Traditional hamburger patties are facing competition from alternatives made of plant-based raw materials or cultivated animal stem cells. This is how they are produced:

**Where’s the Beef?**

Companies such as Impossible Foods and Beyond Meat are booming. That’s because it’s nearly impossible to tell the difference between their plant-based meat substitutes and real meat. The recipes are varied and generally secret. However, we do know a few facts about them.

Producing meat without slaughtering animals—that’s the promise of the scientists developing in vitro meat. A number of companies are trying to grow real meat based on cell samples taken from animals, mainly chickens, pigs, cows, and fish.

The basic elements are **plant proteins**, for example legumes such as **soybeans** and **peas**. The addition of **potatoes** or **rice** adds crispness and roast aromas when the patties are fried.

Modern processing technology gives the protein a meaty structure. For example, in the wet extrusion process, the raw mass is pressed through a nozzle and simultaneously cooked.

After administering local anesthesia, a small sample of muscle tissue is removed from a healthy animal. A few hundred cells are enough.

The muscle cells are separated from the fat cells. The satellite cells are isolated from the muscle cells. These are special stem cells that repair damaged muscle.

When placed in the right nutrient solution, satellite cells multiply almost endlessly. Theoretically, ten tons of tissue could be cultivated from a single cell. The nutrient solution required for this is often still based on calf serum. Companies are looking for plant-based alternatives.

If the amount of certain proteins known as **growth factors** in the nutrient solution is reduced, the satellite cells react by forming muscle cells (myoblasts).

Myoblasts autonomously organize themselves into fibers called **myotubes**, which are only up to a third of a millimeter long. When they are correctly organized on a flexible carrier, they form tiny muscle fibers and begin to contract. The muscle “trains” itself and increases in mass.

About 20,000 of these mini-muscles are needed to make one burger patty. They can be processed in the same way as ground beef. The only thing now missing is fat—either plant-based or cultivated fat.