

# Biological production of arachidonic acid: sources, past and future

[Science](#), [Biology](#)



The paper " Biological Production of Arachidonic Acid: Sources, Past and Future" is an exceptional example of an essay on biology. Arachidonic acid is among the essential fatty acids that the bodies of various mammals require. It is polyunsaturated and is mainly found in cell membranes, muscle cells, and the brain. It is mainly used in cell signaling thus aiding the brain functions. It is also widely used for muscle repair making it very popular among bodybuilders as a supplement. It is commercially produced mainly for this purpose.

#### Uses of Arachidonic Acid in the body

Arachidonic acid is a fatty acid in the omega-6 group. It is mainly found in animal cell membranes. Arachidonic acid is the signaling agent in the body for any changes caused by muscle damage and stimuli. The prostaglandins PGE2 and PGF2 that are involved in the synthesis of proteins are built from arachidonic acid. It is (Arachidonic acid) also involved in the increase of muscle cells and also their repair. Mammals that require arachidonic acid make it in their bodies by the conversion of linoleic acid to arachidonic acid. However, some classes of mammals do not have the ability to make their own arachidonic acid. These mammals obtain the acid through their diet. " Arachidonic acid is necessary for the enhancement of growth of skeletal tissue and muscle tissue and their repair. It plays a large role in muscle anabolism and has a large potential for the increase of muscle size and strength" (Danielle, 2000). Arachidonic acid is also essential in brain functions. " It is one of the most abundant fatty acids in the brain" (Danielle, 2000). The general health of the brain is highly dependant on the levels of

arachidonic acid. One of its most important functions in the brain is the maintenance of the fluidity of the hippocampal cell membrane. “ It also protects the brain from oxidative stress” (Soltov et al. 2006). Research has also shown that Arachidonic acid drastically improved the intelligence of infants of about 18 months old after being administered for 17 weeks. In adults, however, the increase of Arachidonic acid and other omega-6 fatty acids were observed to increase depression. It is also known that arachidonic acid improves the peak muscle power, muscle endurance and the average power of the person. It is therefore widely used as a supplement for bodybuilders (Trappe et al. 2001).

#### Production of Arachidonic acid from microorganisms

“ Arachidonic acid is a precursor of numerous eicosanoids and other compounds” (Bondesen et al. 2004). It can be extracted in small amounts from the adrenal glands and livers of animals. It is also obtained from protozoa, amoeba, algae and other small single-celled microorganisms. For commercial purposes, arachidonic acid is produced from a fungus, *Mortierella* species. Arachidonic acid is also produced from bacteria. It is widely known that Arachidonic acid is produced from gram-negative marine microorganisms but it can also be produced from a positive type of bacterium strain SRS30216T. This strain of bacterium is an orange pigmented bacterium, it is coccus shaped, tests positive for catalase, negative for oxidase and urease. To obtain this particular strain, it can be grown in the lab at a pH of between 5-9 and the temperature range of between 11-40°C. These cells are observed to grow in clusters. For

successful production, there is a requirement of radiation of approximately 180-350 rads an hour. There is also a process for the production of Arachidonic acid that comprises culturing a microorganism from the *Mortierella* group. The culturing is done in a medium that comprises of additives from the group of n-hexadecane and n-octadane, oleic acid, or a pinch of salt from it, olive oil, corn oil, coconut oil, soybean, and linseed oil. This procedure is done at a pH of 6-9 and at temperatures of 20-30 degrees Celcius (Tamura et al. 2006).

The process of obtaining arachidonic acid from *Mortierella Alpina* can be classified as a fermentation process. There are several measures that can be taken in order to optimize the culture. The temperature for one is closely monitored together with the pH of the culture. The time given for the culture to mature is also considered. Sugar was also added to enhance the fermentation.

#### Effects of culture temperature

Research has concluded that the strain of arachidonic acid grows well at temperatures of about 20-30 degrees. The optimum temperature is 25 degrees. It has given the largest amount of yield. This is shown below: (Yuan, 2002)

The temperature in degrees Celsius

#### Effects of culture pH

The pH also affects the production of Arachidonic acid. The range of products is set at 4-10 but it is observed that the optimum pH is 8.00 where the

highest yield was recorded. This is shown in the graph below: (Yuan, 2002) Culture pH

#### Effects of culture time

During the first six days, the biomass slightly increased. The highest mass was obtained on the sixth day and then after that, it started decreasing. The mass then starts to increase gradually and eventually stops on the 11th day. In the whole overall process, the peak is obtained on the sixth day as shown below: (Yuan, 2002) Fermentation/ day

#### Effects of Carbon

Different carbon sources affected the fermentation process. The strain grows very slowly when glycerol was used as the carbon source. However, the production increased when starch and maltose were used but the best results were obtained when glucose was used (Yuan, 2002).

#### Future production of Arachidonic Acid

To avoid patent problems in the production of Arachidonic acid, another way of producing it must be looked into. The patented way of producing Arachidonic acid is by the fermentation of *Mortierella alpine* which has been discussed earlier in this paper. There is another direction of looking into the production of this acid. This is through the use of bacteria. In the past, the possibility of the presence of polyunsaturated fatty acids in bacterium was never looked into. Today, it is considered possible. The option of using a bacterium is a good approach since they can live under conditions of high

temperatures, high pH levels, high pressures, and salinity. They also grow in a radioactive environment (Nelson et al. 1997).

The bacterium strain that makes arachidonic acid is the SRS30216T. In the past, it was thought that polyunsaturated fatty acids were supposedly associated with the adaptation of the bacterium to marine environments. This was later disputed by research that has shown that the adaptation to growth is due to the temperature and pH levels but this is not so. The association is actually due to relation to this particular strain of the bacterium (Ben, 2000).

Although arachidonic acid has been identified in small quantities in a few bacterium cultures, it is an alternative method of production if one is after commercial production and is looking to avoid patent problems.