Unit 3 Germinal and Embryonic development, Chapter 5 and 6 Essay questions

Chapter 5

1. Discuss and differentiate the zygotic, morula and blastocystic phases prior to implantation.

   When we look at zygotic, morula and blastocystic phases we can differentiate them and discuss then prior to implantation. The Zygotic phase is within 24 to 48 hours after fertilization, this is the result of the fuse between the sperm and ovum, after this there is a doubling of cells with each division where the nucleus will split in half, this slowly will pick up some speed. With each cell produced, they all have the exact genetic information that the original cell has, the zygote however does not get any larger as the blastomeres are always half the size of the previous cell. The Morula phase is the next phase in which the zygote becomes a morula, in between 16 and 32 blastomeres, the difference between the zygotic and the morula phase is that in the morula phase the cells begin to organize into a group of cells which will eventually become the baby. Then looking at the Blastocyst phase, at day 4 or 5 there is a fluid filled bubble that emerges into the morula and at this point the morula becomes a blastocyst and when we reach the 6^{th} day, we now have 100 cells. Whilst all three of the processes have similarities, we can see how they differentiate and begin to add different components to the development of the baby.

2. What are the stages of implantation? Briefly discuss and differentiate each from the others.

   There are three stages of implantation with the first 2 being relatively short in duration and the third taking longer, here we can already see a difference. The first being apposition, this includes the first and unstable, adhesion of the blastocyst to the wall of the uterus, small microvilli latch onto pinopodes in the wall of epithelium. The next

phase is called the stable adhesion, which is a continuation of the first phase in which the latching on process from the first phase will involve ore contact enabling it to be more secure. However, the third phase takes a lot longer, this phase being called the invasion phase in which the blastocyst buries itself in the outer wall and also penetrates itself into the second layer of the uterus, this differentiates itself from the other two phases as it adds this process of penetration.

3. What are some of the problems that may influence whether implantation is successful? Discuss several of the potential implantation problems.

There are many different problems that can occur that influence whether this implantation is successful, I am going to discuss three of these. The first being Genetic causes, there is a estimate that between 50 – 70 % of all zygotes do not even survive the first two weeks and some of these lost to genetic issues for example missing or extra genetic material, damaged chromosomes or recessive inheritance in which these can all lead to miscarriage. Another problem being Timing issues, research has found that the ideal time for implantation is 8-9 days after the ovulation period and the risk of pregnancy loss will increase with each day with day 10 being at risk of 26%, day 11 at 52% and day 12 at 82%. Another problem being maternal causes, due to the fallopian and uterine environment this can also be a source of issue. 75% of pregnancy losses are due to failures of implantation with many of these miscarriages being unknown, the presence of certain material conditions can increase the likeliness.

7. Discuss the various types of multiples. Why and how does each type occur?

I find the whole concept of multiple births very interesting, some of these being simply natural will always be amazing to me. The proportion of twins has drastically increased and in the US it has steadily increased since 1996. The first type of multiple births being nonidentical multiples, these types of multiples will develop from

separate ova and sperm, they are no more genetically similar than siblings and after implantation each of the multiples develop in separate placentas and each have their own amniotic sac. Fraternal twins can be rather distinct in the shade of their skin, even though it is rare there have been cases where mothers have given birth to fraternal twins with 2 different fathers. Non identical twinning do tend to run in families but only on the mothers side and not the fathers. For non-identical twins about 25% are boy and boy combinations, 25% are girl and girl combinations and about 50% are boy and girl combinations. The next type of multiple births are identical multiples, these are multiples that develop from a single ovum and a single sperm in which each twin shares the exact same gene pair and therefore must be the same gender but do not share the same fingerprints. These do not tend to run in families and however are a quirk of nature. Some identical twins are mirrored and share the same traits but on opposite sides of their bodies, for example one twin may be left handed and the other right handed. The last type of multiple births is conjoined twins, this is where they have the same amniotic sac and therefore have significant physical contact in which the fusing together of skin will at some point occur, when delivered via C-section, these twins can be separated with sharing organs, however when the fusing is substantial then the complications are much more difficult.

Chapter 6

9. Discuss the various aspects of umbilical cord development and function.

The umbilical cord is also a marvel or nature as it connects the baby to the placenta and develops from the remnants of the yolk sac early on in the embryonic development. One aspect of the umbilical cord is the yolk sac and allantois, this primitive yolk sac comes from the cells that have split off from the inner cell mass of the blastocyst, therefore being outside of the embryo and is filled with vitelline fluid. As the embryo grows so does the volume of the vitelline and thus the yolk sac. This will continue until about 10 weeks, by this time they have matured enough. The allantois will also emerge from the blastocyst cell and serves as a primitive excretion and waste collection structure. Another aspect of the umbilical cord is Whartons jelly, this is a type of specialized tissue which has elastic effects and can be stretched, bent and twisted without harm which allows considerable fetal movement. The function of the umbilical cord primarily serves as a system for oxygen and nutrients from the mother and waste products back to the mother. Amazingly by week 31 the umbilical

cord must carry 70 quarts of blood per day, moving at about 4 miles per hour. During a normal pregnancy, the umbilical cord has 1 vein delivering oxygen and nutrients and 2 arteries returning waste products.

10. Discuss the amniotic sac and amniotic fluid. What are some potential problems?

The amniotic sac helping the embryo and later the fetus is surrounded by fluid and is very flexible, the inner layer being called the amnion and the outer membrane is called the chorion which connects with the placenta and both preventing harm to the baby. The amniotic fluid, 2 weeks after fertilization, the amnion begins to grow, as this grows then it fills up with a watery fluid which contain electrolytes, carbohydrates, proteins and fats, this fluid having many different beneficial functions to help the baby grow, it acts as a lubricant and facilitates from movement for the baby, the fetus will also be breathing some of this fluid into their lungs allowing a kind of practice breathing. Later on in pregnancy the fetus will actually drink this amniotic fluid, getting up to 100 calories per day. Some amniotic sac problems include premature rupture, when the sac leaks prior to 38 weeks or the water breaks prematurely then labour or a c section will have to be performed, this is a condition associated with either structural defects in the cervix or uterus or a infection. Another problem is oligohydramnios, approximately 8% of pregnancies are affected by a condition with this name, it is most commonly seen in pregnancies that are overdue and is usually associated with the presence of birth defects or poor fetal growth. Another problem is polyhydramnios, this is where there is too much amniotic fluid, this affcts about 2% of pregnancies and in most cases, complications are rather mild.

Video – conception to birth

I found this video rather interesting, to summarize this, I took some notes on the video and this was my summary. He starts of by started that everything is made of collagen which was a fascinating discovery for him during his research, using new technologies he studying the development of conception to birth, his visual demonstration showed the fertilization and division of cells which was very interesting for us to actually view through this visualisation as it puts what we learnt into perspective. It shows the heart chamber developing after 25 days, arms and hands developing after 32 days, it then shows how the fetus develops over the next 9 months resulting in its eventual birth, with the embryos heart beating twice as fast as its mothers. He then showed up close the structures of the sperm cell and ova and how

these developed into a joined cell which then begin to divide and grown together to eventually form the fetus.