FUTURE food

MEAT WITHOUT LIVESTOCK

www.futurefood.org, contact: office@futurefood.org

The project "Future Food - Meat without Livestock" focuses on possibilities **for replacing animal products** with products that are not derived from animals. The goal is drastically reducing animal-welfare problems as well as reducing the negative effects of livestock on environment, global hunger and human health.

Problems:

Ecological damage
A recent report (1) from FAO states that livestock production is one of the major causes of the world's most pressing environmental problems, including global warming, land degradation, air and water pollution, and loss of biodiversity.
Traditional meat production is based on growing whole organisms. The main share of input is lost for maintaining the organism, heat increment, travel and so on. Only 10% to 25% of metabolizable energy input produces animal biomass (2). And depending on the species only 78% to 51% of animal biomass is useable for human nutrition (3).

Transgenesis in livestock
Improvement of meat production is an important application of transgenesis in livestock. In 2001 for example a transgenic pig expressing salivary phytase was produced. The benefit of the use of these transgenic pigs could be a decrease of phosphorus pollution from the pig industry. (4) Research on and production of transgenic livestock could be replaced by research on and production of tissue engineered meat.

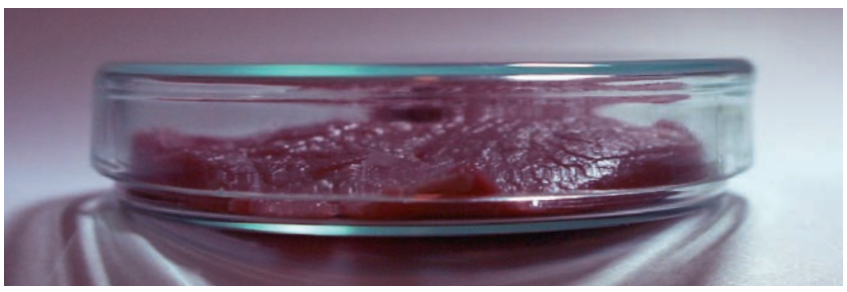
Animal welfare
Beside transport and slaughter especially intensive farming methods like sow stalls, veal crates and fish farming are the cause of suffering for billions of farmed animals each year. Due to the permanently rising demand of meat, intensive farming is becoming increasingly common all over the world.

… and solutions:

Producing meat directly through cell cultures could be much more efficient. Tissue engineered meat could have dramatic environmental advantages. Meat with healthier compositions of fatty acids could be produced. The biggest usage of animals, which affects an annual number of 50 billion individuals worldwide disregarding water animals, could be reduced and replaced.

The market potential is huge: meat has an annual turnover of 250 billions USD.

One possible solution: CULTURED MEAT
manufactoring of meat products through „Tissue-Engineering“ Technology:



In-Vitro meat is the manufacturing of meat products through "tissue-engineering" technology. Cultured meat (= in-vitro meat) could have financial, health, environmental, and animal welfare advantages over traditional meat. The idea: To produce animal meat, simply without using an animal.

Producing cultured meat for processed meat products, such as sausages, burgers and nuggets should be more realistic for the near future than an in-vitro steak. A steak is made of muscle tissue which is threaded through with extremely long, fine capillaries which transport blood and nutrients directly to the cells. It is much more difficult to reproduce such a complex structure than it is to put together the small balls of cells which grow to larger balls of cells which in turn become in-vitro chicken nuggets.

The most important challenges to overcome in order to outperform animal derived meat in terms of taste and economics are:

Starter Cells: These can be taken painlessly from live animals via biopsy. The question is: Which type of cells should be used? The advantage of stem cells is that they proliferate rapidly. The alternative to using stem cells would be to use fully defined muscle cells. A compromise is to use cells which are between the two extremes, in other words, cells that proliferate at an acceptable pace and that are at the same time sufficiently differentiated from other cell types, for example, myoblast cells.

Growth Medium / Culture Media: The aim is to find a medium in which the cells can grow that is cost effective and therefore among other things free from animal ingredients. Serum from calves, for example, cannot be considered with cultured meat.

Material for an edible scaffold for the cells to attach themselves to: In order to produce three-dimensional in-vitro meat, it is necessary to have a scaffold. The ideal is an edible scaffold that would not need to be extracted from the end product. To simulate the stretching that muscle cells undergo as a living creature moves around it is highly desirable to develop a scaffold that could periodically shift its form thus “exercising” the cells. This could be achieved by using a stimuli-sensitive scaffold made of alginate, chitosan or collagen, from non-animal sources. The scaffold would then stretch periodically in response to small changes in temperature or pH levels. The cells could also attach themselves to a membrane or tiny beads which could be layered on top of each other and connected together.

Bioreactor: Through fluctuations in temperature an environment must be created which can be likened to a fitness centre with movement training for the muscle cells. Cultured meat must consist of small and large fibres of muscle cells in addition to connective tissue which produces collagen and elastin as well as fat cells which are important for the taste of the end product.
Economically viable solutions for the above listed points have not yet been fully researched.

What we can achieve together:

- Use the opportunity to carry out research in the area of cultured meat
- Use our address database with 2300 contacts that may be of help to you:
  - ▷ Contacts to all researchers worldwide working on cultured meat, ▷ Contacts to decision makers and research establishments in the food industry, ▷ Contacts to organisations such as FAO, WHO, ILSI etc.
  - ▷ Vegetarian organisations worldwide, ▷Animal welfare and animal rights organisations worldwide

For data protection reasons we are unable to make our address database public. But feel free to contact us per E-Mail office@futurefood.org.

1) Food and Agriculture Organization of the United Nations (FAO) report, “Livestock’s Long Shadow - Environmental Issues and Options.”, 2006; 2) „Vegetarische Ernährung“, C. Leitzmann, et al. 1996, UTB für Wissenschaft, 377-378
3) Unterlagen zur Lehrveranstaltung “Tierzucht”, Kapitel 7 „Tierische Leistungen“, Universität für Bodenkultur Wien, 2005; 4) J Appl Genet. 2007;48(1):47-61. Animal transgenesis: state of the art and applications. E.O. Melo, et al.