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Discovery and Biotechnology for the Better of Humanity and Environmental in Asia Region

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Biotechnology is a rapidly growing cross-disciplinary field involving medicine, biology, chemistry, engineering, nanotechnology, and computer science. Based on the need to discover biotechnology in Asia with new tailored properties, thus this field became the supporting line for scientific discovery, creating innovative medical devices, drugs/vaccine development, disease management products, higher agricultural yields and algorithms that improve human health and the environment around the world. To address challenges related to biotechnology at this moment, miniaturization technology, material innovation, personalized treatment of rare diseases, and cell or gene therapies are needed to support the biotech industry and lead to reach innovation. We have been introduced to new treatment methods against Alzheimer's or cancer and also other areas such as food industry and agriculture. Not forget that this field has risen since the COVID-19 pandemic due to the increasing rate of medical and pharmaceutical sectors.

Recently, technology advancement has proven to play an important role in the healthcare system. The intensive use of biomedical instrumentation helps with diagnostics in normal and pathological states. Herein, it leads to a better understanding of human physiology, for example, by mapping the cognitive measurement of dementia patients using their cortex activities, the electrocochleography of acute stroke patients using neural network data and developing a case of miniature technology that enables us to diagnose dopamine deficiency in a shorter time and in a more simple manner.

In turn, an intervention is likely to be interpreted as surgical treatment according to the available clinical capacity. According to the orthopedic report, the traumatic cases were quite unusual for people in South and East Asia. A higher rate of accidents leading to orthopedic surgery was evident in countries such as Indonesia, Thailand, Vietnam, Philippines, Pakistan and India. A unique anatomical feature requires a specific geometry of the implant and the study related to it. Research on this orthotic device was also reported, such as the design of the spine cage and lumbar spine model that is very important to establish a general framework facilitating the understanding of the technical and medical requirements to develop new tools and methods.

Similarly, modern biotech companies are developing medicines for the specific needs of a particular person. The individualization of drugs makes them more effective, but there

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should also be fewer side effects. Therefore, a study on drug delivery model has also been discussed, such as the newer chitosan-based drug carrier, the molecular study of genotypes related the thalassemia patient, specifically patients in Java, stipulated a gene polymorphism as a risk factor in hypertension and also validation of the cryoprotectant to improve embryo during the preservation.

For developing countries, including Indonesia, in the development of biotech, there is still a gap between research results by academics and products downstream by the medical device industry. The product downstream process takes a long time because not many local medical device industries have developed it. On the other hand, the government's policy for product certification is still very rigid and requires long stages. This is one of the challenges for the local government to come up with the right policies so that biotech development can progress more quickly.

To prevent the spread of the COVID-19 virus, scientists have been forced to consider novel vaccine development and research methods, such as the evaluation of novel vaccine manufacturing from the insect cell baculovirus platform. While vaccine and drug development is constantly evolving, each vaccine/drug is just a product designed for a whole group. Regenerative medicine takes a different approach. Living tissue can be made from biologically active cells that are deposited on biodegradable scaffolds in controlled conditions, such as in a cell culture bioreactor to easily grow cell organoids; the aseptic condition was the main feature of this controlled environment that was harnessed; cell engineering was then followed by tissue recreation to put in a complete cycle of regeneratively engineered tissue; and working on a photo-initiator on natural biomaterial as tissue sealant.

As we know, the Asia Pacific continent has been known as a megabiodiversity region because of the high level of biodiversity it has, including medicinal plants, animals, energy, and also food production. Therefore, there is a need to develop an alternative antibacterial and unique antimicrobial agent, as well as address emerging issues related to antimicrobial resistance. Innovative products derived from the environment were thoroughly investigated, such as the development of an antibacterial agent from the venom of the Asian apis cerana bee and an antifungal agent from Brunei propolis. To increase the possibility and implementation of research, further feasibility studies were also emphasized. A techno-economic analysis of bioethanol production from the palm oil empty fruit bunch to put extra layer on its circular economy. However, in order to ensure the sustainability of the environment in life and in the future, it is necessary to process and treat waste, which is also an important consideration.

In this moment, Faculty of Engineering Universitas Indonesia celebrates the role that technology plays in addressing critical biotechnology and biomedical engineering during the 15th Asian Congress on Biotechnology in conjunction with the 7th International Symposium on Biomedical Engineering on October 4-6, 2022. The theme “Biotech for Stronger Recovery” was aligned with the agenda of the G-20 Presidency of Indonesia. The atmosphere of togetherness was alive with all narratives from 18 countries across the globe. This edition brought 19 articles, 11 of which resulted from collaborative work in bilateral research. Now, more than ever, biotechnology is playing a key role in advancing innovations and achieving positive social impact.

The first paper, written by Asriyanti, K. Saptaji, N. Khoiriyah, M.S. Utomo, M.S. Dwijaya, M.H. Nadhif, and F. Triawan present a method of fabricating a lumbar model made of rigid polyurethane for surgical training using indirect additive manufacturing. The authors argue that the geometrical measurements of middle end-plate depth, upper end-plate width, spinal canal width, spinal canal depth, and lower pedicle length show the error ranged from

0.14% to 0.85% and the density was increased by 64.89% compared to the reference open molded PU foam.

The second paper, written by T.M. Pratamawati, I. Alwi, and Asmarinah investigate the relationship between polymorphism of C677T and A1298C MTHFR (Methyltetrahydrofolate Reductase) gene as a risk factor for essential hypertension. The authors argue that the C677T polymorphism showed statistical significance but did not modify the risk factor for essential hypertension, whereas the A1298C polymorphism is statistically significant and has a 6-fold risk factor for essential hypertension.

The third paper written by K.C.H. Alifia, C. Kontoravdi, Z. Kis, and D. Ismail presents a techno-economic analysis to assess the baculovirus and insect cell system (BICS) platform of vaccine manufacturing and compare it to the mRNA and the saRNA platform. The authors argue that saRNA platforms is about 1,000 times more productive than the BICS platform and 20 times more productive than mRNA. BICS is a feasible option for low to middle income countries (LMIC) to produce vaccines.

The fourth paper written by G. Sabrina, R. Adawiyah, A. Usman, S.C. Mayhana, D.I.Z. Sihotang, and M. Sahlan evaluates the phytochemicals, including the total content of polyphenols and flavonoids, marker compounds, and the anti-fungal activity of propolis Brunei. The authors argue that the Brunei propolis has a total flavonoid content greater than the total polyphenol content, and the Brunei propolis extract showed antifungal activity against *Cryptococcus* and *C. albicans*.

The fifth paper, written by M. Irsyad, Y. Whulanza, P.A. Katili, R.D. Antarianto, C.O.M. Jasirwan and N. Bugtai investigates computational fluid dynamics (CFD) and shear stress-based flow analysis. The authors argue that the applied Pivot parameters correspond to an ideal environment for hepatocyte cell viability and growth, and this research is expected to increase the number of cells produced without reducing the quality of each chamber and be carried out simultaneously, automatically, and remotely controlled.

The sixth paper, written by A. Faadhila, S.F. Rahman, Y. Whulanza, S. Supriadi, J.Y. Tampubolon, S.I. Wicaksana, A.J. Rahyussalim, T. Kurniawati, and A.H. Abdullah presents the design of a Transforaminal Lumbar Interbody Fusion (TLIF) Cage and compares the analysis of the simulation with the experimental testing of the prototype. The authors present that the simulation showed that the designed TLIF spine cage can withstand the force usually given to an implanted lumbar spinal cage.

The seventh paper, written by T. Abuzairi, N.I. Sumantri, N.A. Putri, M.V. Andarini, E.J. Lampung, and D. Sitinjak presents a sterilization box with an ozone generator with a switch timer and the MQ-131 ozone sensor as an indicator if there is a leak in the box. The authors argue that the optimum time for sterilizing medical devices on the sterilization ozone box is 20 minutes which can reduce the colony of Staphylococcus bacteria with an ozone concentration of 4.94 ppm.

The eighth paper, written by H. Zakaria, A.R. Amalia, S. Hadiyoso, and M.F.R. Ashadi presents an analysis of differences in brain activation in healthy elderly (non-stroke) and post-stroke patients with vascular dementia when performing recall memory work. The authors argue that the paired T-test showed that elderly non-strokes subjects produced significant differences in activity when repeating numbers correctly and incorrectly, while in stroke patients with vascular dementia there was no significant difference when repeating numbers correctly and incorrectly.

The ninth paper, written by H. Alfarobi, E.S. Yulianti, N. Intan, Y. Whulanza, D-H. Park, and S.F. Rahman created the screen-printed electrodes (SPEs) by printing several types of ink on a ceramic or plastic substrate, namely a polyethylene terephthalate (PET). The

authors argue that the fabrication of SPEs could be carried out up to 5 layers but still not get results that match the initial design geometry.

The tenth paper, written by D. Puspitasari, W. Budhijanto, E. Purnomo, and P.S. Nugraheni investigate the effect of adding Irgacure® 2959 to chitosan-alginate hydrogel with different concentrations as a tissue sealant designed for the colon. The authors argue that the addition of 4% Irgacure® 2959 reduced the degree of swelling, increased the hydrogel's resistance to water, and had higher adhesion.

The eleventh paper, written by F.Z. Kamala, W. Budhijanto, E. Purnomo, and P.S. Nugraheni, investigate the effect of adding Irgacure® 2959 in the manufacture of hydrogel based on a chitosan-kappa-carrageenan solution formulated as a colon tissue adhesive. The authors argue that the addition of Irgacure® 2959 did not show significantly different results from the control that indicating it cannot increase the crosslinking between chitosan and kappa-carrageenan.

The twelveth paper, written by D. Nauphar, P.A. Wahidiyat, and Y. Ariani presents the most common mutation and identifies genotype-to-phenotype relations in transfusion-dependent thalassemia patients. The authors argue that the most common thalassemia mutations in the Indonesian population can streamline the subsequent diagnostic approaches by focusing on the small range of predominant alleles instead of a wide range of alleles, which can provide critical data for better patient management.

The thirteenth paper, written by Y. Whulanza, A.D. Antory, Warjito, S.F. Rahman, M. Gozan, M.S. Utomo, and S. Kassegne, evaluates a microfluidic platform for dopamine detection developed in an on-chip microsystem. The authors argue that the microfluidic platform that showed the pump module and served as a mixing point was able to deliver a maximum of 121.36 µL with 2-3 strokes of normal finger pressure priming.

The fourthteenth paper, written by A.F. Nurfirdausi, R.A. Apsari, S.K. Wijaya, P. Prajitno, and N. Ibrahim, investigates the optimal epoch length to classify four stroke classes (healthy, minor, moderate, and severe) during the resting condition for a machine learning-based Acutte Ischemic Stroke (AIS) computer-aided diagnostics system. The authors argue that the best performance was obtained at the 60-second epoch length with 89% accuracy using 15 hidden layers.

The fifteenth paper, written by M.D. Larasati, S.W. Lestari, A. Hestiantoro, and M. Pangestu, reviews the modification of a cryoprotectant that can damage the cell, thereby improving embryo quality. The authors argue that for the cryopreservation of spermatozoa to obtain good embryo quality, where modified cryoprotectants can be an alternative cryoprotectant compared to commercial cryoprotectants. The use of antioxidants in spermatozoa cryopreservation can also prevent cell damage due to the negative effects of cryoprotectants.

The sixteenth paper, written by A.S. Purnomo, A.S. Prameswari, H.D. Rizqi, T.R. Alkas, R. Ediati, and Y. Kusumawati, presents the biotransformation of methylene blue (MB) by mixed fungal cultures of *Gloeophyllum trabeum* and Aspergillus oryzae. The addition of A. oryzae to G. trabeum cultures showed methylene blue biodecolorization reaching 69.34%, greater than single cultures of G. trabeum and A. oryzae, which were 31.50% and 36.82%, respectively. The results of this study showed that the addition of *A. oryzae* enhanced the percentage of MB decolorization from *G. trabeum* culture.

The seventeenth paper, written by K. Lischer, I.P. Mustika, M. Sahlan, and B.W. Guslianto, presents isolate bioactive melittin and phospholipase A2 (PLA2) of honey bee venom from Indonesian Apis cerana and examines the antibacterial activity. The diameter of the inhibition zone was 7.76 mm when the concentration of PLA2 was 45 µg/mL against

Escherichia coli. The authors explained that PLA2 has antibacterial activity and may be a promising candidate for the antibacterial agent on Gram-negative bacteria.

The eighteenth paper, written by T.R. Srinophakun and P. Suwajittanont presents the techno-economic analysis of bioethanol production from palm oil empty fruit bunch (EFB) with commercial-scale bioethanol production from EFB of 99.5 wt.% at 10,000 L/day ethanol. The authors argue that the ethanol production rate was 13,950 L/day using an EFB of 47,208 kg/day, and this production is profitable.

The nineteenth paper written by D. Timotius, Y. Kusumastuti, R. Omar, R. Harun, S.M.M. Kamal, S.N.A. Jenie, and H.T.B.M Petrus, investigats how to synthesize sponges from chitosan-graft-maleic anhydride at a certain mass ratio (1:2, 1:1; and 2:1) in dimethyl sulfoxide (DMSO). The authors argue that the drug loading kinetics using methylene blue as the drug model corresponded to a pseudo-first-order model and the adsorption isotherm model followed the Freundlich model.

I hope that this edition of IJTech conveys new insights into how we conduct research. I am pleased to accept and respond to any comment or inquiry you may have on the direction and content of IJTech, and I invite you to join us in this endeavor by submitting your work for consideration. We look forward to updating you on more activities over the course of the year.

With warmest regards from Jakarta,

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