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Veganism and Masculinities

Meat has long been thought to guarantee masculinity. How gender is defined by diet during the "veggie boom" is explained by Professor of Sociology, Tanja Paulitz, and her research associate, Martin Winter.

The research project
The project "Food cultures and gender. An empirical study of masculinity and meat consumption" will continue until the end of 2018 and is funded by the Hessen State Ministry for Higher Education, Research and the Arts. The study is based on qualitative analyses of vegan cookbooks, field studies at trade exhibitions and in the food, butchery, livestock breeding and agricultural technology sectors, as well as interviews with NGOs and nutritionists.

By Jutta Witte

Professor Paulitz, Mr Winter, you are investigating how masculinity and its embodiment are connected to the consumption of meat. What is the basis for the stereotype that meat "makes you strong"?
Winter: It is closely related to industrialisation and the onset of capitalism. Historical studies show that at that time the idea prevailed that meat ensured the development of the muscles that a man needed to be able to do manual labour. This connotation was true both for the industry and the military. In Germany soldiers were supplied with a lot of meat in the First World War. This took on a life of its own in the eating culture.
Paulitz: In capitalist industrial societies, work moved from the farm to the factory. Here the workforce was divided between supposedly easy women's work and heavy men's work. Of course, women worked hard, but were paid less. As, incidentally, were children, too. A family wage was earned. Nevertheless, the idea was that "the hard working (male) breadwinner must be best fed with meat". Therefore, it is a practice that is embedded in the traditional gender asymmetry in society.

Today, for a variety of reasons, people take a more critical view of meat eating. Above all, vegan foods are booming. How can this be explained?
Winter: The figures are interesting: only one percent of Germans currently are vegans, whilst around 10 percent are vegetarian. The bulk of people – just under sixty percent – are so-called flexitarians who, for a wide variety of reasons, simply want to eat less meat. The actual boom is in the vegan food sector. Here we can observe an ever-increasing variety. Why? Nowadays physical work is in decline. This means that an important justification for eating a lot of meat no longer applies – also for men. The question is rather: "how do I nourish my body properly and well?" To many people, beside (occational) vegetarian meals also vegan meat alternatives seem to be an answer. However, visually and with regard to taste those products are very close to meat. In cultural terms it is significant that the idea of masculinity that is symbolically linked to eating meat can be preserved. This is because vegan products are also promoted with a high level of protein, to which a similar strengthening effect to that of meat is attributed.
Paulitz: Yes. Many people are turning away from the traditional Sunday roast, without wanting to become vegetarian or vegan. In the past diet was predominantly about scarcity. The question was more: "How can I fill myself up? Is there enough? What is there in the first place?" Since the end of the 20th century, for a greater breadth of the population, the issue has become one of moderation and making the right choices. Furthermore, choosing a healthy diet is becoming more important, as the element of welfare state protection in the healthcare sector is becoming increasingly depleted. In digital capitalism, eating a health-conscious diet also promises to remain fit, capable and successful. And proteins play a key role in this.

What does the meat industry have to say about this?
Winter: Actually you would imagine that they might oppose the NGOs connected to the vegetarian movement. However, in recent years a kind of alliance has developed. The meat industry has recognised the situation and signalled that "we want to produce meat substitutes" and the NGOs have said "we will show you what to do". The meat industry is investing a great deal here and is strategically presenting tofu sausages and seitan steaks as a new trend – although they have existed for a longer time already. All of the big companies now have their own vegetarian lines and know that they can make money with them.
Paulitz: And for the NGOs it is an attempt to move veganism from its niche, market it more widely and utilise the production structures that large companies are able to provide. In so doing NGOs are

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Photo: Katrin Binner

Representatives of Cultural and Knowledge Sociology at the University: Professor Tanja Paulitz and her research associate, Martin Winter, M.A.

altering their strategy for stimulating change. It is no longer their primary goal to persuade people to adopt a vegetarian or vegan diet. The thrust is much more that we don't need to eschew meat altogether, but rather the less meat we consume the better. For them it is much more a matter, in population policy terms, of an overall dietary balance. In contrast to what was previously a case of foregoing meat for primarily ethical considerations, at present the thought process is tending towards optimising the overall balance by reducing meat consumption. It is a classical win-win situation for the alliance.

If meat replacements are socially acceptable, what does this mean for the idea of masculinity and a masculine body?

Paulitz: First of all, we have to say that even if muscle power is no longer so critical for work, muscles today have remained symbolically important to the concept of a masculine body. The development of specific quantities and types of muscles in the "right" places ensures a social differentiation vis-à-vis femininity. This is significant precisely because this differentiation no longer happens institutionally and formally as it used to do, instead the participation of women in society is now beyond doubt. Food and its ingredients and sport too now play a vital role. Artificial meat with lots of protein thus follows the same logic as "real" meat. This is also how it is marketed and received by the general public. We call it a "coproduction of meat, knowledge and bodies".

Winter: Role models who demonstrate that it is possible to follow a vegan diet and even so have the socially desired rippling muscles are playing an important part in asserting this narrative. Attila Hildmann is a typical example. In his vegan cookbooks, he explains why we should eat this way: for ourselves and to show a nice body. It is a new form of legitimation of nutrition for men.

How will the "veggie boom" develop from here?

Winter: Everyone assumes that the boom will continue. The subject is already becoming institutionalised in many areas. There is, for example, now a degree programme in "Vegan Food Management". The German Nutrition Society has recently published a policy paper on the vegan diet.

Paulitz: In any case, it is posing plenty more questions for us. What new foodstuffs are being created and what is the goal? How are bodies "made"? Is veganism ultimately cementing outdated gender relations? It's still an interesting subject.

The author is a science writer and holds a doctorate in History.

Storing light with water

In association with Professor Wolfram Jaegermann and Dr. Bernhard Kaiser, materials scientists are exploring the basis for an amazingly simple way to store energy: water splitting.

Photo: Katrin Binner

In the laboratory: Dr. Bernhard Kaiser assesses a processing step to produce thin catalyst layers.

By Boris Hänßler

Renewable energy has one decisive disadvantage: It depends on current weather conditions. Solar cells produce energy when the sun shines, and wind turbines depend on wind to function. The energy that is produced must be stored so that it is available throughout the day at the same level of output. But that is a challenge: Conventional storage technologies are not designed to deliver energy rapidly and flexibly as needed. Additionally, power is ideally stored near the location where it is generated, minimising unnecessary losses during transport.

With solar cells, energy can be chemically stored directly on site: by splitting off hydrogen from water. Solar cells must be made ready to do this – but how can this be done with modern cells whose composition is already highly complex? A group of TU researchers have joined Wolfram Jaegermann and Bernhard Kaiser from the Surface Science group to study this. They are investigating third-generation solar cells – layered semiconductor structures on the surfaces of which solar-driven water splitting takes place. But the crucial reaction mechanisms are not yet sufficiently understood.

To prepare the solar cell system to work efficient and stable for water splitting, scientists must do meticulous detective work: What materials are suitable as semiconductors, catalysts or for electrolysis? What

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happens when the materials are combined? What effects occur externally? This research is part of a priority programme 'Regenerative fuel generation using light-driven water splitting' of the Deutsche Forschungsgemeinschaft (German Research Foundation). The programme involves a total of 19 German research institutions.

'This is an excellent yield at this early stage of research,' says Kaiser.

The basic idea for this type of energy storage comes from nature: The leaf of a plant absorbs sunlight and takes in carbon dioxide from the air and water from the soil. These are converted to high-energy hydrocarbon compounds such as sugar. Researchers are experimenting with mimicking these processes – they are developing a solar cell technique that works like artificial leaves. 'The basic idea is the conversion of photons into chemical storage materials,' explains Bernhard Kaiser. 'The artificial cells consist of semiconductor electrodes that convert light energy into electrical charge carriers. Instead of using them immediately as electricity, the photoelectrodes will be used to split water molecules into hydrogen and oxygen at the surface.' The resultant hydrogen can be stored near the cell. Energy reclamation occurs in a fuel cell through a controlled reaction of hydrogen with oxygen. This recreates the starting material pure water. The result: a closed cycle without further waste products.

However, the process is not as simple as it sounds – especially because solutions have thus far been inefficient and unstable. And this is the challenge researchers face: They want to determine exactly how the relevant processes work and what material combinations are optimal. The process of water splitting requires a cell system with a voltage of 1.6 to 1.9 volts. A simple silicon solar cell with a voltage of only 0.7 is insufficient. And so, the research centre Jülich, one of the partners in the priority programme, has combined several layers of amorphous and microcrystalline silicon into one cell. It absorbs different wavelengths of light and increases the photovoltage, e.g. a quadruple cell generates 2.5 volts, so that water molecules can be split successfully.

TU scientists are especially interested in studying the interactions of such a multiple cell with protective layers and electrocatalysts. They determine among others how electrically conductive – and thus, efficient – the cell is. The Darmstadt scientists investigate the processes taking place at the atomic level when these materials grow together layer by layer. For example, atoms on the surface have different properties than atoms inside the same material. 'This can lead to reconstruction on the surface, a shift in the position of the atoms; and thus, a change in electronic properties,' says Kaiser. 'This, and the high reactivity with molecules from the atmosphere, can lead to significant deterioration of the desired material properties.'

Successful detective work. Using triple cells with platinum as catalyst layer and ruthenium oxide as counter electrode, the researchers have achieved an efficiency of 9.5 percent for the conversion of sunlight into hydrogen. 'This is an excellent yield at this early stage of research,' says Kaiser. In the future, promising improvements towards higher efficiencies could be achieved by the combination of the tested cells with solar cells of other materials, and by replacement of the precious metal catalysts.

Besides searching for ideal photo-absorbers and electrocatalysts, scientists are also developing a better understanding of the electrochemical principles underlying photocatalytic systems. Using efficient and economical artificial leaves, hydrogen produced in a future energy scenario could be directly converted with carbon dioxide into gaseous or liquid fuels. These could be used like conventional hydrocarbon compounds – making water, as it were, the petroleum or coal of the future

The author is a technology journalist.

Dates and facts

Priority Programme 1613 of the German Science Foundation with the title 'Fuels Produced Regeneratively Through Light-Driven Water Splitting: Clarification of the Elemental Processes Involved and Prospects for Implementation in Technological Concepts´ has been underway since 2012 and will be funded until March 2019. It is based with a subproject at TU Darmstadt. Coordinator is Professor Wolfram Jaegermann (Department of Materials and Geosciences of TU Darmstadt).

Important publications by the working group:

J. Ziegler, F. Yang, S. Wagner, B. Kaiser, W. Jaegermann, F. Urbain, J.-P. Becker, V. Smirnov, and F. Finger, Interface engineering of titanium oxide protected a-Si:H/a-Si:H photoelectrodes for light induced water splitting, Applied Surface Science 389, 73 (2016).
doi: doi.org/10.1016/j.apsusc.2016.07.074

F. Urbain, V. Smirnov, J.-P. Becker, A. Lambertz, F. Yang, J. Ziegler, B. Kaiser, W. Jaegermann, U. Rau, and F. Finger, Multijunction Si photocathodes with tuneable photovoltages from 2.0 V to 2.8 V for light induced water splitting, Energy & Environmental Science 9, 145 (2016).
doi: 10.1039/C5EE02393A

The working group also addresses fundamental mechanisms of semiconductor interfaces. Among other things, a team have investigated the suitability of hematite and other transition-metal oxides for the regenerative generation of hydrogen. Their results were published in Nature Communications recently: Christian Lohaus, Andreas Klein & Wolfram Jaegermann: Limitation of Fermi level shifts by polaron defect states in hematite photoelectrodes, Nature Communications (2018)9:4309, doi: 10.1038/s41467-018-06838-2

Blockchains in re

Blockchains promise widescale open Internet applications that are organised decentrally. This comes at the price of slow performance for every transaction processed by the system. Cryptography researchers around Professor Sebastian Faust have achieved global awareness with their approach to facilitating real-time transactions using blockchains such as Ethereum.

By Boris Hänßler

Paying by credit card is a quick process: the money transfer is completed only a few seconds after customers place a card in a reader or enter their details online. This process enables a centrally organised company such as Visa to handle over 50,000 transactions per second at peak times. Using a cryptocurrency such as Bitcoin, where transactions are processed locally via a blockchain, a maximum of seven transactions can be processed per second – a tremendous difference that greatly hinders applicability of the technology. Even worse, it can also take several minutes to process a single transaction. These drawbacks do not only apply to Bitcoin. Even more complex applications that are processed using smart contracts over Ethereum are expensive and slow as well.

"A blockchain only becomes relevant in the event of a dispute."

Yet the blockchain is designed for just these cases. Any user can upload and distribute something via a blockchain, and anyone can become part of it. It is decentralised, neutral and effectively the perfect combination of intermediary and judge – but it is also slow. To interact with it inexpensively and in real-time – that is the vision of Sebastian Faust, Professor of Applied Cryptography, and his team. The challenge is that the increase of performance must not be at the expense of safety. The research is part of the Collaborative Research Centre CROSSING, which is supported by the German Research Foundation.

A blockchain is a chain of blocks that contains the state of the decentralised system. In case of a currency such as Bitcoin, this would be payment transactions: who is paying whom how much. Each block also contains a so-called hash of all the data in the block, a kind of fingerprint of the data. If any of the data is changed, this changes the hash value. Furthermore, each block contains a cryptographic hash of the previous block. This results in a linked chain. A new Bitcoin block is created by a network participant – known as a miner – on average every ten minutes. This block is then checked by all the other participants and accepted as a new block in the chain if all the transactions and calculations are correct. This makes the block part of the blockchain, based on which all the miners attempt to find the next block. If the block is incorrect it is ignored. A transaction in a block is only accepted if it has been published in the blockchain and ideally confirmed by several blocks, usually six. This prevents an attacker from being able to publish incorrect transactions or blocks. While this process offers strong security guarantees one of its main shortcomings is that users may have to wait up to 60 minutes for confirmation of new transactions.

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Smart contracts allow particpants to carry out transactions that are significantly more complex than simple payments. These complex rules may be written in a programming language, where payments are then carried out depending on the execution of the code. „These are contracts that are processed by the blockchain," explains Sebastian Faust. „Smart means that the contracts contain logical conditions. If, for instance, someone wants to sell a file online, then the smart contract contains the condition that the money will not be paid until the correct file has been delivered." This happens automatically, which is safe for both parties. The money stays in the blockchain until the file is sent, but the seller cannot spend it elsewhere.

Another example of smart contracts are applications for communication between autonomous vehicles. Some lorries are able to drive autonomously on roads. However, they are expensive because they require a large amount of sensor technology. A semi-autonomous lorry cannot drive itself, but could be co-controlled by an autonomous one. For this to work, the driver of the semi-autonomous lorry would have to enter into a contract with the autonomous one. The driver could sleep during this time without having to take a break to specifically do so. A smart contract could do all this if there would not be the problem that the blockchain is currently too slow for speedy transactions on the road.

„Our idea is not to move everything to the blockchain," says Faust. This means that contracts are first executed directly between the involved parties and only in case of dispute the parties use the expensive blockchain mechanism." „It's a bit like being in court," says Faust. „As the processes in court are slow and costly, parties only go there if they are unable to agree between themselves." The advantage of this approach is scalability. As disputes are an exception in normal daily life, thousands of contracts could be carried out in real-time, thereby significantly reducing the load on the blockchain.

Complex computer programs may also contain fatal security problems. „Smart contracts are often implemented incorrectly, which makes it hard to guarantee that they will work correctly once integrated into a larger

al-time

system," says Sebastian Faust. One prominent example is the case of the „The DAO" smart contract. In "The DAO" a hacker was able to use a programming error to steal cryptocurrency worth US$ 50 million. One of the main aims of the research being carried out at TU Darmstadt is to improve the efficiency of blockchain systems while at the same time offering strong security guarantees.

Developing the cryptographic protocols for these processes is a complex undertaking. The researchers need to define the protocols run by the different parties as well as the underlying smart contracts. One particular challenge is to minimize the interaction with the blockchain, while at the same time the security of the protocol has to be guaranteed. Using formal models from cryptography the researchers have confirmed the security of the protocols. The next steps are now to release the Perun system as an open source software, and integrate blockchain systems that are different from Ethereum.

The system is called Perun – after the Slavic god of thunder and lighting. And they had an impact: the results received broad attention, both from the academic security community and from companies such as Bosch and the Ethereum Foundation, whose blockchain supports smart contracts.

The author is a technology journalist.

Photo: Katrin Binner

Professor Sebastian Faust, expert in cryptography processes.

Facts and figures

Since 2018, research into „Secure and Scalable Blockchain Technology (S07)" has been part of the Collaborative Research Centre 1119 of the DFG entitled project „CROSSING - Cryptography-Based Security Solutions: Enabling Trust in New and Next Generation Computing Environments". Prof. Dr. Sebastian Faust of the Department of Computer Science is responsible for the project „Secure and Scalable Blockchain Technology (S07)".

Three papers by the researchers from the group of Sebastian Faust were accepted at the leading conferences on IT Security, the IEEE S&P and ACM CCS, including:

Stefan Dziembowski, Lisa Eckey and Sebastian Faust: PERUN: Virtual Payment Hubs over Cryptocurrencies. In: 40th IEEE Symposium on Security and Privacy (S&P), 2019

Stefan Dziembowski, Sebastian Faust and Kristina Hostakova: Generalized State Channel Networks. In: 25th ACM Conference on Computer and Communications Security (CCS), 2018

The virtual cancer patient

At the interface between biology and algorithms: Professor Heinz Koeppl and his team develop computer models for personalised medicine.

By Uta Neubauer

No two cancers are the same. Each type of leukaemia has its peculiarities, every tumour patient a unique disease. Why? Cancer cells are degenerate cells whose growth is out of control as the result of various genetic changes. These mutations vary even amongst patients with the same kind of cancer. And even cells within a tumour can vary genetically. These genetic changes not only influence the growth of the diseased cells, but also the way they respond to treatment. „Traditional treatments are often about making adjustments that won‘t work for a particular patient,“ says Heinz Koeppl, Professor of Electrical Engineering and co-member of the Department of Biology.

Currently only one in four cancer treatments is successful, yet all the patients suffer from the side effects. The vision shared by Koeppl and his colleagues: in future, it should be possible to determine whether a particular treatment will be able to help the patient. To this end, the scientists are developing computer models, effectively virtual patients, using the genetic and protein data of cancer cells, the results of laboratory cell trials, histological findings, other clinical investigations, and a wide range of additional information. The research work by the team at Darmstadt is incorporated in two EU projects: the international joint project PrECISE, which is now ending, focused on prostate cancer. The iPC project which addresses the most frequent childhood cancers is due to start in February 2019.

For some types of cancer there are already various basic network models and databases that describe cell processes such as signaling cascades and catalytic protein activities. The researchers refine these skeleton networks by integrating current disease- and patient-specific information. The crux lies in finding algorithms that correctly adapt the existing knowledge to the new molecular data, explains Professor Koeppl. It is extremely important to incorporate the detailed knowledge in the heads of biologists and biochemists into the models: „Purely data-driven AI approaches are not appropriate here.“

The virtual patient depicts the network of molecular interactions in cancer cells. If the researchers want to test a medication that inhibits a specific protein, all they have to do is reduce or switch off this protein‘s activity in their computer model. They can then see the effects on the entire network, and thus also on the cancer cells. Is the desired signaling pathway deactivated? Are the cells now reproducing more slowly? Or even dying? Or is the effect negligible?

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„If you apply various active compounds to the network model, then you can suggest the best available treatment to the patient. That‘s the idea behind personalised medicine,“ says Koeppl. Immunotherapy and other new treatment methods can also be tested on these models. In the PrECISE project, the effects of various anti-cancer compounds have already been estimated on a computer. „Current results correlate well with data from cancer cell lines,“ says Koeppl. Which gives us reason to hope, even if it will be years before we get to clinical application.

The author is a science writer and holds a doctorate in Chemistry.

iPC project: The EU-sponsored project „individualizedPaediatricCure: Cloud-based virtual-patient models for precision paediatric oncology“, iPC for short, starts in February 2019. The total budget is 14.8 million euros, with Professor Koeppl’s group receiving 725,000 euros. The consortium consists of 21 partners from nine European countries, the USA and Australia. **Current publication:** D. Linzner and H. Koeppl, Cluster Variational Approximations for Structure Learning of Continuous-Time Bayesian Networks from Incomplete Data, Advances in Neural Information Processing Systems (NIPS), 2018

Photo: Katrin Binner

In the laboratory: Professor Heinz Koeppl (left) and his research associate Jascha Diemer.