[Amazing Samples: Adipose Tissue](http://blog.fisherbioservices.com/amazing-samples-adipose-tissue)

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Fat - its popularity depends hugely on context, and varies from person to person. On our own bodies, some cultures stigmatize it while others embrace it. In food, some people think well-marbled ribeyes are the best steak, while others prefer the lean filet mignon (and still others don’t like steak, I guess?). Traditionally, candles and soap has been made of tallow, and [some still make it that way](https://www.google.com/search?btnG=1&pws=0&q=how+to+render+tallow&gws_rd=ssl) (ignoring Fight Club fans), while most people today use some sort of substitute wax or surfactant.

The cells in adipose tissue, however, are not as controversial. In fact, adipocytes are valuable for a number of research applications, from understanding the tissue itself to harnessing the power of stem cells and progenitor cells hidden within the tissue. Last time in our Amazing Samples blog series, we concentrated on the value of [progenitor cells](http://blog.fisherbioservices.com/amazing-samples-progenitor-cells). This time, let’s discuss how adipose tissue can be an Amazing Sample.

**Basic Adipocyte Physiology**  
Adipose tissue is, at its core, a place to store fatty acids, which is the most energy-dense compound our bodies metabolize. Adipocytes are [around 87% lipids](https://books.google.com/books?id=og04BAAAQBAJ&pg=PA78&source=bl&ots=W4NUVu6qjD&sig=r5mREwEf92Vx0AqeYmhOlVmXhi4&hl=en&sa=X&ved=0CDUQ6AEwAmoVChMIkbqpvvqbyAIVQTg-Ch1KyQFW#v=onepage&q&f=false), with free fatty acids constantly flowing in and out of the cells, stabilizing inside as triglycerides. There are two different classes of adipose tissue, as well:

* White adipose tissue is used as energy reserves, and with the fatty acids can easily be called to undergo lipolysis and produce ATP for energy, while also producing substantial amounts of [various hormones](http://www.ncbi.nlm.nih.gov/pubmed/12508947).
* Brown adipose tissue, where the metabolism has been uncoupled from ATP production, is purely thermogenic. More on that oddity shortly.

**Heavy Research on Weight Loss**  
Easily the most obvious reason why adipose tissue is being researched is for weight loss. Whether to stimulate elimination of the cells or to block their production, especially during its more active phase during puberty, adipose tissue is being researched to help treat both obesity and various metabolic diseases.

The metabolism of white adipose tissue is rather straightforward, at least on paper - as they are built specifically for energy reserves, just burn more energy than you consume (via food), and you should lose the weight stored in that tissue. Brown adipose tissue is not as easily tapped, however, because of its uncoupling. And while jumping into freezing waters might start up its thermogenic metabolism, such exposure has a tendency to slow down our metabolism over all, occasionally causing that annoying condition called “death.” Various researchers have been working on ways to trigger thermogenesis, from [activating lateral hypothalamic neurons](http://www.ncbi.nlm.nih.gov/pubmed/16125857) to [using liraglutide to agonize the GLP-1 receptors in the brain](http://www.ncbi.nlm.nih.gov/pubmed/24917578).

More recently, however, researchers have been looking into blocking the actual formation of the tissue in the first place, as well as hindering the maintenance. For example, many researchers are currently investigating [adipose angiogenesis as a therapeutic target](http://austinpublishinggroup.com/clinical-cardiology/download.php?file=fulltext/ajcc-v1-id1005.pdf), going in either direction of inhibiting or enhancing the process. The inhibition has proven effective in incurring weight loss and protecting against obesity in [animal models](http://blog.fisherbioservices.com/bid/331002/Biobanking-for-Animal-Health-Morris-Animal-Foundation-is-Taking-Veterinary-Research-to-a-New-Level), but there are implications that the fat may no longer be properly stored, and as such further aggravate various other conditions. Enhancing angiogenesis, on the other hand, led to similar phenotypic results, but most likely just as a function of increasing energy expenditure, and therefore metabolism of the fat cells.

Also, just this year, researchers published their study on the adipose tissue of bone marrow transplant patients where they discovered that bone marrow-derived cells [play a significant role in adipocyte formation](http://www.cell.com/cell-metabolism/abstract/S1550-4131(15)00278-8). One of the more curious observations from this study is that the higher the body fat mass of the subject, the higher the percentage of their adipocytes came from the donor’s DNA rather than their own. Further research into this mechanism might lead to more therapeutic targets for weight loss.

**Adipose is Stuffed with Stem Cells**  
… and progenitor cells! Many researchers have been investigating adipose tissue for its applications in regenerative medicine and [cell therapies](http://connect.fisherbioservices.com/fisher-bioservices-cell-therapy-solutions), as it is both an abundant and accessible source of the stem cells needed for therapy. Specifically, [the tissue is rich in mesenchymal stem cells](http://www.tandfonline.com/doi/abs/10.1517/14712598.3.5.705?journalCode=iebt20), which can differentiate into a number of other cell types beyond adipocytes, and therefore have substantial viability in treatment of conditions afflicting the nervous, muscular, or other systems. Additionally, it has been shown that these adipose-derived stem cells (ADSCs) can also be [induced into pluripotent stem cells](https://www.ncbi.nlm.nih.gov/pmc/articles/PMC2840462/), further expanding the number of potential indications they can be used to treat.

Already, research is ongoing for many conditions, from [cardiovascular disease](http://www.ncbi.nlm.nih.gov/pubmed/26322185)to [brainstem gliomas](http://www.nature.com/cgt/journal/v22/n6/full/cgt201525a.html). One biotech developing adipose-derived cell therapies is [Cytori Therapeutics](http://www.cytori.com/Home.aspx), whose technology is being tested against various autoimmune issues, having completed multiple clinical trials in Europe and [currently undergoing pII and pIII trials in the US](http://www.cytori.com/en/Technology/ClinicalTrials.aspx). One of their pieces of technology is an[automated system](http://www.ncbi.nlm.nih.gov/pmc/articles/PMC3900001/) that processes the adipose tissue to concentrate the regenerative cells, and is being used by such independent investigators such as [Okyanos](http://okyanos.com/), who recently opened a facility in Freeport, Grand Bahama, to treat [a number of autoimmune conditions](http://okyanos.com/autoimmune/).