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The Earth as a Living Organism: Contribution of Integrative Medicine to the Healing of Our Planet (One Health)

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Keywords
Environment · Planetary health · Self-regulation · Sustainability · Transformation

Abstract

Background: Considering the analogies between the disruption in ecological systems and in individuals, the concept of integrative medicine is extended to the One Health concept and integrative medicine is introduced as an innovative model for guidance/correction in patients' therapy as well as in ecological realignment. ***Summary:*** The specific elements of integrative medicine that can be applied to human health as well as to environmental health are described (e.g. self-regulation, salutogenic healing processes, transdisciplinary multimodal approaches, methodological pluralism). The need for sustainable use of limited resources in medicine and pharmacy is pointed out. As examples for urgent action, the need of taking into account the whole life cycle of pharmaceutical products as well as the impact of diet for human and planetary health are mentioned. ***Key Message:*** Self-regulation plays a crucial role in human and environmental health; sustainable promotion of self-regulation enables people to become co-creators of their own health. Such a fundamental change requires transformation of one's inner relationship to nature and to oneself. The aim of the mini-review was to concretize individual fields of action and to investigate the question of whether the concepts of integrative medicine can be transferred from humans to the environment and thus to planetary health and whether this makes sense.

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Die Erde als lebendiger Organismus: Beiträge einer Integrativen Medizin zur Gesundung unseres Planeten (One Health)

Schlüsselwörter
Umwelt · Planetare Gesundheit · Selbstregulation · Nachhaltigkeit · Transformation

Zusammenfassung
Hintergrund: Aufgrund der Analogien, die sich zwischen Störungen in ökologischen Systemen und in der menschlichen Gesundheit zeigen, wird das Konzept der Integrierten Medizin auf das One-Health-Konzept ausgeweitet und die Integrative Medizin als innovatives Modell zur Steuerung/Korrektur der Therapie von Patient*innen sowie für eine ökologische Neuausrichtung vorgestellt. ***Zusammenfassung:*** Die spezifischen Elemente der Integrativen Medizin, die sowohl auf die menschliche Gesundheit als auch auf die Umweltgesundheit angewendet werden können, werden beschrieben (u.a. Selbstregulierung, salutogene Heilungsprozesse, transdisziplinäre multimodale Ansätze, Methodenpluralismus). Es wird auf die Notwendigkeit eines nachhaltigen Umgangs mit den begrenzten Ressourcen in Medizin und Pharmazie hingewiesen. Als Beispiele für dringenden Handlungsbedarf wird die Notwendigkeit hervorgehoben, den gesamten Lebenszyklus pharmazeutischer Produkte zu berücksichtigen, ebenso wie die Bedeutung einer Anpassung der Ernährung, nicht nur für die menschliche Gesundheit, sondern auch für die planetare Gesundheit. ***Kernaussage:*** Die Selbstregulierung spielt eine entscheidende Rolle für die Gesundheit von Mensch und Umwelt. Eine nachhaltige Förderung der Selbstregulierung ermöglicht es den Menschen, zum Mitgestalter ihrer eigenen Gesundheit zu werden. Ein solcher grundlegender Wandel erfordert eine Transformation der inneren Beziehung zur Natur und zu sich selbst. Ziel des Mini-Reviews ist es, einzelne Handlungsfelder zu Konkretisieren und der Frage nachzugehen, ob die Konzepte der integrativen Medizin vom Menschen auf die Umwelt und damit zu einer planetarischen Gesundheit übertragbar und zielführend sind?

Introduction

The idea of "One Health" is the result of numerous conceptualizations with the aim of finding integrating approaches for a globally understood health [1]. The term "One Health" was initially interpreted and implemented in different ways, partly due to the fact that globally understood health involves dynamic processes that require constant adjustments and optimizations [2]. In 2021, the joint tripartite body of WHO, World Organization for Animal Health (WOAH), Food and Agriculture Organization of the United Nations (FAO), and United Nations Environment Programme (UNEP) (thus Quadripartite), agreed to present a unified definition of One Health. In this context, a One Health High Level Expert Panel (OHHLEP) emerged as a group of 26 multidisciplinary international experts and presented the following definition [3]:

> "One Health is an integrated, unifying approach that aims to sustainably balance and optimize the health of people, animals and ecosystems. It recognizes that the health of humans, domestic and wild animals, plants, and the wider environment (including ecosystems) are closely linked and interdependent. The approach mobilizes multiple sectors, disciplines and communities at varying levels of society to work together to foster well-being and tackle threats to health and ecosystems, while addressing the collective need for clean water, energy and air, safe and nutritious food, taking action on climate change, and contributing to sustainable development."

Humanity, at least since the beginning of industrialization, has engaged in unprecedented levels of overexploitation of its own livelihoods and has so severely disrupted the global ecological balance that the regenerative resources necessary for the survival of numerous species including our own have been exceeded, and our planet Earth is now itself in need of intensive therapeutic assistance. The sociologist Rosa [4] shows how the basic attitude of the individual physically, emotionally, and cognitively to their environment characterizes their relationship and connection or appropriation.

There are obvious morphological analogies between the disruption in ecological systems and in individuals. Prolonged imbalance or even (self-)destructive behavior can lead to environmental crises of the Earth and disease in humans [5]. In this paper, we look at integrative medicine as an innovative model for control or correction on both levels: in patient therapy and in ecological realignment.

The Earth as a Living Organism

Integrative medicine implies a holistic view of people and their environment. It integrates the multidimensionality of human existence including the biopsychosocial and spiritual dimensions in diagnostics and therapy. In the last two decades, this view has been increasingly broadened and now explicitly includes a healthy environment in the current definition [6].

Conventional health care is, understandably, predominantly pathogenetically orientated and focuses on problems, disease processes, and their symptomatology. Integrative medicine broadens this approach based on approaches that can be applied not only to people but also to the environment [7]:

1. The central approach of integrative medicine is to promote and harness self-regulation and self-activity in the sense of salutogenic healing processes by activating resources. At the core of this approach is a positive concept of health, which defines health as an active and ongoing achievement of the organism [8]. According to this definition of health, both so-called healthy people and so-called patients can actively contribute to health by utilizing their own natural resources.
2. With this objective, integrative medicine offers a multimodal approach in its health promotion and therapy concepts and promotes transdisciplinary cooperation between patients/clients and health care providers. The importance of the therapeutic relationship between patient/client and practitioner is central to this (relational medicine).
3. Integrative medicine promotes methodological pluralism in research and practice, including the natural sciences, the life sciences, the psychosciences, the social sciences, and the humanities, in response to the complex challenges of individual patient care, public health, and the global community.

The concept and understanding around the topic of "One Health" can, in our opinion, be effectively supported by the therapeutic potential of integrative medicine, thus strengthening medicine in the long term. Herein also lies an opportunity to overcome the (apparent) polarization between natural science-oriented high-tech medicine and holistic-regulative oriented medicine in the sense of integrative medicine. In order to justify this, both intellectually and practically, we propose the following:

In human medicine, the development of an integrative medicine took place by expanding the pathogenetic focus on somatic disease concepts by including, among others, environmental, psychosocial, and spiritual dimensions as well as one's own health development [9]. In this context, the therapeutic relationship level plays a crucial role. In psychotherapy, it has long been known that therapeutic success depends to a large extent on the therapeutic relationship. This principle also applies to many other areas of medicine. The fact-oriented focus on the "it" of the disease needs to be extended by the "you"-perspective (Martin Buber [10], Jürgen Habermas [11]) of the patient in order to do justice to medicine as a practical science of action [12]. By including the personality and their individual lifestyle, the dignity of the patient/client is also explicitly taken into account.

Chronic diseases can often be understood as disintegration and disturbance of biopsychosocial self-regulation [13]. Healing or its best possible therapeutic approximation therefore also means the best possible promotion of system regulation and self-regulation abilities in order to achieve a restoration or stabilization of homeostasis of the various subsystems of the organism [13]. To achieve this goal, pathogenetically oriented interventions may of course also be indicated and necessary. Integrative medicine synergistically combines both approaches in its treatment and therapy concepts, actively addressing the whole person and harnessing individual, psychosocial, cultural and spiritual resources [14]. Through self-determined co-creation of therapeutic processes, patients/clients can proactively help shape the paradigm shift taking place in medicine [15]. With its approach, integrative medicine stands for therapeutic diversity and freedom of choice for patients/clients so that individual health-related prerequisites, expectations and decisions can be sufficiently taken into account in the recovery process. In line with the WHO definition of "the best of both worlds" [16], this approach integrates conventional and complementary therapies and advocates a multi-perspective and multi-professional dialogue in medicine.

The destruction of the environment and our natural habitats by us humans points to a serious disruption of our relationship with the natural world of which we are a part and thus with the ecosystem of planet Earth as a whole [4]. In contrast, the lifestyle of many indigenous peoples with strong ties to nature promotes biodiversity and sustainability in terms of natural resources. The "Western" lifestyle with increasing urbanization and autonomization on the basis of extractionist and expansionist economic models goes hand in hand with an increasing loss of relation with living nature and leads to an alienation from it [4].

In recent years, it has again become increasingly clear how much an organism must be understood as an integrative autonomous system that self-actively regulates itself through interdependent interaction relationships [17, 18]. Network relationships of this type exist not only within the individual organism but also with its environment and within ecosystems themselves. Stresses and disturbances within these networks can either be compensated or lead to pathological changes – both have their costs. This raises the question as to whether such disturbances are often better treated by supporting and controlling these self-regulatory processes rather than by measures targeting presumed individual causes.

Rockström's Planetary Boundaries concept shows that with respect to the whole Earth, the carrying capacity limits for this self-regulation have long been exceeded with respect to some components [19, 20]. Humans as part of

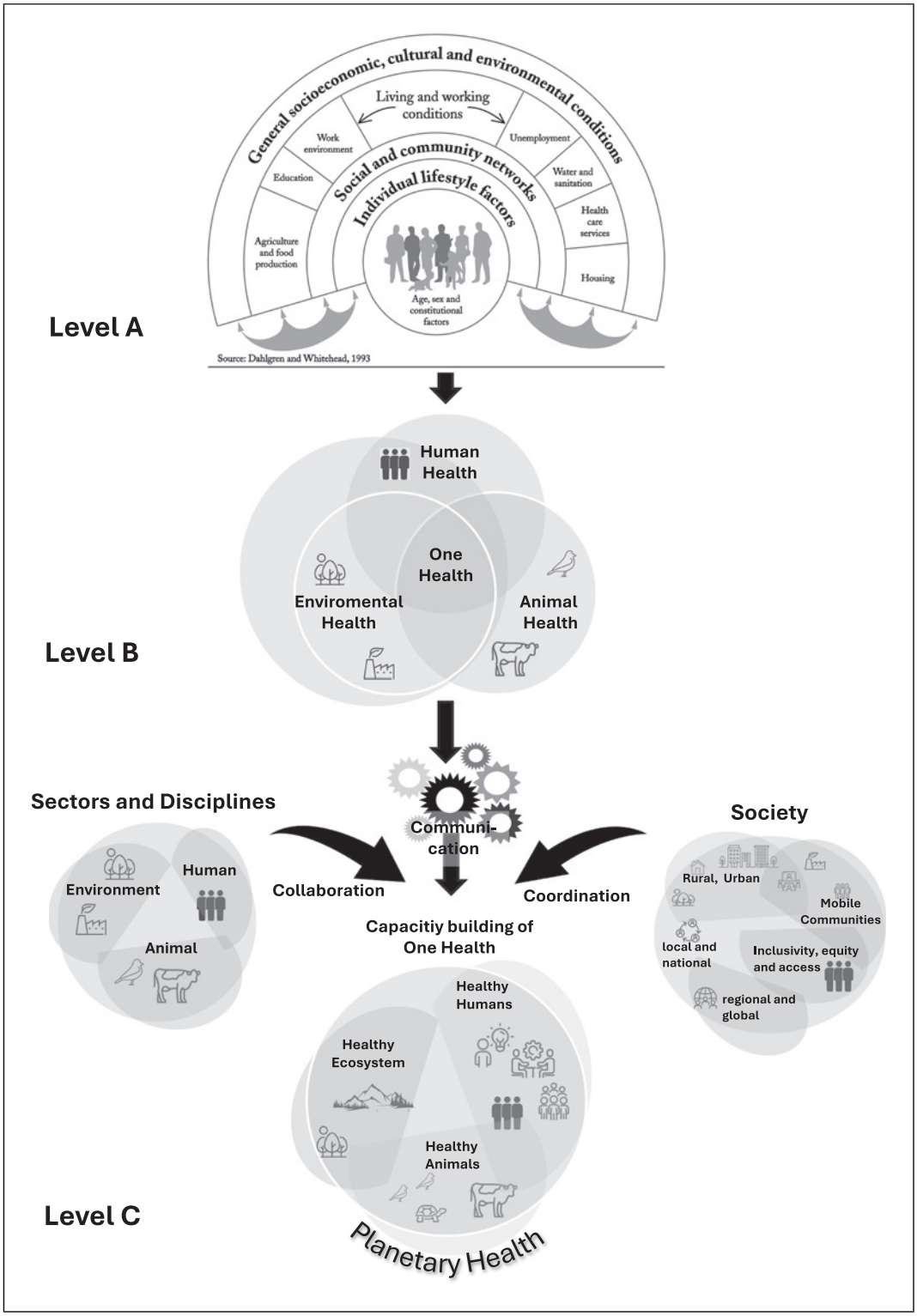

Fig. 1. In their figure from 1991/93, Dahlgren and Whitehead [44] describe the micro-, meso-, and macro-levels of human health (Level A, above). In the One Health understanding, humans are seen as part of the whole so that the intersection of the three sectors (humans, animals, and the environment) results in One Health (Level B). In order to bring together the micro-, meso-, and macro-levels (Level A) with the 3 sectors of the One Health concept (Level B), a transformation and communication process with collaboration (of the 3 sectors and scientific disciplines) and coordination of social processes is required in order to achieve a capacity building of One Health. Values and attitudes of individuals and society are reflected in the communication process and point to a cultural capability of people and humanity. The complex interlocking of the gears symbolizes the transformation process ideally of collaborating science and coordinated society/politics.

these ecosystems are equally affected. The increasing exposure to pollutants through the air and through food is only one example among many [21], which has a great and so far underestimated medical relevance.

Integrative medicine is a holistic medical approach that considers human, animal, and plant health, including the totality of environmental conditions, in a common, dynamic, interdependent context and promotes and explicitly focuses on biodiversity and self-regulation in ecosystems at micro-levels (e.g., individual organisms), meso-levels (e.g., families, societies), and macro-levels (e.g., planet Earth) [22]. It supports eo ipso, ecologically based medicine, the concept of One Health (or Planetary Health and the 17 goals of the UN [23]). Integrative medicine strives for comprehensive *sustainable health and health care systems* through the consistent inclusion of the environment, psychosocial contexts, and economic conditions.

In the pharmaceutical industry, one of the world's largest economic sectors, sustainability efforts are still in their infancy. The dominance of the pharmaceutical industry for profit-oriented drug approvals in the health care sector has been criticized for years [24–26]. The entire "life cycle" of pharmaceuticals must be considered. Planetary Health, e.g., is also significantly affected by environmental impacts arising from production, marketing, packing, transport, and disposal as well as residues after use of pharmaceuticals in water, soil, and food. A brief description of a future sustainable pharmacy from the micro-, meso-, and macro-level can be found in Greco et al. [27], and the approaches range from environmental biodegradability [28] to "green chemistry" [29, 30] and the "circular economy" [31]. In the future, it is expected that there will be an accountable (CO_2) emission amount per daily dose of therapy [32] and that different drugs, synthetic, biological, etc., will be subject to a new evaluation from the perspective of One Health. In this sense, integrative medicine is preparing a sustainable use of limited resources in medicine and pharmacy, as also summarized in the Canmor Declaration 2018 by a group of scientists [33]. In the future, there is also a need for a new, significantly intensified illumination of medicine's responsibility in relation to key nutritional issues from a health and ecological (planetary health) perspective. Many medically necessary changes in this context, such as reduced meat consumption, renunciation of antibiotic-dependent intensive animal husbandry in favor of a diet rich in fruits and vegetables (plant-based diets [34, 35]; e.g., Power Plate [36]), correspond at the same time to the necessities for reshaping agriculture and agribusiness in a globally sustainable way and are in the sense of a healthier environment, a central prerequisite for One Health.

The basis of a sustainable recovery process is the support and promotion of the regulatory capacity of the organism concerned. A mechanistic, defect-oriented view that strives for interventional-suppressive or substitutive-oriented disease control would imply that overcoming the climate crisis is primarily a problem to be solved technologically. Integrative medicine is based on a different understanding of the life processes of the human organism. The human being forms a complex environmentally open system [37, 38] with differentiated regulatory abilities on somatic, psychosocial, and spiritual levels (hygio-, saluto-, and autogenesis) [39, 40]. Accordingly, integrative medicine strives for a sustainable promotion of self-regulation on different levels, which strengthens the independent and social development of the person and enables them to become a co-creator of their own health and that of micro-, meso-, and macro-systems. In doing so, new creative development potentials are opened up.

Health-promoting, preventive as well as therapeutic training in healthy, ecologically responsible nutrition and behavior are essential components of regulatory medicine and salutogenesis. Especially in the case of noncommunicable chronic diseases, which are responsible for more than two-thirds of all causes of death in "Western" industrial societies, the change of lifestyle factors plays a central role. The potential of education, social competence, culture [41], mindful relationships, and health-oriented spiritual practice can be used to improve self-regulation and health promotion.

The basis of existence of our species, the unique ecosystem Planet Earth, has been profoundly diseased by the global actions of humanity. The relationship of the individual human being or humanity as a whole to the earth is chronically disturbed by alienation from nature; the consequences of our collective erratic behavior go far beyond local damage and increasingly threaten life on our planet as a whole. A medicine that pursues the goal of One Health in the sense of a planetary medicine must therefore make innovative and sustained efforts to integrate an appropriate concept of the living organism into its micro- and macro-medical framework of understanding and action in a sustainable way (see also [42, 43]).

The currently still dominant attitude in humanity sees the earth primarily as a supposedly inexhaustible storehouse of raw materials, using its biosphere for unecological economic activities (e.g., in food production), and thereby accepts – or is unaware of – disturbances of the ecological balance with rapidly increasing loss of biodiversity and progressive climate crisis. On the one hand, humanity is directly responsible for the destruction of its own planetary livelihoods. On the other hand, humans are the only self-reflective beings that can not only trigger this relational disturbance but also consciously correct it. Healing can therefore be made

possible here, essentially through a transformative process in relation to humanity's (re)relationship with planet Earth and its living ecosystem.

Constructive relationships are characterized by mutual ever-changing processes of development and learning. The current state of health of the Earth points us humans to our dysfunctional relationship with our common habitat and should be a reason to reflect and correct the mismatch between our actions, the insufficient assessment of their consequences, and the damaging effects on human and planetary health based on them.

It is only in the big picture that it becomes possible to recognize the effects of the many localized disturbances on a global scale and in their interdependence. Global (environmental or One Health) awareness is therefore an essential prerequisite for sustainable and healing action. Effective approaches follow a global systemic approach and are derived and adapted from it for the local levels. Holistic cognitive approaches are thus a prerequisite for sustainable, ecological, and ethical action.

Through their daily actions, people are connected to their environment at the micro-level and inevitably influence it. Human encounter creates the social space on a meso-level. Thanks to a systemic ability to reflect and to cultural ability, humans are capable of a global perception of their own actions and those of humanity on the macro-level (see Fig. 1; Level A: Dahlgreen and Whitehead model [44]). If this is applied to human health in real terms, it is to be understood as the intersection of human, animal, and environmental health (= One Health; see Fig. 1; Level B). If the capacity building of One Health is or must now be actively developed on a human basis, this process requires the collaboration of all sectors and scientific disciplines and the coordination of social and political processes. In this active communication process, the values and attitudes of individuals and society also play a prominent role and point to the cultural capacity of people and humanity (see Fig. 1; transformation process from level B to C). This complex and integrative process for planetary health corresponds in its steps to that of integrative medicine. At the intentional level, a mindful and sustainable use of resources is required (primum non nocere, secundum cavere, tertium sanare [firstly do no harm, secondly be careful, thirdly heal]) with a basic attitude of empathizing with one's environment (Rosa [4]). On the social and communicative level, it is about entering into resonance rather than dissonance with the world and "allowing oneself to be touched" [4], which is practiced by indigenous peoples and which corresponds to relational dynamics in integrative medicine. At the macro-level, planetary health requires the cooperation of all sectors and thus also scientific disciplines and a coordinated approach to social (and political) processes, just as integrative medicine requires interdisciplinary and interprofessional coordinated cooperation in order to be able to offer patients/clients an overall concept [45]. The values and attitudes of those involved are reflected in the cooperative transformation process through a (scientifically comprehensible) communication process (see Fig. 1; from Level B to C).

As long as economic processes dominantly follow the principle of economic growth and economic profit maximization alone, the earth will be subject to further increasing ruthless exploitation that by far exceeds its regenerative capacity, at least with regard to the ecosystemic prerequisites for human life. If, on the other hand, the Earth's biosphere is at the forefront of human thought and action, a circular economy adapted to cyclical life processes and their limits (sustainable health and health care system) can be developed.

Conclusion

Such a fundamental change is not possible without a transformation of the inner relationship to nature and to oneself. Technological innovations and interventions in environment and medicine used on an individual and global level to compensate for the damages of an unsustainable lifestyle are highly useful and welcome in this context. Stabilizing the ecological balance of the Earth requires individuals, organizations, and the global community to reorient themselves quickly and consistently in a direction analogous to that of the integrative medicine approach. Overcoming the climate crisis and the conscious turn of medicine toward an actively understood concept of health in the sense of self-regulation are mutually dependent. Planetary and individual health cannot be separated. This is another reason why it is appropriate to speak of "one" health.

Conflict of Interest Statement

The authors have no conflicts of interest to declare.

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Author Contributions

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References

1 Woods A, Bresalier M. One health, many histories. Vet Rec. 2014;174(26):650–4. https://doi.org/10.1136/vr.g3678
2 Evans BR, Leighton FA. A history of one health. Rev Sci Tech. 2014;33(2):413–20. https://doi.org/10.20506/rst.33.2.2298
3 Villanueva-Cabezas J. One health: a brief appraisal of the Tripartite–UNEP definition. Transboundary and Emerging Diseases. 2022.
4 Rosa H. Resonance: a sociology of our relationship to the world. John Wiley & Sons; 2019.
5 Sharma A, Patel R. Environmental degradation and its societal consequences: a comprehensive study on the relationship with depression. Adv Urban Resilience Sustain City Des. 2023;15(8):14–30.
6 Brinkhaus B, Esch T. [Integrative Medicine and Health: Construct of a Modern Medicine] Integrative Medizin und Gesundheit – Konstrukt einer modernen Medizin. In: Brinkhaus B, Esch T, editors. Integrative Medizin und Gesundheit, Vol. 1. Wissenschaftliche Verlagsgesellschaft; 2020. p. 3–15.
7 Smith BJ, Tang KC, Nutbeam D. WHO health promotion glossary: new terms. Health Promot Int. 2006;21(4):340–5. https://doi.org/10.1093/heapro/dal033
8 Huber M, Knottnerus JA, Green L, Van Der Horst H, Jadad AR, Kromhout D, et al. How should we define health? BMJ. 2011;343:d4163. https://doi.org/10.1136/bmj.d4163
9 Antonovsky A. The structural sources of salutogenic strengths. In: Cooper CL, Payne R, editors. Individual differences: personallity and stress. New York: Wiley; 1994. p. 67–104.
10 Buber M. [The dialogic principle: I and you. Dialogue. The question for the individual. Elements of interpersonal relationships. On the history of the dialogic principle] Das dialogische Prinzip: Ich und Du. Zwiesprache. Die Frage an den Einzelnen. Elemente des Zwischenmenschlichen. Zur Geschichte des dialogischen Prinzips. Schneider. 1997.
11 Habermas J. [Reasonable freedom. Traces of the discourse about faith and knowledge] Vernünftige Freiheit. Spuren des Diskurses über Glauben und Wissen. Suhrkamp. 2019.
12 Wieland W. [Medicine as a practical science – the question of how to view of humanity] Medizin als praktische Wissenschaft – Die Frage nach ihrem Menschenbild. In: Girke M, Hoppe J, Matthiessen P, Willich S, editors. Medizin und Menschenbild. Köln: Deutscher Ärzteverlag; 2006. p. 9–28.
13 Toombs SK. Illness and the paradigm of lived body. Theor Med. 1988;9(2):201–26. https://doi.org/10.1007/BF00489413
14 Esch T, Brinkhaus B. [The importance of self-regulation in integrative and mind-body medicine] Die Bedeutung der Selbstregulation in der Integrativen und Mind-Body-Medicine: Ein Überblick. In: Brinkhaus B, Esch T, editors. Integrative Medizin und Gesundheit. Berlin: Medizinisch Wissenschaftliche Verlagsgesellschaft; 2020.
15 Weizsäcker E, von Wijkman A. Come on! Capitalism, shorttermism, population and the destruction of the planet. A report to the Club of Rome Springer Science and Business Media LLC; 2018.
16 Ong C, Bodeker G, Grundy C, Burford G, Shein K. WHO global atlas of traditional, complementary and alternative medicine. In: Bodecker G, Ong C, editors. books.google.com: google schoolar; 2005.
17 Noble D. The music of life: biology beyond genes. Oxford University Press; 2008.
18 Rosslenbroich B, Properties of life towards a theory of organismic biology. Cambridge MA: MIT Press; 2022.
19 Rockström J, Steffen W, Noone K, Persson Å, Chapin FS, Lambin EF, et al. A safe operating space for humanity. Nature. 2009;461(7263):472–5. https://doi.org/10.1038/461472a
20 Persson L, Carney Almroth BM, Collins CD, Cornell S, de Wit CA, Diamond ML, et al. Outside the safe operating space of the planetary boundary for novel entities. Environ Sci Technol. 2022;56(3):1510–21. https://doi.org/10.1021/acs.est.1c04158
21 Zaller J. [Our daily poison: pesticides – the underestimated danger]. Unser täglich Gift: Pestizide – die unterschätzte Gefahr. Paul Zsolnay Verlag; 2018.
22 What is, One Health'? [Internet]. WHO. 2017 [cited 2024 July 1]. Available from: https://www.who.int/news-room/questions-and-answers/item/one-health#
23 17 Ziele der Vereinten Nationen für nachhaltige Entwicklung (SDG's) [Internet]. Engagement Global; Das #17Ziele-Team. 2024 [cited 2024 July 1]. Available from: https://17ziele.de/info/was-sind-die-17-ziele.html
24 Angell M. Industry-sponsored clinical research: a broken system. JAMA. 2008;300(9):1069–71. https://doi.org/10.1001/jama.300.9.1069
25 Angell M, Reading K. The truth about the drug companies: how they deceive us and what to do about it. New York: Random House Trade Paperbacks; 2005.
26 Götsche PC. [Deadly medicine and organized crime. How the pharmaceutical industry is corrupting the healthcare system] Tödliche Medizin und organisierte Kriminalität. Wie die Pharmaindustrie das Gesundheitswesen korrumpiert. München. 2015;2:2020.
27 Greco A, Mennet-von Eiff M, Christoph M, Keusgen M, Edelhäuser F, Peifer C. [One Health approach: How can pharmacy contribute to sustainability?] One-Health-Ansatz: Wie kann die Pharmazie zur Nachhaltigkeit beitragen? Pharmazeutische Zeitung. 2022;167(47):48–52.
28 Kümmerer K. From a problem to a business opportunity-design of pharmaceuticals for environmental biodegradability. Sustain Chem Pharm. 2019;12:100136. https://doi.org/10.1016/j.scp.2019.100136
29 Elschami M, Kümmerer K. Design of a master of science sustainable chemistry. Sustain Chem Pharm. 2020;17:100270. https://doi.org/10.1016/j.scp.2020.100270
30 Holm G, Snape JR, Murray-Smith R, Talbot J, Taylor D, Sörme P. Implementing ecopharmacovigilance in practice: challenges and potential opportunities. Drug Saf. 2013;36(7):533–46. https://doi.org/10.1007/s40264-013-0049-3
31 Kümmerer K, Clark JH, Zuin VG. Rethinking chemistry for a circular economy. Science. 2020;367(6476):369–70. https://doi.org/10.1126/science.aba4979
32 Milanesi M, Runfola A, Guercini S. Pharmaceutical industry riding the wave of sustainability: review and opportunities for future research. J Clean Prod. 2020;261:121204. https://doi.org/10.1016/j.jclepro.2020.121204
33 Prescott SL, Logan AC, Albrecht G, Campbell DE, Crane J, Cunsolo A, et al. The Canmore declaration: statement of principles for planetary health. Challenges. 2018;9(2):31. https://doi.org/10.3390/challe9020031
34 Sabaté J, Soret S. Sustainability of plant-based diets: back to the future. Am J Clin Nutr. 2014;100(Suppl 1):476S–82S. https://doi.org/10.3945/ajcn.113.071522
35 Perkin J, Sealey-Potts C, Hochwald R. Plates and dietary advice: a current trend in nutrition education messaging for the public. 2014.
36 Power Plate: a model for plant-based healthy eating from PCRM [Internet]. [cited 2024 July 1]. Available from: https://yummyplants.com/vegan-nutrition/power-plate-a-new-model-for-healthy-eating-from-pcrm/
37 Prigogine I. [From being to becoming – time and complexity in the natural sciences] Vom Sein zum Werden – Zeit und Komplexität in den Naturwissenschaften. Piper Verlag; 1979.
38 Prigogine I, Geheniau J, Gunzig E, Nardone P. Thermodynamics of cosmological matter creation. Proc Natl Acad Sci U S A. 1988;85(20):7428–32. https://doi.org/10.1073/pnas.85.20.7428
39 Matthes H. [Drug question in integrative medicine] Arzneimittelfrage in der Integrativen Medizin. In: Matthes H, Schad F, Hofheinz RD, editors. Integrative Onkologie. 1. 1 ed. Stuttgart: Wissenschaftliche Verlagsgesellschaft; 2022. p. 39–55.
40 Nicholson DJ. The return of the organism as a fundamental explanatory concept in biology. Philos Compass. 2014;9(5):347–59. https://doi.org/10.1111/phc3.12128
41 Fancourt D, Steptoe A. The art of life and death: 14 year follow-up analyses of associations between arts engagement and mortality in the English Longitudinal Study of Ageing. BMJ. 2019;367:l6377. https://doi.org/10.1136/bmj.l6377
42 Dijksterhuis EJ. The mechanization of the world picture. JSTOR; 1961.
43 Verhoog H. Reductionist and organicistic thinking in science. In: Van Der Wal J, Lammerts Van Bueren ET, editors. Is there a Future in our DNA? Louis Bolk Institute. Driebergen: Louis Bolk Institute; 1993. p. 17–30.
44 Dahlgren G, Whitehead M. European strategies for tackling social inequities in health: levelling up Part 2. Copenhagen: WHO Regional Office for Europe; 2006.
45 Pongsiri MJ, Gatzweiler FW, Bassi AM, Haines A, Demassieux F. The need for a systems approach to planetary health. Lancet Planet Health. 2017;1(7):e257–9. https://doi.org/10.1016/S2542-5196(17)30116-X