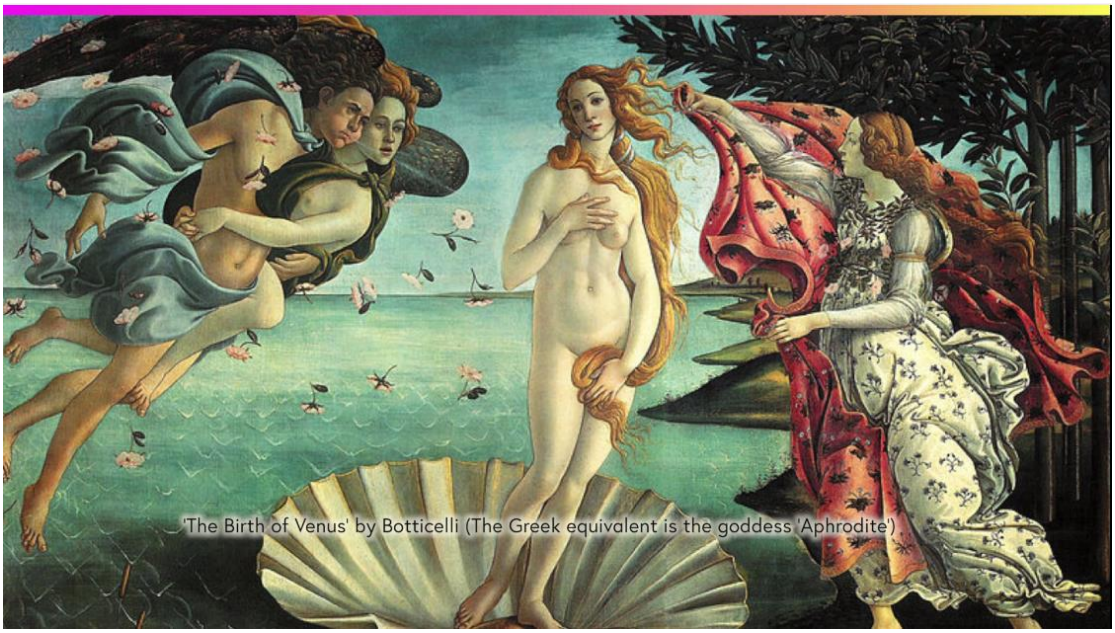
WEEK 4 MEDICINE & THE ARTS – REPRODUCTION AND INNOVATION
BIRTH AND CREATIVITY

00:00:00

I shall speak about the complex and amazing physiological processes, meaning the natural biological operating systems in the human body, which underlie what can aptly be called the ultimate creative process,- that of hum reproduction. I shall also talk about some of the creative solutions relating to a different form of art. And here I mean assisted reproductive technology, which is a group of intervention to help infertile couples conceive.

By way of introduction, I would like to show you this very beautiful painting by Botticelli depicting the birth of Aphrodite.

BOTTICELLI PAINTING



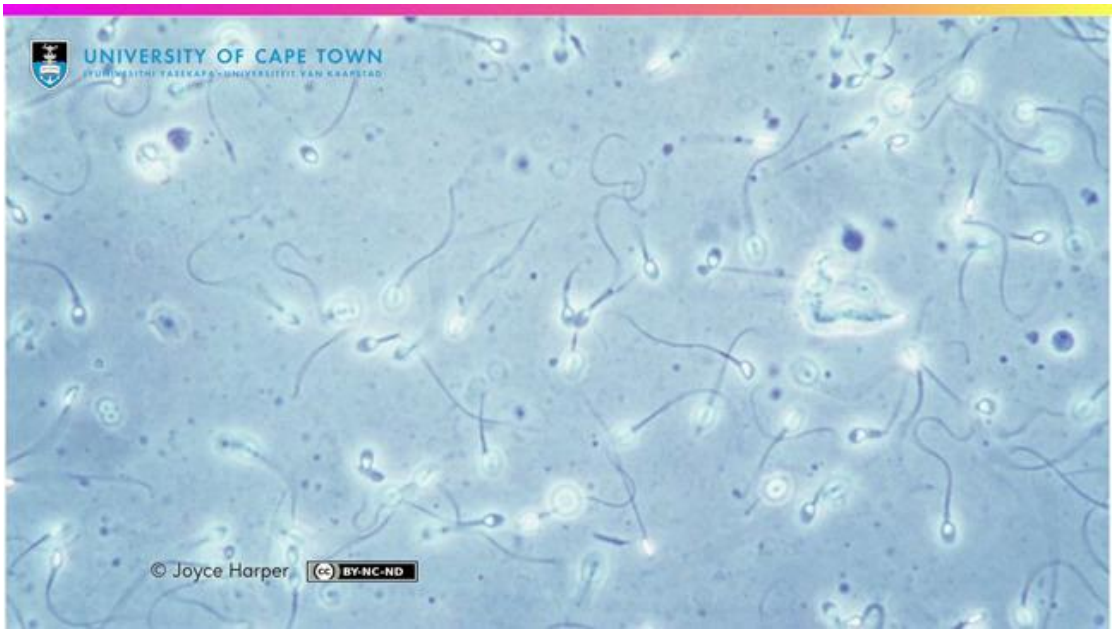
Public Domain Sandro Botticelli

Aphrodite was born when Uranus, the father off the Greek gods, was castrated by his son Kronos. And Kronos threw the severed genitals into the sea. And the sea began to foam. And out of the foam of the aphros, Aphrodite was born and carried to the shore.

Fortunately, human reproduction is not quite as violent, but in my opinion, it is just as beautiful as this painting. The purpose of reproduction is to propagate and to diversify the genetic information in the next generation. A key process is the fertilisation of the egg, the oocyte by the sperm, with both of these germ cells carrying a single set of the chromosomes.

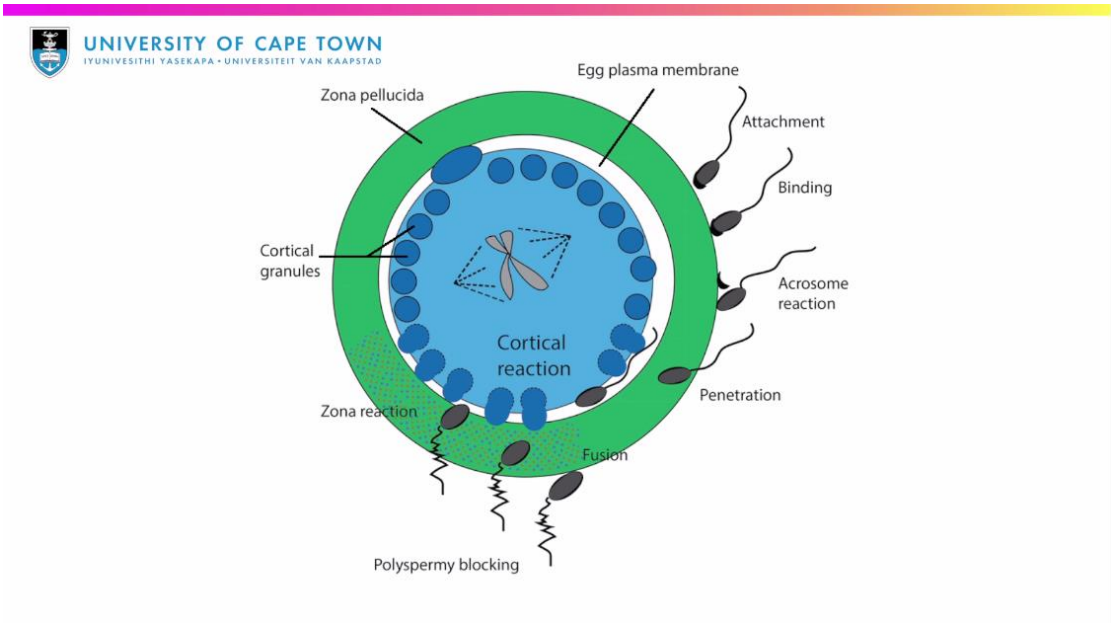
Successful fertilisation, however, is not the beginning of life, because life can only begin when the embryo implants in the uterus. There are many similarities in the development of the male and female germ cell. But there are also some profound differences.

The oocyte represents the power of one, because the biological processes leading to its development seek to single out a single oocyte out of a pool of resting oocytes growing in follicles, which are little fluid-filled structures in which the oocyte is growing. And so the development of a single dominant follicle, which we can see on ultrasound, ultimately leads to the birth of a single baby. And this is the most successful and the safest way of reproduction because multiple pregnancies are far more risky for both the mother and the offsprings.



In contrast, the theme of sperm is strength in numbers, because you need millions of sperm, motile, healthy sperm to maximise the chance of fertilisation, as only a very, very small percentage of sperm actually reach the other side. And of course, the other purpose is to outperform competitors in polygamous relationships.

SPERM CELLS



Fertilisation involves the penetration of the cell layers surrounding the oocyte-- which we call zona pellucida-- and then the actual penetration of the oocyte membrane. And as soon as a sperm cell has entered the egg, the egg membrane will harden to prevent additional sperms from entering, in a process called cortical reaction. And 24 hours later, the embryologist in the IVF lab can see in the microscope the fertilised oocyte. And in the oocyte, the male and female pronucleus just before they're fused, to combine the chromosomes and the genetic information.

As clinicians and embryologists, we have become quite skilled in assisting nature when underlying dysfunctional dysregulation prevent natural conception from occurring. For example, in the case of severe male factor infertility, when the sperm cannot fertilise the egg, we can assist with assisted reproductive technology. We start by administering hormones to the woman to stimulate the ovaries to grow a number of dominant follicles. We then aspirate the follicles to retrieve the egg through small surgical intervention. And then the embryologist in the IVF laboratory is able to inject a single sperm into the oocyte, hence facilitating fertilisation in a process that we call ICSI, or intracytoplasmic sperm injection.

INJECTING SPERM

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Over the next few days, the embryologist will then seek to determine the potential for life both in each developing embryo using the milestones of cell division and its morphological appearance as criteria. But additional criteria for evaluation of the embryo are currently being developed in research settings. After two to five days in the IVF laboratory, the clinician will transfer one, perhaps two, embryos back into the uterus under ultrasound guidance.

EMBRYO HATCHING

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CATHETER

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And for this we load the embryo into very thin, flexible catheters, which we then transfer through the cervix into the uterus.

And then thereafter there's a very complex interaction between the embryo and the endometrium, the lining off the uterus which determines implantation. And generally speaking, scientifically we still understand relatively little about this process of implantation. And we certainly at this stage, are not able to manipulate it in a medical way.

So by the end of 2013, approximately five million babies were born with the help of assisted reproductive technology. And that really represents the enormous scientific advances made in helping infertile couples to conceive. And these advances have been paralleled by amazing insights in human reproduction and to the beginning of life. And today the scenario in which children can look at images off their pre-life self is already entirely feasible.