Bulletin de veille risques biologiques N°125 – Novembre-décembre 2023

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 éléments issus de cette veille sont fournis sans garantie d'exhaustivité.

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

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Veille risque biologique

- **Protection respiratoire : ajustement**

Bryant RA, Smith JM, Tervola NK, Smith C, Hoyt C, Dawud B, et al.

Use of Elastomeric Half-Mask Respirator in the Clinical Care Environment.

J Nurs Care Qual. 2024;39(1):37-43.

https://www.ncbi.nlm.nih.gov/pmc/articles/PMC10655906/pdf/jncqu-39-37.pdf

Background:Elastomeric half-mask respirators (EHMR) reduce health care workers' exposure to airborne hazards including bioaerosols but have primarily been used in the industrial setting.Purpose:To assess health care workers' perceptions, attitudes, and experiences wearing EHMRs in a clinical environment.Methods:Employees within a single health care system who wore the EHMR continuously during their shift completed an investigator developed survey. Descriptive statistics and thematic analysis were used.Results:Of the 8273 EHMR "fit-tested" eligible employees, 1478 met inclusion criteria and participated. Respondents reported that they felt well protected with the EHMR and confident in their care and maintenance of the EHMR. Although skin changes developed, they were primarily managed by adjusting the straps. Clarity of communication was a concern across all respondents and disciplines.Conclusions:The EHMR was preferred over reusing the N95 although clarity in communication was challenging.

Goko C, Forster E, Mason M, Zimmerman PA.

Effectiveness of fit testing versus fit checking for healthcare workers respiratory protective equipment: A systematic review.

Int J Nurs Sci. 2023;10(4):568-78.

https://www.ncbi.nlm.nih.gov/pmc/articles/PMC10667321/pdf/main.pdf

Objectives: Respiratory protection is critical in healthcare to minimise the risk of airborne infections for healthcare workers (HCWs). It emphasizes the use of proper fitting of particulate filter respirators and equivalent respiratory protective equipment (RPE) to ensure a good facial seal. The systematic review aimed to compare the effectiveness of fit testing and fit checking for HCWs' respiratory protective equipment.Methods: A systematic review of the literature exploring RPE for HCWs to determine the effectiveness of fit-testing versus fit-checking from January 2003 to April 2022 was identified using CINAHL Complete via EBSCO Host, Cochrane Library, EMBASE, PubMed, and MEDLINE via Ovid electronic databases, and grey literature. The study protocol was registered with PROSPERO (registration number: CRD42020213968). Results: Of the 561 articles identified in the search, 25 articles (22 quantitative studies and three guidelines) were included in this review. Overall, these studies suggest fit-testing as a method that is more effective, widely adopted, and reliable in assessing the effectiveness of RPE; however, a respiratory program should include both fit-testing and fit-checking to maximise effectiveness of the RPE. The COVID-19 epidemic highlighted a lack of knowledge among HCWs regarding fit-checking and fit-testing, and relevant education increased the effectiveness of respiratory equipment protection.Conclusion: It is imperative that both fit-testing and fit-checking is implemented in order to ensure HCW safety. It is recommended to integrate education, fit-testing and

fit-checking into a comprehensive respiratory protective program run by trained fit-testers. There is also a need for practical testing methods that incorporate the clinical environment.(c) 2023 The authors. Published by Elsevier B.V. on behalf of the Chinese Nursing Association. This is an open access article under the CC BY-NC-ND license (http://creativecommons.org/licenses/by-nc-nd/4.0/).

Lam SC, Odetayo A, Yu ITS, So SNY, Cheung K, Lee PH, Suen LKP.

Evaluation of N95 respirators on fit rate, real-time leakage, and usability among Chinese healthcare workers: study protocol of a randomized crossover trial.

Frontiers in public health. 2023;11:13.

https://doi.org/10.3389%2Ffpubh.2023.1266607

Background: N95 respirators are used to limit the transmission of respiratory viruses in clinical settings. There are two to three major types of N95 available for all healthcare workers in Hong Kong. However, after the coronavirus outbreak and the consequent shortage of many commonly used respirators, several new N95 respirators were adopted temporarily in clinical settings without evaluation. Prior literature indicates that traditional N95 respirators used in hospitals in Hong Kong are not fit for Chinese people and have fit rates ranging from 50 to 60%. This study aims to investigate and compare the fit rate, real-time leakage, and mask usability of traditional and new N95 respirators among Chinese healthcare workers.Methods: This study will employ two sequential phases. Phase 1 has a cross-sectional exploratory design used to investigate the fit rate and mask usability of three types of respirators. Phase 2 will examine the effectiveness of respiratory protection by comparing traditional and new N95 respirators by a randomized crossover trial. Eligible participants will be randomly allocated through a controlled crossover experiment to either a traditional or new respirator group (n = 100 in each arm) for performing standard clinical procedures. The primary outcome (real-time leakage) will be recorded at 30 s intervals during nasopharyngeal suctioning and cardiopulmonary resuscitation. The secondary outcomes are the fit rate and mask usability. After a 2 min suctioning (15 s twice) and 4 min one-person CPR, the fit rate (assessed by standard N95 fit testing) and mask usability (measured by self-reported mask usability scale) will be recorded as data of post-procedure. After 10 min rest, measurement of real-time leakage (i.e., crossover), fit test, and usability will be repeated.Discussion: The result of real-time leakage will be a vital indicator of the respiratory protection of Chinese healthcare workers while performing prevalent clinical procedures, such as resuscitation. The fit rate and usability result will serve as an essential reference for consumable purchase policy in clinical settings.

Wong HM, Mun CH, Loke WK, Lim WQ, Chee GWY, Tan SL, et al.

Moist heat as a promising method to decontaminate N95 masks: A large scale clinical study comparing four decontamination modalities-moist heat, steam, ultraviolet-C irradiation, and hydrogen peroxide plasma.

Int J Infect Dis. 2023;136:151-7.

https://doi.org/10.1016/j.ijid.2023.09.016

Background: Early in the COVID-19 pandemic, there was a global shortage of masks. Although mask reprocessing was practiced, no clinical study has assessed systematically the impact of repeated cycles of wear and decontamination on the integrity of N95 filtering facepiece respirators (FFRs).Methods: We evaluated mask fit assessed by qualitative respirator fit test (QRFT) after each cycle of wear and decontamination, as well as four measures of mask integrity-bacterial filtration efficacy, particle filtration efficacy, differential pressure, and splash resistance through five cycles of wear and

decontamination using one of the four modalities (moist heat, steam, ultraviolet-C irradiation, and hydrogen peroxide plasma).Results: A total of 60.6% (hydrogen peroxide plasma) to 77.5% (moist heat) of the FFRs passed five cycles of wear and decontamination, as assessed by the wearers passing QRFT all five times. Moist heat -decontaminated FFRs retained all technical measures of integrity through all five cycles. Conclusions: This is the first large-scale study to assess systematically the impact (clinically and quanti-tatively) on N95 FFR integrity of repeated cycles of wearing followed by decontamination. Our results suggest that moist heat is a promising method for decontaminating N95 FFRs. Performing QRFT after every cycle of wear and decontamination ensures wearer safety. Although there is currently no mask shortage, reprocessing may reduce medical waste and improve sustainability.(c) 2023 The Authors. Published by Elsevier Ltd on behalf of International Society for Infectious Diseases. This is an open access article under the CC BY-NC-ND license (http://creativecommons.org/licenses/by-nc-nd/4.0/)

- ## Zoonoses : pathologies émergentes

Aceng FL, Kayiwa J, Elyanu P, Ojwang J, Nyakarahuka L, Balinandi S, et al.

Rift valley fever outbreak in Sembabule District, Uganda, December 2020.

One Health Outlook. 2023;5(1):7.

https://onehealthoutlook.biomedcentral.com/counter/pdf/10.1186/s42522-023-00092-3.pdf

Background Rift Valley Fever (RVF) is a viral zoonosis that can cause severe haemorrhagic fevers in humans and high mortality rates and abortions in livestock. On 10 December 2020, the Uganda Ministry of Health was notified of the death of a 25-year-old male who tested RVF-positive by reverse-transcription polymerase chain reaction (RT-PCR) at the Uganda Virus Research Institute. We investigated to determine the scope of the outbreak, identify exposure factors, and institute control measures.Methods A suspected case was acute-onset fever (or axillary temperature > 37.5(degrees)C) and >= 2 of: headache, muscle or joint pain, unexpected bleeding, and any gastroenteritis symptom in a resident of Sembabule District from 1 November to 31 December 2020. A confirmed case was the detection of RVF virus nucleic acid by RT-PCR or serum IgM antibodies detected by enzyme-linked immunosorbent assay (ELISA). A suspected animal case was livestock (cattle, sheep, goats) with any history of abortion. A confirmed animal case was the detection of anti-RVF IgM antibodies by ELISA. We took blood samples from herdsmen who worked with the index case for RVF testing and conducted interviews to understand more about exposures and clinical characteristics. We reviewed medical records and conducted an active community search to identify additional suspects. Blood samples from animals on the index case's farm and two neighbouring farms were taken for RVF testing.Results The index case regularly drank raw cow milk. None of the seven herdsmen who worked with him nor his brother's wife had symptoms; however, a blood sample from one herdsman was positive for anti-RVF-specific IgM and IgG. Neither the index case nor the additional confirmed case-patient slaughtered or butchered any sick/dead animals nor handled abortus; however, some of the other herdsmen did report high-risk exposures to animal body fluids and drinking raw milk. Among 55 animal samples collected (2 males and 53 females), 29 (53%) were positive for anti-RVF-IgG.Conclusions Two human RVF cases occurred in Sembabule District during December 2020, likely caused by close interaction between infected cattle and humans. A district-wide animal serosurvey, animal vaccination, and community education on infection prevention practices campaign could inform RVF exposures and reduce disease burden.

Amman B, Schuh A, Akurut G, Kamugisha K, Namanya D, Sealy T, et al.

Micro–Global Positioning Systems for Identifying Nightly Opportunities for Marburg Virus Spillover to Humans by Egyptian Rousette Bats.

Emerging Infectious Disease journal. 2023;29(11):2238.

https://wwwnc.cdc.gov/eid/article/29/11/23-0362_article

https://www.ncbi.nlm.nih.gov/pmc/articles/PMC10617345/pdf/23-0362.pdf

Marburg virus disease, caused by Marburg and Ravn orthomarburgviruses, emerges sporadically in sub-Saharan Africa and is often fatal in humans. The natural reservoir is the Egyptian rousette bat (ERB), which sheds virus in saliva, urine, and feces. Frugivorous ERBs discard test-bitten and partially eaten fruit, potentially leaving infectious virus behind that could be consumed by other susceptible animals or humans. Historically, 8 of 17 known Marburg virus disease outbreaks have been linked to human encroachment on ERB habitats, but no linkage exists for the other 9 outbreaks, raising the question of how bats and humans might intersect, leading to virus spillover. We used micro–global positioning systems to identify nightly ERB foraging locations. ERBs from a known Marburg virus–infected population traveled long distances to feed in cultivated fruit trees near homes. Our results show that ERB foraging behavior represents a Marburg virus spillover risk to humans and plausibly explains the origins of some past outbreaks.

del Giudice P, Freychet F, Kopec L, Fenollar F, Eldin C, Velin M, et al.

Erythema Migrans Caused by Borrelia spielmanii, France.

Emerging Infectious Disease journal. 2023;29(11):2366.

https://wwwnc.cdc.gov/eid/article/29/11/23-0149_article

https://www.ncbi.nlm.nih.gov/pmc/articles/PMC10617338/pdf/23-0149.pdf

We describe a rare case of early Lyme borreliosis in France caused by Borrelia spielmanii, which manifested as a large erythema chronicum migrans rash. The patient completely recovered after a 15-day course of amoxicillin. Absence of pathognomonic signs prevented distinguishing B. spielmanii from other etiologies as cause in this case-patient.

Gamboa-Prieto J, Cruz-Romero A, Jiménez-Hernández JA, Ramos-Vázquez JR, Ballados-González GG, Romero-Salas D, et al.

Detection of Bartonella bovis DNA in blood samples from a veterinarian in Mexico.

Rev Inst Med Trop Sao Paulo. 2023;65:6.

https://www.scielo.br/j/rimtsp/a/YMbPgyqpLGDPVXTFJWXvLvt/?lang=en&format=pdf

The genus Bartonella encompasses 38 validated species of Gram-negative, facultative intracellular bacteria that colonize the endothelial cells and erythrocytes of a wide spectrum of mammals. To date, 12 Bartonella species have been recorded infecting humans, causing diseases of long historical characterization, such as cat scratch fever and trench fever, and emerging bartonellosis that mainly affect animal health professionals. For this reason, this study aimed to report a documented case of Bartonella bovis infecting a veterinarian from Mexico by the amplification, sequencing and phylogenetic reconstruction of the citrate synthase (gltA) and the RNA polymerase beta-subunit (rpoB)

genes, and to report the natural course of this infection. To our knowledge, this work is the first to report the transmission of B. bovis via needlestick transmission to animal health workers in Latin America.

Heger F, Schindler S, Pleininger S, Fueszl A, Blaschitz M, Lippert K, et al.

Three Cases of Tickborne Francisella tularensis Infection, Austria, 2022.

Emerging Infectious Disease journal. 2023;29(11):2349.

https://wwwnc.cdc.gov/eid/article/29/11/23-0460_article

https://www.ncbi.nlm.nih.gov/pmc/articles/PMC10617340/pdf/23-0460.pdf

Tularemia is increasing in Austria. We report Francisella tularensis subspecies holarctica isolated from 3 patients who had been bitten by arthropods. Next-generation sequencing showed substantial isolate similarity. Clinicians should consider bloodstream F. tularensis infections for patients with signs/symptoms of ulceroglandular tularemia, and surveillance of potential vectors should be intensified.

Minhaj F, Singh V, Cohen S, Townsend M, Scott H, Szumowski J, et al.

Prevalence of Undiagnosed Monkeypox Virus Infections during Global Mpox Outbreak, United States, June–September 2022.

Emerging Infectious Disease journal. 2023;29(11):2307.

https://wwwnc.cdc.gov/eid/article/29/11/23-0940_article

https://www.ncbi.nlm.nih.gov/pmc/articles/PMC10617324/pdf/23-0940.pdf

Since May 2022, mpox has been identified in 108 countries without endemic disease; most cases have been in gay, bisexual, or other men who have sex with men. To determine number of missed cases, we conducted 2 studies during June–September 2022: a prospective serologic survey detecting orthopoxvirus antibodies among men who have sex with men in San Francisco, California, and a retrospective monkeypox virus PCR testing of swab specimens submitted for other infectious disease testing among all patients across the United States. The serosurvey of 225 participants (median age 34 years) detected 18 (8.0%) who were orthopoxvirus IgG positive and 3 (1.3%) who were also orthopoxvirus IgM positive. The retrospective PCR study of 1,196 patients (median age 30 years; 54.8% male) detected 67 (5.6%) specimens positive for monkeypox virus. There are likely few undiagnosed cases of mpox in regions where sexual healthcare is accessible and patient and clinician awareness about mpox is increased.

Rashid H, Omoloye AK, Abualnaja SY, Oyibo SO, Akintade OO.

A Fish Farmer's Encounter With Leptospirosis: A Case Report.

Cureus J Med Sci. 2023;15(11):6.

Leptospirosis is a zoonotic infection primarily caused by bacteria of the genus Leptospira. This infectious disease mainly occurs through direct contact with infected animals or indirect contact via contaminated soil or water. While the incidence rate of leptospirosis in the developing world is as high as 100 cases per 100,000 population, the incidence rate in the United Kingdom is low (0.14 cases per 100,000 population). We present a 56-year-old male fish farmer who presented to the emergency department

with a history of intense thigh pain and sudden inability to mobilise following a week-long period of a flu-like illness, characterised by worsening myalgia localised to the inner thighs, fever, and episodes of passing dark red urine. Initial investigations demonstrated acute renal impairment, hepatitis, thrombocytopenia, mild rhabdomyolysis and raised inflammatory markers. With a suspected diagnosis of leptospirosis after a detailed clinical history and preliminary blood tests, treatment was immediately commenced with intravenous antibiotics, intravenous rehydration and vigilant monitoring of urinary output. The patient's condition rapidly improved and the diagnosis was later confirmed by a positive Leptospira polymerase chain reaction (PCR) report and serology. We believe prompt treatment prevented deterioration in this case. The aim of this case report is to highlight the importance of a detailed clinical history, with a particular focus on occupational exposure, especially in the developed world. Additionally, a low clinical threshold for leptospirosis is imperative, as rapid clinical deterioration can happen if no immediate medical intervention is performed.

- ## Légionellose

Grossmann NV, Milne C, Martinez MR, Relucio K, Sadeghi B, Wiley EN, et al.

Large Community Outbreak of Legionnaires Disease Potentially Associated with a Cooling Tower - Napa County, California, 2022.

Mmwr-Morbidity and Mortality Weekly Report. 2023;72(49):6.

https://www.cdc.gov/mmwr/volumes/72/wr/mm7249a1.htm

Legionnaires disease is a serious infection acquired by inhala-tion of water droplets from human-made building water systems that contain Legionella bacteria. On July 11 and 12, 2022, Napa County Public Health (NCPH) in California received reports of three positive urinary antigen tests for Legionella pneumophila serogroup 1 in the town of Napa. By July 21, six Legionnaires disease cases had been confirmed among Napa County resi-dents, compared with a baseline of one or two cases per year. NCPH requested assistance from the California Department of Public Health (CDPH) and CDC to aid in the investigations. Close temporal and geospatial clustering permitted a focused environmental sampling strategy of high-risk facilities which, coupled with whole genome sequencing results from samples and investigation of water system maintenance, facilitated potential linking of the outbreak with an environmental source. NCPH, with technical support from CDC and CDPH, instructed and monitored remediation practices for all environmental locations that tested positive for Legionella. The investigation response to this community outbreak illustrates the importance of inter-disciplinary collaboration by public health agencies, laboratory support, timely communication with the public, and coopera-tion of managers of potentially implicated water systems. Timely identification of possible sources, sampling, and remediation of any facility testing positive for Legionella is crucial to interrupting further transmission.

Jain N, Krygowska AM.

Legionnaire's looms: Europe's wake-up call to enhance vigilance in detection and reporting.

New microbes and new infections. 2023;55:101194.

https://www.ncbi.nlm.nih.gov/pmc/articles/PMC10661190/pdf/main.pdf

Laganà P, Facciolà A, Palermo R, De Giglio O, Delia SA, Gioffrè ME.

The Presence of Legionella in Water Used for Car Washing: Implications for Public Health.

Microorganisms. 2023;11(12).

https://mdpi-res.com/d_attachment/microorganisms/microorganisms-11-02992/article_deploy/microorganisms-11-02992.pdf?version=1702638552

Although today all of the aspects of Legionella are better understood than in the past, in many countries the interest is still mainly focused on healthcare and tourism facilities. Other at-risk areas are less explored, such as those where workers are often in contact with water during their activities. In reality, any water system capable of producing aerosols can be considered a potential source of Legionella transmission, including car washes, where a large number of users work and flow through annually. From January to May 2022, 120 samples were carried out in 30 car washes located in Messina (Italy): 60 samples of water and 60 of aerosols. The aim of this investigation was to evaluate the risk of legionellosis in car washing workers exposed to potentially contaminated aerosols. To increase the probability of finding Legionella, the sample collections were organized on different days of the week. Of the total samples taken, 10 (8.3%) were positive for Legionella: seven (11.7%) water (range 100-1000 CFU) and three (5%) aerosol (range 10-150 CFU) samples. Detected serogroups were L. pneumophila sgr 1, 7, 10 and Legionella gormanii. Given the results obtained, preventative measures should be implemented in such facilities in order to protect the health of users and car wash operators.

• Endotoxines

Abaya SW, Bråtveit M, Kumie A, Deressa W, Moen BE.

Bacterial contamination of coffee and personal exposure to inhalable dust and endotoxin in primary coffee processing factories in Ethiopia.

Annals of agricultural and environmental medicine : AAEM. 2023;30(4):611-6.

https://www.aaem.pl/pdf-173222-95585?filename=Bacterial contamination.pdf

INTRODUCTION AND OBJECTIVE: Endotoxins from gram-negative bacteria might be released when the coffee cherries are processed and may cause respiratory health problems among workers in the coffee industry. The relationship between bacterial contamination and occupational exposure to endotoxin levels has not been thoroughly explored previously in primary coffee processing factories in Ethiopia, or elsewhere. The aim of this study was to characterize the level of personal endotoxin exposure and its relations with bacterial contamination of coffee cherries in such factories in Ethiopia. MATERIAL AND METHODS: A cross-sectional study was conducted from March 2020 - February 2021 in 9 primary coffee processing factories in 3 regions in Ethiopia. A total of 180 personal air samples were collected to analyze workers' exposure to inhalable dust and endotoxin. Correlation tests were performed to assess the relationship between total bacteria and endotoxin levels and between inhalable dust and endotoxin levels. RESULTS: The geometric mean (GM) of personal inhalable dust exposure among machine room workers and hand pickers were 9.58 mg/m(3) and 2.56 mg/m(3), respectively. The overall GM of endotoxin exposure among machine room workers and hand pickers were 10,198 EU/m(3) and 780 EU/m(3), respectively. Gram-negative bacteria were found in all 54 coffee samples. The correlation between inhalable dust and endotoxin exposure was significant (r=0.80; P <0.01). CONCLUSIONS: About 92% of the samples from hand pickers and all samples from machine room workers exceeded the occupational exposure limit of 90 EU/m(3) recommended by the Dutch Expert Committee on

Occupational Standards. Prevention and control of bacterial contamination of the coffee in primary coffee processing are suggested to reduce endotoxin exposure that might cause respiratory health problems among coffee workers.

Daae HL, Graff P, Foss OAH, Kofoed VC, Afanou AK, Frederiksen MW, Madsen AM.

A cross-sectional study on occupational exposure to microorganisms, endotoxin, hydrogen sulfide, and dust during work at drilling waste treatment plants.

Annals of work exposures and health. 2023:20.

https://doi.org/10.1093/annweh/wxad069

This cross-sectional study aims to obtain knowledge about workers' exposure to airborne dust, bacterial and fungal species, endotoxin, biofilm formation, and hydrogen sulfide (H2S) in drilling waste treatment plants. In total, 408 full-shift personal samples, 66 work areas, 40 drilling waste, and reference (outdoor air and seawater) samples were analyzed. Some workers were exposed to high levels of endotoxin (207 EU/m3), bacteria (3.8 x 104 colony forming units (CFU)/m3 and 9.8 x 104 DNA copies/m3), or fungi (1.4 x 107 CFU/m3 and 3,600 copies/m3). The exposure levels to endotoxin, bacteria, and peaks of H2S were dependent on the treatment technique. All types of drilling waste contained large concentrations of bacteria compared to the seawater references. Elevated concentrations of airborne bacteria were found close to drilling waste basins. In total, 116, 146, and 112 different bacterial species were found in workers' exposure, work areas, and the drilling waste, respectively. An overlap in bacterial species found in the drilling waste and air (personal and work area) samples was found. Of the bacterial species found, 49 are classified as human pathogens such as Escherichia coli, Enterobacter cloacae, and Klebsiella oxytoca. In total, 44 fungal species were found in the working environment, and 6 of these are classified as human pathogens such as Aspergillus fumigatus. In conclusion, across the drilling waste treatment plants, human pathogens were present in the drilling waste, and workers' exposure was affected by the drilling waste treated at the plants with elevated exposure to endotoxin and bacteria. Elevated exposure was related to working as apprentices or chemical engineers, and working with cleaning, or slop water, and working in the daytime.

Górny RL, Cyprowski M, Gołofit-Szymczak M, Ławniczek-Wałczyk A, Stobnicka-Kupiec A, Wolska L.

Production of pro-inflammatory mediators stimulated by exposure of poultry house workers to airborne dust particulates.

Annals of agricultural and environmental medicine : AAEM. 2023;30(4):623-33.

https://www.aaem.pl/pdf-174201-95717?filename=Production of.pdf

INTRODUCTION AND OBJECTIVE: Poultry house employees spend a significant part of their work shift being exposed to airborne particulate pollutants. The aim of this study was to assess their exposure at different stages of chicken production cycle, based on quantification of pro-inflammatory mediators (IL-1β, IL-6, IL-8, and TNFα) in nasal lavage (NAL) samples. MATERIAL AND METHODS: The concentrations of airborne dust at 3 different stages of the production cycle (i.e. empty poultry house, with 7- and 42-day-old chickens) were stationary measured using Grimm spectrometer, as well as CIS and Button samplers. The dust collected by the latter 2 samplers was analyzed for endotoxin and (1→3)-β-D-glucan content. NAL samples were collected from employees after their work shift to determine the pro-inflammatory mediator levels. RESULTS: The maximum particulate aerosol, endotoxin, and (1→3)-β-D-glucan concentrations at workplaces reached the levels of 4.12 mg/m(3), 45.21 ng/m(3), and 56.54 ng/m(3), respectively. The IL-1β, IL-6, and IL-8 concentrations in NAL samples ranged between 0.62-18.12 pg/mL, <0.70-25.37 pg/mL, and <3.50-259.5 pg/mL, respectively. All TNFα levels

were below 4 pg/mL. There were no significant differences between these cytokine concentrations in NAL samples collected at different stages of chicken breeding in either 'winter' or 'summer' seasons. CONCLUSIONS: Inhalation stimulation with poultry dust containing endotoxins and (1→3)-β-D-glucans resulted in the production of pro-inflammatory mediators, which proves the course of immunological processes in the exposed employees that may lead to adverse effects. The use of nasal lavage fluid in the control of such exposure confirms that NAL analysis is a reliable laboratory tool for assessing the impact of poultry dust on exposed farm workers.

Marchand G, Wingert L, Viegas C, Caetano L, Viegas S, Twaruzek M, et al.

Assessment of waste workers occupational risk to microbial agents and cytotoxic effects of mixed contaminants present in the air of waste truck cabin and ventilation filters.

J Air Waste Manag Assoc. 2024.

https://doi.org/10.1080/10962247.2023.2299424

Workers in the waste-processing industry are potentially exposed to high concentrations of biological contaminants, leading to respiratory and digestive problems and skin irritations. However, few data on the exposure of waste collection truck (WCT) drivers are available. The goal was to document the microbial risk of the waste collection truck (WCT) workers while in the vehicle cab. Long-period sampling using the truck air filters (CAF) and short time ambient air sampling in the cab were used. The potential release of microbial particles from CAFs was also investigated since it could contribute to the microbial load of the cabin air. A combination of analytical methods also helped assess the complex mixture of the biological agents. Aspergillus sections Fumigati and Flavi, E. coli, Enterobacter spp. and Legionella spp. were detected in the CAF of trucks collecting three types of waste. The highest levels of bacteria and fungi were found in the CAF from organic WCT. The highest endotoxin concentrations in CAF were 300 EU/cm2. Most of the CAF showed cytotoxic effects on both lung cells and hepatocytes. Only one mycotoxin was detected in a CAF. The maximal concentrations in the ambient WCT air varied according to the type of waste collected. The highest proportion (84%) of the air samples without cytotoxic effects on the lungs cells was for the recyclable material WCTs. The results revealed the potential microbial risk to workers from a complex mixture of bio-contaminants in the cabs of vehicles collecting all types of waste. The sustained cytotoxic effect indicates the potential adverse health-related impact of mixed contaminants (biological and non-biological) for the workers. Overall, this study highlights the benefits of using complementary sampling strategy and combined analycal methods for a the assessment of the microbial risk in work environments and the need to implement protective measures for the workers. Implications Exposure to microbial agents is a well-known occupational hazard in the waste management sector. No previous study had evaluated the cytotoxicity of ambient air and ventilation filters to document worker exposure to a combination of contaminants during waste collection. This research confirms the usefulness of ventilation filters for long-term characterization of exposure to infectious agents, azole-resistant fungi, coliform bacteria and mycotoxin. Overall, this study highlights the importance of using several sampling and analysis methods for a comprehensive assessment of microbial risk in work environments, as well as the need to implement appropriate protective measures for collection workers.

Biotechnologies

- ## Nouveaux procédés

Adarshan S, Sree VSS, Muthuramalingam P, Nambiar KS, Sevanan M, Satish L, et al.

Understanding Macroalgae: A Comprehensive Exploration of Nutraceutical, Pharmaceutical, and Omics Dimensions.

Plants (Basel). 2023;13(1).

https://mdpi-res.com/d_attachment/plants/plants-13-00113/article_deploy/plants-13-00113.pdf?version=1704005474

Driven by a surge in global interest in natural products, macroalgae or seaweed, has emerged as a prime source for nutraceuticals and pharmaceutical applications. Characterized by remarkable genetic diversity and a crucial role in marine ecosystems, these organisms offer not only substantial nutritional value in proteins, fibers, vitamins, and minerals, but also a diverse array of bioactive molecules with promising pharmaceutical properties. Furthermore, macroalgae produce approximately 80% of the oxygen in the atmosphere, highlighting their ecological significance. The unique combination of nutritional and bioactive attributes positions macroalgae as an ideal resource for food and medicine in various regions worldwide. This comprehensive review consolidates the latest advancements in the field, elucidating the potential applications of macroalgae in developing nutraceuticals and therapeutics. The review emphasizes the pivotal role of omics approaches in deepening our understanding of macroalgae's physiological and molecular characteristics. By highlighting the importance of omics, this review also advocates for continued exploration and utilization of these extraordinary marine organisms in diverse domains, including drug discovery, functional foods, and other industrial applications. The multifaceted potential of macroalgae warrants further research and development to unlock their full benefits and contribute to advancing global health and sustainable industries.

Arnolds KL, Higgins RC, Crandall J, Li G, Linger JG, Guarnieri MT.

Risk Assessment of Industrial Microbes Using a Terrestrial Mesocosm Platform.

Microbial Ecology. 2024;87(1):12.

https://link.springer.com/content/pdf/10.1007/s00248-023-02321-8.pdf

Industrial microbes and bio-derived products have emerged as an integral component of the bioeconomy, with an array of agricultural, bioenergy, and biomedical applications. However, the rapid development of microbial biotechnology raises concerns related to environmental escape of laboratory microbes, detection and tracking thereof, and resultant impact upon native ecosystems. Indeed, though wild-type and genetically modified microbes are actively deployed in industrial bioprocesses, an understanding of microbial interactivity and impact upon the environment is severely lacking. In particular, the persistence and sustained ecosystem impact of industrial microbes following laboratory release or unintentional laboratory escape remains largely unexplored. Herein, we investigate the applicability of soil-sorghum mesocosms for the ecological risk assessment of the industrial microbe, Saccharomyces cerevisiae. We developed and applied a suite of diagnostic and bioinformatic analyses, including digital droplet PCR, microscopy, and phylogenomic analyses to assess the impacts of a terrestrial ecosystem perturbation event over a 30-day time course. The platform enables reproducible,

high-sensitivity tracking of S. cerevisiae in a complex soil microbiome and analysis of the impact upon abiotic soil characteristics and soil microbiome population dynamics and diversity. The resultant data indicate that even though S. cerevisiae is relatively short-lived in the soil, a single perturbation event can have sustained impact upon mesocosm soil composition and underlying microbial populations in our system, underscoring the necessity for more comprehensive risk assessment and development of mitigation and biocontainment strategies in industrial bioprocesses.

Blackburn HD, Azevedo HC, Purdy PH.

Incorporation of Biotechnologies into Gene Banking Strategies to Facilitate Rapid Reconstitution of Populations.

Animals. 2023;13(20):3169.

https://www.mdpi.com/2076-2615/13/20/3169

https://www.ncbi.nlm.nih.gov/pmc/articles/PMC10603745/pdf/animals-13-03169.pdf

Bouguerra OM, Wahab RA, Huyop F, Al-Fakih AM, Mahmood W, Mahat NA, Sabullah MK.

An Overview of Crosslinked Enzyme Aggregates: Concept of Development and Trends of Applications.

Applied biochemistry and biotechnology. 2024.

https://link.springer.com/article/10.1007/s12010-023-04809-y

Enzymes are commonly used as biocatalysts for various biological and chemical processes in industrial applications. However, their limited operational stability, catalytic efficiency, poor reusability, and high-cost hamper further industrial usage. Thus, crosslinked enzyme aggregates (CLEAs) are developed as a better enzyme immobilization tool to extend the enzymes' operational stability. This immobilization method is appealing because it is simpler due to the absence of ballast and permits the collective use of crude enzyme cocktails. CLEAs, so far, have been successfully developed using a variety of enzymes, viz., hydrolases, proteases, amidases, lipases, esterases, and oxidoreductase. Recent years have seen the emergence of novel strategies for preparing better CLEAs, which include the combi- and multi-CLEAs, magnetics CLEAs, and porous CLEAs for various industrial applications, viz., laundry detergents, organic synthesis, food industries, pharmaceutical applications, oils, and biodiesel production. To better understand the different strategies for CLEAs' development, this review explores these strategies and highlights the relevant concerns in designing innovative CLEAs. This article also details the challenges faced during CLEAs preparation and solutions for overcoming them. Finally, the trending strategies to improve the preparation of CLEAs alongside their industrial application trends are also discussed.

Buziashvili A, Kolomiiets Y, Butsenko L, Yemets A.

Biotechnological approaches for enhancing the resistance of tomato plants to phytopathogenic bacteria.

Biol Plant. 2023;67:305-21.

http://bp.ueb.cas.cz/pdfs/bpl/2023/01/35.pdf

Bacterial diseases of vegetable crops cause significant losses of yield and substantially decrease food quality. For sustainable development of agriculture, it is highly important to use the most effective strategies for the protection of vegetable crops from bacterial diseases which allows the creation of

resistant cultivars and their introduction in regions with an increased risk of damage by phytopathogenic bacteria. This paper reviews the most widespread bacterial diseases of tomatoes, the mechanisms of interaction of plants with phytopathogenic bacteria, and the advantages of the biotechnological strategies over traditional and marker-associated breeding for creation of the resistant tomato cultivars. The current research progress on the use of biotechnological approaches such as cell selection, genetic engineering, genome editing, and gene silencing is summarized, with a special emphasis on the advantages and limitations of these methods.

Diniz MSD, Mourao MM, Xavier LP, Santos AV.

Recent Biotechnological Applications of Polyhydroxyalkanoates (PHA) in the Biomedical Sector-A Review.

Polymers. 2023;15(22):17.

https://mdpi-res.com/d_attachment/polymers/polymers-15-04405/article_deploy/polymers-15-04405.pdf?version=1699957896

Petroleum-derived plastics are materials of great importance for the contemporary lifestyle, and are widely used commercially because they are low cost, resistant, malleable, and weightless, in addition to their hydrophobic character. However, some factors that confer the qualities of these materials also cause problems, mainly environmental, associated with their use. The COVID-19 pandemic aggravated these impacts due to the high demand for personal protective equipment and the packaging sector. In this scenario, bioplastics are environmentally positive alternatives to these plastics due to their applicability in several areas ranging from packaging, to biomedicine, to agriculture. Polyhydroxyalkanoates (PHAs) are biodegradable biopolymers usually produced by microorganisms as an energy reserve. Their structural variability provides a wide range of applications, making them a viable option to replace polluting materials. PHAs can be applied in various biotechnology sectors, such as producing drug carriers and scaffolds for tissue engineering. This review aimed to survey works published in the last five years on the study and biotechnological application of PHAs in the biomedical sector, exploring the versatility and advantages of their use and helping to understand how to enhance their application.

Nayeri S, Dehghanian Z, Lajayer BA, Thomson A, Astatkie T, Price GW.

CRISPR/Cas9-Mediated genetically edited ornamental and aromatic plants: A promising technology in phytoremediation of heavy metals.

Journal of Cleaner Production. 2023;428:23.

https://doi.org/10.1016/j.jclepro.2023.139512

Phytoremediation, as a green, sustainable, and cost-effective plant-based remediation technology has garnered great attention for remediating heavy metals (HMs) from polluted soil and water resources. However, HM type and concentration, phytoremediation method, climatic conditions, type of plant species, potential of biomass production, level of plant sensitivity, and signaling pathways efficiency are all crucial factors affecting plant's phytoremediation performance. Ornamental, medicinal, and aromatic plants with medicinal, pharmaceutical, cosmetics, and decorative uses are promising species for the phytoremediation of HMs from soil and water due to their fast growth and high biomass production. Furthermore, new genetic technologies such as, the clustered regularly interspaced short palindromic repeats - CRISPR associated protein 9 (CRISPR/Cas9) gene/genome editing system, may become a tool that provides sustainable phytoremediation by targeted editing of genes of interest to improve the phytoremediation capacity of the selected ornamental plants (OPs) without raising

genetically modified organisms (GMO) concerns. This review summarizes the current state of knowledge associated with protection mechanisms and molecular aspects of plant tolerance to HMs by ornamental, medicinal and aromatic plants. The review also focuses on the use of genetically engineered ornamental and medicinal aromatic plants applying recent advances in CRISPR/Cas9 genome editing to enhance phytoremediation properties. Risk assessments and regulatory approaches associated with environmental protection, livestock, and human health for transgenic plants released into the environment are also discussed. This work elicits inter-disciplinary aspects and an understanding of the long-term management of HMs using ornamental, medicinal, and aromatic plants in an innovative way that no prior study has considered.

Saraf M, Ranjan R, Balasubramaniam B, Thakur VK, Gupta RK.

Polydopamine-Enabled Biomimetic Surface Engineering of Materials: New Insights and Promising Applications.

Adv Mater Interfaces. 2023:28.

https://doi.org/10.1002/admi.202300670

Surface modification is an important approach to modify the properties of materials. Numerous approaches have been adopted to tailor the properties of such materials, which have been proven successful at many scales and parameters. However, most of these techniques are often tedious, poorly adhesive, costly, sometimes hazardous, and surface-specific, hence cannot be extended on a large scale and all kinds of surfaces. These shortcomings have led to the emergence of new dopamine (DA) based green surface modification technique where a thin polydopamine (PDA) layer is deposited on surfaces through a facile polymerization of DA under alkaline conditions to enable the surface for various applications. This surface modification strategy has several advantages over other techniques in deposition processing under mild conditions, cost-effective and straightforward ingredients, and applicability to all kinds of surfaces regardless of their sizes, shapes, and types. Moreover, the PDA layer enhances the surface functionality. Therefore, it can serve as a versatile platform for various secondary reactions for a wide range of applications. Herein, the chemistry of DA is summarized and its polymerized form PDA for the modification of different families of materials' surfaces with an emphasis on energy, environmental and biological applications. Surface modification is one of the compelling strategies in ensuring the diverse applications of polydopamine in emerging fields e.g., electrochemical energy storage, conversion, photothermal therapy, bioengineering, adhesives, purification, sensors, and environment protection. In this review, the chemistry of dopamine is summarized and its polymerized form polydopamine for the modification of different families of materials' surfaces with an emphasis on energy, environmental and biological applications.

Vasudevan SN, Pooja SK, Raju TJ, Damini CS.

Cisgenics and intragenics: boon or bane for crop improvement.

Front Plant Sci. 2023;14:11.

https://doi.org/10.3389%2Ffpls.2023.1275145

Recent advances in molecular biology and genetic engineering have made it possible to increase agricultural yields when compared to conventional methods. However, lots of challenges are to be addressed due to changing climatic conditions. Although genetically modified organisms (GMOs) have proven their potential in a few crops, but needs to be explored in majority of the field/vegetable crops to overcome food and nutritional security in view of alarming population explosion. In spite of advantages from GMO crops due to the presence of foreign DNA, queries regarding their safety,

environmental dangers and health effects needs to be addressed. One of the major environmental issues concerning transgenic crops is the mixing of genetic components across species that cannot hybridize naturally. Due to these limitations, new revolutionary technologies have been developed, such as intragenesis and cisgenesis for the transformation and development of superior plants. While cisgenesis entails genetic modification employing a complete copy of natural genes with their native regulatory components that only belong to sexually compatible species, intragenesis refers to the transfer of unique combinations of genes and regulatory sequence inside the same species. In cisgenesis, the donor genes are the same genes employed in conventional breeding. The two benefits of cisgenics are avoiding linkage drag and making greater use of existing gene alleles. This method significantly shortens the time it takes to breed plants by combining conventional methods with cutting-edge biotechnological tools. Because of this, plant genomes can be altered without causing drastic changes to the whole plant population and the environmental effects of cisgenic plants cannot be compared to those of transgenics. Transgenesis and cisgenesis share the same transformation methods; hence, cisgenic, intragenic and transgenic plants produced through random insertion do not pose any distinct risks with regard to host genome modifications. In contrast, using new genome techniques lessens the dangers related to potential unintentional changes to the host DNA. The use of cisgenesis and intragenesis as alternatives to transgenesis has been restricted to a small number of species due to incomplete understanding of the required regulatory sequences.

Yang G, Waheed S, Wang C, Shekh M, Li ZB, Wu J.

Exosomes and Their Bioengineering Strategies in the Cutaneous Wound Healing and Related Complications: Current Knowledge and Future Perspectives.

Int J Biol Sci. 2023;19(5):1430-54.

https://www.ncbi.nlm.nih.gov/pmc/articles/PMC10086759/pdf/ijbsv19p1430.pdf

Exosomes, as therapeutically relevant cell-secreted extracellular vesicles, have attracted enormous interest because they participate in intercellular communication and facilitate wound healing. Stem cell-derived exosomes exhibit similar biological effects to source cells with the exception of low immunogenicity and no tumorigenicity, as well as superior efficacy in promoting wound healing. Exosomes accelerate wound healing by promoting angiogenesis and cell proliferation, as well as balancing inflammatory responses. Particularly, when exosomes are genetically modified or used in combination with materials, they can exhibit better comprehensive therapeutic properties, such as enriching active ingredients, targeted delivery, and physiological barrier to penetration, which are not available in traditional single products. Besides, exosomes have also been considered for diagnostic and therapeutic uses related to wounds, such as repairing complex wounds, enhancing graft success, treating related complications, and serving as diagnostic biomarkers. However, their clinical applications still face challenges, as reliable commercial products are not yet available. This review will focus on recent research advances that describe the characteristics and isolation of exosomes, introduce the sources of exosomes suitable for wound repair and related complications, illustrate the value of engineered exosomes and their development directions in the future, and provide evidence for the potential therapeutic application of exosomes in wound healing, as well as discuss potential risks, challenges, and solutions for future applications.

Organismes français et internationaux - Actualités

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

- **Antibiorésistance**

Santé Publique France, Antibiorésistance en 2023 : de la surveillance en santé humaine vers une approche « une seule santé », BEH n° 22-23 du 21/12/2023.

ECDC (Europe), Simulation exercise on preparedness for cross-border spread of healthcare-associated drug-resistant bacteria, 15/12/2023.

- **Biosûreté**

ECDC (Europe),

Countering chemical, biological, radiological, and nuclear incidents through intersectoral cooperation: an interview with Cornelius Bartels, 07/12/2023.

ECDC, Europol, NCDC and Georgia's Ministry of Internal Affairs organises training on biorisk awareness and mitigation, 01/12/2023.

- **Chenilles urticantes**

ANSES, Évaluer le risque d'exposition aux chenilles urticantes pour mieux s'en protéger, 09/01/2024.

- **Maladies infectieuses (hors maladies vectorielles/zoonoses)**

COVARS, Note sur l'intensification de la campagne de prévention de la Covid-19 et des infections respiratoires aigües, 14/12/2023.

France Diplomatie,

Mali – Recrudescence des cas de dengue, 11/12/2023.

Sri Lanka – Dengue, 05/12/2023.

HAS, Infections respiratoires à Mycoplasma pneumoniae : la HAS publie des réponses rapides, 22/12/2023.

HCSP, Priorisation d'une liste de maladies infectieuses, 27/12/2023.

INSERM,

Covid-19 : la stéatose hépatique ouvre les portes du foie au virus, 14/12/2023.

Formes graves de Covid : quel impact de la génétique ?, 13/12/2023.

Institut Pasteur,

Améliorer le diagnostic des infections : une étude prospective précise les indications d'un outil innovant de métagénomique, 05/12/2023.

Covid-19 : persistance du SARS-CoV-2 dans les poumons et rôle de l'immunité innée, 05/12/2023.

40 ans après la découverte du VIH : la recherche nourrit l'espoir de rémission, 01/12/2023.

Santé Publique France,

Infections respiratoires aiguës (grippe, bronchiolite, COVID-19), bulletin, 10/01/2024.

Gastro-entérites aiguës, bulletin, 09/01/2024.

Décryptage d'une stratégie zéro-Covid-19 en territoire insulaire : l'exemple de Saint-Pierre-et-Miquelon, BEH n°1, 08/01/2024, pp. 11-17.

Infections à Mycoplasma pneumoniae en France : point de situation au 19 décembre 2023, 26/12/2023.

VIH et autres infections sexuellement transmissibles : enjeux de la surveillance et de la prévention, BEH n°24-25 du 12/12/2023.

ECDC (Europe),

RespiCast: the new European Respiratory Diseases Forecasting Hub, 15/01/2024.

Acute respiratory infections in the EU/EEA: epidemiological update and current public health recommendations, 15/12/2023.

Public health action needed to mitigate the impact of respiratory pathogens for 2023-24 winter season in Europe, 15/12/2023.

Rising rates of sexually transmitted infections across Europe, 08/12/2023.

CDC (US), Outbreaks,

Global Polio – Level 2 : practice enhanced precautions, 12/2023.

Diphteria in Niger – Level 2 : practice enhanced precautions, 12/2023.

- ## Maladies vectorielles - Zoonoses

Institut Pasteur,

Paludisme à plasmodium vivax : l'épidémie pourrait être largement sous-estimée en Afrique sub-Saharienne, 06/12/2023.

Santé Publique France,

Epidémie de Mpox en France : caractéristiques épidémiologiques et comportement sexuel de cas de plus de 15 ans, 2022, 15/01/2024.

Grippe aviaire : quels sont les bons réflexes face au risque d'exposition ?, 02/01/2024.

ECDC (Europe),

Joint ECDC-WHO Regional office for Europe Mpox surveillance bulletin, 12/01/2024.

ECDC assesses EU/EEA zoonotic avian flu preparedness and issues investigation protocol, 14/12/2023.

Campylobacteriosis and salmonellosis still below pre-pandemic levels - West Nile virus infections on the rise, 12/12/2023.

ECDC assesses risk associated with ongoing mpox epidemic in the Democratic Republic of the Congo, 05/12/2023.

Chikungunya worldwide overview, Situation update, 12/2023.

Dengue worldwide overview, Situation update, 12/2023.

CDC (US), Outbreaks :

Western Equine Encephalitis Virus in Argentina – Level 1 : practice usual precautions, 12/2023.

Dengue in Africa and the Middle East – Level 1 : practice usual precautions, 12/2023.

Rocky mountain spotted fever in Mexico – Level 1 : practice usual precautions, 12/2023.

Mpox in the Democratic Republic of Congo (DRC) – Level 2 : practice enhanced precautions, 12/2023.

Chikungunya in Burkina Faso – Level 2 : practice enhanced precautions, 11/2023.

- ## Microorganismes pathogènes/fabrication de fromage

ANSES, Fabriquer des fromages pour étudier les risques sanitaires, 13/12/2023.