Rapport de veille n°118

Risques biologiques
Octobre-décembre 2022

Objectifs : veilles spécifiques sur la thématique du risque biologique : biotechnologies (nouveaux procédés), équipements de protection individuelle (fièvre hémorragique, Ebola), protection respiratoire (ajustement), zoonoses (pathologies émergentes), légionellose (cas professionnels), endotoxines (effets toxiques/multi-expositions).

+ suivi d'organismes français et internationaux (sélection d'actualités classées par thème).

La validation des informations fournies (exactitude, fiabilité, pertinence par rapport aux principes de prévention, etc.) est du ressort des auteurs des articles signalés dans la veille. Les informations ne sont pas le reflet de la position de l'INRS.

Les liens mentionnés dans le bulletin donnent accès aux documents sous réserve d'un abonnement à la ressource.

Sommaire :

Veille risque biologique

• Protection respiratoire : ajustement

Cordeiro L, Gnatta JR, Ciofi-Silva CL, Price A, de Oliveira NA, Almeida RMA, et al.

Personal protective equipment implementation in healthcare: A scoping review.

American Journal of Infection Control. 2022;50(8):898-905.

https://doi.org/10.1016/j.ajic.2022.01.013

Background: Adherence to infection prevention and control (IPC) measures, including the proper use of pro-tective personal equipment (PPE), in health care is complex and is influenced by many factors. Isolated inter-ventions do not have the potential to achieve optimal PPE adherence and appropriate provision, leading to incomplete PPE implementation.Objective: To map PPE implementation in health care with a focus on its barriers and facilitators.Methods: A scoping review was conducted across 14 electronic databases using the Joanna Briggs Institute methodology.Results: Seventy-four papers were included in the review. Findings were analyzed and synthesized into categories to match the Consolidated Framework for Implementation Research domains. The content was then synthesized into barriers for PPE implementation and interventions to address them. The main barriers were discomfort in clinical work; shortage, supply and logistics problems; inadequacies in facilities infrastructure, weakness in policies and communication procedures; and health workers' (HW) psychological issues and lack of preparedness. Implementation interventions reported were related to HW wellbeing assurance; work reorganization; IPC protocols; adoption of strategies to improve commu-nication and HW training; and adoption of structural and organizational changes to improve PPE adherence.Conclusions: PPE implementation, which is critical IPC programs, involves multilevel transdisciplinary complexity. It relies on the development of context-driven implementation strategies to inform and harmonize IPC policy in collaboration with local and international health bodies.(c) 2022 Association for Professionals in Infection Control and Epidemiology, Inc. Published by Elsevier Inc. All rights reserved.

Novak M, Gloor C, Wicki E, Herb D, Schibli A, Richner G.

Assessment of a novel, easy-to-implement, aerosolized H2O2 decontamination method for single-use filtering facepiece respirators in case of shortage.

Journal of occupational and environmental hygiene. 2022;19(10-11):663-75.

https://doi.org/10.1080/15459624.2022.2125519

The COVID-19 pandemic has affected the world and caused a supply shortage of personal protection equipment, especially filtering facepiece respirators (FFP). This has increased the risk of many healthcare workers contracting SARS-CoV-2. Various strategies have been assessed to tackle these supply issues. In critical shortage scenarios, reusing single-use-designed respirators may be required.

Thus, an easily applicable and reliable FFP2 (or alike) respirator decontamination method, allowing safe re-use of FFP2 respirators by healthcare personnel, has been developed and is presented in this study. A potent and gentle aerosolized hydrogen peroxide (12% wt) method was applied over 4 hr to decontaminate various brands of FFP2 respirators within a small common room, followed by adequate aeration and storage overnight. The microbial efficacy was tested on unused respirator pieces using spores of Geobacillus stearothermophilus. Further, decontamination effectiveness was tested on used respirators after one 12-hr shift by swabbing before and after the decontamination. The effects of up to ten decontamination cycles on the respirators' functionality were evaluated using material properties, the structural integrity of the respirators, and fit tests with subjects. The suggested H2O2 decontamination procedure was proven to be (a) sufficiently potent (no microbial recovery, total inactivation of biological indicators as well as spore inoculum on critical respirator surfaces), (b) gentle as no significant damage to the respirator structural integrity and acceptable fit factors were observed, and (c) safe as no H2O2 residue were detected after the defined aeration and storage. Thus, this easy-to-implement and scalable method could overcome another severe respirator shortage, providing enough flexibility to draft safe, effective, and logistically simple crisis plans. However, as highlighted in this study, due to the wealth of design and material used in different models and brands of respirators, the decontamination process should be validated for each FFP respirator model before its field implementation.

- ## Zoonoses : pathologies émergentes

Andersen K, Vestergaard L, Nissen J, George S, Ryt-Hansen P, Hjulsager C, et al.

Severe Human Case of Zoonotic Infection with Swine-Origin Influenza A Virus, Denmark, 2021.

Emerging Infectious Disease journal. 2022;28(12):2561.

https://wwwnc.cdc.gov/eid/article/28/12/22-0935_article

https://wwwnc.cdc.gov/eid/article/28/12/pdfs/22-0935.pdf

During routine surveillance at the National Influenza Center, Denmark, we detected a zoonotic swine influenza A virus in a patient who became severely ill. We describe the clinical picture and the genetic characterization of this variant virus, which is distinct from another variant found previously in Denmark.

Caldas J, Valdoleiros S, Rebelo S, Tavares M.

Monkeypox after Occupational Needlestick Injury from Pustule.

Emerging Infectious Disease journal. 2022;28(12):2516.

https://wwwnc.cdc.gov/eid/article/28/12/22-1374_article

https://wwwnc.cdc.gov/eid/article/28/12/pdfs/22-1374.pdf

We report a case of monkeypox in a physician after an occupational needlestick injury from a pustule. This case highlights risk for occupational transmission and manifestations of the disease after percutaneous transmission: a short incubation period, followed by a solitary lesion at the injured site and later by systemic symptoms.

Cossaboom C, Nyakarahuka L, Mulei S, Kyondo J, Tumusiime A, Baluku J, et al.

Rift Valley Fever Outbreak during COVID-19 Surge, Uganda, 2021.

Emerging Infectious Disease journal. 2022;28(11):2290.

https://wwwnc.cdc.gov/eid/article/28/11/22-0364_article

https://wwwnc.cdc.gov/eid/article/28/11/pdfs/22-0364.pdf

Rift Valley fever, endemic or emerging throughout most of Africa, causes considerable risk to human and animal health. We report 7 confirmed Rift Valley fever cases, 1 fatal, in Kiruhura District, Uganda, during 2021. Our findings highlight the importance of continued viral hemorrhagic fever surveillance, despite challenges associated with the COVID-19 pandemic.

Esser H, Lim S, de Vries A, Sprong H, Dekker D, Pascoe E, et al.

Continued Circulation of Tick-Borne Encephalitis Virus Variants and Detection of Novel Transmission Foci, the Netherlands.

Emerging Infectious Disease journal. 2022;28(12):2416.

https://wwwnc.cdc.gov/eid/article/28/12/22-0552_article

https://wwwnc.cdc.gov/eid/article/28/12/pdfs/22-0552.pdf

Tick-borne encephalitis virus (TBEV) is an emerging pathogen that was first detected in ticks and humans in the Netherlands in 2015 (ticks) and 2016 (humans). To learn more about its distribution and prevalence in the Netherlands, we conducted large-scale surveillance in ticks and rodents during August 2018–September 2020. We tested 320 wild rodents and >46,000 ticks from 48 locations considered to be at high risk for TBEV circulation. We found TBEV RNA in 3 rodents (0.9%) and 7 tick pools (minimum infection rate 0.02%) from 5 geographically distinct foci. Phylogenetic analyses indicated that 3 different variants of the TBEV-Eu subtype circulate in the Netherlands, suggesting multiple independent introductions. Combined with recent human cases outside known TBEV hotspots, our data demonstrate that the distribution of TBEV in the Netherlands is more widespread than previously thought.

Guzzetta G, Mammone A, Ferraro F, Caraglia A, Rapiti A, Marziano V, et al.

Early Estimates of Monkeypox Incubation Period, Generation Time, and Reproduction Number, Italy, May–June 2022.

Emerging Infectious Disease journal. 2022;28(10):2078.

https://wwwnc.cdc.gov/eid/article/28/10/22-1126_article

https://wwwnc.cdc.gov/eid/article/28/10/pdfs/22-1126.pdf

We analyzed the first 255 PCR-confirmed cases of monkeypox in Italy in 2022. Preliminary estimates indicate mean incubation period of 9.1 (95% CI 6.5–10.9) days, mean generation time of 12.5 (95% CI 7.5–17.3) days, and reproduction number among men who have sex with men of 2.43 (95% CI 1.82–3.26).

Leibler JH, Abdelgadir A, Seidel J, White RF, Johnson WE, Reynolds SJ, et al.

Influenza D virus exposure among US cattle workers: A call for surveillance.

Zoonoses and public health.5.

https://doi.org/10.1111/zph.13008

Although cattle are a reservoir for influenza D virus (IDV), little is known about human exposure to IDV. We assessed IDV exposure and associated health effects among United States dairy workers, a population at heightened risk of cattle zoonoses. In prospective, cross-shift sampling of 31 workers employed at five large-herd dairy operations in two states, we found evidence of IDV in the nasal washes of 67% of participants at least once during the 5-day study period. IDV exposure was not associated with respiratory symptoms in these workers. These findings suggest that IDV is present in dairy cattle environments and can result in worker exposure.

Luciani L, Lapidus N, Amroun A, Falchi A, Souksakhone C, Mayxay M, et al.

Orthopoxvirus Seroprevalence and Infection Susceptibility in France, Bolivia, Laos, and Mali.

Emerging Infectious Disease journal. 2022;28(12):2463.

https://wwwnc.cdc.gov/eid/article/28/12/22-1136_article

https://wwwnc.cdc.gov/eid/article/28/12/pdfs/22-1136.pdf

To determine a demographic overview of orthopoxvirus seroprevalence, we tested blood samples collected during 2003–2019 from France (n = 4,876), Bolivia (n = 601), Laos (n = 657), and Mali (n = 255) for neutralizing antibodies against vaccinia virus. In addition, we tested 4,448 of the 4,876 samples from France for neutralizing antibodies against cowpox virus. We confirmed extensive cross-immunity between the 2 viruses. Seroprevalence of antibodies was <1% in Bolivia, <5% in Laos, and 17.25% in Mali. In France, we found low prevalence of neutralizing antibodies in persons who were unvaccinated and vaccinated for smallpox, suggesting immunosenescence occurred in vaccinated persons, and smallpox vaccination compliance declined before the end of compulsory vaccination. Our results suggest that populations in Europe, Africa, Asia, and South America are susceptible to orthopoxvirus infections, which might have precipitated the emergence of orthopoxvirus infections such as the 2022 spread of monkeypox in Europe.

Lulli LG, Baldassarre A, Mucci N, Arcangeli G.

Prevention, Risk Exposure, and Knowledge of Monkeypox in Occupational Settings: A Scoping Review.

Tropical Medicine and Infectious Disease. 2022;7(10):15.

https://mdpi-res.com/d_attachment/tropicalmed/tropicalmed-07-00276/article_deploy/tropicalmed-07-00276-v2.pdf?version=1666247608

With ongoing climate change, which alters the conditions for pathogens and vectors, zoonotic diseases such as monkeypox virus will become a challenge and a great threat impacting global health in future decades. A current outbreak of monkeypox is occurring in over 125 countries, with a report of thousands of cases in countries where this virus has never appeared. Occupational exposure to the monkeypox virus has recently been identified as an issue of major concern for occupational health, especially in healthcare settings. A scoping review following the PRISMA guidelines was performed, aiming to analyze the effects that the current monkeypox outbreak has in workplaces, given the potential exposure of healthcare workers to the virus, the possible spread of the virus in occupational settings, and the preventive measures that are necessary to implement. At the end of the selection process, 21 studies were included in the review. Healthcare workers are considered at a high risk, and similar preventive measures to those adopted during the SARS-CoV-2 pandemic must be implemented in all

healthcare settings. The main recommendations for preventing and managing monkeypox in occupational settings are the vaccination of exposed workers, the prompt identification and isolation of infected individuals, and good hygiene practices. Education and specific training are necessary in non-endemic countries to make healthcare workers able to recognize the disease and prevent further contagions. Although monkeypox seems unlikely to reach the pandemic spread of COVID-19, an approach to global health even to avoid future zoonotic epidemics is required by all stakeholders.

McBride D, Nolting J, Nelson S, Spurck M, Bliss N, Kenah E, et al.

Shortening Duration of Swine Exhibitions to Reduce Risk for Zoonotic Transmission of Influenza A Virus.

Emerging Infectious Disease journal. 2022;28(10):2035.

https://wwwnc.cdc.gov/eid/article/28/10/22-0649_article

https://wwwnc.cdc.gov/eid/article/28/10/pdfs/22-0649.pdf

Reducing zoonotic influenza A virus (IAV) risk in the United States necessitates mitigation of IAV in exhibition swine. We evaluated the effectiveness of shortening swine exhibitions to <72 hours to reduce IAV risk. We longitudinally sampled every pig daily for the full duration of 16 county fairs during 2014–2015 (39,768 nasal wipes from 6,768 pigs). In addition, we estimated IAV prevalence at 195 fairs during 2018–2019 to test the hypothesis that <72-hour swine exhibitions would have lower IAV prevalence. In both studies, we found that shortening duration drastically reduces IAV prevalence in exhibition swine at county fairs. Reduction of viral load in the barn within a county fair is critical to reduce the risk for interspecies IAV transmission and pandemic potential. Therefore, we encourage fair organizers to shorten swine shows to protect the health of both animals and humans.

Muroni G, Pinna L, Serra E, Chisu V, Mandas D, Coccollone A, et al.

A Chlamydia psittaci Outbreak in Psittacine Birds in Sardinia, Italy.

International Journal of Environmental Research and Public Health. 2022;19(21):9.

https://mdpi-res.com/d_attachment/ijerph/ijerph-19-14204/article_deploy/ijerph-19-14204.pdf?version=1667125756

Chlamydia psittaci is an intracellular bacterium belonging to the Chlamydiaceae family. It is the ethiologic agent of psittacosis, an occupational zoonotic disease that mainly concerns people who work in close contact with birds that represent the main infection route for human transmission. In Italy, information about this disease is lacking. This study is the first case of avian chlamydiosis reported from a pet shop in Sardinia, Italy. Chlamydia psittaci detected in psittacine birds by molecular analysis, direct immunofluorescence test together with anatomo-pathological observed lesions, highlighted the importance of focusing the attention over this underestimated zoonosis in a "One Health" prospective.

Nyakarahuka L, Whitmer S, Kyondo J, Mulei S, Cossaboom C, Telford C, et al.

Crimean-Congo Hemorrhagic Fever Outbreak in Refugee Settlement during COVID-19 Pandemic, Uganda, April 2021.

Emerging Infectious Disease journal. 2022;28(11):2326.

https://wwwnc.cdc.gov/eid/article/28/11/22-0365_article

https://wwwnc.cdc.gov/eid/article/28/11/pdfs/22-0365.pdf

Crimean-Congo hemorrhagic fever (CCHF) was detected in 2 refugees living in a refugee settlement in Kikuube district, Uganda. Investigations revealed a CCHF IgG seroprevalence of 71.3% (37/52) in goats within the refugee settlement. This finding highlights the need for a multisectoral approach to controlling CCHF in humans and animals in Uganda.

Salvato RS, Rodrigues Ikeda ML, Barcellos RB, Godinho FM, Sesterheim P, Bitencourt LCB, et al.

Possible Occupational Infection of Healthcare Workers with Monkeypox Virus, Brazil.

Emerging Infectious Disease journal. 2022;28(12):2520.

https://wwwnc.cdc.gov/eid/article/28/12/22-1343_article

https://wwwnc.cdc.gov/eid/article/28/12/pdfs/22-1343.pdf

We evaluated epidemiologic and molecular characteristics of monkeypox virus (MPXV) infections sampled from 2 healthcare nurses. Five days after collecting samples from an infected patient, the nurses showed typical MPXV manifestations; quantitative PCR and whole-genome sequencing confirmed MPXV infection, most likely transmitted through contact with fomites.

Sit THC, Sun W, Tse ACN, Brackman C, Cheng SMS, Tang AWY, et al.

Novel Zoonotic Avian Influenza A(H3N8) Virus in Chicken, Hong Kong, China.

Emerging Infectious Disease journal. 2022;28(10):2009.

https://wwwnc.cdc.gov/eid/article/28/10/22-1067_article

https://wwwnc.cdc.gov/eid/article/28/10/pdfs/22-1067.pdf

Zoonotic and pandemic influenza continue to pose threats to global public health. Pandemics arise when novel influenza A viruses, derived in whole or in part from animal or avian influenza viruses, adapt to transmit efficiently in a human population that has little population immunity to contain its onward transmission. Viruses of previous pandemic concern, such as influenza A(H7N9), arose from influenza A(H9N2) viruses established in domestic poultry acquiring a hemagglutinin and neuraminidase from influenza A viruses of aquatic waterfowl. We report a novel influenza A(H3N8) virus in chicken that has emerged in a similar manner and that has been recently reported to cause zoonotic disease. Although they are H3 subtype, these avian viruses are antigenically distant from contemporary human influenza A(H3N2) viruses, and there is little cross-reactive immunity in the human population. It is essential to heighten surveillance for these avian A(H3N8) viruses in poultry and in humans.

Walker M, Tan LM, Dang LH, Van Khang P, Ha HTT, Hung TTM, et al.

Spatiotemporal Patterns of Anthrax, Vietnam, 1990–2015.

Emerging Infectious Disease journal. 2022;28(11):2206.

https://wwwnc.cdc.gov/eid/article/28/11/21-2584_article

https://wwwnc.cdc.gov/eid/article/28/11/pdfs/21-2584.pdf

Anthrax is a priority zoonosis for control in Vietnam. The geographic distribution of anthrax remains to be defined, challenging our ability to target areas for control. We analyzed human anthrax cases in

Vietnam to obtain anthrax incidence at the national and provincial level. Nationally, the trendline for cases remained at ≈61 cases/year throughout the 26 years of available data, indicating control efforts are not effectively reducing disease burden over time. Most anthrax cases occurred in the Northern Midlands and Mountainous regions, and the provinces of Lai Chau, Dien Bien, Lao Cai, Ha Giang, Cao Bang, and Son La experienced some of the highest incidence rates. Based on spatial Bayes smoothed maps, every region of Vietnam experienced human anthrax cases during the study period. Clarifying the distribution of anthrax in Vietnam will enable us to better identify risk areas for improved surveillance, rapid clinical care, and livestock vaccination campaigns.

• Endotoxines : effets toxiques, multi-expositions

Luedders J, Poole JA.

Influence of Rural Environmental Factors in Asthma.

Immunology and allergy clinics of North America. 2022;42(4):817-30.

https://doi.org/10.1016/j.iac.2022.05.008

PURPOSE: The objective of this article is to review recent literature on the implications of agricultural factors including pesticides, animal/livestock production facilities, agricultural dust, endotoxin, biomass/crop burning, and nutritional factors with respiratory health. METHODS: PubMed, Embase, and CINAHL literature searches for the years 2016 to 2021 were conducted with librarian assistance. RESULTS: Several studies suggest increased risk for asthma or wheeze with certain rural exposures, particularly for pesticides, livestock production facilities, agricultural dust, and biomass and crop burning. CONCLUSION: A complex network of environmental factors exists, which may have detrimental effects on the respiratory health of rural residents.

Biotechnologies

• Nouveaux procédés

Bhattacharya D, Nanda PK, Pateiro M, Lorenzo JM, Dhar P, Das AK.

Lactic Acid Bacteria and Bacteriocins: Novel Biotechnological Approach for Biopreservation of Meat and Meat Products.

Microorganisms. 2022;10(10):25.

https://mdpi-res.com/d_attachment/microorganisms/microorganisms-10-02058/article_deploy/microorganisms-10-02058-v2.pdf?version=1666671574

Meat and meat products are perishable in nature, and easily susceptible to microbial contamination and chemical deterioration. This not only results in an increased risk to health of consumers, but also causes economic loss to the meat industry. Some microorganisms of the lactic acid bacteria (LAB) group and their ribosomal-synthesized antimicrobial peptides-especially bacteriocins-can be used as a natural preservative, and an alternative to chemical preservatives in meat industry. Purified or partially purified bacteriocins can be used as a food additive or incorporated in active packaging, while bacteriocin-producing cells could be added as starter or protective cultures for fermented meats. Large-scale

applications of bacteriocins are limited, however, mainly due to the narrow antimicrobial spectrum and varying stability in different food matrixes. To overcome these limitations, bioengineering and biotechnological techniques are being employed to combine two or more classes of bacteriocins and develop novel bacteriocins with high efficacy. These approaches, in combination with hurdle concepts (active packaging), provide adequate safety by reducing the pathogenicity of spoilage microorganisms, improving sensory characteristics (e.g., desirable flavor, texture, aroma) and enhancing the shelf life of meat-based products. In this review, the biosynthesis of different classes of LAB bacteriocins, their mechanism of action and their role in the preservation of meats and meat products are reviewed.

Fernandes de Souza H, Aguiar Borges L, Dédalo Di Próspero Gonçalves V, Vitor Dos Santos J, Sousa Bessa M, Fronja Carosia M, et al.

Recent advances in the application of xylanases in the food industry and production by actinobacteria: A review.

Food research international (Ottawa, Ont). 2022;162(Pt B):112103.

https://doi.org/10.1016/j.foodres.2022.112103

The microbial production of enzymes has been gaining prominence in the industry, because, in addition to presenting specificity and acting in mild reaction conditions, they can also be considered eco-friendly. An example with growing importance for the food industry is xylanases, which are prominent in beverage processing, bakery products and the production of emerging prebiotics. Microorganisms of the phylum Actinobacteria are promising sources for the production of these enzymes, however few studies in the literature report investigations on the production of xylanases by actinobacteria. This review brings together important information on the production of xylanases by actinobacteria and recent advances in the use of the enzyme in the food industry.

Ghosh B.

Artificial cell design: reconstructing biology for life science applications.

Emerging topics in life sciences. 2022;6(6):619-27.

https://doi.org/10.1042/ETLS20220050

Artificial cells are developed to redesign novel biological functions in a programmable and tunable manner. Although it aims to reconstitute living cell features and address 'origin of life' related questions, rapid development over the years has transformed artificial cells into an engineering tool with huge potential in applied biotechnology. Although the application of artificial cells was introduced decades ago as drug carriers, applications in other sectors are relatively new and could become possible with the technological advancement that can modulate its designing principles. Artificial cells are non-living system that includes no prerequisite designing modules for their formation and therefore allow freedom of assembling desired biological machinery within a physical boundary devoid of complex contemporary living-cell counterparts. As stimuli-responsive biomimetic tools, artificial cells are programmed to sense the surrounding, recognise their target, activate its function and perform the defined task. With the advantage of their customised design, artificial cells are being studied in biosensing, drug delivery, anti-cancer therapeutics or artificial photosynthesis type fields. This mini-review highlights those advanced fields where artificial cells with a minimalistic setup are developed as user-defined custom-made microreactors, targeting to reshape our future 'life'.

Jeong E, Choi S, Cho SW.

Recent Advances in Brain Organoid Technology for Human Brain Research.

ACS Appl Mater Interfaces. 2022.

Brain organoids are self-assembled three-dimensional aggregates with brain-like cell types and structures and have emerged as new model systems that can be used to investigate human neurodevelopment and neurological disorders. However, brain organoids are not as mature and functional as real human brains due to limitations of the culture system with insufficient developmental patterning signals and a lack of components that are important for brain development and function, such as the non-neural population and vasculature. In addition, establishing the desired brain-like environment and monitoring the complex neural networks and physiological functions of the brain organoids remain challenging. The current protocols to generate brain organoids also have problems with heterogeneity and batch variation due to spontaneous self-organization of brain organoids into complex architectures of the brain. To address these limitations of current brain organoid technologies, various engineering platforms, such as extracellular matrices, fluidic devices, three-dimensional bioprinting, bioreactors, polymeric scaffolds, microelectrodes, and biochemical sensors, have been employed to improve neuronal development and maturation, reduce structural heterogeneity, and facilitate functional analysis and monitoring. In this review, we provide an overview of the latest engineering techniques that overcome these limitations in the production and application of brain organoids.

Kaur S, Tiwari V, Kumari A, Chaudhary E, Sharma A, Ali U, et al.

Protective and defensive role of anthocyanins under plant abiotic and biotic stresses: An emerging application in sustainable agriculture.

Journal of biotechnology. 2023;361:12-29.

Global warming is the major cause of abiotic and biotic stresses that reduce plant growth and productivity. Various stresses such as drought, low temperature, pathogen attack, high temperature and salinity all negatively influence plant growth and development. Due to sessile beings, they cannot escape from these adverse conditions. However, plants develop a variety of systems that can help them to tolerate, resist, and escape challenges imposed by the environment. Among them, anthocyanins are a good example of stress mitigators. They aid plant growth and development by increasing anthocyanin accumulation, which leads to increased resistance to various biotic and abiotic stresses. In the primary metabolism of plants, anthocyanin improves the photosynthesis rate, membrane permeability, up-regulates many enzyme transcripts related to anthocyanin biosynthesis, and optimizes nutrient uptake. Generally, the most important genes of the anthocyanin biosynthesis pathways were up-regulated under various abiotic and biotic stresses. The present review will highlight anthocyanin mediated stress tolerance in plants under various abiotic and biotic stresses. We have also compiled literature related to genetically engineer stress-tolerant crops generated using over-expression of genes belonging to anthocyanin biosynthetic pathway or its regulation. To sum up, the present review provides an up-to-date description of various signal transduction mechanisms that modulate or enhance anthocyanin accumulation under stress conditions.

Mandal S, Das T, Nandy S, Ghorai M, Saha SC, Gopalakrishnan AV, et al.

Biotechnological and endophytic-mediated production of centellosides in Centella asiatica.

Applied microbiology and biotechnology. 2022.

https://link.springer.com/article/10.1007/s00253-022-12316-z

In vitro culture of a plant cell, tissue and organ is a marvellous, eco-friendly biotechnological strategy for the production of phytochemicals. With the emergence of recent biotechnological tools, genetic engineering is now widely practiced enhancing the quality and quantity of plant metabolites. Triterpenoid saponins especially asiaticoside and madecassoside of Centella asiatica (L.) Urb. are popularly known for their neuroprotective activity. It has become necessary to increase the production of asiaticoside and madecassoside because of their high pharmaceutical and industrial demand. Thus, the review aims to provide efficient biotechnological tools along with proper strategies. This review also included a comparative analysis of various carbon sources and biotic and abiotic elicitors. The vital roles of a variety of plant growth regulators and their combinations have also been evaluated at different in vitro growth stages of Centella asiatica. Selection of explants, direct and callus-mediated organogenesis, root organogenesis, somatic embryogenesis, synthetic seed production etc. are also highlighted in this study. In a nutshell, this review will present the research outcomes of different biotechnological interventions used to increase the yield of triterpenoid saponins in C. asiatica. KEY POINTS: • Critical and updated assessment on in vitro biotechnology in C. asiatica. • In vitro propagation of C. asiatica and elicitation of triterpenoid saponins production. • Methods for mass producing C. asiatica.

Pourmasoumi P, Moghaddam A, Nemati Mahand S, Heidari F, Salehi Moghaddam Z, Arjmand M, et al.

A review on the recent progress, opportunities, and challenges of 4D printing and bioprinting in regenerative medicine.

Journal of biomaterials science Polymer edition. 2023;34(1):108-46.

https://doi.org/10.1080/09205063.2022.2110480

Four-dimensional (4 D) printing is a novel emerging technology, which can be defined as the ability of 3 D printed materials to change their form and functions. The term 'time' is added to 3 D printing as the fourth dimension, in which materials can respond to a stimulus after finishing the manufacturing process. 4 D printing provides more versatility in terms of size, shape, and structure after printing the construct. Complex material programmability, multi-material printing, and precise structure design are the essential requirements of 4 D printing systems. The utilization of stimuli-responsive polymers has increasingly taken the place of cell traction force-dependent methods and manual folding, offering a more advanced technique to affect a construct's adjusted shape transformation. The present review highlights the concept of 4 D printing and the responsive bioinks used in 4 D printing, such as water-responsive, pH-responsive, thermo-responsive, and light-responsive materials used in tissue regeneration. Cell traction force methods are described as well. Finally, this paper aims to introduce the limitations and future trends of 4 D printing in biomedical applications based on selected key references from the last decade.

Qin C, Wang Y, Hu J, Wang T, Liu D, Dong J, et al.

Artificial Olfactory Biohybrid System: An Evolving Sense of Smell.

Advanced science (Weinheim, Baden-Wurttemberg, Germany). 2022:e2204726.

https://doi.org/10.1002/advs.202204726

The olfactory system can detect and recognize tens of thousands of volatile organic compounds (VOCs) at low concentrations in complex environments. Bioelectronic nose (B-EN), which mimics olfactory systems, is becoming an emerging sensing technology for identifying VOCs with sensitivity and specificity. B-ENs integrate electronic sensors with bioreceptors and pattern recognition technologies to enable medical diagnosis, public security, environmental monitoring, and food safety. However,

there is currently no commercially available B-EN on the market. Apart from the high selectivity and sensitivity necessary for volatile organic compound analysis, commercial B-ENs must overcome issues impacting sensor operation and other problems associated with odor localization. The emergence of nanotechnology has provided a novel research concept for addressing these problems. In this work, the structure and operational mechanisms of biomimetic olfactory systems are discussed, with an emphasis on the development and immobilization of materials. Various biosensor applications and current developments are reviewed. Challenges and opportunities for fulfilling the potential of artificial olfactory biohybrid systems in fundamental and practical research are investigated in greater depth.

Sacramento MMA, Borges J, Correia FJS, Calado R, Rodrigues JMM, Patrício SG, et al.

Green approaches for extraction, chemical modification and processing of marine polysaccharides for biomedical applications.

Frontiers in bioengineering and biotechnology. 2022;10:1041102.

https://doi.org/10.3389%2Ffbioe.2022.1041102

Over the past few decades, natural-origin polysaccharides have received increasing attention across different fields of application, including biomedicine and biotechnology, because of their specific physicochemical and biological properties that have afforded the fabrication of a plethora of multifunctional devices for healthcare applications. More recently, marine raw materials from fisheries and aquaculture have emerged as a highly sustainable approach to convert marine biomass into added-value polysaccharides for human benefit. Nowadays, significant efforts have been made to combine such circular bio-based approach with cost-effective and environmentally-friendly technologies that enable the isolation of marine-origin polysaccharides up to the final construction of a biomedical device, thus developing an entirely sustainable pipeline. In this regard, the present review intends to provide an up-to-date outlook on the current green extraction methodologies of marine-origin polysaccharides and their molecular engineering toolbox for designing a multitude of biomaterial platforms for healthcare. Furthermore, we discuss how to foster circular bio-based approaches to pursue the further development of added-value biomedical devices, while preserving the marine ecosystem.

Soozanipour A, Ejeian F, Boroumand Y, Rezayat A, Moradi S.

Biotechnological advancements towards water, food and medical healthcare: A review.

Chemosphere. 2023;312(Pt 1):137185.

https://doi.org/10.1016/j.chemosphere.2022.137185

The global health status is highly affected by the growing pace of urbanization, new lifestyles, climate changes, and resource exploitation. Modern technologies pave a promising way to deal with severe concerns toward sustainable development. Herein, we provided a comprehensive review of some popular biotechnological advancements regarding the progress achieved in water, food, and medicine, as the most substantial fields related to public health. The emergence of novel organic/inorganic materials has brought about significant improvement in conventional water treatment techniques, anti-fouling approaches, anti-microbial agents, food processing, biosensors, drug delivery systems, and implants. Particularly, a growing interest has been devoted to nanomaterials and their application for developing novel structures or improving the characteristics of standard components. Also, bioinspired materials have been widely used to improve the performance, efficiency, accuracy, stability, safety, and cost-effectiveness of traditional systems. On the other side, the fabrication of innovative devices for precisely monitoring and managing various ecosystem and human health issues is of great importance.

Above all, exceptional advancements in designing ion-selective electrodes (ISEs), microelectromechanical systems (MEMs), and implantable medical devices have altered the future landscape of environmental and biomedical research. This review paper aimed to shed light on the wide-ranging materials and devices that have been developed for health applications and mainly focused on the impact of nanotechnology in this field.

Wang Y, Tang Q, Pu L, Zhang H, Li X.

CRISPR-Cas technology opens a new era for the creation of novel maize germplasms.

Front Plant Sci. 2022;13:1049803.

Maize (Zea mays) is one of the most important food crops in the world with the greatest global production, and contributes to satiating the demands for human food, animal feed, and biofuels. With population growth and deteriorating environment, efficient and innovative breeding strategies to develop maize varieties with high yield and stress resistance are urgently needed to augment global food security and sustainable agriculture. CRISPR-Cas-mediated genome-editing technology (clustered regularly interspaced short palindromic repeats (CRISPR)-Cas (CRISPR-associated)) has emerged as an effective and powerful tool for plant science and crop improvement, and is likely to accelerate crop breeding in ways dissimilar to crossbreeding and transgenic technologies. In this review, we summarize the current applications and prospects of CRISPR-Cas technology in maize gene-function studies and the generation of new germplasm for increased yield, specialty corns, plant architecture, stress response, haploid induction, and male sterility. Optimization of gene editing and genetic transformation systems for maize is also briefly reviewed. Lastly, the challenges and new opportunities that arise with the use of the CRISPR-Cas technology for maize genetic improvement are discussed.

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Suivi d'organismes français et internationaux. Sélection d'actualités classées par thème.

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ANSES, Suivi de la diffusion planétaire de la résistance aux antimicrobiens, 12/12/2022.

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- **Arbovirus**

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- **Chenilles à poils urticants**

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ECDC, Impact of surge in China COVID-19 cases on epidemiological situation in EU/EEA, 03/01/2023.

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