Arcondis

Opinion:

The healthcare industry's green revolution: Why sustainable labs can't wait

By Floriane Leseur &
Samantha Alex Gordine, Arcondis

While global environmental change, including climate change, is now widely recognised, the healthcare sector has only recently begun to fully acknowledge its impact on the environment. The sector is still in the early stages of identifying necessary changes and taking actions to significantly address and reduce its impact. With time running out, the healthcare sector must urgently address sustainability.

GROWING A SUSTAINABILITY MINDSET

The first Earth Day was celebrated in 1970, marking the beginning of global awareness about humanity's impact on the environment. This milestone spurred a series of congresses and reports that highlighted the effects of human activities on climate change. Among the first to clearly articulate these concerns was "The Limits to Growth," a book published in 1972 by an international research team[1]. Using a simulation-based model, the authors projected the potential negative consequences of human population and economic exponential growth within a finite resource environment and highlighted the resulting catastrophic outcomes of these trends, including environmental disasters and economic collapse. This book had a profound impact, shifting public opinion on humanity's influence on the planet. This momentum continued with another significant development in 1987—the UN's Brundtland Report. This report introduced the concept of sustainable development, defined as "meeting the needs of the present without compromising the ability of future generations to meet their own needs"[2]. This marked a growing recognition of the need to balance economic and societal progress and development with the planet's limited resources.

Since the beginning of the Industrial Revolution, resource consumption has increased drastically in response to humans' need. This period brought many benefits like economic growth, increasing employment opportunities, making ground-breaking innovations, improvement of people's lives by education and significant advances in healthcare[3]. Yet, it also resulted in the increase of human activity and its strong impact on the environment. Extracting rare ores and metals, drilling for oil and gas, and using groundwater for agriculture are just a few examples of such impactful resource (over-) consumption processes. A recent study showed that the pharma industry is 13% more polluting than the automative sector[4] due to its growing energy and material consumption, resulting from its steady need for innovation and R&D. In addition to the increased consumption of resources and energy, the healthcare sector directly impacts wildlife, as R&D requires the use of animals (e.g. rats, mice, rabbits, fishes, birds, amphibians and primates) for drug and clinical testing, toxicological screening, and antibodies development. Globally, it is estimated that 79.9 millions of animals are used in research per year[5]. Although, the 3 R principles (replacement, reduction and refinement of animals) are increasingly acknowledged and several new alternative methods and non-animal methods[6] (NAMs) (such as drug repurposing[7], virtual control groups, "in-vitro" tests and "in-silico" predictive models) are being developed, these alternatives are often challenging to implement due to limited knowledge or financial constraints[8]. Breeding animals for research purposes is costly, however, capturing animals from the wild has severe ecological impacts, particularly on species like the horseshoe crab, which is widely used for standard assays for vaccines, injectable drugs and other pharmaceutical products, leading to significant population declines, now red listed as "vulnerable" and "endangered" species by the International Union of for Conservation of Nature (IUCN)[9] despite the development of some alternatives[10]. These growing needs have stressed the planet's finite boundaries - many of which we have already exceeded[11].

"These growing needs have stressed the planet's finite boundaries – many of which we have already exceeded."

As sustainability is a global challenge that every individual is affected by and every industry must address, the United Nations created a framework of 17 Sustainable Development Goal (SDGs) to address urgent social, economic, and environmental challenges to achieve a better and more sustainable future for all by 2030[12]. This framework was adopted in September 2015 to help organisations and individuals develop strategic plans that ensure innovation and progress while integrating sustainability into every decision. A few months later, during the 2015 Paris Agreement, many pharmaceutical and biotechnology companies took the initiative to officially commit to reducing their environmental impact globally[13]. These global-scale commitments included reducing Greenhouse gas (GHG) emissions, increasing renewable energy use, promoting sustainability throughout the supply chain, and reducing waste, all while continuing to foster innovation and improving healthcare.

WHY WE NEED MORE SUSTAINABILITY IN LABS

Such global commitments are very important because the pharmaceutical and biotechnological development are very resource-intensive sectors. For example, the pharmaceutical industry's carbon emission intensity is 55% higher than the automative production industry, despite the pharmaceutical market being 28% smaller[4]. This is because buildings for research and development in the healthcare industry require sophisticated heating, cooling and ventilation systems, computing power, sterilisation and refrigeration processes as well as medical and laboratory equipment – the production thereof also being heavily resource and energy intensive sterilisation and refrigeration processes[14]. Interestingly, within the pharmaceutical industry, there is great variability in the amount of carbon pharmaceutical labs emit. Among companies of similar size, carbon emissions from labs with similar purpose (e.g. drug discovery, clinical trials or manufacturing) can vary up to 5.5 times. However, not only pharmaceutical labs are resource intensive, but all research labs in general. For instance, laboratories consume three to ten times more energy per square foot than typical office buildings and four times more water[15]. They are responsible for producing 2% of global plastic waste[16] and releasing 197 million tons of CO_2 annually. Labs use significant amounts of water for experiments, equipment rinsing, and operating various devices. Similarly, they consume a lot of energy for different equipment like autoclaves, fume hoods, and HVAC systems.

"Laboratories consume three to ten times more energy per square foot than typical office buildings and four times more water, making them significant contributors to global resource use."

While reducing consumption is crucial, sustainability efforts should not obstruct research development and/or the quality of results. The benefits must outweigh the costs to positively encourage change. Starting a journey toward a greener lab begins with raising awareness among team members, aiming for at least 25% participation to shift the collective mindset, as it is the critical number to make a change in the general mindset in a population[17]. Although initial resistance is common, new habits can take hold if they are widely adopted. The first major challenge is often the lack of knowledge of where to start. Building a green team with the best intentions can be held back by uncertainty about where to begin. So, education and awareness are essential to changing mindsets and implementing long-term changes.

BENEFITS OF MAKING LABS GREENER

Identifying and implementing initial actions that will have lasting effects is crucial. Some sustainability improvements like revising sample or reagent inventory systems require more effort in rethinking the process or more time to implement, and therefore can face greater resistance. Yet, simple actions can often still lead to significant savings without implementing massive organisational changes around the lab. For example, closing the fume hood sash when not in use can significantly reduce energy consumption and save costs. However, even if this action seems easy to reach and with no associated cost,

embedding such changes into daily routines can be challenging especially during busy lab work.

Yet, there is a substantial business case for implementing sustainable practices, despite seeming complex. Sustainable business practices save money, especially as water and energy prices face strong fluctuations due to economic crises or geopolitical events like the war in Ukraine[18]. For example, leaving a fumehood sash open when not in use can cost $6,000 annually per fumehood, which represents the energy usage of 3.5 US houses per year[19]. On a larger scale, for example on a university campus with hundreds of fumehoods, this sort of energy consumption is enormous. Another simple measure is to install aerators on lab faucets, which can save significant amounts of water. A study run at the University of San Diego showed that more than 2-million gallons of water per year could be saved by simply installing 476 aerators on faucets in different areas of the campus[20].

"The long-term gains for a sustainable lab far outweigh the initial challenges."

Making labs greener also improves people's health by reducing exposure to hazardous reagents and solvents, decreasing the risk of contamination of lab equipment but also of water used to rinse equipment, and lowering the need for special waste disposal. This creates a virtuous cycle of safety and environmental protection. Additionally, working in a safer environment improves mental health as it decreases the risk of hazardous exposure, and brings a feeling of doing good for the planet. It also has a likely beneficial impact on productivity, as happier employees tend to be 13% more productive[21]. Overall, implementing more sustainable practices would bring a positive mindset to the workplace.

CONCLUSION

In conclusion, transforming labs to adopt more sustainable practices requires initial hurdles and investments in changing mindsets, investigating what changes should and could be made, exploring sustainable alternatives, and encouraging behavioral changes. However, these efforts are quickly rewarded by significant direct and indirect benefits such as cost savings, improved health and mental health, and enhanced productivity. The long-term gains for a sustainable lab far outweigh the initial challenges. Fostering innovation with research and development in a sustainable way is essential to pursue progress while keeping the environmental impact of the lab facilities and the work as low as possible. As such, addressing the footprints of labs is a critical step to reduce the environmental impact of the life science industry, and particularly the healthcare and pharmaceutical industry. To realise and live the true principles of sustainability, the continued, unsustainable operation of research infrastructures cannot be justified and weighed up against the positive impact that such research might generate for improving global health. This is why we firmly believe that future-fit labs also have to be sustainable labs. The industry thus needs to address this transformative challenge now, not only to meet sustainability targets, but specifically to safeguard continued innovation and operation in the healthcare sector.

References (in Vancouver style):

1. Meadows DH, Randers J, Meadows DL. The Limits to Growth (1972). In: Robin L, Sörlin S, Warde P, editors. Documents of Global Change [Internet]. New Haven: Yale University Press; 2013 [cited 2024 Jul 31]. p. 101–16. Available from: https://doi.org/10.12987/9780300188479-012
2. World Commission on Environment and Development (WCED). Our Common Future. Oxford and New York : Oxford University Press; 1987
3. Mokyr J, Strotz RH. The second industrial revolution, 1870-1914. Storia dell'economia Mondiale. 1998;21945(1):219–45.
4. L. Belkhir & A. Elmeligi, Carbon footprint of the global pharmaceutical industry and relative impact of its major players, Journal of Cleaner Production, Volume 214, 2019, Pages 185-194, ISSN 0959-6526.
5. Taylor K, Alvarez LR. An Estimate of the Number of Animals Used for Scientific Purposes Worldwide in 2015. Alternatives to Laboratory Animals. 2019;47(5–6):196–213.
6. Stresser DM, Kopec AK, Hewitt P, Hardwick RN, Van Vleet TR, Mahalingaiah PKS, et al. Towards in vitro models for reducing or replacing the use of animals in drug testing. Nature Biomedical Engineering [Internet]. 2023 Dec 27; Available from: https://doi.org/10.1038/s41551-023-01154-7
7. Greco A, Coperchini F, Croce L, Magri F, Teliti M, Rotondi M. Drug repositioning in thyroid cancer treatment: the intriguing case of anti-diabetic drugs. Frontiers in Pharmacology [Internet]. 2023;14. Available from: https://www.frontiersin.org/journals/pharmacology/articles/10.3389/fphar.2023.1303844
8. Pistoia Alliance. Advancing Research: Reducing Animals Models in Experiments [Video]. 2024. Available from: Advancing Research: Reducing Animal Models in Experiments - Pistoia Alliance.
9. Wang CC, Kwan KY, Shin PKS, Cheung SG, Itaya S, Iwasaki Y, et al. Future of Asian horseshoe crab conservation under explicit baseline gaps: A global perspective. Global Ecology and Conservation. 2020;24:e01373.
10. Maloney T, Phelan R, Simmons N. Saving the horseshoe crab: A synthetic alternative to horseshoe crab blood for endotoxin detection. PLOS Biology. 2018 Oct;16(10):1–10.
11. Richardson K, Steffen W, Lucht W, Bendtsen J, Cornell SE, Donges JF, et al. Earth beyond six of nine planetary boundaries. Vol. 9, Science Advances. 2023. p. eadh2458.
12. UN. 2015. Resolution adopted by the General Assembly on 25 September 2015. Transforming our world: the 2030 Agenda for Sustainable Development. General Assembly. Seventieth session Agenda items 15 and 116. Oct. 21st.
13. Conference of the Parties, Adoption of the Paris Agreement. In U.N. Doc. FCCC/CP/2015/L.9/Rev/1; 2015.
14. Eckelman MJ, Sherman J. Environmental Impacts of the U.S. Health Care System and Effects on Public Health. PLOS ONE. 2016 Jun;11(6):1–14.
15. International Institute for Sustainable Laboratories. Smart Labs Toolkit. Available from: Home | I2SL [Accessed 15 August 2024].
16. Urbina MA, Watts AJR, Reardon EE. Labs should cut plastic waste too. Nature. 2015 Dec 1;528(7583):479–479.
17. Centola D, Becker J, Brackbill D, Baronchelli A. Experimental evidence for tipping points in social convention. Science. 2018;360(6393):1116–9.
18. European Central Bank. Economic Bulletin [Internet]. 2022 Jun. Report No.: Issue 4. Available from: https://www.ecb.europa.eu/pub/pdf/ecbu/eb202204.en.pdf
19. Davis C. Saving Energy in Labs Looks Like This [Internet]. Sustainability. 2015. Available from: https://sustainability.ncsu.edu/blog/changeyourstate/save-energy-in-lab/
20. Water Action Plan [Internet]. San Diego: University of California; 2017 Dec. Available from: https://aquaholics.ucsd.edu/_files/water-action-plan/ucsd-water-action-plan-and-appendices.pdf
21. Bellet C, De Neve J, Ward G. Does Employee Happiness have an Impact on Productivity? Saïd Business School. WP 2019-13. 2019 Oct 14.

About the authors

Samantha Gordine
Arcondis Sustainability Lead
samantha.gordine@arcondis.com
+41 79 596 74 72

Samantha Gordine, an environmental scientist with a PhD in Marine Biology, is a sustainability professional in the healthcare sector. At Arcondis, she leads the Sustainability Solutions Team, managing the service portfolio and working with major healthcare organisations to develop sustainable solutions and enhance environmental practices.

Floriane Leseur
Sustainable Lab Specialist
floriane.leseur@arcondis.com
+41 79 600 54 93

Floriane Leseur holds a PhD in Molecular Biology and has always been strongly passionate about sustainability. At Arcondis, she works as a Sustainable Lab specialist, focusing on helping lab facilities to transition to greener practices.

About Arcondis

Arcondis is a global professional services company exclusively focused on the life sciences and healthcare sector. Owned by a Foundation and committed to healthcare improvement, we accelerate value creation for our clients in R&D, Manufacturing & Supply Chain, Marketing, Sales & Services, to ultimately benefit patients.

Our solutions and services include Digitalisation, Data, IT & Infrastructure; Product Lifecycle Management; Industry Compliance & Managed Services and People & Culture. As an independent solutions and Managed Service provider, we have the flexibility to prioritise our clients' best interests without being constrained by exclusive partnerships. We follow an outcomes-based approach – from strategy to hands-on delivery and beyond.

With a well-established reputation built over two decades, we have earned the trust of leading companies in Pharma, MedTech, Healthcare and Start-ups. Headquartered in Switzerland, we employ more than 250 specialists and professionals, with offices in North America, Europe and APAC.

We make healthcare better, globally!

Visit our website to learn more about us