

## The world facing Covid-19: The African perspective

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COVID-19 was first reported in Africa (in Egypt) on 14 February 2020. Since then, Africa has recorded more than 7.8 million cases and almost 200,000 deaths by 1 September 2021. South Africa has the highest burden of COVID-19 in Africa, accounting for 37 per cent of all cases and 42 per cent of all reported COVID-19 deaths on the continent.

In the first wave, the average daily COVID-19 cases in Africa peaked at 18,163 on 24 July 2020, driven principally by variants with the D614G mutation. The second wave began in late November 2020 and the average daily Covid-19 cases peaked at 32,750 on 11 January 2021. By mid-May 2021, Africa once again began experiencing a surge in cases, reaching a peak of 41,863 in mid-July 2021 in the continent's third wave. The surge in cases in the second and third waves corresponded with the increasing dominance of two SARS-CoV-2 variants of concern; namely the Beta and Delta variants.

Although vaccines are being implemented in Africa, the pace of the scale up has been very slow. This is partially due to lack of availability of doses in Africa due to vaccine nationalism globally. To rectify this, the Africa CDC launched the Partnership for African Vaccine Manufacturing (PAVM) in April 2021 and WHO has established an mRNA vaccine technology transfer hub.

The large number of immuno-compromised individuals, especially due to advanced undiagnosed HIV infection, may lead to new variants being generated in Africa. Hence the Africa CDC has increased genomic surveillance across the continent. With the risk of new variants being ever-present, vaccination on its own may not be enough to control viral spread. Vaccination will need to be accompanied by ongoing public health measures like masking and social distancing while the threat of new variants remain.

## Towards closing the connectivity divide

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It goes without saying that we suffer from severe gaps in global internet connectivity. We tend indeed to forget that we still have about half of the world population (or about four billion people) without broadband connectivity. And it is expected that the 5G (in its current initial deployment stages) will further accentuate this connectivity divide. The Covid-19 pandemic also showed that the connectivity divide is in a way becoming one of the modern faces of inequality, deepening the economic and social unbalances between the 'Haves' and 'Have Nots' in a digital context. To achieve digital inclusiveness, we need to develop and deploy new technological solutions that help connect the unconnected or under-connected in an affordable fashion.

In this context, this talk aims to:

- (i) provide an envisioned picture of 6G;
- (ii) serve as a research guideline in the beyond 5G era; and
- (iii) go beyond the recently proposed solutions to provide high-speed connectivity in under-covered areas to serve and contribute to the development of far-flung regions.

## Wrestling with Internet Alligators

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The Internet has delivered striking benefits, especially with the development of the World Wide Web and its facilitating capability to aid in the production, sharing, discovery and use of information writ large. An entire information industry has evolved since the Internet was formally activated, in 1983. Since that time, we have seen how the reduction in barriers to information production and access has enabled many new applications in traditional enterprises, and the creation of entirely new ones such as streaming audio and video. At the same time, the reduction in barriers has also enabled a Pandora's box of harmful behaviors ranging from online bullying to ransomware and malware attacks against information infrastructure. These challenges are international in scope and, consequently, require serious international attention. As we have learned from experience, these problems are complex and will only be solved by serious, multi-stakeholder deliberations to develop and analyze potential solutions. Governments, private sector, civil society and the academia all have roles to play in the development and implementation of solutions. New tools and practices are needed to increase safety, security and privacy of Internet-based products and services. If we are to rely increasingly on the Internet for daily life, it must

# Protein subunit vaccine (ZF2001) against COVID-19: from bench to bedside

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We present the structure-guided design of a coronavirus immunogen comprised of two protein subunits, each containing the virus spike receptor-binding domain fused together via a disulfide link or tandem repeat. The immunogen elicits strong immunogenicity in mice and protects them against viral challenge. The vaccine design strategy can be universally applied to SARS, MERS, COVID-19, and other CoV vaccines to counter emerging threats. COVID-19 protein subunit vaccine (ZF2001) based on this concept has completed phase I, II, and III trials, with an overall protection rate of 81.76%, and has been approved for emergency use in China and Uzbekistan.

# The Role of Gender Responsive Organizations in Global Science

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The presentation covers the meaning of a 'gender-responsive organization', why it is an important notion, how to create a gender-responsive organization and how these organizations can contribute to global science.

In essence, gender transformation moves beyond individual self-improvement among women and girls, by tackling the root causes of gender inequality.

It aims to change gender norms, which include gender roles, expectations, stereotypes, harmful attitudes and customs and practices, to address imbalances of power and privilege between men and women. The meaning of gender responsiveness for The World Academy of Sciences (TWAS) is explored and relevant survey results from a report recently published by GenderInSITE, in collaboration with the InterAcademyPartnership (IAP) and the International Science Council (ISC), are discussed.

For example, the average share of women's representation, in terms of membership, across the 85 academies that responded to the survey, is 16%. The individual organizations surveyed, be they academies, disciplinary unions or associations, through their membership of international bodies such as the IAP and ISC, represent a large proportion of the global scientific endeavour. In total, they represent over 250 unique organizations that are coordinated at a global level. It is argued that the survey results provide important baseline information for a transformative action agenda for gender equality in the global science.

## From the Above and the Bottom

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At the heart of the United Nations sustainable development goals (SDGs) lies the essence of connectivity, as it brings distant services and the world's advances within the hands of the unconnected. Connecting people tremendously helps realize different SDGs including mitigating poverty, improving well-being, and ensuring quality education.

Connectivity not only helps improve social life but also boosts a country's economy. An International Telecommunication Union economic study found out that an increase of one per cent in mobile broadband penetration yields an increase of 0.15 per cent in the Gross Domestic Product.

Here we consider two different perspectives, above and bottom, to make connectivity available and useful for everyone. The first perspective is to consider both the bottom and upper layers of the system, namely supply and demand, respectively. Spending much effort to improve infrastructure and connectivity will not close the circle unless people are able to utilize such networks. Therefore, the focus should be oriented to balance the demand side considering the aspects of affordability, Internet literacy, and localization-customization of needs and content. The Covid-19 era has already accelerated and increased the demand and adoption of online services, in both urban and rural areas. We just need to capitalize on this momentum to widen the upper layer of demand.

The second perspective then zooms into the supply side and considers the availability of infrastructure. This entails the provisioning of connectivity from both the above and the bottom, namely considering both space-aerial and underground connectivity. In this regard, we address two potentially promising scenarios to connect the unconnected. The first is the connection from the above using high-altitude platforms (HAPs) and low Earth orbit (LEO) satellites while addressing their opportunities and relevant challenges. The second is the connection from the bottom using innovative techniques such as installing fibre cables within utilities' pipes, as a fast and cheaper method than conventional ones.

# Advancing Frontier Science, Technology and Innovation for SDGs in Developing Countries

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For decades humanity has struggled to end hunger and poverty and now the numbers have been marching up. How do we end that struggle to achieve Zero Hunger once and for all? How do we align the global agendas around food/nutrition security, biodiversity and climate change? How has the challenge of producing more food changed since COVID-19? How has agriculture, science, technology and innovation advanced how we produce and consume our food and changed the face of farming around the world? These and more questions will be discussed during a talk by the Chief Scientist of the FAO, Ismahane Elouafi.

# Plant-Growth Promoting Microorganisms for Agricultural Sustainability and Environmental Responsibility

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There is a strong global demand for increasing food production and quality but this is requiring a new approach. Important as it is producing more, it is also necessary to consider agricultural sustainability, to recover degraded areas, to lower emissions of greenhouse gases (GHG), and to avoid soil and water pollution by agrochemicals. All these issues require a rational use of inputs. Although fundamental to productivity, chemical fertilizers have limitations associated with:

- (i) high cost and external dependency, as the great majority of the developing countries have to import most of the fertilizers they use;
- (ii) low efficiency in the use of fertilizer by the crops, rarely more than 50 per cent in the tropics;
- (iii) high energy requested for their synthesis, transport, and use, with impacting emissions of greenhouse gases.

In this context, microorganisms carrying properties such as biological nitrogen fixation (BNF), synthesis of phytohormones, solubilization of phosphates and potassic rocks, among others, can promote plant growth with full or partial replacement of chemical fertilizers. This strategy may represent a new era of a micro-green revolution, benefiting agricultural productivity with environmental responsibility. One major example of the biotechnological potential of microorganisms in agriculture is the BNF of the soybean crop in Brazil. Research programs including the selection of microbial strains, development of high-quality inoculants, and strategies of inoculation compatible with every novelty for crop management, in addition to rural extension activities with the farmers, resulted in the most successful microbial story in agriculture worldwide, adopted and benefiting all Brazilian soybean farmers. Estimates are that the use of selected microbial inoculants in the last soybean crop season allowed Brazil to save US\$ 17,8 billion in Nitrogen fertilizers and contributed to mitigate the emission of 205 mg of Carbon dioxide (CO<sub>2</sub>) equivalents. Interestingly, research has also shown the feasibility of transference of microbiological technologies in South-South collaborations, speeding up the achievement of benefits to the farmers. Policies to guarantee financial support to innovative basic research, biotechnological development, and new strategies of communication with the farmers associated with the use of microbial inoculants in agriculture in replacement or complementation of N-fertilizers should be a governmental priority. Globally, the adoption of environmentally friendly and productively effective technologies as the use of selected microorganisms in agriculture may result in a high economic and environmental returns to society.

*Note: M. Hungria is also the coordinator of the National Institute of Science and Technology of Plant-Growth Promoting Microorganisms for Agricultural Sustainability and Environmental Responsibility.*



# On the Role of High Altitude Platform Station (HAPS) Systems for Access Equality

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As wireless networks evolve towards 6G, the seamless integration of terrestrial networks with non-terrestrial networks (NTNs) is envisioned to help address the ever-increasing data-rate requirements. High altitude platform station (HAPS) systems that operate in the stratosphere at an altitude of around 20 kilometres will be among the elements of NTNs. Precipitated by technological innovations in the areas of autonomous avionics, array antennas, solar panel efficiency levels, and battery-energy densities, and fueled by flourishing industry ecosystems, HAPS systems are emerging as an indispensable component of 6G networks. They are expected to be instrumental for providing not only communication services but also caching, offloading, and sensing services. With their 3D mobility, HAPS systems have larger line-of-sight coverage due to their geometric advantages that can compensate for the path loss due to longer distances than the terrestrial base stations. A HAPS can simply serve as a mega-tower in the sky. This talk will focus on HAPS systems for providing coverage in both urban areas and sparsely populated remote areas. Use-cases of HAPS systems will be presented, including delivering IoT services, backhauling, and delivering support for intelligent transportation and fleet management. Noting that a large portion of the global population is still unconnected or under-connected, the role of HAPS base stations to provide access equality will be highlighted. Their potential to bridge the ever-existent digital divide through their large footprint will be revealed. The role towards networks of 2040 will be detailed as both a stand-alone network element and also as an enabler for the vertical integration in the era of low Earth orbit (LEO) mega-constellations. The talk will be concluded with a discussion of the relevant open-research problems.

# The Economic Case for a Sustainable Recovery from COVID-19: Co-Developing the Future Vision based on SDGs and the Climate Agreement

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European COVID 19-related recovery packages are financed by national debt, which means they are loans from future generations. This creates a moral responsibility for the current generation, to "build Back Better" by investing in the transformations of the socio-economic, financial, industrial, and political systems, which will trigger the exponential change needed to face the climate and biodiversity crises, the economic crisis, and the health crisis in a sustainable, resilient, and socially inclusive future.

Beyond a fiscal stimulus that is expected to boost aggregate demand, this crisis calls for transformative public investments that will shape a sustainable, green, digital, and fair transition, and leverage private sector investment. The 2030 Agenda and the Paris Agreement provide the long-term vision and blueprints for developing these transformation pathways. The good news is, in addition to a moral responsibility, there is an economic case for "Building Back Better". Although all countries are facing a central trade-off, whether they should provide "stimulus spending" in order to provide immediate support to maintain business as usual, or provide "transformative spending" focused on accelerating the transition to a job-based green and digital economy and inclusive society, recent simulations from green recovery plans worldwide confirm that a green economic stimulus is more growth-enhancing than a "return-to-normal" stimulus that would merely boost current, unsustainable consumption and production patterns. Moreover, cleaning unsustainable supply chains and production processes that lead to deforestation and biodiversity threats can help reduce the risk of future zoonotic diseases and pandemics, while investing in climate resilience also helps reduce the risk of extreme weather events and poverty for hundreds of millions of people.

Based on the United Nations Sustainable Development Solutions Network report on the "Transformations for the Joint Implementation of Agenda 2030 for Sustainable Development and the European Green Deal: A Green and Digital, Job-Based and Inclusive Recovery from COVID-19 Pandemic", that I led, in this webinar I will connect the dots between four major policy initiatives—the SDGs, the European Green Deal, the European Semester, and the EU recovery plan and showcase actionable strategies for policymakers that can guide EU-wide and national economic recovery in line with the continent's overarching sustainability agenda. I will also argue that the recovery should be driven by science and innovation and introduce aspects of my work that aim to support this, through a presentation of the research and innovation projects, innovation acceleration initiatives, education and training programs, and networks of research-policy interface, which I lead.

# Steps Towards Life: Chemistry!

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The evolution of the universe has generated more and more complex forms of matter through self-organization, from particles up to living and thinking matter. Mankind has created science to unravel the ways and means by which matter has become organized up to a thinking organism in particular on our planet Earth. Self-organization is the process by which steps towards life and thoughts have emerged. Animate as well as inanimate matter, living organisms as well as materials, are formed of molecules and of organized entities resulting from the mutual interaction of molecules. Chemistry provides the bridge and unravels the steps from molecules of inanimate matter and the highly complex molecular architectures and systems which make up living and thinking organisms. Molecular chemistry has developed very powerful methods to build ever more complex molecules from atoms. Supramolecular chemistry seeks to understand and control the formation of complex molecular assemblies. The field of chemistry is the universe of all possible structures and transformations of molecular matter, of which those actually realized in nature represent just one world among all the worlds that await to be created. Conceptual considerations on science in general will be presented. Science shapes the future of humanity.

# Understanding the molecular mechanisms underlying high-yield superior-quality traits and breeding elite varieties of rice

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Rice is one of the most important crops, which feeds more than half of the world population. It is a great challenge to understand the molecular mechanisms underlying grain yield and quality in rice and to develop a powerful system for breeding high-yield good quality rice varieties, especially in the context of growing population and climate change.

Li's laboratory has systematically cloned and studied the function of key genes controlling rice plant architecture, which is crucial for grain yield and mainly determined by tiller number, plant height, tiller angle, panicle size, grain number, and grain weight. It has further revealed the genetic networks that regulate the eating and cooking quality, resistance starch biosynthesis, and storage stability of rice grains.

Based on these discoveries, Li and his team have established a powerful molecular design breeding system in rice through integrating the fundamental knowledge of plant architecture and starch biosynthesis with biotechnology, and succeeded in breeding a series of new elite rice varieties with high yield and superior quality. Their work has developed an effective strategy to break the mutual restrictiveness between yield and quality, making fundamental progress in the rice functional genomic study and breeding superior rice varieties by rational design.

# Anti-spike antibodies and neutralising antibody activity in People Living With HIV (PLWHIV) vaccinated with COVID-19 mRNA-1273 vaccine: a prospective cohort study

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Vaccines against COVID-19 are a powerful tool to control the current SARS-CoV-2 pandemic. A thorough description of their immunogenicity among people living with HIV (PLWHIV) is necessary. We aimed to assess the immunogenicity of the mRNA-1273 vaccine among PLWHIV. In this prospective cohort, 71 PLWHIV and 10 HDs (healthy donors) were enrolled during the Italian vaccination campaign.

Enrolment was allowed irrespective of ongoing combination antiretroviral therapy, HIV viral load and CD4+ T cell count. Blood samples from PLWHIV in care at the Infectious Diseases Unit of the Ospedale Maggiore Policlinico in Milan, who received COVID-19 vaccination with mRNA-1273, were collected before the first vaccine shot (T0), before the second shot (T1a) and 28 days after the second shot (T1b). Nine PLWHIV and 2 HDs had a history of COVID-19. The primary outcomes were anti-spike (anti-S) antibody titres at T1b and neutralising antibody activity, assessed at both T1a and T1b.

We observed that a history of COVID-19 was the only variable associated with anti-S antibody levels and neutralising activity. Anti-S antibodies were higher in COVID-19-experienced PLWHIV than in COVID-19-naïve PLWHIV, but did not differ from those observed in COVID-19-experienced HDs. Neutralising antibody activity was also higher in COVID-19-experienced PLWHIV compared to COVID-19-naïve PLWHIV, but comparable to those observed in COVID-19-experienced HDs.

When stratified according to CD4+ T cell count, both anti-S antibody levels and neutralising activity resulted unaffected by CD4+ T cell count and were all similar to those displayed by HDs. Of note, a strong correlation between anti-S antibody titres and neutralising activity was observed among PLWHIV COVID-19-naïve. In conclusion, inoculation with mRNA-1273 vaccine given four weeks apart produced adequate antibody responses in PLWHIV, who are well controlled on ART, irrespective of CD4+ T cell count and equivalent to individuals without HIV infection, supporting vaccination in PLWHIV.

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<sup>1</sup> The content of the abstract was provided by Lara Manganaro, National Institute of Molecular Genetics, Romeo ed Enrica Invernizzi, Milan, Italy, and authored also by: Andrea Lombardi<sup>1,2,3\*</sup>, Giacomo M. Butta<sup>4,5\*</sup>, Lorena Donnici<sup>4</sup>, Giorgio Bozzi<sup>1</sup>, Massimo Oggioni<sup>6</sup>, Patrizia Bono<sup>6</sup>, Malvina Matera<sup>1</sup>, Dario Consonni<sup>6</sup>, Serena Ludovisi<sup>1</sup>, Antonio Muscatello<sup>1</sup>, Ferruccio Ceriotti<sup>6</sup>, Matteo Conti<sup>4</sup>, Susanna Scaglioni<sup>5</sup>, Greta Gallo<sup>5</sup>, Edoardo Scarpa<sup>4,8</sup>, Sergio Abrignani<sup>4</sup>, Renata Grifantini<sup>4</sup>, Raffaele De Francesco<sup>4,5</sup>, Andrea Gori<sup>1,2,3</sup>, Lara Manganaro<sup>1,4,5§</sup> and Alessandra Bandera<sup>1,2,3§</sup>

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# Transforming Energy Systems to Achieve Sustainability

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Today's energy systems are the biggest source of emissions causing climate change. We can make some "easy" changes today, where technical solutions are known. Examples of solutions that are already in hand include decarbonizing electricity generation, electrifying end uses, and making energy consumption more efficient. Developing countries in particular can advance the wellbeing of their citizens while achieving great sustainability by leapfrogging to low-carbon systems. Some parts of the problem will be hard to address for technical reasons: e.g., powering transportation, agriculture, air travel, and industrial processes. Equally hard will be the challenges related to people, processes and institutions. It is the responsibility of advanced nations to lower those technical, process, and institutional barriers to achieve more sustainable energy systems. By investing in the development of game-changing solutions, with luck and ingenuity, the "hard" problems will eventually seem "easy."

# Amazon Green Deal: An Urgent Need for an Innovative Bioeconomy of Standing Forests in the Amazon

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The Amazon is very close to a tipping point of the savannization of more than 50 per cent of the forest, caused by the synergistic interaction of changes to climate due to global warming and deforestation, and the increased vulnerability of the rainforest to fire. Reducing the risk of losing a great portion of the rainforest requires zeroing deforestation in a few years, and the forest restoration of more than 200,000 km<sup>2</sup>, mainly in the south of the region. It is urgently necessary to create and implement a new bioeconomy of standing forest and flowing rivers, valorizing through value adding of the immense potential richness of forest products. This is the key idea of the Amazon 4.0 project, which seeks to demonstrate the feasibility of this new bioeconomy through bioindustrialization in rural and urban communities in the Amazon.

# Digital inclusion: the urgent need to ensure inclusive, equal access and use of ICTs

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Over the last year, the world has experienced unprecedented change. Alongside massive loss of life, the COVID-19 pandemic has resulted in a reordering of our social and economic fabric. Around the world, we have seen the dial on connectivity shift sharply from “desirable” to “essential”. The global pandemic has amplified the importance of connectivity for digital, social and economic inclusion, and yet, as with other crises, COVID-19 risks widening inequality. The pandemic has exposed and exacerbated long-standing social and economic inequalities.

Even before the COVID-19 pandemic, there was growing recognition that internet connectivity is foundational to human development. Universal connectivity is a fundamental element of an inclusive and sustainable world – to access education and health care, as well as improve standards of living and overall life satisfaction. One cannot achieve the United Nations Sustainable Development Goals without universal affordable broadband and digital inclusion.

The main three “A” pillars of the digital inclusion are: Access (connectivity – Internet access, which will enable us to receive the information); Affordability (economic power to pay for Internet service and devices) and Accessibility of the ICTs, which enable everyone to understand the information received through whatever digital platforms is developed and delivered.

The International Telecommunication Union (ITU) strives for an inclusive digital society where everyone, everywhere, benefits from the power of digital technology to enable social development and economic growth. To help achieve this aim, ITU focuses on six target groups: children, youth, older persons, girls/women, persons with disabilities and indigenous peoples.

Digital inclusion is urgently needed, by ensuring inclusive, equal access and use of ICTs for all, especially in the face of our current challenges. No one should be left behind. Let us work together and empower everyone, everywhere, to participate in the digital future.



# SARS-CoV-2 pandemic and its implication for Bangladesh

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Bangladesh reported the first case of COVID-19 in early March 2020. Since then, the country has been attempting to control the pandemic using preventive measures for treatment, vaccination and behavior-change strategies. Our attempt has been to work with the Government to facilitate the rapid testing, seroprevalence and immunological studies, as well as design vaccine trials to study effectiveness of vaccines that are being deployed in the country as well as the changing genomic characteristics of SARS-Cov-2. These results show the rising seroprevalence rates to the receptor binding domain of the spike protein, T cell responses and the effect of infection on vaccine take rates. All new genomic variants have emerged in Bangladesh with the Delta variant replacing all others at present. Clinical studies and immunological studies have been carried out and evaluated with reference to each variant that has emerged. Vaccination attempts have led to about 10-14 per cent coverage in the country and attempts to increase vaccination by obtaining vaccines from through COVAX as well as direct purchase or local production have been initiated. The question of herd immunity is still left unanswered based on the limitations of vaccination.

# Achievements in Biotechnology for Improved World Health

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There are many advancements in the application of biotechnology, and in diverse areas such as health and medicine, industry, agriculture, environment and marine systems. This discussion is focused on medical biotech helps to enhance patients' quality of life and alleviate suffering. Here, biotechnology is defined as a direct science that taps the power and potential of biological processes. With this approach, lessons are learnt from the nature of cell activities to make remarkable technologies and products that improve the lives of people. Biological processes have been used for more than 6,000 years to make useful food products, and this potential has increased in the 21st century with more discoveries on cells, characteristics and how they operate and can be applied in many ways, ranging from reducing the ageing process to disease protection. The science of Biotechnology allows us to silence disease and protect our planet. It has led to a new world with the power to extend life, to solve disease and to repair organs.

Some of the key inventions, applications and solutions from biotechnology are highlighted, such as antivirals, growing organs, hyperbaric therapy, nutrition-based AI, gene editing, mRNA and remarkable life extension biotechnology. Through these solutions, hope is available in the form of either treatment, relief or vaccines, depending on the context, for severe conditions and diseases, such as river blindness, cancer, COVID-19, brain haemorrhage, Malaria, HIV and Alzheimer's Disease, to name a few, not to mention the possibility of growing organs.

Some of the scientists whose discoveries made this possible include: Satoshi and his partners for antiviral discoveries, who received the Nobel prize for this in 2015; Emmanuele Charpentier and Jennifer Doudna, who recently received the Nobel Prize in 2020 for what's called the Crispr/Cas9 toolkit.

Based on the progress highlighted, as well as more improvements to come, there is hope for the developing and least developed countries in terms of healthy populations, which can lead to sound development.

# Tackling the pandemic: Towards a healthier, safer and fairer world

**Peter SINGER**

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The pandemic is the worst global health crisis in a century and it has painfully reminded us that health is the foundation of our societies, economies and national security. As of this writing, more than 220 million cases and 4.7 million deaths have been reported to the WHO. Although almost 6 billion vaccines have been distributed, we face an outrageous vaccine injustice: in Africa less than 5 per cent are fully vaccinated, compared to more than 50 per cent in high-income countries. With the G20 Summit in October, and the Special Session of the World Health Assembly in November, the coming months will be a critical period for shaping the governance and finance of pandemic preparedness and response. In this talk, I will address current and key issues in vaccine equity and justice; pandemic preparedness and response; and ways to accelerate and equitable and resilient recovery to the Sustainable Development Goals. Most fundamentally, I will argue that leadership is the ultimate “vaccine” against the pandemic and the other global challenges we face including climate change and injustice.

## Small Brains, Smart minds: From Bees and Birds to UAVs

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Flying insects and birds are remarkably adept at seeing and perceiving the world, and navigating effectively in it. This presentation will describe some of the research in my laboratory on investigating how bees and birds use their vision to guide and control several aspects of their flight such as regulating flight speed, negotiating narrow passages safely, navigating long routes and orchestrating smooth landings, using computational principles that are often elegant and unprecedented. It will conclude with a description of our advances in the design and testing of biologically inspired vision systems for the guidance of autonomous aerial vehicles.

# The COVID-19 pandemic: lessons from Brazil

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As of the end of August 2021, Brazil leads the world in the cumulative mortality rate due to COVID-19, with 268 reported deaths per 100,000 inhabitants and a total of nearly 600,000 deaths. I will review the course of the epidemic in the country using reported cases and deaths, as well as population-based serological surveys carried out by the Federal University of Pelotas that have identified the early dynamics of the epidemic, with remarkably high seroprevalence along the Amazon River. I will also present data on socioeconomic and ethnic group inequalities in morbidity and mortality, with special emphasis on the high risk faced by indigenous populations. The emergence of the Gamma Variant in the Amazon, and more recently the spread of the Delta Variant throughout the country, will be described. The governmental response to the pandemic will also be discussed, particularly in terms of how different decisions during the first months of the pandemic would likely have contributed to reducing its heavy toll on the Brazilian population. Lastly, I will describe the roll-out of vaccinations and its impact on mortality rates. The lessons learned in Brazil are highly relevant to other countries facing the current pandemic, and to how to tackle new emerging pathogens.