of the anterior-posterior axis during gastrulation in fish. (2p)

4a) Which axes of asymmetry can be distinguished in the mammalian blastocyst? (2p)

4b) Suggest an experiment that demonstrates that blastomeres at the eight-cell stage are unspecified and can develop into various different cell types. (2p)

4c) Which polarity is established at “compaction” and how is it established? (2p)

4d) Briefly outline how the first cell lineage decision is made in the inner cell mass of the mammalian blastocyst (2p)

5a) In the very early nervous system there are three primary brain vesicles formed. One of these is called the prosencephalon. Give an example of an adult brain structure that originates from the prosencephalon! (2p)

5b) So called radial glial cells have a particular localization in the early neural tube. How are they organized? (2p)

5c) Name two different cell types that neural crest cells can give rise to and state where these cell types can be found! (2p).

5d) The formation of eyes starts with a single eye-field. Name a molecule that is important for splitting up the single eye-field into two developing eyes! (2p)

number:

6a) Name two molecules that are relevant to define the dorso-ventral axis of the limb (2p)

6b) How are stem cells in the mammalian skeletal muscle called? How can they be activated? (2p)

6c) Explain and give an example of compensatory regeneration. (2p)

6d) Name two organs or structures that salamanders can regenerate! (2p)

number:

7a) Name the different kidney types. Which type gives rise to the adult kidney? (2p)

7b) What is the role of SHH in pancreas induction? (2p)

7c) Name a feature of the mammalian heart that allows efficient segregation between oxygen-rich and oxygen-poor blood. (2p)

7d) Name at least 4 characteristics of the Fetal Alcohol Syndrome in children or mice! (2p)

number:

In the essay section, describe more in detail. But: stay focused such that we understand what you mean!

E1. Describe the cellular processes, from fertilization up to the two cell stage, that determine anterior-posterior axis formation in *C. elegans*. Name proteins that play an important role during this process. (10p)

number:

E2. Describe establishment of dorsal-ventral polarity in the Drosophila oocyte prior to fertilization and subdivision of the dorsal-ventral axis into regions of specific gene activity in the embryo following fertilization. (10p)

number:

E3. Describe in detail the molecular events that are initiated at fertilization and lead to establishment of tissue organizers in the amphibian blastula. Include the function of these organizers. (10p)

number:

E4. Describe early development of the chicken embryo up to extension of the primitive streak. Include establishment of different tissues and molecular factors controlling positioning and extension of the primitive streak. (10p)

number:

E5. With respect to the process of nervous system formation, describe (using also figures) what happens from the point that a neural plate is formed until there is a structure with primitive brain vesicles! (10p)

number:

E6. Bone morphogenetic proteins (BMPs) have specialized functions during finger development. What are these? Where are the BMPs expressed? Describe the experiments that showed an involvement of BMPs! How can one and the same signal trigger different responses? (10p)

number:

E7. Describe the mechanisms controlling somite formation and differentiation. Which signaling molecules are involved and where are they secreted from? What structures are derived from the somite? (10p)

number: