

Zbornik 27. mednarodne multikonference
INFORMACIJSKA DRUŽBA – IS 2024
Zvezek I

Proceedings of the 27th International Multiconference
INFORMATION SOCIETY – IS 2024
Volume I

Konferenca o zdravi dolgoživosti
Conference on Healthy Longevity

Urednika / Editors

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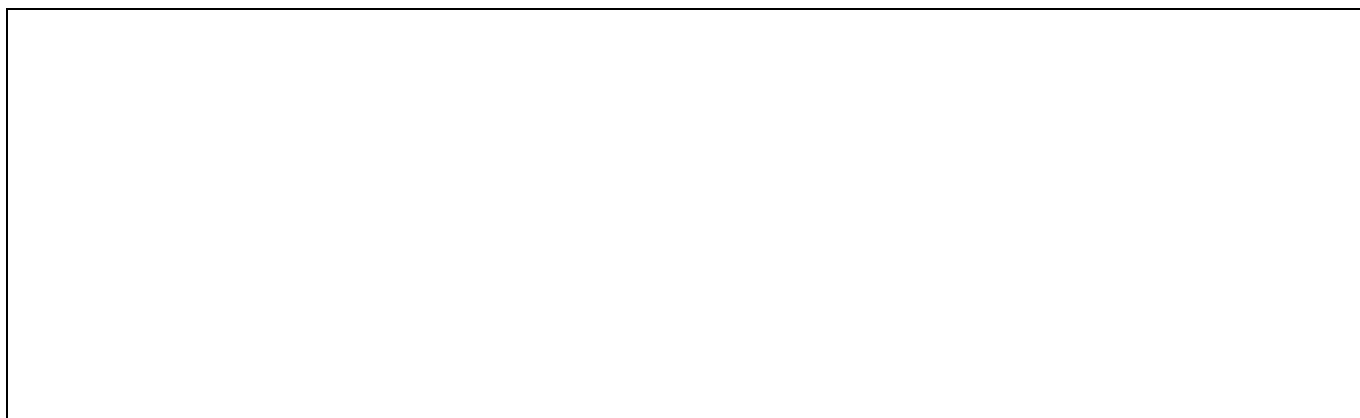
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PREDGOVOR MULTIKONFERENCI INFORMACIJSKA DRUŽBA 2024

Leto 2024 je hkrati udarno in tradicionalno. Že sedaj, še bolj pa v prihodnosti bosta računalništvo, informatika (RI) in umetna inteligenca (UI) igrali ključno vlogo pri oblikovanju napredne in trajnostne družbe. Smo na pragu nove dobe, v kateri generativna umetna inteligenca, kot je ChatGPT, in drugi inovativni pristopi utirajo pot k superinteligenci in singularnosti, ključnim elementom, ki bodo definirali razcvet človeške civilizacije. Naša konferenca je zato hkrati tradicionalna znanstvena, pa tudi povsem akademsko odprta za nove pogumne ideje, inkubator novih pogledov in idej.

Letošnja konferenca ne le da analizira področja RI, temveč prinaša tudi osrednje razprave o perečih temah današnjega časa – ohranjanje okolja, demografski izzivi, zdravstvo in preobrazba družbenih struktur. Razvoj UI ponuja rešitve za skoraj vse izzive, s katerimi se soočamo, kar poudarja pomen sodelovanja med strokovnjaki, raziskovalci in odločevalci, da bi skupaj oblikovali strategije za prihodnost. Zavedamo se, da živimo v času velikih sprememb, kjer je ključno, da s poglobljenim znanjem in inovativnimi pristopi oblikujemo informacijsko družbo, ki bo varna, vključujoča in trajnostna.

Letos smo ponosni, da smo v okviru multikonference združili dvanajst izjemnih konferenc, ki odražajo širino in globino informacijskih ved: CHATMED v zdravstvu, Demografske in družinske analize, Digitalna preobrazba zdravstvene nege, Digitalna vključenost v informacijski družbi – DIGIN 2024, Kognitivna znanost, Konferenca o zdravi dolgoživosti, Legende računalništva in informatike, Mednarodna konferenca o prenosu tehnologij, Miti in resnice o varovanju okolja, Odkrivanje znanja in podatkovna skladišča – SIKDD 2024, Slovenska konferenca o umetni inteligenci, Vzgoja in izobraževanje v RI.

Poleg referatov bodo razprave na okroglih mizah in delavnicah omogočile poglobljeno izmenjavo mnenj, ki bo oblikovala prihodnjo informacijsko družbo. "Legende računalništva in informatike" predstavljajo slovenski "Hall of Fame" za odlične posameznike s tega področja, razširjeni referati, objavljeni v reviji *Informatica* z 48-letno tradicijo odličnosti, in sodelovanje s številnimi akademskimi institucijami in združenji, kot so ACM Slovenija, SLAIS in Inženirska akademija Slovenije, bodo še naprej spodbujali razvoj informacijske družbe. Skupaj bomo gradili temelje za prihodnost, ki bo oblikovana s tehnologijami, osredotočena na človeka in njegove potrebe.

S podelitvijo nagrad, še posebej z nagrado Michie-Turing, se avtonomna RI stroka vsakoletno opredeli do najbolj izstopajočih dosežkov. Nagrado Michie-Turing za izjemen življenjski prispevek k razvoju in promociji informacijske družbe je prejel prof. dr. Borut Žalik. Priznanje za dosežek leta pripada prof. dr. Sašu Džeroskemu za izjemne raziskovalne dosežke. »Informacijsko limono« za najmanj primerno informacijsko tematiko je prejela nabava in razdeljevanjem osebnih računalnikov ministrstva, »informacijsko jagodo« kot najboljšo potezo pa so sprejeli organizatorji tekmovanja ACM Slovenija. Čestitke nagrajencem!

Naša vizija je jasna: prepoznati, izkoristiti in oblikovati priložnosti, ki jih prinaša digitalna preobrazba, ter ustvariti informacijsko družbo, ki bo koristila vsem njenim članom. Vsem sodelujočim se zahvaljujemo za njihov prispevek k tej viziji in se veselimo prihodnjih dosežkov, ki jih bo oblikovala ta konferenca.

Mojca Cigliarič, predsednica programskega odbora

Matjaž Gams, predsednik organizacijskega odbora

PREFACE TO THE MULTICONFERENCE INFORMATION SOCIETY 2024

The year 2024 is both ground-breaking and traditional. Now, and even more so in the future, computer science, informatics (CS/I), and artificial intelligence (AI) will play a crucial role in shaping an advanced and sustainable society. We are on the brink of a new era where generative artificial intelligence, such as ChatGPT, and other innovative approaches are paving the way for superintelligence and singularity—key elements that will define the flourishing of human civilization. Our conference is therefore both a traditional scientific gathering and an academically open incubator for bold new ideas and perspectives.

This year's conference analyzes key CS/I areas and brings forward central discussions on pressing contemporary issues—environmental preservation, demographic challenges, healthcare, and the transformation of social structures. AI development offers solutions to nearly all challenges we face, emphasizing the importance of collaboration between experts, researchers, and policymakers to shape future strategies collectively. We recognize that we live in times of significant change, where it is crucial to build an information society that is safe, inclusive, and sustainable, through deep knowledge and innovative approaches.

This year, we are proud to have brought together twelve exceptional conferences within the multiconference framework, reflecting the breadth and depth of information sciences:

- CHATMED in Healthcare
- Demographic and Family Analyses
- Digital Transformation of Healthcare Nursing
- Digital Inclusion in the Information Society – DIGIN 2024
- Cognitive Science
- Conference on Healthy Longevity
- Legends of Computer Science and Informatics
- International Conference on Technology Transfer
- Myths and Facts on Environmental Protection
- Data Mining and Data Warehouses – SIKDD 2024
- Slovenian Conference on Artificial Intelligence
- Education and Training in CS/IS.

In addition to papers, roundtable discussions and workshops will facilitate in-depth exchanges that will help shape the future information society. The “Legends of Computer Science and Informatics” represents Slovenia’s “Hall of Fame” for outstanding individuals in this field. At the same time, extended papers published in the *Informatica* journal, with over 48 years of excellence, and collaboration with numerous academic institutions and associations, such as ACM Slovenia, SLAIS, and the Slovenian Academy of Engineering, will continue to foster the development of the information society. Together, we will build the foundation for a future shaped by technology, yet focused on human needs.

The autonomous CS/IS community annually recognizes the most outstanding achievements through the awards ceremony. The Michie-Turing Award for an exceptional lifetime contribution to the development and promotion of the information society was awarded to Prof. Dr. Borut Žalik. The Achievement of the Year Award goes to Prof. Dr. Sašo Džeroski. The "Information Lemon" for the least appropriate information topic was given to the ministry's procurement and distribution of personal computers. At the same time, the "Information Strawberry" for the best initiative was awarded to the organizers of the ACM Slovenia competition. Congratulations to all the award winners!

Our vision is clear: to recognize, seize, and shape the opportunities brought by digital transformation and create an information society that benefits all its members. We thank all participants for their contributions and look forward to this conference's future achievements.

Mojca Cigliarič, Chair of the Program Committee

Matjaž Gams, Chair of the Organizing Committee

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KAZALO / TABLE OF CONTENTS

<i>Konferenca o zdravi dolgoživosti / Conference on Healthy Longevity</i>	<i>1</i>
PREDGOVOR / FOREWORD	3
PROGRAMSKI ODBORI / PROGRAMME COMMITTEES	5
Vital Longevity – Challenges and Opportunities for Future Society / Javornik Branka	7
The 8 Pillars of Health – What We Can Do Ourselves and the Opportunities in Medicine – Gordana's Method / Kalan Živčec Gordana.....	9
The Power of Royal Jelly in Healthy Aging / Kopinč Rok	10
Advocacy in Action: How Patient Advocacy, Public Policy, and Science Communication Drive Scientific Progress and Benefit Society / King Melissa	11
The Right to Health and Longevity: An Evolving Human Right? / Tietz - Latza Alexander	12
Should Christians Be Opposed to Technologically Achieved Life Extension? Why Kierkegaard Might Make a Bad Transhumanist / Buben Adam	13
<i>Indeks avtorjev / Author index</i>	<i>15</i>

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PREDGOVOR

Po velikem uspehu Konference o podaljševanju življenja, ki smo jo leta 2023 izvedli v okviru mednarodne multikonference Informacijska družba na IJS, smo se letos organizatorji odločili, da ponovimo zgodbo in konferenco še dodatno izboljšamo. Tudi tokrat je bil namen dvojen: povezovanje strokovnjakov, ki se ukvarjajo s podaljševanjem življenja na sicer nepovezanih področjih, ter promocija ideje o podaljšanju življenja med javnostjo. Je konferenca dosegla zastavljene cilje?

V primerjavi z lanskim letom smo tokrat v živo lahko poslušali ne le vse domače, temveč tudi nekatere od tujih govorcev. Iz Nemčije se nam je pridružil Alexander Tietz-Latza, ki je s perspektive pravnika govoril o pravici do podaljševanja življenja, iz ZDA pa Melissa King, ki je delila svoje bogate izkušnje iz agitacije in lobiranja za raziskave preprečevanja staranja. Znanstveniki, ki se v malih državah ukvarjajo z določenimi področji, so vajeni ustrezno majhnih zneskov: Kingova ima iz Washingtona izkušnje z borbo za večstomilijonske zneske, ki je bila večkrat tudi uspešna, in ob njeni pripovedi je bila pozornost poslušalcev zagotovljena. Več vrhunskih strokovnjakov se nam je pridružilo tudi prek videopovezave: Adam Buben iz Nizozemske, Ilya Stambler iz Izraela in Bryan Johnson iz ZDA.

Ne le da smo uspeli poleg že omenjenih pridobiti še izvrstne domače predavatelje, temveč se nam je prvič doslej pridružila tudi predstavnica Ministrstva za zdravje Vesna Marinko. Za razliko od večine znanstvenih konferenc, ki so namenjene majhni tarčni skupini strokovnjakov, je bila naša odprta za širšo javnost, in javnost je z veseljem tudi prišla. Lanska konferenca je bila obilno obiskana tako v živo kot preko videoprenosa, toda ali so obiskovalci dejansko prišli, ker bi jih tema zanimala? Številni odzivi, ki smo jih organizatorji prejeli po zaključku, potrjujejo, da je res tako. Letošnji prvi odzivi občinstva nakazujejo, da tudi tokrat ni nič drugače.

Martin Lipovšek, Boštjan Petrič

FOREWORD

After the great success of the Life Extension Conference, which we held in 2023 as part of the international multiconference Information Society at the Jožef Stefan Institute, this year the organizers decided to repeat the event and further improve the conference. Once again, the purpose was twofold: to connect experts working on life extension in otherwise unrelated fields and to promote the idea of life extension among the public. Did the conference meet these goals?

Compared to last year, this time we were able to hear not only all the Slovenian speakers live but also some international ones. Alexander Tietz-Latza from Germany joined us to talk about the right to life extension from a legal perspective, and Melissa King from the USA shared her extensive experience in advocacy and lobbying for anti-aging research. Scientists in small countries are used to working with relatively small budgets, while King, during her visits to Washington, has fought for hundreds of millions of dollars, often successfully; needless to say, she had the audience's attention. Several top experts also joined us via video link: Adam Buben from the Netherlands, Ilya Stambler from Israel, and Bryan Johnson from the USA.

Not only did we manage to bring in excellent Slovenian speakers in addition to all the foreign ones already mentioned, but for the first time, we were also joined by a representative from the Ministry of Health, Vesna Marinko. Unlike most scientific conferences, which are aimed at a small target group of experts, ours was open to the general public - and the public gladly attended. Last year's conference was well-attended both in person and via video stream, but did the attendees come because they were genuinely interested in the topic? Numerous responses that we received afterward confirm that they were. Early feedback from this year's audience suggests that the second Life Extension Conference was no different.

Martin Lipovšek, Boštjan Petrič

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Vitalna dolgoživost – izzivi in priložnosti za bodočo družbo

Danes smo priča naraščajočemu pričakovanemu trajanju življenja, ki je v zadnjih desetletjih izjemno porasla zaradi ugodnejših zdravstvenih, prehranskih, ekonomskih in socialnih razmer kot odraz različnih odkritij ter novih spoznanj v znanosti in družbi ter njihovih aplikacij v vsakdanjem življenju. Starejše se sicer zaradi pojavnosti starostne oviranosti in različnih kroničnih bolezni večkrat obravnava kot posebno skupino, potrebno specializirane pomoči na področju medicine, sociale, politike, zakonodaje, bivanjskih razmer, servisnih služb, posebnih organizacij in podobno. Zato ne čudi razmišljanje, da je »znanost podaljšala življenjsko dobo, vendar to pomeni daljšo starost«.

Res je, staranju ne morem ubežati – z leti se začnejo kopičiti okvare in napake v telesu, ki se odražajo kot upad fizičnih in kognitivnih sposobnosti in razvoj kroničnih bolezni, vendar danes znanost ponuja več, kot le podaljševanje »starega« življenja! In kaj nam ponuja znanost o biologiji staranja? V zadnjem desetletju smo priča eksploziji različnih aktivnosti in znanstvenih odkritij na tem področju, nekateri to imenujejo kar revolucija znanosti na področju dolgoživosti. Področje biologije staranja imenujemo tudi biogerontologija, ki obravnava predvsem mehanizme staranja, in geroznanost, ki obravnava mehanizme staranja povezuje s pojavom kroničnih bolezni. Te raziskave skušajo odgovoriti na vprašanja na molekulskem in celičnem nivoju ter na nivoju organizma, zakaj in kako se staramo ter ali je mogoče omiliti/upočasniti procese staranja, predvsem s preprečevanjem razvoja starostnih tegob in kroničnih bolezni in tako podaljšati zdrava leta življenja.

In kakšne so možnosti za vitalno dolgoživost? V prispevku bomo predstavili vplive genetske zasnove in okolja (življenjskega sloga) na procese staranja in novejša spoznanja o možnostih uporabe geroterapevtikov ter celičnih in genskih terapij za vitalno dolgoživost.

Vital Longevity – Challenges and Opportunities for Future Society

Today, we are witnessing increasing life expectancy, which has significantly risen in recent decades due to improved health, nutrition, economic, and social conditions, reflecting various discoveries and new understandings in science and society and their application in daily life. Older individuals are often treated as a special group due to the prevalence of age-related disabilities and various chronic diseases, requiring specialized assistance in medicine, social services, politics, legislation, housing conditions, service agencies, special organizations, and more. This gives rise to the notion that "science has extended lifespan, but that means longer old age."

Indeed, aging is inevitable—over time, defects and errors accumulate in the body, reflected in a decline in physical and cognitive abilities and the development of chronic diseases. However, today's science offers more than just the extension of "old age." So, what does the science of aging biology offer us? In the past decade, we have witnessed an explosion of various activities and scientific discoveries in this field, with some even calling it a revolution in longevity science. The field of aging biology, also known as biogerontology, primarily deals with the mechanisms of aging, while geroscience links these mechanisms with the emergence of chronic diseases. These studies aim to answer questions at the molecular, cellular, and organismal levels about why and how we age and whether it is possible to alleviate or slow down aging processes, especially by preventing the development of age-related ailments and chronic diseases, thus extending the healthy years of life.

What are the possibilities for vital longevity? This article will present the influences of genetic makeup and the environment (lifestyle) on the aging processes and recent findings on the potential use of gerotherapeutics, as well as cellular and gene therapies, for achieving vital longevity.

Gordana Kalan Živčec

8 stebrov zdravja – kaj lahko naredimo sami in kaj so priložnosti medicine – Gordanina Metoda

Zdravje in kakovostna dolgoživost sta neposredno povezani. Kakovostna dolgoživost je tesno povezana s koncepti, ki so v osnovi enostavni in jih lahko izvajamo samostojno: gibanje, prehrana, počitek, socialni stiki/domače živali, ... tehnike sproščanja. Nadgradimo jih s koncepti medicine: preventiva, prehranska dopolnila in šele na koncu zdravila. Prvi steber zdravja je gibanje - Drugi steber zdravja je prehrana - Tretji steber zdravja je počitek - Četrty steber zdravja je kakovostna socialna mreža in tudi hišni ljubljenci - Peti steber zdravja je zmanjševanje mentalnega, fizičnega in okoljskega stresa - Šesti steber zdravja je preventiva - Sedmi steber zdravja so prehranska dopolnila - Osmi steber zdravja so zdravila. Hiša stoji na 4 stebrih. Za zdravo življenje jih je potrebno 8. Srečno!

The 8 Pillars of Health – What We Can Do Ourselves and the Opportunities in Medicine – Gordana's Method

Health and quality longevity are directly connected. Quality longevity is closely tied to concepts that are fundamentally simple and can be implemented independently: movement, nutrition, rest, social connections/pets, and relaxation techniques. These are then enhanced by medical concepts: prevention, nutritional supplements, and only as a last resort, medications. The first pillar of health is movement. - The second pillar of health is nutrition. - The third pillar of health is rest. - The fourth pillar of health is a strong social network, including pets. - The fifth pillar of health is reducing mental, physical, and environmental stress. - The sixth pillar of health is prevention. - The seventh pillar of health is nutritional supplements. - The eighth pillar of health is medication. A house stands on four pillars. For a healthy life, eight are needed. Good luck!

Rok Kopinč

Moč matičnega mlečka pri zdravem staranju

Matični mleček ima že v razvoju čebel vlogo epigenetskega reprogramiranja. Ličinke, ki so hranjene celotno obdobje razvoja izključno z matičnim mlečkom, se razvijejo v čebelje matice, medtem ko se ličinke, ki so hranjene z matičnim mlečkom le prve tri dni, razvijejo v navadne čebele delavke, čeprav sta obe genetsko identični. Matice so še enkrat večje od delavk, za razliko od delavk plodne in živijo do 20-krat dlje. Razlog je v tem, da matični mleček omogoča utišanje določenih genov (genov delavke) in izražanje genov matice. Ker so matice celo življenje hranjene le z matičnim mlečkom, se razlika v izražanju genov ohranja in s tem lastnosti, ki so značilne za čebeljo matico. Če navadno čebelo delavko začnemo hraniti z matičnim mlečkom, začne dobivati nekatere lastnosti matice. Pa lahko takšno delovanje matičnega mlečka pričakujemo tudi pri drugih organizmih? Raziskave kažejo, da matični mleček za 10 do 20 % podaljša življenje tudi pri nekaterih drugih modelnih organizmih, kot so črvi *C. elegans*, vinske mušice, črčki in miške. Prav tako poveča odpornost teh živali na stres, kot so UV svetloba, izpostavljenost kemijskim sredstvom in na bakterijske/virusne infekcije. V različnih kliničnih študijah je bilo dokazano, da matični mleček spodbuja procese, ki so sicer povezani z dolgoživostjo in podaljšanjem zdravega obdobja življenja. Tako so dokazali, da matični mleček aktivira enake procese kot kalorična restrikcija, še zlasti glavna sestavina matičnega mlečka, to je 10-hidroksi-decenojska kislina, poveča izražanje sirtuinov. V nedavni klinični raziskavi smo tudi sami potrdili, da aktivira obrambne sisteme, ki ščitijo celice pred oksidativnimi poškodbami ter poviša raven adiponektina, katerega višje ravni so pri ljudeh povezane z dolgoživostjo. Matični mleček vsebuje tudi spermidin, ki je znan po tem, da spodbuja avtofagijo in preprečuje staranje celic.

The Power of Royal Jelly in Healthy Aging

In the development of bees, royal jelly plays a role in epigenetic reprogramming. Larvae that are fed exclusively with royal jelly throughout their entire development become queen bees, while those that are fed royal jelly only for the first three days develop into ordinary worker bees, even though both are genetically identical. Queens are twice the size of workers, are fertile, and live up to 20 times longer. This is because royal jelly enables the silencing of certain genes (worker bee genes) and the expression of queen genes. Since queens are fed only royal jelly throughout their lives, the difference in gene expression is maintained, along with the traits characteristic of a queen bee. If a regular worker bee starts being fed royal jelly, it begins to develop some queen-like characteristics. But can we expect such effects of royal jelly in other organisms as well? Research shows that royal jelly extends the lifespan of some other model organisms, such as *C. elegans* worms, fruit flies, crickets, and mice, by 10 to 20%. It also increases these animals' resistance to stress, such as UV light, exposure to chemicals, and bacterial/viral infections. Various clinical studies have proven that royal jelly promotes processes associated with longevity and the extension of the healthy period of life. It has been shown that royal jelly activates the same processes as calorie restriction, particularly the main component of royal jelly, 10-hydroxy-2-decenoic acid, which increases the expression of sirtuins. In a recent clinical study, we also confirmed that royal jelly activates defense systems that protect cells from oxidative damage and increases levels of adiponectin, which in humans is linked to longevity. Royal jelly also contains spermidine, known for promoting autophagy and preventing cellular aging.

Melissa King

Advocacy in Action: How Patient Advocacy, Public Policy, and Science Communication Drive Scientific Progress and Benefit Society

This talk underscores the vital role of advocacy, policy, and communication in advancing scientific progress, especially in healthy longevity. It illustrates how engaged citizens, through patient advocacy, can drive research funding and policy changes, significantly impacting healthcare outcomes. The presentation highlights the global spread of initiatives like Right to Try laws and stresses the importance of public funding for early-stage research and the need for scientists to actively communicate with the public.

There is a great need in the healthy longevity field for more patient advocacy, public policy, public information through science communications, and global collaborative planning to drive both scientific progress and distributive justice. The impact of patient advocacy on various areas of biomedical research and healthcare is immeasurable, as shown by examples such as California's Propositions 71 & 14 for stem cell research funding, JDRF's efforts in type 1 diabetes research, and HIV/AIDS activism.

Ongoing public policy efforts are of great importance for both research and patients. Efforts like Brain Mapping Day at the US Congress, part of the inspiration for President Obama's Brain Initiative, and the implementation of Right to Try legislation are not always visible to the public at large but impact billions of people. A global overview of Right to Try legislation and similar programs across different regions provides an example of how complex public policy efforts can be when the focus is global.

The role of public funding in scientific advancements is enormous, given that private industry and funding often enter only after initial public investments reduce risk. The critical need for accurate science communication to the public provides an opportunity for scientists and others well-informed about science to engage in outreach and education efforts.

This presentation is a call to action, meant to inspire and empower attendees to become active participants in shaping the future of science and health policy, including and especially around healthy longevity for all.

Alexander Tietz - Latza

The Right to Health and Longevity: An Evolving Human Right?

The recognition and enforcement of the right to health as a fundamental human right can significantly enhance longevity and healthspan. By ensuring access to comprehensive healthcare, promoting preventive measures, interventions, and addressing socio-economic determinants of health, we can advocate a legal framework that supports a healthier population.

Several international human rights instruments, such as the Universal Declaration of Human Rights (UDHR) and the International Covenant on Economic, Social and Cultural Rights (ICESCR), enshrine the right to health. In Europe, the European Social Charter and national constitutions further reinforce this right. Effective implementation of these legal frameworks can lead to better health outcomes.

This right encompasses access to timely, acceptable, and affordable health care of appropriate quality as well as the underlying determinants of health, such as safe drinking water, adequate sanitation, and a healthy environment. The right to health implies that everyone should have access to the necessary health services and conditions that enable them to live a long and healthy life - including Longevity?

Adam Buben

Should Christians Be Opposed to Technologically Achieved Life Extension? Why Kierkegaard Might Make a Bad Transhumanist

It might seem obvious to most readers of Kierkegaard, an important thinker in the Christian tradition, that he would have little interest in, and would probably be radically opposed to, the goals of transhumanism. The difficult part, however, is explaining exactly what he would be opposed to and why. It is true that Kierkegaard does not put much stock in science and technology, but transhumanism is not a monolithic movement; the futurists, philosophers, scientists, and sci-fi enthusiasts who might consider themselves transhumanists have a wide array of hopes and dreams about what technology might eventually be able to do for, and to, humankind. This variety means certain understandings of transhumanism might actually be quite compatible with all sorts of religious traditions, including Christianity. In fact, it is important to many transhumanists that their ideas not be perceived as sacrilegious, irreligious, or heretical, because they think a “broad, diverse coalition” of support for, or at least tolerance of, their agenda is practically and politically necessary for their goals to be realized. Given such intentional inclusivity, we must dig a little deeper into Kierkegaard’s views to determine if he would truly be an opponent of transhumanism. There may well be several approaches to explaining “why Kierkegaard might make a bad transhumanist,” but mine will be to argue—focusing on the example of technologically achieved life extension—that there is something in his Christian commitments that runs counter to the very spirit of transhumanism.

Indeks avtorjev / Author index

Buben Adam.....	13
Javornik Branka	7
Kalan Živčec Gordana.....	9
King Melissa	11
Kopinč Rok	10
Tietz - Latza Alexander.....	12