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WAMJ

World Asian Medical Journal

Inspirational Asian Healthcare Leader

EDISON LIU

President and Chief Executive Officer,
The Jackson Laboratory (JAX)

BIOPHARMA REPORT I
New SARS-CoV-2 Variants Push Back COVID-19 Vaccine Long-Term Durability Questions

BIOPHARMA REPORT II
COVID-19 Long-Hauler Treatments Could Employ Repurposed Trial Endpoints to Prove Aptitude

SPECIAL REPORT
Medical Korea 2021 - Insight into Global Healthcare and Medical Tourism

OUR EDITORIAL BOARDS

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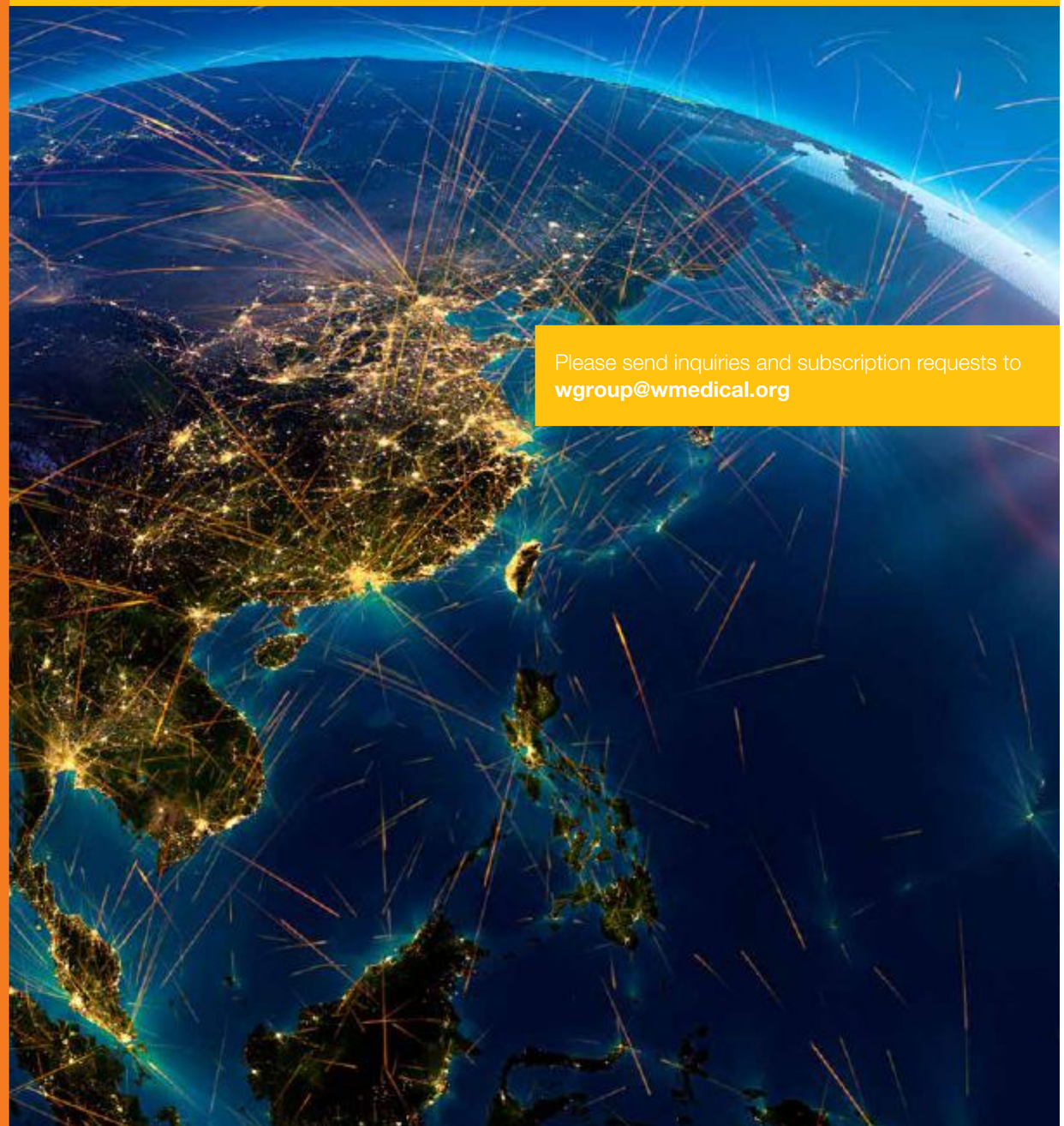
WAMJ
World Asian Medical Journal



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From the Publisher

I recently read a biography of my business partner and mentor, 'Dr. H', a book that made me contemplate how fast time flies and how magical life is. We typically start as a dependent of a household and grow up with people and the environment surrounding us. Then accumulation of incidents, chances, and decisions bring us to where we are today. One may have an idea, a dream, a passion that he/she runs with, jumping over obstacles, tackling problems, and hoping God will support him/her. We put all of our energy into our lives until things start moving. We live every single moment of our lives, and that is what life is about.

The World Asian Medical Journal was launched several years ago. Time has passed and the journal has grown—from one cover story interviewee to more than 20 eminent thought leaders across the globe. The journal grew in reach from a handful of readers to tens of thousands of them issue by issue. We did not have all the knowledge or network from the start; the ingredients for the journal's success were mostly our effort, partially luck, and advice from respected experts.

For this issue, we interviewed Dr. Edison Liu, the President and CEO of The Jackson Laboratory (JAX). He is globally recognized for his accomplishments in cancer biology, particularly his molecular analysis of breast cancer, and for his contribution to the global advancement of human genomics. In the interview, Dr. Liu mentioned, "there isn't a definite path to success but there are traits that he has found in successful people—individuals who are deemed successful over their lifetimes rather than flash-in-the-pan successes. They love what they do. They seek excellence even in the small tasks and can weave a wonderful narrative of this work. They are resilient in that failure does not alter that passion." This message about success was especially inspiring to me, and I am confident that Dr. Liu's story will be an inspiration to all our readers.

This issue also features a special report introducing the upcoming "Medical Korea 2021" conference. This event is being held to share the significance of Korea's advancing medical industry and to discuss the latest global healthcare trends. Our readers can learn more about "Medical Korea 2021" in the special report.

In addition to these two major articles, we have a rich selection of articles and reports which will bring excitement to our readers.

I hope our readers enjoy reading this edition as much as we did preparing it. Stay safe and healthy!

DoHyun Cho, PhD
Publisher
President & CEO of W Medical Strategy Group
Chairman of New York Health Forum

From the Editor-in-Chief

Welcome to the 23rd edition of the World Asian Medical Journal. This issue offers articles on the SARS-CoV-2 variants and their implications for vaccination, repurposed trial endpoints to assess treatments of COVID "long-haulers," and the long-term effects of COVID-related innovation. We present a special report about KHIDI's Medical Korea 2021 as well.

This month we are privileged to present our interview of Edison Liu, M.D., the President and CEO of The Jackson Laboratory (JAX). Founded in 1929, the mission of JAX is "to discover precise genomic solutions for disease and empower the global biomedical community in the shared quest to improve human health." Given those objectives, JAX would have been hard-pressed to find a better leader than Dr. Liu.

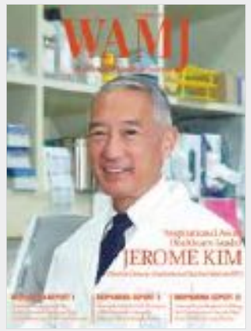
Born into a medical family, it's almost as though Dr. Liu's own genome dictated that he would become a physician. After training in hematology and oncology at Stanford and pursuing postdoctoral studies in the new field of molecular biology, he joined UNC Chapel Hill, founding its School of Public Health's Molecular Epidemiology laboratory. Dr. Liu came to JAX in 2012, where he and his associates have enhanced the lab's already sterling record of innovation and insight. Dr. Liu has long investigated oncogenes and their effect upon treatment and outcomes, pointing out that cancers develop numerous mutations, that themselves change over time. Dr. Liu has also pursued his interest in predictive biology—the prognosis for a given patient's cancer, or for the next pandemic.

As one might guess, Dr. Liu has been showered with honors and accolades. An author of over 300 scientific papers, reviews, and books, he served as president of the Human Genome Organization (HUGO) from 2007-2013, and on the boards of both the American Cancer Society and American Association for Cancer Research, which conferred on him the Rosenthal Award for the discovery that HER-2 status determines response to adjuvant chemotherapy with doxorubicin.

Dazzling though it is, Dr. Liu's CV may not adequately convey, as our interview tries to do, the most moving parts of his story: the impact on his life of influential mentors, his passion for a deeper understanding of cancer biology, his focus upon relieving the sufferings of patients, especially those with breast cancer, and his "determination to always 'do Good.'" Enjoy.

Joseph P. McMenamin, MD, JD, FCLM
Editor in Chief
EVP of W Medical Strategy Group

WAMJ Recap of the Last Issue



COVER STORY
Jerome Kim, M.D., Director General, International Vaccine Institute (IVI)

Dr. Jerome Kim is an international expert on the evaluation and development of vaccines, and he currently serves as the Director General of the International Vaccine Institute (IVI) in Seoul, South Korea. Formerly, he was the principal deputy and chief at the Laboratory of Molecular Virology and Pathogenesis at the Military HIV Research Program. He also served as the project manager for the HIV Vaccines and Advanced Concepts Evaluation Project Management Offices. He led the Army's Phase III HIV vaccine trial (RV144), the first demonstration that an HIV vaccine could protect against infection. Throughout his career to date, Dr. Kim has authored over 250 publications and received the John Maher Award for Research Excellence. To learn more about Dr. Kim, please refer to issue 22 of the WAMJ.

BIOPHARMACEUTICAL REPORT I
Aurinia's Voclosporin Has Nephrotoxicity Concerns That Could Minimize First-Line Potential for Lupus Nephritis Patients

Aurinia Pharmaceutical's voclosporin has potential long-term nephrotoxicity concerns that could preclude widespread first-line use in lupus nephritis (LN) until extended safety data becomes available. Although the mode of action indicates that there is first-line treatment potential for patients with elevated proteinuria risk, some experts countered this view, noting that the mechanism of action means there will be no significant nephrotoxicity concerns and that voclosporin will likely serve as a second-line treatment. Some agree that a lack of extended safety data will likely preclude many nephrologists from considering voclosporin as a first-line therapy until more data becomes available. To read more about Aurinia Pharmaceutical's voclosporin, please refer to issue 22 of the WAMJ.

BIOPHARMACEUTICAL REPORT II
Fate and Celyad's CAR Therapies Offer Potential to Amplify Efficacy With Multiple Doses

Fate Therapeutics' and Celyad's natural killer (NK) cell biology-focused cell therapies could overcome cell persistence challenges and consequent efficacy concerns with redosing strategies. One of Fate's lead products, FT596, is an allogeneic, multitargeted, chimeric antigen receptor NK cell product. Celyad's autologous and allogeneic are CAR T cell products using NK cell specificity to target T-cells. The potential to redose allogeneic products is viewed as a key item to consider while assessing clinical potential. While the clinical data establishing additive efficacy advantages of giving multiple doses is still preliminary, redosing allogeneic products could increase their expansion and persistence. To learn more about Fate and Celyad's CAR Therapies, please read issue 22 of the WAMJ.

BIOPHARMACEUTICAL REPORT III
Lessons From Bergamo: Halting the Complement Cascade May Stop COVID-19 in Its Tracks

Research results from Bergamo, Italy, the epicenter of COVID-19 in Europe, brought up the speculation that treatments for COVID-19 may have been focusing on the wrong elements of the disease. Physicians at Bergamo realized that COVID-19 is an endothelial injury rather than a pulmonary event and that stopping the complement cascade can have a significant effect on the escalation of symptoms during a patient's illness. Research showed co-deposition of virus spike points along with complement in the damaged vessels, which leads to activation of MASP2. Consequently, the virus can directly activate MASP2 and this finding emphasizes the role of complement in COVID-19. To read more about the COVID-19 research at Bergamo, please refer to issue 22 of the WAMJ.

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Dr. Liu in a laboratory at the Bar Harbor JAX campus

Inspirational Asian Healthcare Leader

Edison Liu, M.D.

President and Chief Executive Officer, The Jackson Laboratory (JAX)

1. Dr. Edison Liu, you have been recognized for your contributions to cancer biology, particularly the molecular analysis of breast cancer, and to the global advancement of human genomics. Can you share with our readers what motivated you to become a physician and to specialize in the functional genomics of human cancers?

- I have always wanted to be a physician since I was five years old. Both my parents were physicians, as were uncles and aunts, and my only brother is also a physician, so you can say it's a family vocation. However, the deviation from this family tradition was when I decided to go into research and academics. In medical school, I was considering cardiovascular surgery or cardiology as a specialty until I encountered a remarkable teacher by the name of Dr. Saul Rosenberg, who was then the chief of oncology at Stanford University. He was a world-renowned lymphoma expert who pioneered the curative treatment of Hodgkin's disease. His knowledge and reputation were superior, but it was his demeanor as a compassionate healer that drew me to the discipline. Despite the grueling nature of the treatments that often were not successful, Saul had more impact on patients' sense of well-being than the heart surgeon who could technically restore health more definitively. This was because of his ability to connect with his patients and to project caring with competence. He taught me the technical knowledge to optimally treat cancer patients, but equally importantly, he showed me how my persona as a physician can make a difference to the comfort and security of my patients and their families. When Saul Rosenberg asked me to continue my training in oncology with him at Stanford, I readily agreed.

Throughout my medical training, I always thought I would end up practicing medicine. However, it was also during my oncology training that I found that the knowledge of medicine, about how cancer started and why the drugs work in some and not other malignancies, was surprisingly rudimentary. Everything seemed uncomfortably empirical and without secure theoretical grounding. At the close of my medical training, I decided to take a detour from the practice of medicine to explore the new field of molecular biology as it was being applied to answer fundamental questions about cancer. Another great mentor then entered my life: Dr. J. Michael Bishop at the University of California at San Francisco. Mike is well known because he won the Nobel Prize in 1989 for his discovery of oncogenes. It was in his lab that I investigated the oncogenes that start cancers. From that work, I published a seminal paper showing that a specific mutation in the K-ras gene was present in a premalignant disorder (preleukemia). This work launched my academic career as a faculty member at the University of North Carolina at Chapel Hill Lineberger Cancer Center. My research was focused on the discovery of oncogenes in human cancers and investigating their function in the treatment and outcomes of cancer patients. I began the laboratory of Molecular Epidemiology at UNC's school of public health and moved into the field of population-based somatic genetics. In 1996, I was then asked to lead the Division of Clinical Sciences as scientific director at the National Cancer Institute (USA), and it was there that I used genomic technologies to interrogate the clinical meaning of the expression profiles of human cancers which was the basis then of function genomics. Genetics is the study of individual genes and their function; genomics is the study of how all genes work to generate a biological output or outcome. Functional genomics goes beyond the DNA sequence, focusing on how the genetic workhorse, RNA expression, is configured to explain state changes such as from benign to malignant, from undifferentiated to differentiated cells, from an egg to an embryo. It was at the National Cancer Institute (NCI) that I began my conversion to become a genomicist.

Dr. Liu at the 2019 Healthcare Forum at The Jackson Laboratory for Genomic Medicine in Farmington Connecticut

In 2001, my conversion was complete when the Singaporean government asked me to start the Genome Institute of Singapore (GIS) as the foundation for genomic sciences for the country. We focused on using genomic tools to explain human disease in the Asian context. Because the field was young, we contributed to

developing new technologies such as ditag[1] approaches to understand distant chromatic interactions. As the founding executive director of the GIS, I was able to recruit a wonderful group of both Singaporean and overseas scientists to bring genomic technologies to the country and to build the GIS into one of the top powerhouses of genomics in all of Asia.

Finally, at The Jackson Laboratory (JAX), I was able to bring deep genomic and computational platforms to mouse genetics and murine models of human disease. This moved us to yet another level of analysis, a systems genomics approach to bring a greater resolution to complex mechanisms of disease. Through it all, and to this day as President and CEO of The Jackson Laboratory, I have continued my personal research into this system's logic of breast cancer genomics. I have been extremely fortunate to have had such a rich experience in science and medicine.

Dr. Liu spoke at a conference focused on molecular mechanisms of cancer therapy in Cadenabbia, Italy in 2019. His talk was titled: "Genomic Configurations Define a Cancer State: Tandem Duplicator Phenotype"

2. The Jackson Laboratory (JAX) is an independent, nonprofit biomedical research institution, which has now become a major international research center for complex genetics and genomics. As the President and CEO of the JAX, please share with our readers the JAX's mission and operations. What do you envision for the future of the JAX and how do you hope to contribute?

> "At The Jackson Laboratory (JAX), I was able to bring deep genomic and computational platforms to mouse genetics and murine models of human disease"

- JAX is a unique organization that started in 1929 as a small research institution focused on the new discipline of genetics, using the mouse as a model system for cancer genetics; JAX pioneered the use of mice in disease research, and our research have led to key medical breakthroughs ever since. We were the place that generated many of the commonly used mouse strains; we discovered the first sign that a pluripotent stem cell existed; we identified the viral transmission of an oncogenic virus that causes breast cancers in mice; we uncovered the genetic roots of tissue rejection for which one of our senior scientists, George Snell, received the Nobel Prize in 1980; and we found the biochemical cause for obesity. Over the years, as a not-for-profit, not only did we uncover important genetic discoveries, but we also progressively became a key provider of research mice for all of North America, and now the world. Therefore, our mission is a bipartite one: To discover precise genomic solutions for disease and empower the global biomedical community in the shared quest to improve human health. We are unique because of the focus and scale of our work. Our focus is on complex genetics and functional genomics to explain human disease using two model systems, the human and the mouse. The scale is found in the 2,500 staff at JAX who share this focus.

With these capabilities, we integrate computational, genomic, and experimental approaches and iterate towards predictive biology. This means we wish to predict clinical outcomes more precisely using individual genomic, and epigenetic profiles. Because the majority of human diseases are disorders of entire systems rather than single cells, this systems approach will be the only way to resolve biological complexity.

*1 Also known as paired-end tags (PET) sequencing; it refers to a short DNA sequence that is unique enough to identify a particular segment of the genome (Dawson et al., 2019)

Dr. Liu at the 2016 JAX Board of Trustees farewell dinner with trustees Richard S. Gurin and Charles E. Hewett, Ph.D. Gurin is now a Trustee Emeritus and Hewett, former EVP and COO of JAX, currently serves on the Board of Trustees

3. As an internationally esteemed physician and scientist with decades of experience, you have served on many notable committees and advisory boards. You have been a member of the American Association for Cancer Research (AACR) Board of Directors since 2018 and you were recently designated as a member of the board of directors for the American Cancer Society (ACS). What are the major challenges that current cancer research faces and what advancements do you foresee to conquer these challenges in the next 10 years?

- When oncogenes were discovered, we thought that the cure for cancer was in sight now that we knew the genetic causes of cancer. Though we found new therapies, the cure remained elusive. This is because of the major challenge in cancer research—its genetic complexity. Even though a few genetic mutations may initiate a malignancy, each cancer ultimately has a multitude of genomic mutations by the time it emerges clinically. Though there are genetic similarities among some tumors, there is not one tumor that is identical to another. Moreover, these mutations change overtime and like the changes in the SARS-CoV2 virus that cause the COVID-19 pandemic, these mutations alter the virulence and the resistance to therapy of any cancer.

The big question is how to fight something so complex and ever-changing. The first step is to be able to detect all the components of the complex system. In this step, genomic sequencing and accompanying analytical capabilities are essential in identifying each and every important oncogenic element. The second step is acquiring knowledge of the biological meaning of each mutation. This requires knowledge of each gene's function, which comes from basic research and will be an ever-continuing effort. The third step is gaining the ability to use this information about gene mutations and gene functions to create a virtual model of tumor behavior, including projecting evolutionary changes when the cancer is subjected to therapeutic interventions. This kind of systems genomics has not yet been achieved and is what The Jackson Laboratory seeks to do.

4. You led the scientific response for the country of Singapore for the SARS crisis in 2003, introducing several key measures to strengthen Singapore's pandemic management capabilities. How have the lessons learned from and the measures taken during the SARS outbreak informed our response to COVID-19? With COVID-19 presenting a greater challenge globally, how are you seeking answers to the many unknowns of the pandemic?

- I wrote an op-ed for *The Straits Times* of Singapore on November 23, 2020, that touched on Singapore's excellent current response to COVID-19 and its relationship to what we learned in 2003. We encountered a major epidemic challenge in 2003 that our generation had not experienced before, so the public health infrastructures of most countries, including Singapore, were not prepared. However, Singapore mobilized its resources and efficiently organized them around scientific principles. With each successive epidemic, such as the H5N1 and H1N1 influenzas, Singapore exercised the infrastructure and improved as a learning system, so that when COVID-19 hit, Singapore was ready and so was China. The first and most important step was to understand the pathogenic cause. Sequencing (genomics) showed that the epidemic was caused by a coronavirus akin to SARS. The sequence was then relayed to all health agencies throughout the world by our Chinese scientific colleagues. Everything, from the diagnostics to the formulation of the vaccines was based on the dissemination of the SARS-CoV2 viral sequence.

How do we "predict" future pandemics? The answer is the same as predicting tumor behavior; it is the challenge of predicting the behavior of a complex system. We need a great amount of data and the ability to use this data to create a model behavior—no different from modeling global weather systems to predict local weather conditions.

Actor Patrick Dempsey, founder of the Dempsey Center - an organization that provides free quality of life care to people impacted by cancer - and members of the Center's team, visited with Dr. Liu in 2016

5. Dr. Liu, you have extensive publications and authorship in over 300 scientific papers, reviews, and books. As an opinion leader whose scientific investigations span molecular epidemiology to molecular biochemistry of humans, what do you think are current necessities and urgencies in these fields? How does your projection affect your research?

- In the past, the works of a few individual brilliant scientists were sufficient to drive innovation in medicine. Individual brilliance still is important but cannot be the only force to advance the field. The urgency today is how to collate all these efforts into a cogent information system so that we can mine the collective wisdom. This means standard data formats and mandatory data submissions. The scale of the data is such that no single lab can handle the onslaught. There need to be national and global efforts.

This new reality is what JAX is preparing for, and it is in this new reality that JAX will further strengthen its role as a global leader.

6. Many of our readers will find your path to be an inspiration. Could you please share a message for future physicians and healthcare professionals that aspire to exceptional careers and accomplishments?

- As I mature in my profession, I have found this question a difficult one to answer. There isn't a definite path to success but there are traits that I have found in successful people—individuals who are deemed successful over their lifetime rather than a flash-in-the-pan success. They love what they do. They seek excellence even in the small tasks and can weave a wonderful narrative of this work. They are resilient in that failure does not alter that passion; they are realists and will change course when facts tell them their plans are futile, and they are unbelievably adaptable. It is the convergence of contradictory traits, the balancing of opposing proclivities that seems to be the core to success in scientific (or any other) endeavors—detailed but comprehensive, steadfast but flexible, always able to tell a compelling story.

Finally, the one unifying force that has guided me is my determination to always "do good." No matter what I am doing, regardless of how big the task is, whether I'm helping my kids or building an institute, I always seek to do good. This has been my North Star that has guided me to whatever success I have achieved and has given me personal contentment. W

Edison Liu, M.D.

President and Chief Executive Officer, The Jackson Laboratory (JAX)

Edison Liu, M.D., is the president and CEO of The Jackson Laboratory, an independent research institute focused on complex genetics and functional genomics with campuses in Maine, Connecticut, and California. Previously, he was the founding executive director of the Genome Institute of Singapore and the president of the Human Genome Organization (HUGO). He was also the scientific director of the National Cancer Institute's Division of Clinical Sciences in Bethesda, MD, where he was in charge of the intramural clinical translational science programs. In his earlier career, Dr. Liu was a faculty member at the University of North Carolina at Chapel Hill, where he was the director of the UNC Lineberger Comprehensive Cancer Center's Specialized Program of Research Excellence in Breast Cancer; the director of the Laboratory of Molecular Epidemiology at UNC's School of Public Health; and the Chief of Medical Genetics. Dr. Liu is an international expert in cancer biology, systems genomics, human genetics, molecular epidemiology, and translational medicine. Dr. Liu's own scientific research has focused on the functional genomics of human cancers, particularly breast cancer, uncovering new oncogenes, and deciphering on a genomic scale the dynamics of gene regulation that modulate cancer biology. He has authored over 320 scientific papers and reviews and co-authored two books. He obtained his B.S. in chemistry and psychology, as well as his M.D., at Stanford University. He then received his residency and fellowship training at Washington University, St, Louis, and Stanford, and post-doctoral training in molecular oncology at the University of California at San Francisco.

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SPECIAL REPORT

Medical Korea 2021 – Insight into Global Healthcare and Medical Tourism

The upcoming "Medical Korea 2021" conference is being held virtually to share Korea's advancing medical industry and to discuss the latest healthcare trends and forecasts. Here is everything you need to know about the brand "Medical Korea" and its 2021 conference.

About Medical Korea and KHIDI

Since 2009, Korea has been promoting its medical competitiveness and established a national medical brand titled "Medical Korea" to represent the excellence of Korea's medical services. Over the past decade, more than 2.76 million visitors from 198 countries around the world visited Korea to experience medical services. Also, Korea has provided a medical training program for international medical professionals from around the world, sharing and expanding the Korean medical system and resources across the world.

The Korea Health Industry Development Institute (KHIDI) is a Korean government-affiliated institution that provides systematic and professional support for the improvement of public health and enhancement of international competitiveness in the health industry. Over the past decade, KHIDI has been promoting Medical Korea and the development of Korea's healthcare industry around the world. This year, to further support Medical Korea, KHIDI is organizing the "Medical Korea 2021" conference, hosted by Korea's Ministry of Health and Welfare (MoHW).

About Medical Korea 2021 Conference

Medical Korea 2021, the 11th Global Healthcare and Medical Tourism Conference, will be held virtually from March 18th – 24th. The link can be found on the Medical Korea 2021 website (https://www.medical-korea.org).

With the theme "Global Healthcare, Where Your Days Begin Again," the conference will bring together academic and industry experts from around the world to analyze and share insights on the latest healthcare industry trends. The event will provide opportunities for business networking among stakeholders in the global healthcare industries. Also, Korea's treatment cases for severe illnesses and the trend of digital healthcare will be introduced, recognizing Korea's medical treatments.

Moreover, Medical Korea 2021 will be held together with KIMES, Korea's largest medical and hospital equipment exhibition. Therefore, the conference will also allow participants to take a glance at current trends in the global medical device industry.

The conference will begin with opening remarks by Deok-cheol Kwon, the Minister of Health and Welfare, followed by a keynote speech by Stephanie Allen, PhD, the Global Healthcare Leader at Deloitte, on the topic "The Challenges of the Global Healthcare Industry After COVID-19."

The opening will be followed by a panelist discussion session titled "Changes and Prospects of the Global Healthcare Market." In this session, experts will cover various trends and changes in the recent healthcare market, discussing areas that cover the general topic of the conference. The panel will be led by the moderator, Joseph McMenamin, MD, JD, EVP of W Medical Strategy Group and a medical law expert. Panelists with in-depth of knowledge of different fields will come together to share their insights: a media Principal with a specialty in healthcare, a healthcare intellectual property expert, and a life sciences advisory expert.

Photos from Medical Korea 2019

To address the session's main topic, the panelists will discuss points related to trends in global healthcare, market diversification, policy comparison and countermeasures in 2021 and post-pandemic. The session will bring the following questions to our attention—What are the changes in investment trends regarding vaccines, diagnostics, and respiratory as a category? What have we learned from the record breaking vaccine development process and how will that impact future product development processes? How were digital health and medical tourism impacted and will they re-shape the future? How were pharmaceuticals, med-tech industries, and their policies influenced? What changes have we faced in drug pricing?

Including session 1, there will be a total of 11 sessions throughout the conference. There will be sessions that further discuss topics in global healthcare including trends in medical tourism, global healthcare policies, and digital health trends. Other sessions will be composed of insights shared by experts in the medical field and academia, discussing the latest medical technologies, therapies, and their position in global health in the era of COVID-19. There will also be special sessions that discuss Korea's medical advancement, especially in the treatments of severe illnesses and medical training.

by WAMJ Editorial Team

Registration is required.
Please check the online streaming schedule on the website.

Conference

Session	Topic
	Global Healthcare
Keynote talk	The Challenges of the Global Healthcare Industry After COVID-19
1	Changes and Prospects of the Global Healthcare Market
2	Trends and Strategies of Medical Tourism Marketing for the Post COVID-19 era
3	Global Healthcare Policy & Management Forum: "Emerging issues in the medical tourism market during COVID-19 pandemic"
4	The 8th Global Strategic Forum : Global Digital Healthcare Trends and Successful case of K-Digital Healthcare
	Academic Exchange
5	Korea-China Academic Exchanges : Related to the latest medical technology in the field of severe diseases
6	Changes to the dental care environment of various countries before, during, and after the COVID-19 pandemic
7	The latest physio-therapeutic technology to strengthen global competitiveness
8	The present and future of innovative non-face-to-face medical technology in the post-pandemic era
	Special Sessions
9	Korea as a destination for patients from all over the world
10	Korea, the center of training and clinical experience
11	K-medical : bringing the excellence in medical treatments

Side Events

Medical Korea exhibition

- Exhibition: Medical institutes, Local governments, Relevant organizations

Business meeting

- Business Meeting between international (including Korean) buyers
  and sellers in global healthcare business

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Biopharma Report

BIOPHARMACEUTICAL REPORT I

NEW SARS-COV-2 VARIANTS PUSH BACK COVID-19 VACCINE LONG-TERM DURABILITY QUESTIONS

BIOPHARMACEUTICAL REPORT II

COVID-19 LONG-HAULER TREATMENTS COULD EMPLOY REPURPOSED TRIAL ENDPOINTS TO PROVE APTITUDE

BIOPHARMACEUTICAL REPORT III

INNOVATIONS FORGED IN THE COVID CRUCIBLE WILL RESHAPE MEDICINE

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Asia Pacific Leading CRO with One-stop Network Solutions

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- GCLP Central Lab
- Imaging Core Lab
- CRDMO, K-BIO CSO Acceleration
- CDISC Gold Member, SDTM/ADaM Formatting
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New SARS-CoV-2 Variants Push Back COVID-19 Vaccine Long-Term Durability Questions

Long-term COVID-19 vaccine durability has become less of an endgame since it has become increasingly likely additional shots will be needed after initial vaccination to combat new SARS-CoV-2 variants, experts said. However, it is unclear if the current crop of authorized vaccines needs immediate adjustment to combat the new variants first identified in Brazil, South Africa and the UK, they noted.

With the growing prevalence of more transmissible SARS-CoV-2 variants—P.1, B.1.351 and B.1.1.7 in Brazil, South Africa and the UK, respectively—there is heightened concern authorized COVID-19 vaccines may need to be modified for public administration, including in people who already have been vaccinated. In a news conference yesterday (10 February), South Africa health minister Zweli Mkhize said it is considering swapping or selling its University of Oxford and **AstraZeneca's** (LON:AZN) AZD1222 doses for **Johnson & Johnson's** (NYSE:JNJ) JNJ-78436735 due to AZD1222's minimal effect against mild-to-moderate COVID-19. In the US, the FDA is evaluating frameworks based on the regulatory process involved in approving annual influenza vaccines, and the UK government is working with pharmaceutical companies to develop COVID-19 vaccines against future variants.

Addressing new variants has become more of a priority because there are signs SARS-CoV-2 selection pressure can reduce vaccine efficacy, experts said.

However, some countries are still grappling with the original variant these vaccines were based on, experts noted. Additionally, authorized COVID-19 vaccines trigger a high level of neutralizing antibodies and high protection rates, so some reduction may not dramatically decrease the vaccine's present value, particularly during a pandemic, they added. In contrast, there is still limited information about whether waning durability is an immediate concern, they said.

SARS-CoV-2 does not mutate as quickly as the influenza virus, which means it is unlikely to change as often as once per year after this year's variants of concern are addressed, experts said. If a new version of an authorized vaccine must be produced, it would likely only need noninferior immunogenicity data versus its older version, they added. This puts vaccines yet to be authorized at a disadvantage, in addition to the added complication of the new variants potentially dampening forthcoming protection data from ongoing registrational trials, some said.

Some evidence B.1.351 decreases vaccine efficacy

Between the recently identified, more transmissible variants and the potential for low durability, the former is a more pressing concern, because information shows the new variants can impact vaccine efficacy, said Richard Webby, PhD, director, World Health Organization (WHO) Collaborating Center for Studies on the Ecology of Influenza in Animals and Birds, Memphis, Tennessee. On 29 January, Johnson & Johnson, which did not respond to a request for comment, announced the Phase III ENSEMBLE trial (NCT04505722) investigating single-dose JNJ-78436735 showed a 66% efficacy rate in preventing moderate-to-severe disease, but only 57% in its South Africa cohort, where 95% of all cases were due to the B.1.351 variant.

On 28 January, **Novavax** (NASDAQ:NVAX) reported a double dose of NVX-CoV2373 had 60% efficacy in the South Africa Phase IIb trial (NCT04533399), where 90% of infection events were from B.1.351. The result in the UK Phase III trial (NCT04583995) was 29.3 points higher. Novavax is aiming to develop vaccines offering both durability and breadth of protection, a spokesperson said. With new variants, there may be a higher likelihood of a longer-term need for potential additional vaccine administrations and modified COVID-19 vaccines, said a spokesperson for **Pfizer** (NYSE:PFE), which collaborated with **BioNTech** (NASDAQ:BNTX) on Comirnaty (BNT162b2).

"Addressing new variants has become more of a priority because there are signs SARS-CoV-2 selection pressure can reduce vaccine efficacy"

COVID-19 vaccine durability still has many unknowns, Webby added. There are two theories on how long COVID-19 protection could last, noted Kevin Maki, PhD, chief scientist, Midwest Biomedical Research, Addison, Illinois. Protection against common coronavirus infection lasts for a few months, but in severe acute respiratory syndrome (SARS) and Middle East respiratory syndrome (MERS), postinfection neutralizing antibodies are present many years later, he explained. This contrast could be because common coronaviruses affect the upper lung, while SARS and MERS proliferate in the lower lung, he explained. However, in COVID-19, SARS-CoV-2 can be present in both lung regions, Maki added.

mRNA vaccines such as **Moderna's** (NASDAQ:MRNA) are encouraging for long-term durability, said Dr Peter Palese, professor, Department of Microbiology, Icahn School of Medicine, Mount Sinai, New York. Among companies with authorized vaccines in the US or EU, Moderna is the only firm with immunogenicity results for as long as 90 days. In its Phase I trial (NCT04283461), neutralizing antibodies declined slightly but remained elevated for the 100μg dose in 34 volunteers (Widge, A, et al., N Engl J Med, 2021 Jan 7;384(1):80–82).

It is unclear if this neutralizing antibody data could be a surrogate for vaccine-triggered immunological memory, said Dr Edward Belongia, director, Center for Clinical Epidemiology and Population Health, Marshfield, Wisconsin. This data may also be hard to extrapolate to other vaccines, even other mRNA vaccines, Webby added. Comirnaty is the other authorized mRNA vaccine.

Uncertainty around when authorized vaccines need a makeover

Both new variants and low durability may warrant changes in authorized vaccines, added Belongia. However, having to modify authorized vaccines to accommodate P.1, B.1.351 and/or B.1.1.7 may be premature, Palese said. While AstraZeneca and the University of Oxford did not respond to a comment request, 8 February media reports state AstraZeneca will likely have a modified version of AZD1222 to combat B.1.351 by this autumn. More data is needed to assess whether the new variants change SARS-CoV-2 spike protein's ability to enter its host, which is the primary reason to refresh vaccines, said Ciro Leonardo Pierri, PhD, spike protein researcher, Department of Biosciences, Biotechnologies and Biopharmaceutics, University of Bari, Italy.

In countries where the new variants are not yet dominant, modifying the current vaccines to address the new strains may be unnecessary, Webby noted. The Pfizer spokesperson said studies needed to evaluate a

vaccine with an updated viral antigen have yet to be determined, in agreement with regulators. Moderna, which did not respond to a request for comment, stated on 25 January it is advancing mRNA-1273.351, a booster to address B.1.351.

It is unclear if vaccinating a certain number of the population would prevent the new variants from spreading, because such a preventive approach requires a borderless vaccination effort, said Dr Susan Buchbinder, director, Bridge HIV, San Francisco Department of Public Health. In It may be wiser to develop vaccines specifically targeting predominant variants instead, she noted.

Additionally, there may be other factors such as country-specific volunteer profiles dulling vaccine efficacy in South Africa, which can extend beyond the new variants, making B.1.351's true impact nebulous and perhaps lacking relevance in countries like the US, Palese said. According to the US Centers for Disease Control and Prevention (CDC), there were 932 B.1.1.7 cases as of 9 February, but only 34 states were reporting, and the US is reportedly well behind other developed countries in sequencing infections.

Moderna's and Pfizer/BioNTech's respective FDA-authorized vaccines lead to a high level of neutralizing antibody titres, which could still lead to acceptable protection levels even with some decrease, Palese said. In a study investigating sera from 20 individuals vaccinated with Pfizer/BioNTech's Comirnaty, titres against B.1.351 were 0.81–1.41-fold lower compared to the original virus (Xie, X, et al., BioRxiv. https://doi.org/10.1101/2021.01.27.427998). Study authors pointed out a four-fold decrease is needed to modify influenza vaccines. Moderna stated its mRNA-1273 triggered a six-fold reduction of neutralizing antibody titres with B.1.351 relative to prior SARS-CoV-2 variants, although such titres remain above levels expected to be protective.

However, there is still no correlative data between immunogenicity and protection. Nonetheless, even if protection drops 15 points, for example, it would still be valuable, Pierri noted. Moderna's and Pfizer/BioNTech's vaccines currently have protection of more than 90%.

COVID-19 vaccine amendment unlikely to be as often as in influenza

While modifications to authorized vaccines may be needed this year to deal with the newly identified more transmissible variants, in the long term, vaccine changes may not be as frequent as in influenza. Influenza mutations manifest more quickly because replication mistakes are not corrected, while SARS-CoV-2 has systems in place to correct replication errors, Webby explained.

On 4 February, the FDA stated it will utilize influenza experience to inform a path forward with the SARS-CoV-2 variants. This is based on influenza and COVID-19 vaccines featuring parts of their respective viruses, specifically those which undergo selection pressure, Webby said.

For changes to influenza vaccines, three factors are considered, and these could be used in COVID-19, Webby said. The first is sequencing information of new strains, he noted. WHO has the Global Influenza Surveillance and Response System, which features more than 100 laboratories worldwide and can also be used to monitor SARS-CoV-2, he noted. A **CureVac** (NASDAQ:CVAC) spokesperson said it has recently entered a collaboration with the UK government's Vaccine Task Force related to virus mutation surveillance and virus genomics.

The other two factors are related to laboratory testing of antigenic information and the current vaccine's efficacy in the community, Webby said. The challenge

> "In countries where the new variants are not yet dominant, modifying the current vaccines to address the new strains may be unnecessary"

with the former is the relatively limited information on SARS-CoV-2 variants versus rich data from the many influenza strains, he added. SARS-CoV-2 is a strain of the coronavirus family. Assessing vaccine effectiveness in public vaccination campaigns may also be difficult, as they are dependent on the number of people seeking medical care and counting how many of those received the vaccine, which is time consuming and not ideal for an ongoing pandemic, Palese said.

With authorized COVID-19 vaccines, consistent immunogenicity data between old and new versions may be enough to maintain authorization, giving authorized vaccines an advantage over vaccines without regulatory support, Webby said.

Out of the different vaccine technologies, mRNA vaccines have the benefit of being straightforward to produce and manufacture, this news service reported on 16 April. This may give the technology the advantage in adjusting to the new variants, experts added. There are currently no pressing concerns about potential long-term side effects relating to of repeated vaccine technology use, experts said. However, mRNA vaccines are more reactogenic, which precludes their overall use in very old people, who may be at risk of a serious health impact due to this side effect, Palese said.

Reynald Castaneda
Reporter, London

Reynald Castaneda, prior to moving to London, was a journalist for healthcare newspaper New Zealand Doctor, covering primary care health politics and medical research. He has a BSc in Biological Sciences from the University of Auckland and a postgraduate diploma in journalism from AUT University. Prior to venturing into journalism, Reynald worked as a laboratory technician for Massey University's Institute of Molecular Biosciences.

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Jane's Journey: The Rare Disease Landscape From a Mother's Perspective

When Jane discovered that her 15-month-old son had the autoimmune disorder Histiocytosis, suddenly she was forced to navigate the complex and unfamiliar terrain of what she called "rare disease land."

She began her journey with questions. The answers were not straightforward. Jane needed compassionate experts to translate the complex clinical language and guide her family through the steps. Fortunately, she connected with doctors who didn't define her son by his disease, as well as with advocates who provided resources for understanding and navigating the clinical landscape.

Over time, Jane became part of the support network, and now serves as a board member of the Histiocytosis Association, helping others who seek guidance for their own journeys.

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BIOPHARMA REPORT II

COVID-19 Long-Hauler Treatments Could Employ Repurposed Trial Endpoints to Prove Aptitude

COVID-19 long-hauler treatment trials will likely rely on established endpoints and trial design features used in other conditions, and will be based on a specific group of symptoms to prove clinical utility, experts said.

COVID-19 long-haulers, or long COVID, are terms used to encompass patients experiencing long-term symptoms in the months after a SARS-CoV-2 infection, including fatigue, as well as respiratory and cognitive complications. A growing number of such cases has prompted research efforts, mostly from academia, including large observational studies and some therapeutic studies.

Rather than starting from the beginning, experts expect the field to exploit endpoints and trial design features from other conditions with similar symptoms, like chronic fatigue syndrome (CFS) and myalgic encephalomyelitis (ME). Endpoints like the six-minute walk test (6MWT) for respiratory symptoms and executive function scores for neurological symptoms are also rational choices, experts added. One recently initiated long-hauler trial, **PureTech Health's** (LSE:PRTC) Phase II study (NCT04652518) of LYT-100 (deupirfenidone), uses the 6MWT as its primary endpoint. The trial has a planned primary completion date in August, according to ClinicalTrials.gov.

Still, the lack of any standardized definition to classify patients and the wide variability of symptoms make targeting the ideal patient population for COVID-19 long-hauler treatments particularly challenging, experts said. Additionally, limited data on the potential correlation between acute symptom severity and long-term presentation of symptoms following infection further complicate the trial design process, they added.

Patients may need to be stratified based on their prior hospitalization history and comorbidities to ensure an efficacy signal is not lost, some experts said. However, neurological symptoms in hospitalized and nonhospitalized patients appear to be anecdotally similar and likely have similar underlying mechanisms, two intensive care unit (ICU) clinicians added.

The FDA recognizes patients who have recovered from COVID-19 infection may have residual clinical symptoms, and will continue to work closely with sponsors and researchers to design appropriate development programs to address COVID-19, an agency spokesperson said. The NIH has also launched a 900-patient longitudinal trial (NCT04411147) to study COVID-19 sequelae and immunity.

Diverse symptoms prompt various design considerations

There is no consensus on how to best define COVID-19 long-haulers, said Dr Peter Rowe, director, Children's Center Chronic Fatigue Clinic, Johns Hopkins University, Baltimore, Maryland. Given the range of symptoms, the endpoints for such trials need to be tailored to the outcome a therapy can change, he said. However, the commonalities between ME/CFS and long-term COVID-19 symptoms help in deciding outcomes for long-haulers trials without having to start over from the beginning, he added. Still, while repurposing existing measures is efficient, they need to be validated in the COVID-19 context, said former FDA employee Laurie Burke, founder of the pharma consultancy firm LORA Group, Royal Oak, Maryland. For example, patient-reported outcome (PRO) questionnaires in CFS may ask about the patient's ability to perform specific activities and how fatigue impacts them, Burke said. However, whether the specific scale is appropriate for the level of fatigue seen in COVID-19 is unknown, she said.

One important takeaway from ME/CFS trials is the way studies need to have a large sample size,

> "Experts expect the field to exploit endpoints and trial design features from other conditions with similar symptoms"

which allows evidence of modest but clinically important improvements to be collected, Rowe said. Rowe referred to fibromyalgia trials as a potential benchmark for appropriately powered studies in terms of appropriate trial size. **AbbVie's** (NYSE:ABBV) Savella (milnacipran HCL) received an FDA approval in 2009 based on a Phase III 2,084-patient study following a 125-patient Phase II trial.

The deupirfenidone study is enrolling 168 patients with postacute COVID-19 respiratory complications who were treated with, but no longer require, mechanical ventilation, extracorporeal membrane oxygenation, noninvasive ventilation (eg CPAP or BiPAP), high-flow nasal oxygen therapy, or a combination thereof. The trial was powered to capture change in 6MWT based on emerging data from COVID-19 patients and historical data from severe acute respiratory syndrome, said a PureTech spokesperson, adding the study is powered while keeping in mind the inherent variability in the 6MWT.

Deupirfenidone is intended to address the disease's long-term respiratory complications and related sequelae. Typically, lung function measured by forced vital capacity is used to assess efficacy in respiratory disorders like idiopathic pulmonary fibrosis, but is known to already be reduced in hospitalized COVID-19 patients and is expected to naturally recover with time, said deupirfenidone investigator Dr Toby Maher, director, Interstitial Lung Disease program, Keck School of Medicine of USC, Los Angeles. Moreover, spirometry measurements have been difficult during the pandemic due to the inherent risk of spreading viral particles. Muscle strength, cardiovascular disease, respiratory disease and general fitness influence 6MWT results, which may improve naturally in patients after hospital discharge, Maher said. However, an investigational drug will likely have a large enough impact on the lungs to see a greater improvement in COVID-19 long-haulers, he added. A difference of 27 meters in the 6MWT compared to placebo is considered significant enough in fibrotic lung disease to judge a treatment's impact, Maher said.

Nonetheless, there is an element of uncertainty in designing studies on COVID-19 long-term symptoms since the impact on 6MWT without treatment is unknown in this situation, Maher said. The 6MWT has been used as a primary endpoint in other pulmonary trials and is a direct measure of patient functioning, said the PureTech spokesperson, adding the trial will also assess dyspnea as a secondary endpoint in addition to other respiratory-related PROs.

Similarly, to evaluate long-term COVID-19 neurological symptoms, repurposing existing scales for cognitive impairment is the most efficient research strategy, said James Jackson, PsyD, assistant director, ICU Recovery Center, Vanderbilt University, Nashville, Tennessee. For patients experiencing long-term neurological symptoms after COVID-19, a sharp decline in executive functioning and an inability to return to work are among the most common and harmful symptoms, Jackson added.

Neurological symptoms in COVID-19 long-haulers include loss of memory, concentration difficulty, anxiety and depression, among others. Because these are difficult to measure biologically, patient-assessed scales of cognitive function are best equipped to determine symptom improvement, he explained. The Minnesota Multiphasic Personality Inventory scale for depression, the Hopkins Symptom Checklist and the Chalder Fatigue Scale are among the symptom scales used for diagnosing and measuring improvements in these syndromes.

Scales used for diagnosing mild cognitive mild impairment, such as the Montreal Cognitive Assessment, could also be used, added Dr Jin Ho Han, associate professor, Department of Emergency Medicine, Vanderbilt University, Nashville, Tennessee. However, concerns remain about these scales lacking the sensitivity to detect subtler changes seen in COVID-19 long-haulers, he explained.

Additionally, reducing acute disease severity and inflammation could have a positive effect on addressing long-term neurological symptoms, Han said. Anecdotally, the higher severity of more severe acute COVID-19 symptoms, particularly a longer time in the ICU, is correlated with worse, more persistent long-term cognitive impairment, he added. As such, any therapy improving disease outcomes could theoretically reduce long-term symptom severity, Han explained.

General challenges on study populations

In choosing study populations, experts said there is an important distinction between patients who have been previously hospitalized and those who have not. Even outside of COVID-19, patients on mechanical ventilation for an extended period tend to have long-term symptoms, experts noted. Intubated patients may develop prolonged tachycardia and fatigue linked to their horizontal positioning, which is different from the same long-term symptoms seen in nonhospitalized COVID-19 patients, Rowe said. However, ICU delirium in both hospitalized and nonhospitalized COVID-19 long-haulers likely involve similar underlying mechanisms, Han said.

If the focus is only on hospitalized patients, the results with any intervention may not hold true for the much larger population with chronic symptoms, Rowe said. In a survey of 3,700 respondents who reported long-term symptoms beyond 90 days, only 8.4% were hospitalized for COVID-19 (Davis; et al; 27 December 2020; medRxiv preprint).

Another challenge with identifying the right trial participants is the way differences in standard treatments for other comorbidities can interfere with the efficacy signal of the investigational treatment, Rowe said, referring to a similar experience with fludocortisone in CFS patients. Among COVID-19 patients, those with comorbid conditions like diabetes and hypertension are at a higher risk for severe disease. Enrichment strategies allowing for the stabilization of comorbid conditions before randomizing patients, or incorporating crossover trial designs where each patient can act as their own control, both have the potential to detect effective therapies, Rowe said.

The field is still trying to understand the prevalence of these long-term symptoms and their relation to the initial infection severity, Maher said, adding the unknowns with long-term COVID-19 symptoms makes trial design challenging. Overall, the lack of observational data, including its incidence and possible risk factors, makes it particularly challenging to study the effect of potential therapies, Han and Jackson agreed. W

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Reporter, New York

Manasi Vaidya has a Masters degree in biotechnology. After a stint in a research lab, she spent two years as correspondent in India for BioSpectrum, a publication focused on the Asian biotechnology industry. She then moved to the United States to pursue a Masters degree in Science, Health and Environmental Reporting at New York University. Manasi has reported primarily on topics that combine health and policy, and her work has appeared in Nature Medicine, Nautilus and Scienceline. Her coverage at BioPharm Insight focuses on cancer.

William Newton

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William Newton is a healthcare reporter for GlobalData focusing on central nervous system diseases and ophthalmology. Previously, he worked at the healthcare information firm Close Concerns, where he covered breaking news in diabetes therapeutics and technology for the company's industry-facing publication, and at the digital health startup Fitscript, where he assisted in researching digital health and lifestyle intervention approaches to treating diabetes. He graduated Williams College with a BA in Economics and Spanish and worked as a News Editor, Executive Editor, and Managing Editor of the Williams Record.

FOLLOW THE JOURNEY OF VIREAD

COMPLETE RESPONSE RESULTS AT YEAR 1...

#1 **Prescribed oral antiviral** according to US prescription data for treatment of CHB[1a]

AT YEAR 1
The primary endpoint—complete response*—was evaluated in Studies 102 and 103[2]

THROUGH YEAR 8
Resistance was evaluated as a secondary endpoint[2,3]

In Study 102 (HBeAg–, n=375) and Study 103 (HBeAg+, n=266), a combined total of 641 adult patients with chronic hepatitis B (CHB) and compensated liver disease who were primarily nucleoside treatment naïve entered a 48-week, randomized, double-blind, active-controlled treatment period comparing VIREAD 300 mg to adefovir dipivoxil 10 mg. Subjects who completed double-blind treatment at Week 48 were eligible to roll over with no interruption in treatment to open-label VIREAD. Of 641 patients enrolled in the initial trials, 412 (64%) completed 384 weeks of treatment.[2]

***The primary endpoint in Studies 102 and 103 was complete response to treatment at 48 weeks as defined by HBV DNA <400 copies/mL (69 IU/mL) + histological response (Knodell necroinflammatory score improvement of ≥2 points without worsening in Knodell fibrosis score). Annual evaluation of resistance was a prespecified secondary endpoint. Cumulative VIREAD genotypic resistance was evaluated annually for up to 384 weeks in Studies 102, 103, 106, 108, and 121.[2,3]**

71% of HBeAg– VIREAD patients vs **49%** of adefovir dipivoxil patients.[2-4]
67% of HBeAg+ VIREAD patients vs **12%** of adefovir dipivoxil patients.[2,3,5]

INDICATION AND USAGE

VIREAD® (tenofovir disoproxil fumarate) is indicated for the treatment of chronic hepatitis B in adults and pediatric patients 12 years of age and older.

The following points should be considered when initiating therapy with VIREAD for the treatment of HBV infection:

- The indication in adults is based on data from treatment of subjects who were nucleoside–treatment-naïve and treatment-experienced with documented resistance to lamivudine. Subjects were adults with HBeAg-positive and HBeAg-negative chronic hepatitis B with compensated liver disease
- VIREAD was evaluated in a limited number of subjects with chronic hepatitis B and decompensated liver disease
- The numbers of subjects in clinical trials who had adefovir resistance-associated substitutions at baseline were too small to reach conclusions of efficacy

IMPORTANT SAFETY INFORMATION

BOXED WARNING: LACTIC ACIDOSIS/SEVERE HEPATOMEGALY WITH STEATOSIS and POST TREATMENT EXACERBATION OF HEPATITIS

- **Lactic acidosis and severe hepatomegaly with steatosis, including fatal cases, have been reported with the use of nucleoside analogs, including VIREAD, in combination with other antiretrovirals**
- **Severe acute exacerbations of hepatitis have been reported in HBV-infected patients who have discontinued anti-hepatitis B therapy, including VIREAD. Hepatic function should be monitored closely with both clinical and laboratory follow-up for at least several months in patients who discontinue anti-hepatitis B therapy, including VIREAD. If appropriate, resumption of anti-hepatitis B therapy may be warranted**

[a]Healthcare Analytics Monthly data, August 2014-June 2015.

Please see Brief Summary of full Prescribing Information including **BOXED WARNING** on the following pages.

GILEAD IS COMMITTED TO THE EDUCATION AND TREATMENT OF CHRONIC HEPATITIS B.

Viread® 300 mg tablets
tenofovir disoproxil fumarate

Not an actual patient, but is representative of a real patient type. Models are used for illustrative purposes only.

...AT 8 YEARS: NO RESISTANCE WAS

Annual evaluation of resistance was a prespecified secondary endpoint for Studies 102 and 103 in HBeAg- and HBeAg+ chronic hepatitis B patients[3]; no evidence of resistance was found. Cumulative VIREAD genotypic resistance was evaluated annually for up to 384 weeks in Studies 102, 103, 106, 108, and 121.[2,4,5]

- In the nucleotide-naïve population from Studies 102 and 103, HBeAg+ subjects had a higher baseline viral load than HBeAg– subjects and a significantly higher proportion of the subjects remained viremic at their last time point on VIREAD monotherapy (15% vs 5%, respectively)[2]
- HBV isolates from these subjects who remained viremic showed treatment-emergent substitutions; however, no specific substitutions occurred at a sufficient frequency to be associated with resistance to VIREAD (genotypic and phenotypic analyses)[2]

IMPORTANT SAFETY INFORMATION (cont'd)

WARNINGS AND PRECAUTIONS

- **New onset or worsening renal impairment:** Cases of acute renal failure and Fanconi syndrome have been reported with the use of VIREAD. In all patients, assess estimated creatinine clearance (CrCl) prior to initiating and during therapy. In patients at risk for renal dysfunction, including those who previously experienced renal events while receiving adefovir dipivoxil, additionally monitor serum phosphorus, urine glucose, and urine protein. In patients with CrCl <50 mL/min, adjust dosing interval and closely monitor renal function. Avoid concurrent or recent use with a nephrotoxic agent. Cases of acute renal failure, some requiring hospitalization and renal replacement therapy, have been reported after initiation of high dose or multiple NSAIDs in HIV-infected patients with risk factors for renal dysfunction; consider alternatives to NSAIDs in these patients. Persistent or worsening bone pain, pain in extremities, fractures and/or muscular pain or weakness may be manifestations of proximal renal tubulopathy and should prompt an evaluation of renal function
- **Coadministration with other products:**
  – Do not use in combination with other products containing tenofovir disoproxil fumarate
  – Do not administer in combination with adefovir dipivoxil
- **Patients coinfected with HIV-1 and HBV:** Due to the risk of development of HIV-1 resistance, VIREAD should only be used in HIV-1 and HBV coinfected patients as part of an appropriate antiretroviral combination regimen. HIV-1 antibody testing should be offered to all HBV-infected patients before initiating therapy with VIREAD
- **Bone effects:** Decreases in bone mineral density (BMD) and mineralization defects, including osteomalacia, have been seen in patients treated with VIREAD. Consider assessment of BMD in adult and pediatric patients who have a history of pathologic bone fracture or other risk factors for bone loss. In a clinical trial conducted in pediatric subjects 12 to <18 years of age with chronic hepatitis B, total body BMD gain was less in VIREAD-treated subjects as compared to the control group. In patients at risk of renal dysfunction who present with persistent or worsening bone or muscle symptoms, hypophosphatemia and osteomalacia secondary to proximal renal tubulopathy should be considered

ADVERSE REACTIONS

- **In HBV-infected subjects with compensated liver disease:** Most common adverse reaction (all grades) was nausea (9%). Other treatment-emergent adverse reactions reported in >5% of patients treated with VIREAD included: abdominal pain, diarrhea, headache, dizziness, fatigue, nasopharyngitis, back pain, and skin rash
- **In HBV-infected subjects with decompensated liver disease:** Most common adverse reactions (all grades) reported in ≥10% of patients treated with VIREAD were abdominal pain (22%), nausea (20%), insomnia (18%), pruritus (16%), vomiting (13%), dizziness (13%), and pyrexia (11%)

DRUG INTERACTIONS

- **Didanosine:** Coadministration increases didanosine concentrations. Use with caution and monitor for evidence of didanosine toxicity (e.g., pancreatitis, neuropathy). Didanosine should be discontinued in patients who develop didanosine-associated adverse reactions. In patients weighing >60 kg, the didanosine dose should be reduced to 250 mg once daily when it is coadministered with VIREAD and in patients weighing <60kg, the didanosine dose should be reduced to 200 mg once daily when coadministered with VIREAD

DETECTED AT YEAR 1 THROUGH YEAR 8

NO HBV RESISTANCE DEVELOPED
YEAR 1 through YEAR 8
in clinical trials (Studies 102 and 103)[2,3]*

*Data for Years 2 through 8 are from the open-label phase.[6]

- There was a 64% (412/641) retention rate at Year 8: 266/426 patients given VIREAD→VIREAD; 146/215 patients given adefovir dipivoxil→VIREAD[2,6]

IMPORTANT SAFETY INFORMATION (cont'd)

DRUG INTERACTIONS (cont'd)

- **HIV-1 protease inhibitors:** Coadministration decreases atazanavir concentrations and increases tenofovir concentrations; use atazanavir given with ritonavir. Coadministration of VIREAD with atazanavir and ritonavir, darunavir and ritonavir, or lopinavir/ritonavir increases tenofovir concentrations. Monitor for evidence of tenofovir toxicity
- **Drugs affecting renal function:** Coadministration of VIREAD with drugs that reduce renal function or compete for active tubular secretion may increase concentrations of tenofovir

DOSAGE AND ADMINISTRATION

- Recommended dose, in adults and pediatric patients ≥12 years of age (≥35 kg), for the treatment of chronic hepatitis B: one 300 mg tablet, once daily, taken orally, without regard to food
- In the treatment of chronic hepatitis B, the optimal duration of treatment is unknown
- Safety and efficacy in pediatric patients <12 years of age or weighing <35kg with chronic hepatitis B have not been established
- The dosing interval of VIREAD should be adjusted (using recommendations in the table below) and renal function closely monitored in patients with baseline creatinine clearance <50 mL/min

DOSAGE ADJUSTMENT FOR PATIENTS WITH ALTERED CREATININE CLEARANCE

	Creatinine clearance (mL/min)[a]			Hemodialysis patients
	≥50	30-49	10-29	
Recommended 300 mg dosing interval	Every 24 hours	Every 48 hours	Every 72 to 96 hours	Every 7 days or after a total of approximately 12 hours of dialysis[b]

[a]Calculated using ideal (lean) body weight.

[b]Generally once weekly assuming three hemodialysis sessions a week of approximately 4 hours duration. VIREAD should be administered following completion of dialysis.

- The pharmacokinetics of tenofovir have not been evaluated in non-hemodialysis patients with creatinine clearance <10 mL/min; therefore, no dosing recommendation is available for these patients
- No dose adjustment is necessary for patients with mild renal impairment (creatinine clearance 50-80 mL/min). Routine monitoring of estimated creatinine clearance, serum phosphorus, urine glucose, and urine protein should be performed in these patients
- No data are available to make dose recommendations in pediatric patients with renal impairment

Please see Brief Summary of full Prescribing Information including **BOXED WARNING** on the following pages.

References: 1. Data on file, Gilead Sciences, Inc. Healthcare Analytics. **2.** VIREAD [package insert]. Foster City, CA: Gilead Sciences, Inc.; May 2015. **3.** Marcellin P, Heathcote EJ, Buti M, et al. Tenofovir disoproxil fumarate versus adefovir dipivoxil for chronic hepatitis B. *N Engl J Med.* 2008;359(23):2442-2455. **4.** Data on file, Gilead Sciences, Inc. Study 102 CSR. **5.** Data on file, Gilead Sciences, Inc. Study 103 CSR. **6.** Marcellin P, Gane EJ, Flisiak R, et al. Long term treatment with tenofovir disoproxil fumarate for chronic hepatitis B infection is safe and well tolerated and associated with durable virologic response with no detectable resistance: 8 year results from two phase 3 trials [AASLD abstract 229]. *Hepatology.* 2014;60(4)(suppl):313A-314A.

For more information, visit www.viread.com/hcp

300 mg tablets
Viread®
tenofovir disoproxil fumarate

VIREAD® (tenofovir disoproxil fumarate) tablets

Brief summary of full Prescribing Information. Please see full Prescribing Information including Boxed WARNING. Rx only

WARNING: LACTIC ACIDOSIS/SEVERE HEPATOMEGALY WITH STEATOSIS and POST TREATMENT EXACERBATION OF HEPATITIS

- **Lactic acidosis and severe hepatomegaly with steatosis, including fatal cases, have been reported with the use of nucleoside analogs, including VIREAD, in combination with other antiretrovirals *(See Warnings and Precautions)***
- **Severe acute exacerbations of hepatitis have been reported in HBV-infected patients who have discontinued anti-hepatitis therapy, including VIREAD. Hepatic function should be monitored closely with both clinical and laboratory follow-up for at least several months in patients who discontinue anti-hepatitis B therapy, including VIREAD. If appropriate, resumption of anti-hepatitis B therapy may be warranted *(See Warnings and Precautions)***

INDICATIONS AND USAGE: VIREAD is indicated for the treatment of chronic hepatitis B in adults and pediatric patients 12 years of age and older.

The following points should be considered when initiating therapy with VIREAD for the treatment of HBV infection:

- The indication in adults is based on safety and efficacy data from treatment of subjects who were nucleoside-treatment-naïve and subjects who were treatment-experienced with documented resistance to lamivudine. Subjects were adults with HBeAg-positive and HBeAg-negative chronic hepatitis B with compensated liver disease *(See Adverse Reactions)*
- VIREAD was evaluated in a limited number of subjects with chronic hepatitis B and decompensated liver disease *(See Adverse Reactions)*
- The numbers of subjects in clinical trials who had adefovir resistance-associated substitutions at baseline were too small to reach conclusions of efficacy

DOSAGE AND ADMINISTRATION: For the treatment of chronic hepatitis B the recommended dose, in adults and pediatric patients ≥12 years of age (≥35 kg), is one 300 mg tablet, once daily, taken orally, without regard to food. In the treatment of chronic hepatitis B, the optimal duration of treatment is unknown. Safety and efficacy in pediatric patients <12 years of age with chronic hepatitis B weighing <35 kg have not been established. **Dose Adjustment for Renal Impairment in Adults:** Significantly increased drug exposures occurred when VIREAD was administered to subjects with moderate to severe renal impairment. Therefore, the dosing interval of VIREAD tablets 300 mg should be adjusted in patients with baseline creatinine clearance <50 mL/min using the recommendations in Table 1. These dosing interval recommendations are based on modeling of single-dose pharmacokinetic data in non-HIV and non-HBV infected subjects with varying degrees of renal impairment, including end-stage renal disease (ESRD) requiring hemodialysis. The safety and effectiveness of these dosing interval adjustment recommendations have not been clinically evaluated in patients with moderate or severe renal impairment, therefore clinical response to treatment and renal function should be closely monitored in these patients *(See Warnings and Precautions)*. No dose adjustment of VIREAD tablets 300 mg is necessary for patients with mild renal impairment (creatinine clearance 50–80 mL/min). Routine monitoring of calculated creatinine clearance, serum phosphorus, urine glucose and urine protein should be performed in patients with mild renal impairment *(See Warnings and Precautions)*.

Dosage Adjustment for Adult Patients with Altered Creatinine Clearance

	Creatinine clearance (mL/min)[a]			Hemodialysis patients
	≥50	30-49	10-29	
Recommended 300 mg dosing interval	Every 24 hours	Every 48 hours	Every 72 to 96 hours	Every 7 days or after a total of approximately 12 hours of dialysis[b]

a. Calculated using ideal (lean) body weight.

b. Generally once weekly assuming three hemodialysis sessions a week of approximately 4 hours duration. VIREAD should be administered following completion of dialysis.

The pharmacokinetics of tenofovir have not been evaluated in non-hemodialysis patients with creatinine clearance <10 mL/min; therefore, no dosing recommendation is available for these patients. No data are available to make dose recommendations in pediatric patients with renal impairment.

CONTRAINDICATIONS: None.

WARNINGS AND PRECAUTIONS: Lactic Acidosis/Severe Hepatomegaly with Steatosis: Lactic acidosis and severe hepatomegaly with steatosis, including fatal cases, have been reported with the use of nucleoside analogs, including VIREAD, in combination with other antiretrovirals. A majority of these cases have been in women. Obesity and prolonged nucleoside exposure may be risk factors. Particular caution should be exercised when administering nucleoside analogs to any patient with known risk factors for liver disease; however, cases have also been reported in patients with no known risk factors. Treatment with VIREAD should be suspended in any patient who develops clinical or laboratory findings suggestive of lactic acidosis or pronounced hepatotoxicity (which may include hepatomegaly and steatosis even in the absence of marked transaminase elevations). **Exacerbation of Hepatitis after Discontinuation of Treatment:** Discontinuation of anti-HBV therapy, including VIREAD, may be associated with severe acute exacerbations of hepatitis. Patients infected with HBV who discontinue VIREAD should be closely monitored with both clinical and laboratory follow-up for at least several months after stopping treatment. If appropriate, resumption of anti-hepatitis B therapy may be warranted. **New Onset or Worsening Renal Impairment:** Tenofovir is principally eliminated by the kidney. Renal impairment, including cases of acute renal failure and Fanconi syndrome (renal tubular injury with severe hypophosphatemia), has been reported with the use of VIREAD *(See Adverse Reactions)*. It is recommended that estimated creatinine clearance be assessed in all patients prior to initiating therapy and as clinically appropriate during therapy with VIREAD. In patients at risk of renal dysfunction, including patients who have previously experienced renal events while receiving adefovir dipivoxil, it is recommended that estimated creatinine clearance, serum phosphorus, urine glucose, and urine protein be assessed prior to initiation of VIREAD, and periodically during VIREAD therapy. Dosing interval adjustment of VIREAD and close monitoring of renal function are recommended in all patients with creatinine clearance <50 mL/min *(See Dosage and Administration)*. No safety or efficacy data are available in patients with renal impairment who received VIREAD using these dosing guidelines, so the potential benefit of VIREAD therapy should be assessed against the potential risk of renal toxicity. VIREAD should be avoided with concurrent or recent use of a nephrotoxic agent (e.g., high-dose or multiple non-steroidal anti-inflammatory drugs (NSAIDs)) *(See Drug Interactions)*. Cases of acute renal failure after initiation of high dose or multiple NSAIDs have been reported in HIV-infected patients with risk factors for renal dysfunction who appeared stable on tenofovir DF. Some patients required hospitalization and renal replacement therapy. Alternatives to NSAIDs should be considered, if needed, in patients at risk for renal dysfunction. Persistent or worsening bone pain, pain in extremities, fractures and/or muscular pain or weakness may be manifestations of proximal renal tubulopathy and should prompt an evaluation of renal function in at-risk patients. **Coadministration with Other Products:** VIREAD should not be used in combination with the fixed-dose combination products ATRIPLA®, COMPLERA®, STRIBILD® or TRUVADA® since tenofovir disoproxil fumarate is a component of these products. VIREAD should not be administered in combination with adefovir dipivoxil *(See Drug Interactions)*. **Patients Coinfected with HIV-1 and HBV:** Due to the risk of development of HIV-1 resistance, VIREAD should only be used in HIV-1 and HBV coinfected patients as part of an appropriate antiretroviral combination regimen. HIV-1 antibody testing should be offered to all HBV-infected patients before initiating therapy with VIREAD. It is also recommended that all patients with HIV-1 be tested for the presence of chronic hepatitis B before initiating treatment with VIREAD.

Bone Effects

Bone Mineral Density: In clinical trials in HIV-1 infected adults, VIREAD was associated with slightly greater decreases in bone mineral density (BMD) and increases in biochemical markers of bone metabolism, suggesting increased bone turnover relative to comparators. Serum parathyroid hormone levels and 1,25 Vitamin D levels were also higher in subjects receiving VIREAD *(See Adverse Reactions)*.

Clinical trials evaluating VIREAD in pediatric and adolescent subjects were conducted. Under normal circumstances, BMD increases rapidly in pediatric patients. In HIV-1 infected subjects aged 2 years to less than 18 years, bone effects were similar to those observed in adult subjects and suggest increased bone turnover. Total body BMD gain was less in the VIREAD-treated HIV-1 infected pediatric subjects as compared to the control groups. Similar trends were observed in chronic hepatitis B infected adolescent subjects aged 12 years to less than 18 years. In all pediatric trials, skeletal growth (height) appeared to be unaffected *(See Adverse Reactions)*.

The effects of VIREAD-associated changes in BMD and biochemical markers on long-term bone health and future fracture risk are unknown. Assessment of BMD should be considered for adults and pediatric patients who have a history of pathologic bone fracture or other risk factors for osteoporosis or bone loss. Although the effect of supplementation with calcium and vitamin D was not studied, such supplementation may be beneficial for all patients. If bone abnormalities are suspected then appropriate consultation should be obtained.

Mineralization Defects: Cases of osteomalacia associated with proximal renal tubulopathy, manifested as bone pain or pain in extremities and which may contribute to fractures, have been reported in association with the use of VIREAD *(See Adverse Reactions)*. Arthralgias and muscle pain or weakness have also been reported in cases of proximal renal tubulopathy. Hypophosphatemia and

Brief Summary (Cont'd)

osteomalacia secondary to proximal renal tubulopathy should be considered in patients at risk of renal dysfunction who present with persistent or worsening bone or muscle symptoms while receiving products containing tenofovir DF *(See Warnings and Precautions).*

ADVERSE REACTIONS: Clinical Trials in Adult Subjects with Chronic Hepatitis B and Compensated Liver Disease: *Treatment-Emergent Adverse Reactions:* In controlled clinical trials in subjects with chronic hepatitis B (0102 and 0103), more subjects treated with VIREAD during the 48-week double-blind period experienced nausea: 9% with VIREAD versus 2% with adefovir dipivoxil. Other treatment-emergent adverse reactions reported in >5% of subjects treated with VIREAD included: abdominal pain, diarrhea, headache, dizziness, fatigue, nasopharyngitis, back pain, and skin rash. No significant change in the tolerability profile was observed with continued treatment with VIREAD for up to 384 weeks.

Laboratory Abnormalities: in Studies 0102 and 0103 (0–48 Weeks) laboratory abnormalities (Grades 3–4) reported in ≥1% of subjects treated with Viread (n=426) and adefovir dipivoxil (n=215), respectively, were: any ≥Grade 3 laboratory abnormality (19%, 13%); creatine kinase (M: >990 U/L; F: >845 U/L) (2%, 3%); serum amylase (>175 U/L) (4%, 1%); glycosuria (≥3+) (3%, <1%); AST (M: >180 U/L; F: >170 U/L) (4%, 4%); and ALT (M: >215 U/L; F: >170 U/L) (10%, 6%). Laboratory abnormalities (Grades 3–4) were similar in subjects continuing VIREAD treatment for up to 384 weeks in these trials.

The overall incidence of on-treatment ALT flares (defined as serum ALT >2 × baseline and >10 × ULN, with or without associated symptoms) was similar between VIREAD (2.6%) and adefovir dipivoxil (2%). ALT flares generally occurred within the first 4-8 weeks of treatment and were accompanied by decreases in HBV DNA levels. No subject had evidence of decompensation. ALT flares typically resolved within 4-8 weeks without changes in study medication. The adverse reactions observed in subjects with chronic hepatitis B and lamivudine resistance who received treatment with VIREAD were consistent with those observed in other hepatitis B clinical trials in adults. *Clinical Trial in Adult Subjects with Chronic Hepatitis B and Decompensated Liver Disease:* In a small randomized, double-blind, active-controlled trial (0108), subjects with CHB and decompensated liver disease received treatment with VIREAD or other antiviral drugs for up to 48 weeks. Among the 45 subjects receiving VIREAD, the most frequently reported treatment-emergent adverse reactions of any severity were abdominal pain (22%), nausea (20%), insomnia (18%), pruritus (16%), vomiting (13%), dizziness (13%), and pyrexia (11%). Two of 45 (4%) subjects died through Week 48 of the trial due to progression of liver disease. Three of 45 (7%) subjects discontinued treatment due to an adverse event. Four of 45 (9%) subjects experienced a confirmed increase in serum creatinine of 0.5 mg/dL (1 subject also had a confirmed serum phosphorus <2 mg/dL through Week 48). Three of these subjects (each of whom had a Child-Pugh score ≥10 and MELD score ≥14 at entry) developed renal failure. Because both VIREAD and decompensated liver disease may have an impact on renal function, the contribution of VIREAD to renal impairment in this population is difficult to ascertain. One of 45 subjects experienced an on-treatment hepatic flare during the 48 week trial.

Clinical Trials in Pediatric Subjects 12 Years of Age and Older with Chronic Hepatitis B: Assessment of adverse reactions is based on one randomized study (0115) in 106 pediatric subjects (12 to less than 18 years of age) infected with chronic hepatitis B receiving treatment with VIREAD (N = 52) or placebo (N = 54) for 72 weeks. The adverse reactions observed in pediatric subjects who received treatment with VIREAD were consistent with those observed in clinical trials of VIREAD in adults. In this study, both the VIREAD and placebo treatment arms experienced an overall increase in mean lumbar spine BMD over 72 weeks, as expected for an adolescent population. The BMD gains from baseline to Week 72 in lumbar spine and total body BMD in VIREAD-treated subjects (+5% and +3%, respectively) were less than the BMD gains observed in placebo-treated subjects (+8% and +5%, respectively). Three subjects in the VIREAD group and two subjects in the placebo group had significant (greater than 4%) lumbar spine BMD loss at Week 72. At baseline, mean BMD Z-scores in subjects randomized to VIREAD were −0.43 for lumbar spine and −0.20 for total body, and mean BMD Z-scores in subjects randomized to placebo were −0.28 for lumbar spine and −0.26 for total body. In subjects receiving VIREAD for 72 weeks, the mean change in BMD Z-score was −0.05 for lumbar spine and −0.15 for total body compared to +0.07 and +0.06, respectively, in subjects receiving placebo. As observed in pediatric studies of HIV-infected patients, skeletal growth (height) appeared to be unaffected *(See Warnings and Precautions).*

Postmarketing Experience: The following adverse reactions have been identified during postapproval use of VIREAD. Because postmarketing reactions are reported voluntarily from a population of uncertain size, it is not always possible to reliably estimate their frequency or establish a causal relationship to drug exposure: allergic reaction, including angioedema, lactic acidosis, hypokalemia, hypophosphatemia, dyspnea, pancreatitis, increased amylase, abdominal pain, hepatic steatosis, hepatitis, increased liver enzymes (most commonly AST, ALT gamma GT), rash, rhabdomyolysis, osteomalacia (manifested as bone pain and which may contribute to fractures), muscular weakness, myopathy, acute renal failure, renal failure, acute tubular necrosis, Fanconi syndrome, proximal renal tubulopathy, interstitial nephritis (including acute cases), nephrogenic diabetes insipidus, renal insufficiency, increased creatinine, proteinuria, polyuria, asthenia. The following adverse reactions listed above, may occur as a consequence of proximal renal tubulopathy: rhabdomyolysis, osteomalacia, hypokalemia, muscular weakness, myopathy, hypophosphatemia.

DRUG INTERACTIONS: Didanosine: Coadministration of VIREAD and didanosine should be undertaken with caution and patients receiving this combination should be monitored closely for didanosine-associated adverse reactions. Didanosine should be discontinued in patients who develop didanosine-associated adverse reactions. When administered with VIREAD, C_{max} and AUC of didanosine increased significantly. The mechanism of this interaction is unknown. Higher didanosine concentrations could potentiate didanosine-associated adverse reactions, including pancreatitis and neuropathy. Suppression of $CD4^+$ cell counts has been observed in patients receiving VIREAD with didanosine 400 mg daily. In patients weighing >60 kg, the didanosine dose should be reduced to 250 mg once daily when it is coadministered with VIREAD. In patients weighing <60 kg, the didanosine dose should be reduced to 200 mg once daily when it is coadministered with VIREAD. When coadministered, VIREAD and didanosine EC may be taken under fasted conditions or with a light meal (<400 kcal, 20% fat). For additional information on coadministration of VIREAD and didanosine, please refer to the full Prescribing Information for didanosine. **HIV-1 Protease Inhibitors:** VIREAD decreases the AUC and C_{min} of atazanavir. Viread should not be coadministered with atazanavir without ritonavir. Lopinavir/ritonavir, atazanavir coadministered with ritonavir, and darunavir coadministered with ritonavir have been shown to increase tenofovir concentrations. Tenofovir disoproxil fumarate is a substrate of P-glycoprotein (Pgp) and breast cancer resistance protein (BCRP) transporters. When tenofovir disoproxil fumarate is coadministered with an inhibitor of these transporters, an increase in absorption may be observed. Patients receiving VIREAD concomitantly with lopinavir/ritonavir, ritonavir-boosted atazanavir, or ritonavir-boosted darunavir should be monitored for VIREAD-associated adverse reactions. VIREAD should be discontinued in patients who develop VIREAD-associated adverse reactions. **Drugs Affecting Renal Function:** Since tenofovir is primarily eliminated by the kidneys, coadministration of VIREAD with drugs that reduce renal function or compete for active tubular secretion may increase serum concentrations of tenofovir and/or increase the concentrations of other renally eliminated drugs. Some examples include, but are not limited to cidofovir, acyclovir, valacyclovir, ganciclovir, valganciclovir, aminoglycosides (e.g., gentamicin), and high-dose or multiple NSAIDs *(See Warnings and Precautions).* In the treatment of chronic hepatitis B, VIREAD should not be administered in combination with adefovir dipivoxil.

USE IN SPECIFIC POPULATIONS: Pregnancy: *Pregnancy Category B:* There are no adequate and well-controlled studies in pregnant women. Because animal reproduction studies are not always predictive of human response, VIREAD should be used during pregnancy only if clearly needed. *Antiretroviral Pregnancy Registry:* To monitor fetal outcomes of pregnant women exposed to VIREAD, an Antiretroviral Pregnancy Registry has been established. Healthcare providers are encouraged to register patients by calling 1-800-258-4263. *Animal Data:* Reproduction studies have been performed in rats and rabbits at doses up to 14 and 19 times the human dose based on body surface area comparisons and revealed no evidence of impaired fertility or harm to the fetus due to tenofovir. **Nursing Mothers: The Centers for Disease Control and Prevention recommend that HIV-1-infected mothers not breastfeed their infants to avoid risking postnatal transmission of HIV-1.** Samples of breast milk obtained from five HIV-1 infected mothers in the first post-partum week show that tenofovir is secreted in human milk. The impact of this exposure in breastfed infants is unknown. Because of both the potential for HIV-1 transmission and the potential for serious adverse reactions in nursing infants, **mothers should be instructed not to breastfeed if they are receiving VIREAD. Geriatric Use:** Clinical studies of VIREAD did not include sufficient numbers of subjects aged 65 and over to determine whether they respond differently from younger subjects. In general, dose selection for the elderly patient should be cautious, keeping in mind the greater frequency of decreased hepatic, renal, or cardiac function, and of concomitant disease or other drug therapy. **Patients with Impaired Renal Function:** It is recommended that the dosing interval for VIREAD be modified in patients with estimated creatinine clearance <50 mL/min or in patients with ESRD who require dialysis *(See Dosage and Administration).*

For detailed information, please see full Prescribing Information. To learn more call 1-800-GILEAD-5 (1-800-445-3235) or visit www.VIREAD.com.

BIOCENTURY & GETTY IMAGES

EDITOR'S COMMENTARY

Innovations forged in the COVID crucible will reshape medicine

BY STEVE USDIN, WASHINGTON EDITOR

The fight against COVID-19 is far from finished, but victory is close enough to start considering how the tools created to tame SARS-CoV2 will reshape the post-war world.

As with World War II and the Cold War, the world's brightest minds have enlisted in a race to create tools to extinguish an existential danger. Intellect, enhanced by immense financial resources and industrial capacity, is once again developing technologies that will be applied immediately and will also fundamentally change the course of history. As in past conflicts, technologies accelerated, perfected and proven in the pandemic crucible will become the springboards for innovation that will continue long after COVID-19 has been tamed.

The intense focus and investments of World War II unlocked the power of the atom and produced technologies such as the jet engine, radar and computers that defined the second half of the twentieth century.

The modern pharmaceutical industry was also a direct result of the war, especially of a crash project to create processes to mass-produce penicillin. While Alexander Fleming had alerted the world to his serendipitous discovery in 1929, it took the pressure of war to transform it from a lab reagent into a medicine. In the early years of World War II, penicillin was so precious that researchers routinely recycled it from patients' urine while British and American businesses and governments invested massively to create industrial penicillin-production processes.

In 1943, a small citric acid manufacturer was one of about a dozen U.S. companies that bet their futures that they could develop and master the fermentation technology needed to make the first antibiotic. The gamble paid off for the allied soldiers — and for American industry. Medics had penicillin in their bags when they landed at Normandy and government contracts started the citric acid company, Charles Pfizer & Co. — today's Pfizer Inc. (NYSE:PFE) — on the path to becoming the world's largest pharmaceutical company.

TECHNOLOGIES THAT ONLY A YEAR AGO SEEMED PROMISING BUT UNPROVEN, OR WERE DEEMED NICE-TO-HAVE BUT NOT ESSENTIAL, HAVE BECOME REAL AND ESSENTIAL.

The viral war of 2020 will have similar effects on medicine and the companies that make medicines. Technologies that only a year ago seemed promising but unproven, or were deemed nice-to-have but not essential, have become real and essential.

Companies that were on nobody's short list of hot biotechs a year ago have soared. For example, Novavax Inc. (NASDAQ:NVAX), which in Spring 2019 was facing a delisting threat from NASDAQ, has received $1.6 billion from the U.S. government for COVID-19 vaccine R&D and manufacturing, while Canadian biotech AbCellera Biologics Inc. (NASDAQ:ABCL) has gone from relative obscurity to a $555 million IPO and a market cap of nearly $11 billion.

One of the silver linings of the pandemic could be the reinvigoration of two technologies that could be the most cost-effective in medicine, but that have languished as a result of broken business models: diagnostics and preventive vaccines. The spin-offs from advances in these two fields will improve the way diseases are defined, treated and prevented.

Technologies developed because of COVID-19 will make it possible to protect populations, making a repeat of this year's disaster less likely. They will also empower individuals by giving them the ability to detect and monitor their medical conditions cheaply and easily at home. Processes accelerated in response to the pandemic will democratize care by validating and perfecting tools that make it easy for people and communities that have been left out to benefit from participation in biomedical research.

The decade of progress that has been compressed into the last 10 months hasn't come easily or without missteps. Continued advances are not inevitable. Smart public policies, including government investments and regulations, will be needed to capitalize on the potential that has been unlocked.

The tragic failures to ramp-up production and administer therapeutic mAbs, along with bumbling vaccine administration programs that are leaving life-saving countermeasures in warehouses and vulnerable senior citizens camping overnight in lawn chairs, demonstrate that scientific and technological progress is not sufficient. To realize their promise, advances in discovering, developing and manufacturing vaccines, therapies and diagnostics must be coupled to investments in public health and injections of competence and confidence in government institutions.

Biopharma companies, regulators, academic researchers, funders and payers must all be willing to change the way they operate to incorporate some of the collaborative behaviors showcased in the pandemic into their routine operations.

Vaccines

Seven decades after it helped turn penicillin from a lab tool into a pillar of medicine, Pfizer is again among a handful of companies that are taking enormous risks and executing beyond all expectations.

Like penicillin in 1943, mRNA vaccine technology was conceived long before COVID-19 struck, but in the absence of wartime conditions, it could have taken a decade or longer to make the progress that has been achieved in the past 10 months.

If the mRNA vaccines developed by partners BioNTech SE (NASDAQ:BNTX) and Pfizer, and by Moderna Inc. (NASDAQ:MRNA) and NIH's National Institute of Allergy and Infectious Diseases, along with those coming from CureVac N.V. (NASDAQ:CVAC) and other companies live up to their promise, the lag between identification of an antigen target and deployment of vaccines could be even shorter the next time the world is threatened by a pathogen with pandemic potential.

The ability to rapidly respond to mutations is a major advantage over other vaccine technologies, with benefits not only for pandemics but also for seasonal influenza and other outbreaks.

The successful development of mRNA vaccines is also a shot in the arm for the cancer vaccines BioNTech and Moderna were founded to develop.

The pandemic has been a proving ground for a variety of vaccine technologies beyond mRNA that, combined with investments in manufacturing capacity, could fuel public health gains for a generation as some of the hundreds of companies that have started down the path to creating a COVID-19 vaccine shift their sights onto other challenges.

Diagnostic technologies

The need for rapid screening and testing in a variety of settings has accelerated the development of diagnostic technologies, including tests based on CRISPR technology, the deployment of pooled testing protocols, and the dissemination of point-of-care tests.

Diagnostic advances sparked by COVID-19 will be applied to battles against other infectious pathogens, especially antibiotic-resistant bacteria. The ability to quickly identify the pathogen in tests conducted in hospitals and physicians' offices will make it possible to improve treatment of individual patients and stewardship programs that protect populations against resistant organisms.

The wave of in-home, point-of-care and lab-based diagnostics that are being developed for the novel coronavirus will be adapted, first to other infectious diseases, and later to other conditions.

Just as radar created for the battlefield made possible massive improvements in meteorology, diagnostic advances developed for COVID-19 will have broad effects beyond infectious diseases. New diagnostic technologies could extend the kinds of advances that have occurred in cancer, including the redefinition of disease and the associated development of precision medicines, to other fields of medicine.

Master protocols

2020 has been the year of the master protocol.

While BioCentury has been reporting about and advocating wider use of master protocols for a decade, uptake outside of cancer has been slow.

The urgency of the pandemic swept aside commercial concerns and funding constraints that have limited uptake of master protocols. Missteps on hydroxychloroquine and convalescent plasma, along with the massive missed opportunities caused by a plethora of underpowered and poorly designed trials have pounded home the importance of rigorous clinical research.

The U.K. RECOVERY trial, stood up in a matter of days, provided the first reliable demonstration that medicines can benefit COVID-19 patients, and just as importantly, solid data debunking therapies that had appeared promising based on anecdotes and underpowered studies.

In the U.S., the ACTIV public-private partnership and the COVID R&D industry consortium turned to master protocols to test a wide range of therapies.

Having proved their value in the race to tame COVID-19, master protocols will become the tool of choice, not only for pandemic response, but also for determining the safety and efficacy of interventions targeting diseases and conditions that aren't feasible to study with bespoke clinical trials. Prime candidates for master protocols include rare diseases, as well as Alzheimer's, diabetes and other common chronic diseases where the benefits of maintaining permanent trial infrastructure outweigh the costs.

Establishing ongoing master protocols for a wide range of diseases and conditions could be the first step in a much-needed modernization of the clinical trial enterprise. They will be platforms for advancing the use of adaptive trial designs, testing digital biomarkers, and especially for integrating clinical research into community settings. Realizing this potential will require substantial government funding, along with commitments to change on the part of physicians, hospitals, payers and biopharmaceutical companies.

Remote clinical trials technologies

In 2019 integrating remote data collection into clinical trials was an interesting idea, something added onto traditional trials or used experimentally.

The pandemic turned remote data collection and decentralized trials from niche ideas to mission-critical tools.

Just as diagnostic advances lead to the redefinition of disease, the ability to integrate data collection into routine care and to use sensors to gather data continuously rather than relying on tests conducted during visits to clinics will change the way diseases are defined and treated.

Expanded use of remote technology also has the power to reduce the disparities in clinical trial participation.

The COVID-19 experience has accelerated and will quickly make routine digital trial recruitment and integration of remote monitoring into trials. Together with digital sensors this means trials will become much more "real world." This will lead to the redefinition of diseases as researchers and physicians move away from describing diseases based on sporadic measurements at clinical visits and instead use continuous assessments of more relevant endpoints.

Scientific communication and collaboration

The sprint to create COVID-19 countermeasures was launched by a tweet on Jan. 10, 2020 from Edward Holmes, a scientist at the University of Sydney, reporting that he'd uploaded the genome sequence for the virus that causes COVID-19 to a public database. The sequence was the work of Zhang Yongzhen, a researcher in Shanghai who risked his career, and possibly his liberty, to release the information without waiting for Chinese government permission.

Presaging the spread of the virus itself, the tweet revealing that the sequence had been published flew around the world. For scientists in Oxford, Boston, Moscow and Mainz, the understated announcement was as loud as the crack of a starter's pistol.

Within hours, researchers in academic labs and biotech companies were using the data to start designing vaccines and diagnostics and searching for therapies.

COVID-19 could have led governments around the world to set aside their differences long enough to defeat SARS-CoV2. That didn't happen, but international collaboration and communication among scientists has been so critical to the pandemic response that new expectations have been created that will persist after the crisis has passed.

LIKE THE FRIENDSHIPS FORGED IN FOXHOLES, THE INTENSE COLLABORATION IN THE BATTLE AGAINST SARS-COV2 WILL NOT BE FORGOTTEN.

THE PANDEMIC TURNED REMOTE DATA COLLECTION AND DECENTRALIZED TRIALS FROM NICHE IDEAS TO MISSION-CRITICAL TOOLS.

Life sciences researchers have been banging on the doors of academic journals for years, complaining that stodgy and snobby habits carried over from the paper and postage stamp era were unnecessarily slowing progress. Under the pressure of COVID, scientists have rushed the gates, publishing and critiquing research in real time on preprint servers rather than allowing a handful of prestigious journals to act as gatekeepers, throttling the pace of progress to match the speed of academic peer review.

At biopharma companies, the coronavirus crisis prompted scientists to reach out to competitors and join with academics to form consortia, share data and collaborate.

When COVID-19 is in the rearview mirror, it will not be possible to maintain the 24/7 pace of activity and biopharma companies will revert to their traditional competitive postures.

Nonetheless, like the friendships forged in foxholes, the intense collaboration in the battle against SARS-CoV2 will not be forgotten.

Patients, also, will not forget that medical product development that traditionally requires a decade or more can be accomplished in less than a year.

New clauses in the social contract are being written that will require biopharma companies to expand their conceptions of the precompetitive space, and that will expand expectations about data-sharing and collaboration.

Beyond all of the scientific and technological progress, one of the most important lessons from the pandemic may be the need to restore confidence in science, to develop and adhere to sound principles for communicating about medicine and public health.

Signed commentaries do not necessarily reflect the views of BioCentury.

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Happy smile and hope after pain

D.K. Lee has related to It's A Wig that she will promote to cancer patients about the beauty classes and healing programs she attended. The beauty classes are held at Kyung Hee Medical Center and it is for cancer patients to help them feel more womanly during their hard times. She would like to thank all the people who gave her hope. "Thank you for giving me a second chance to live as a woman. With the hopes and gifts that I have received, it encourages me to work harder to volunteer my time for the people who are fighting against cancer."

Kyung Hee Medical Center patient
D. K. Lee

Cancer-free D.K. Lee

D.K. Lee attending
beauty classes while chemotherapy treatment

Conference Alerts

North America

CUGH 2021- 12th Annual Global Health Conference

March 12-14, 2021 | Virtual Conference

Website: https://www.cugh2021.org
Contact: info@cugh.org

The theme of the 12th Annual Consortium of Universities for Global Health is "Addressing Critical Gaps in Global Health and Development." Over 1,800 scientists, students, and implementers from academia, NGOs, government, and the private sector will present, learn and collaborate to address some of the pressing challenges our world faces. Attendees will have opportunities to challenge, develop a partnership to address global health, and collaborate with others in inspiring and improving the environment.

GHIC2021- Global Health & Innovation Conference

April 8-11, 2021 | Virtual Conference

Website: https://ghic.uniteforsight.org
Contact: ufs@uniteforsight.org

The Global Health & Innovation Conference is the world's leading and largest global health conference as well as the largest social entrepreneurship conference, with nearly 2,000 professionals and students from all 50 states and more than 55 countries. This is must-attend, thought-leading conference convenes leaders, changemakers, and participants from all sectors of global health, international development, and social entrepreneurship.

WHCC21-The 17th Annual World Health Care Congress

April 11-14, 2021 | Washington, D.C., USA

Website: https://www.worldhealthcarecongress.com
Contact: wcreg@worldcongress.com

WHCC21 brings together global thought leaders and key decision-makers from all sectors of healthcare. The World Health Care Congress offers unique conferences and events in health care, life sciences, and pharmaceutical that are unmatched by any other organizer. Through our educationally focused events, we convene CEOs and senior-level executives from all segments of the health care and life sciences industries to exchange ideas, discuss market trends, and explore solutions to the most pressing challenges facing a variety of roles within these organizations.

MD Expo

April 16-17, 2021 | Dallas, Texas, USA

Website: https://mdexposhow.com
Contact: event@mdpublishing.com

MD Expo strives to provide healthcare technology management professionals with a unique, intimate, and rewarding conference. The expo will gather clinical engineers, biomedical technicians, procurement/ asset managers, and others responsible for medical technology. The industry's most unique networking events connect and share best services, practices, and technologies with leading healthcare technology management (HTM) professionals.

HCSRN- The 2021 Health Care Systems Research Network

May 11-12, 2021 | Virtual Conference

Website: https://www.hcsrnmeeting.org/#home
Contact: admin@hcsrn.org

The HCSRN is the annual conference and the nation's preeminent gathering for researchers based in real-world health care systems and our numerous collaborators in academic health systems, funding agencies, and patient-partner communities. The conference offers a diverse slate of content, showcasing rigorous, relevant research on important conditions affecting millions of patients.

Europe

DIA Europe 2021

March 22-25, 2021 | Virtual Conference

Website: https://informaconnect.com/bioeurope-spring
Contact: contact@imcas.com

DIA Europe 2021 is the largest and most forward-looking neutral healthcare conference in Europe. This annual healthcare meeting reflects DIA's strategic initiatives across several Thought Leadership streams, including Clinical Development & Operations, Regulatory Science & Operations, Pharmacovigilance, Value and Access, Medical Affairs, and many others.

BIO-Europe Spring 2021

March 22-25, 2021 | Virtual Conference

Website: https://informaconnect.com/bioeurope-spring/
Contact: ebdcustomerservice@ebdgroup.com

The 2021 Biotechnology Innovation Organization (BIO)-Europe Spring is one of the largest independent investor conferences focused on biopharma business development. BIO-Europe Spring is the largest digital partnering event and provides importance and relevance to the life science sector. It will attract a wide range of business leaders, including senior executives of leading biotech, pharmaceutical companies, investors, and other industry experts.

Innovation Summit Dublin 2021

April 13-15, 2021 | Virtual Conference

Website: https://www.medtechstrategist.com/dublin-2021
Contact: info@medtechstrategist.com

The 8th year Innovation Summit Dublin 2021 is recognized as the leading medical technology investment forum in Europe. The annual investment and networking conference will bring over 4,000 MedTech executives, 500 leading experts, innovators, and key decision-makers to discuss the critical challenges facing the ever-evolving global medical device community. The event will feature nearly 2,000 partnering meetings and explore the needs, opportunities, and challenges facing the global MedTech industry.

Conference Alerts

EuroGUCH 2021

May 4-5, 2021 | Virtual Conference

Website: https://euroguch2021.com
Contact: euroguch2021@bcocongresos.com

The 12th Annual European Meeting on Adult Congenital Heart Disease is one of the most prestigious meetings in the world, organized by the Working Group on Adult Congenital Heart Disease of the European Society of Cardiology. The scientific program is designed to cover a wide range of ACHD subjects from multimodality imaging innovations, electrophysiological issues, pulmonary, myocardial, pericardial, and issues beyond heart disease including advanced precision therapies.

Asia

Medical Korea 2021 - The 11th Global Healthcare & Medical Tourism Conference

March 18-24, 2021 | Virtual Conference

Website: https://www.medical-korea.org
Contact: info.medicalkorea@gmail.com

Medical Korea 2021 is hosted by Korea's Ministry of Health and Welfare (MoHW) and organized by Korea Health Industry Development Institute (KHIDI). The conference will bring together world-leading academic and industry experts to discuss the new market trends in the healthcare field. It also provides a chance for business networking among stakeholders in the global healthcare industries.

PPH Asia 2021- Precision Public Health Asia

April 7-9, 2021 | Virtual Conference

Website: https://pphasia.com
Contact: sshsphevents@nus.edu.sg

PPH Asia 2021 is organized by NUS Saw Swee Hock School of Public Health, in partnership with the Government of Western Australia, Department of Health. The conference aims to bring industry leaders and professionals to explore the concept of precision public health and consider the impact of the latest technology. It will specifically examine how the COVID-19 pandemic has accelerated the use of health technologies and the potential of precision public health in Asia and beyond.

HIMSS Conference & Exhibition 2021

May 18-19, 2021 | Singapore, Singapore

Website: https://www.himss.org/event-himss-singapore
Contact: Evelyn.Wee@himss.org

HIMSS is a global advisor and thought leader supporting the transformation of health through information and technology. The theme of HIMSS Conference & Exhibition 2021 in Singapore is "Future-proof Healthcare: The Emergence of Asia." The conference will explore the quality of healthcare and the power of technology. And the event will bring together solutions to develop and implement for a sustainable healthcare ecosystem.

LATEST HEALTHCARE INDUSTRY NEWS

DEC 2020 – FEB 2021

1. Israel to Share Data with Pfizer in Exchange for COVID-19 Vaccine Doses

Israel has committed to send Pfizer statistical data and details in exchange for COVID-19 vaccine doses. Pfizer will send Israel a weekly consignment of between 100,000 and 500,000 vaccine doses, with more than a million doses set to be provided by the middle of March. In return, Pfizer will receive anonymized data about consequences of the inoculations, side effects, efficacy, and the amount of time it takes to develop antibodies, according to different types of population, age, gender, pre-existing conditions, and other factors. Israel's Ministry of Health has also secured six million doses of the Moderna COVID vaccine. Results from this huge research will serve to set vaccination strategies in the rest of the world and assist pharmaceutical companies in continuing R&D for coronavirus vaccinations and other treatments. Data will also be shared with the World Health Organization (WHO).

https://www.healthcareitnews.com/news/emea/israel-share-data-pfizer-exchange-covid-19-vaccine-doses

2. FDA Clears Lilly's COVID-19 Antibody Cocktail for Emergency Use

Eli Lilly & Co.'s combination antibody drug for COVID-19 was cleared for emergency use by U.S. regulators, providing doctors with a treatment option that is expected to be better able to combat new coronavirus mutations. The Food and Drug Administration authorized the treatment for use in COVID-positive adults and children 12 and older who are at high risk of developing severe forms of the disease or progressing to the hospital. The combo treatment is the second antibody therapy from the Indianapolis-based drugmaker to gain an emergency authorization from the FDA. In November, the agency cleared bamlanivimab, one of the two antibodies used in the cocktail, for use in non-hospitalized, high-risk patients with mild-to-moderate symptoms of COVID-19.

https://www.bloomberg.com/news/articles/2021-02-10/lilly-covid-antibody-combo-gets-u-s-emergency-use-authorization

3. J&J Asks FDA for Emergency Clearance of Coronavirus Vaccine

Johnson & Johnson (J&J) has applied to the FDA seeking Emergency Use Authorization (EUA) for the single-dose COVID-19 vaccine candidate developed by the company's Janssen Pharmaceutical. The FDA scheduled for February 26 a meeting of its Vaccines and Related Biological Products Advisory Committee (VRBPAC) to consider the Janssen COVID-19 vaccine candidate. J&J said its EUA will be based on topline efficacy and safety data from the nearly 44,000-patient Phase III trial. According to that data, the vaccine was 66% effective overall in preventing moderate to severe COVID-19 28 days after vaccination.

https://www.genengnews.com/news/jj-seeks-eua-for-covid-19-vaccine/

4. Celgene's Cell Therapy Spinout Nets $292M from Blank-Check Merger

Cell therapy developer Celularity is raising a total of $372 million, and announced a merger with a blank-check acquisition company and a separate financing from selling shares to institutional investors. The merger with GX Acquisition is the latest in a series of biotech deals with SPACs, or "special purpose acquisition companies," which provide a streamlined route to public equity markets. Celularity spun out from Celgene in 2017 to develop off-the-shelf therapies derived from cells in human placental tissue. The company is planning on initiating trials in 2021 of three experimental treatments for solid and blood cancers. The deal continues a trend of SPAC acquisitions that kicked off 2020. Nuvation Bio, Cerevel Therapeutics and Immatics all went public through these transactions, which surged 250% in the biotech sector in 2020, according to analysis firm Global Data.

https://www.biopharmadive.com/news/celularity-292-million-spac-merger/593068/

5. McKinsey Settles for Nearly $600 Million over Role in Opioid Crisis

McKinsey & Company, the consultant to blue-chip corporations and governments around the world, has agreed to pay nearly $600 million to settle investigations into its role in helping "turbocharge" opioid sales, a rare instance of it being held publicly accountable for its work with clients. The settlements come after lawsuits unearthed a trove of documents showing how McKinsey worked to drive sales of Purdue Pharma's OxyContin painkiller amid an opioid crisis in the United States that has contributed to the deaths of more than 450,000 people over the past two decades. McKinsey's extensive work with Purdue included advising it to focus on selling lucrative high-dose pills, the records show, even after Purdue Pharma pleaded guilty in 2007 to federal criminal charges that it had misled doctors and regulators about OxyContin's risks.

https://www.nytimes.com/2021/02/03/business/mckinsey-opioids-settlement.html

6. AbbVie, Biogen Lead Pharma in New Year's Drug Price Hikes

AbbVie raised the list prices of many of its drugs on Jan. 1, while Biogen hiked the price tag of its old multiple sclerosis treatment Tysabri, part of broad, sector-wide increases typically taken at the start of a new year. The hikes could feature in calls for drug pricing legislation as a new Congress and new administration begin work. About 70 drugmakers raised prices to open 2021, averaging around 3.3%, lower than the average boost of 5.8% at the beginning of 2020, according to an analysis by RX Savings Solutions. The effect on prices seen by consumers is likely to be more limited, however, since insurers negotiate discounts off list prices. In his campaign, president-elect Joseph Biden endorsed controlling drug prices by allowing Medicare to negotiate directly with drug companies, something the program is barred from doing now. Congress is likely to begin debating such a plan once again, along with alternative proposals like imposing rebates on drugs when price increases outpace inflation.

https://www.biopharmadive.com/news/abbvie-biogen-drug-price-increases-2021/592768/

7. Health-Tech Funding Breaks Another Record in 2020

Healthcare technology companies brought in record levels of funding for 2020. Health-tech startups raised a total of $15.3 billion in 2020, up from $10.6 billion in 2019. With a total of 614 deals, for the first time, healthcare technology surpassed biopharma for deal volume. With the COVID-19 pandemic, healthcare investment across the board reached record levels, but digital health companies in particular were thrust into the spotlight, as practices needed support communicating with patients, pharmaceutical companies launched virtual clinical trials and many people tried out telehealth visits for the first time. More companies are turning toward hybrid care models, pairing virtual services with in-person clinics.

https://medcitynews.com/2021/01/health-tech-funding-breaks-another-record-in-2020/

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