

## 2. ADIPOSE

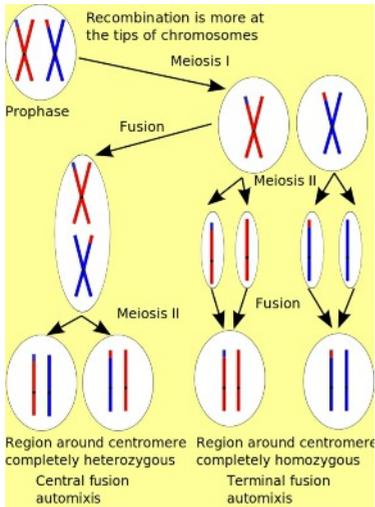
THE ADIPOSE FIRST APPEARED IN THE 2008 EPISODE *PARTNERS IN CRIME*, and were creatures composed solely of adipose tissue (or fat) that were being bred on Earth after the loss of their home planet. They were created from the fat, and sometimes other tissues, of obese humans, in a process called parthenogenesis. They are soft and squishy, cute and cuddly. How could such a sweet creature be responsible for so much scientific inaccuracy?



Image: Sam Howzit.  
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### We have unscheduled parthenogenesis.

#### — *Partners in Crime*



The term parthenogenesis already exists in biology. It is a form of asexual reproduction where an egg cell will develop into an embryo without fertilisation. There are three types of parthenogenesis. The first is where a cell undergoing meiosis to become a haploid (half DNA amount) egg cell only undergoes one division, or mitosis, producing a diploid (full DNA amount) cell that is a direct clone of the mother. Another type, known as full cloning, has the cell replicating its DNA twice, during interphase (the period when the cell isn't dividing), and so when it divides twice during meiosis, this results in a diploid cell. Identical pairs of sister chromosomes line up, instead of homologous chromosomes (which have the same genes but not necessarily the same allele/type) so the offspring are clones of the mother. In half cloning, the egg cell divides as normal, but a haploid polar body fuses with the haploid ovum to produce an embryo, and so will be either ZZ (male), WW (female, usually infertile except in species like the boa constrictor) or ZW (female) in ZW sex selection or XX (female) in XY sex selection. This fusion can either occur after meiosis I or II. This does not produce complete clones, as recombination, where sections of chromosome change between which pair they are on, leads to novel combinations of genetics, leading to the activation of genes that may be dormant or repressed in the mother.

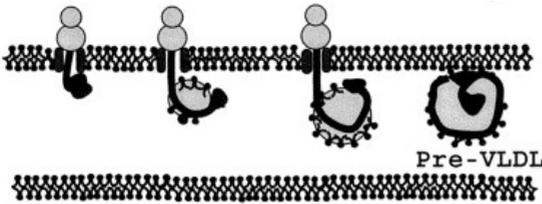
As most of our studies come from captivity, many vertebrates have been found to parthenogenetically reproduce, but many of these are attributed to tycoparthenogenesis,

or accidental parthenogenesis, when errors in meiosis lead to hatching of unfertilised eggs, many of which don't survive. Another competing theory, however, suggests that female Komodo dragons and some other reptiles can conduct facultative (intentional) parthenogenesis, and do this to create a number of male offspring with which sexual reproduction leads to colonisation of a new habitat. Sawfish have been found in the wild to do it in response to a huge drop in species numbers, though again, this may be accidental. It's even possible in human cells, where embryos can be made that last for a few days before they die.

Parthenogenesis is not more widespread at least partly due to genomic imprinting, especially in mammals. Here, certain genes are only active when they are inherited from a particular parent, something regulated by the binding of epigenetic markers like methyl groups. The trophoblast defence hypothesis suggests that only with the presence of genes from the father can the placenta and embryo develop properly, with the mother's equivalent genes imprinted to stop parthenogenesis.

## The mobilising lipase breaks up the triglycerides stored in the adipose cells...

### — *Partners in Crime*



So what biological process is similar to the one described on the show? The general transport of lipids comes to mind. Normally, lipids are transported around the body in the form of lipoproteins, a complex of fats and proteins.

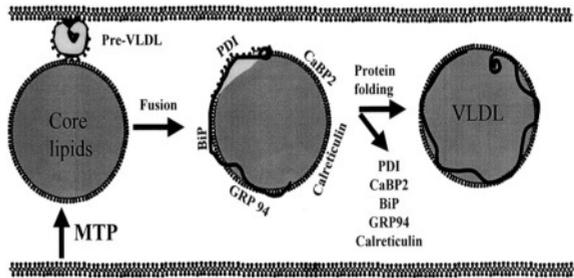
Lipoproteins are made in cells when ribosomes, the makers of protein, bind to the rough endoplasmic reticulum (ER), a series of membranes that extend throughout the cell. On binding, they continue forming the apolipoprotein into it. Here, the microsomal triglyceride transfer protein (MTP) binds to the inside of the ER, where it disrupts the membrane. This allows it to start transferring fats to the apolipoprotein, which changes its conformation so it starts to coil up. After forming a pre-lipoprotein, this is then moved by vesicles to the smooth ER via other membranous structures. Vesicles are formed by coat proteins, that bind to the membrane and deform it into a specific shape, determined by which is most stable with the intermolecular forces of the proteins themselves.

Once the membrane has formed the vesicle and detached, the coat proteins can leave to form more vesicles, and then the vesicle is free to fuse to its target. In this case, it is targeted to the smooth endoplasmic reticulum, which is the same as the rough ER but without ribosomes, and it synthesises lipids. In the smooth ER, MTP appears again, this

time forming the lipids into a large droplet, with a membrane layer around the outside. This then fuses with the pre-lipoprotein to form a lipoprotein. The exact composition varies to give different types of lipoprotein depending on the protein. These lipoproteins can then move around the blood, and are then taken up by specific receptors, which import the lipids into cells in vesicles.

The genesis of the Adipose is normally caused by the accumulation of lipids, stimulated by the Adipose pill. Assuming that this pill contains a large amount of these receptors, it could be possible to accumulate a large enough amount of lipid to form an

Adipose. However, the ability to mould these lipids into specific shapes would probably require a skeleton of some kind, perhaps a protein based structure to deposit it on. In addition, it is mentioned that they can convert other tissues for Adipose formation, which is transdifferentiation as mentioned in the Time Lord article.



Enormous Adipose? Gallifrey One, 2012  
Image: Katie, <https://flic.kr/p/bxJhYR>  
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## Seems to be a bio-flip digital stitch...

— *Partners in Crime*

So is the term parthenogenesis used correctly in **Doctor Who**? No. While they are virgin births (parthenogenesis translates to this in English), they do not involve genetics of any kind, and so cannot be termed parthenogenesis. In addition, the ability to create these Adipose through genuine biological methods would certainly show noticeable symptoms over the three-week course, and more time than the few minutes when the signal on the inducer is fully activated. The use of the pill is also problematic. To form the skeleton, or even just collect the required amount of lipid, would require a much larger object to have the needed number of receptors, and some kind of method to stimulate the creation of the Adipose,

which would probably require some kind of genetic aspect. Therefore, the use of parthenogenesis is totally unrealistic, as the two concepts have no link, except in name.