

## **Podcast Episode 19: Young blood**

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### Teaser

Hey everyone! Welcome to the new episode of the Life Extension Podcast – technology & magic, society & business. Among all the anti-aging treatments discussed so far in this podcast, young blood is the most charged emotionally. Contrary to gene and stem cell therapies, or NMN and Rapamycin, blood has always been there and is very much part of the human identity – in the biological and cultural sense. In this episode I will talk about current efforts of science and businesses to exploit anti-aging properties of blood, how the idea of rejuvenation is firmly built into all historical mythologies of blood, and how it came about that old symbolisms have today produced ethical concerns to the point of restricting certain treatment options involving blood. Listen to this short episode, if you want to understand the significance of human blood as anti-aging treatment from a variety of perspectives, which I hope, you will find inspiring.

### Mythologies of blood

This episode is about young blood, or more precisely the idea that blood from young organisms acts to rejuvenate older organisms. Throughout known human history blood was intimately related to the mysteries of life and rejuvenation. Already 700 years before Christ the figure of Medea appeared in Greek mythology as engaging in the rejuvenation business for evil career purposes involving an exchange of blood. Mythologies of blood persist until today in the form of conspiracy theories against social sub-groups, recently involving American billionaires allegedly injecting themselves with young human blood (Frymorgen 2017), or regular accusations that Jews kill non-Jews to use their blood for ritualistic purposes.

Ritualistic cannibalism is when the blood and flesh of conquered enemies is consumed. We can imagine here communal celebrations of victory over competing groups when after battle the victorious group celebrates itself in the symbolic act of drinking blood and eating body parts of the defeated in a mysterious merging of power, revenge, spiritual exaltation, and of course strengthening and rejuvenation of the group.

Several tropes of meaning can be distinguished in this practice. Drinking the blood of a killed enemy is the ultimate and most primordial exercise of power by an individual or of the victorious group, over the conquered. No wonder that blood in many cases came to play a role in nationalist rhetoric. Drinking blood or eating body parts of animals or humans was furthermore perceived as transferring desirable qualities from the dead to the living, e.g. the courage of a worthy adversary. Last, blood was used as the key ingredient in sacrificing to the gods. Blood was able to facilitate these different purposes all at the same time because of its imagined sacredness. It was perhaps the experience that blood appears

synonymous with life itself, when the body was drained of blood after an injury in combat or when killing an animal. Blood and life seem to leave the body at the same time.

The long history of ritual cannibalism and blood sacrifice provides a window into our understanding of the emotions involved with blood. It explains why blood transfusions automatically echo old mythological meanings of power and rejuvenation, and why blood has always been symbolically related to the mysteries of life. Its importance during sacrifice originated in the observation of life's circularity, that life and death are intimately related, and that life can be given and taken.

The Romans have put an end to the practice of human sacrifices, although the gladiator games certainly inherited that function in a more refined way. During the Middle-Ages, when the Catholic Church actively replaced former magical beliefs with its own brand of beliefs, the practice of handling blood for its sacred properties was incorporated into church ritual in the form of drinking wine as a placeholder for the Christ's blood, while at the same time unauthorized handling of blood was demonized. Witches were regularly accused of drinking blood, a theme that later reappeared in the stories of vampires.

In spite of some considerable normalization efforts under the Romans and the Catholic Church, in European culture the obsession with blood never really stopped. Marsilio Ficino was a famous natural philosopher in early renaissance around 1500 A.D. In his medical writings he promoted drinking young blood as a means for the elderly to regain their youthful vigor (Ficino 1489). He was inspired by folk stories about magical practices of witches, but also by the medical system of his time, more precisely by Galen's theory about the different fluids, under which blood letting was regularly practiced. (Kodera 2010:121).

Ritualistic cannibalism was therefore complemented and increasingly replaced by medical cannibalism. Particularly epileptics, an illness which has appeared otherworldly to people during most of human history, were thought to benefit from drinking warm human blood. The practice of epileptics rushing into the arena to drink the blood of fallen gladiators was reported in Roman times (Kodera 2010). As folk medicine this practice continued until the late 19<sup>th</sup> century, e.g. in the form of epileptic patients drinking warm blood of executed criminals in Denmark and Switzerland (Peacock 1896, Fitzharris 2011).

### Science and business

In the 17<sup>th</sup> century scientific experiments were conducted, when a physician transfused animal blood to a mentally handicapped man in Paris as perhaps the first clinical trial involving blood transfusion, unfortunately resulting in the patient's death and the doctor's accusation of murder (Tucker 2012).

The obsession with blood as an elixir of youth continued, but for a long time, doctors did not have the means to handle blood in a meaningful and safe way for rejuvenation purposes. But in 2005 research in rejuvenation properties of blood was kick-started again with a bizarre experiment. In a process called heterochronic parabiosis an old mouse and a young mouse were stitched together, so that they share their circulatory systems (Pandika 2019). Since then, it has been proven without a doubt that transfusion of young mouse blood revitalizes older mice with significant effects demonstrated in muscle stem cell regeneration, liver, spinal cord, heart, and brain (Kaiser 2014). In a further experiment it has been shown that even human plasma injected into old mice would rejuvenate them, e.g. in terms of

neurogenesis, the forming of new neurons in the brain, resulting in an increase of cognitive abilities (Hamzelou 2016).

The challenge is now to translate lab results from mice into therapeutic interventions for humans, which is not an easy task. Regulatory authorities do not yet recognize aging as a disease and effectively block human trials when the trial target is rejuvenation. The FDA has issued a warning to Ambrosia, a start-up company offering young blood transfusions for USD 8000 in a pay-to participate human trial without control group. A few anti-aging clinics are offering young blood plasma from blood banks for rejuvenation purposes (e.g. <http://www.atlantisclinic.com/anti-aging.html>), but need to walk a fine line between market opportunity and legality. Although it is fairly easy to obtain human plasma for anti-aging purposes in a few countries, as a therapy the procedure is not really satisfactory due to unproven efficacy in humans. This is why researchers are now focusing on the underlying reasons of young blood's rejuvenating properties. They analyzed blood proteins, distinguishing between youth-related factors and aging factors. Proteins qualify as youth-related if their quantity is high in young age and naturally decreases with age, and vice versa for age-related proteins. The idea is now to manipulate those factors to design therapies (Kang et al. 2020). One research team has tested on mice that rejuvenation effects would also occur through simple dilution of blood, that salty water could replace young blood. The underlying mechanism is supposed to be that proteins which are age-related are reduced through dilution (Mehdipour 2020). This experiment has stimulated Russian biohackers to try the procedure on themselves with self-reported positive effects (Dolgin 2021).

Research strategies at present target those proteins, trying to understand their role in molecular pathways involving specific age-related disease conditions. Contrary to blood plasma transfusions, this targeted approach is not at odds with the regulatory system, and is expected to ultimately provide therapeutically effective compounds, which can be synthetically produced without involving human blood. Various start-ups which were founded by researchers are applying different research and business strategies. E.g. Alkahest ([www.alkahest.com](http://www.alkahest.com)) is trying a relatively faster, but less specific strategy by creating a statistically relevant fraction of the blood's youth-related proteins. Researchers are expected to demonstrate benefits against age-related diseases, but will still not know for sure, which proteins have triggered therapeutic success, and which ones were not relevant in the procedure. Another approach is applied by Elevian, by focusing from the start on a single molecule for its potential benefits against heart disease and after brain stroke ([www.elevian.com](http://www.elevian.com)). The different approaches of Alkahest and Elevian exemplify the possible strategies in the gamble of doing research with complex molecular systems in biological cells.

As a reader of research reports about blood proteins as rejuvenation factors, one should however not overlook an important flaw in those apparent success stories. Measuring the quantity of proteins in young and old age and deducting certain statistical patterns is certainly useful. Those measurements provide us with age markers, but they tell us nothing about cause and effect. Is blood the source of age, or the manifestation of age? Therapeutic benefits cannot be proven in a single short-term trial. Only long-term trials with humans will provide deeper understanding on mechanistic pathways involving those proteins, as well as required dosage of potential therapeutic interventions, and their possible side-effects.

### Ethical concerns

More than with any other anti-aging therapy, serious ethical concerns are voiced in the case of young blood. Same as all therapies promising benefits for health and longevity those concerns relate to the difficulties of the consumer to distinguish between true and false promises relating to efficacy and safety, and to businesses making money on the base of fear and false hopes. But blood for rejuvenation purposes implies additional concerns. For once it would disrupt markets for blood transfusion. Blood at present is largely donated voluntarily as an act of solidarity and is in short supply. A competing demand for blood plasma for rejuvenation would entail commercialization of the blood market, and potentially reduce the quantity of plasma available for saving lives. Commercialization of blood donation could perhaps be accommodated through the public health insurance system without social implications. But rejuvenation treatments are unlikely to be covered by public health insurance at the moment, resulting in additional years of life as a commodity for those who can pay. Poor people on average would then enjoy even shorter lifespans than middle-class or wealthy segments of society. Although, this is the case anyway, causal relations between longevity and wealth are mostly mystified. But blood donated by poor people, which is paid and used for rejuvenation by wealthy people is a different matter and may not be acceptable. Ethical concerns about social equality dresses itself as anti-capitalist critique. But at a deeper level, blood with all its heavy cultural history and symbolism is emotionally incredibly charged, to the point of rising apocalyptic fears. Even researchers working with young blood for rejuvenation have been heard to express fears of scarce resources resulting in famine and a breakdown of the social fabric (e.g. Bechard 2020). This is curious. In molecular and cell biology scientists work with complex systems involving numerous pathways and feedback loops and have learned not to expect mono-causal processes. But in social systems they are afraid that a single medical therapy would lead to total breakdown, as if social systems were static structures. This is an unconscious echo of the historical obsession with blood as a magical substance from at least antiquity until well into the 19<sup>th</sup> century, when modern science started to deconstruct blood.

So ethical concerns raised by critics of young blood plasma for rejuvenation are largely not based on science, but on fears about social and cultural acceptance. Devils are lurking in the social fabric, their image threatening to be projected on the wealthy in case they touch the ultimate social question, which is inequality in lifespan. Inequality in material wealth can be partly rationalized with individual life choices and luck, but images of old, rich people consuming blood of the young, poor, and innocent invokes fears of vampirism and could result in witch hunts.

Such fears can help to explain, why blood transfusions for rejuvenation will remain ethically unacceptable, although they might be beneficial to the individual consumer. Any acceptable treatment needs to get away from the blood label, which is why most businesses are deconstructing the idea of blood and focus instead on specific proteins and molecular pathways.

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