

# Bulletin de veille risques biologiques

## N°124 – Octobre 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**

Fakherpour A, Jahangiri M, Jansz J.

**A systematic review of passing fit testing of the masks and respirators used during the COVID-19 pandemic: Part 1-quantitative fit test procedures.**

PloS one. 2023;18(10):49.

<https://journals.plos.org/plosone/article/file?id=10.1371/journal.pone.0293129&type=printable>

*Background* During respiratory infection pandemics, masks and respirators are highly sought after, especially for frontline healthcare workers and patients carrying respiratory viruses. The objective of this study was to systematically review fit test pass rates and identify factors influencing the fitting characteristics. *Methods* Potentially relevant studies were identified using PubMed, Scopus, Web of Science, and Science Direct during the COVID-19 pandemic from February 5, 2020, to March 21, 2023. The search strategy using the following keywords was conducted: Quantitative Fit Test, Condensation Nuclei Counter, Controlled Negative Pressure, PortaCount, Sibata, Accufit, Fit, Seal, Mask, Respirator, Respiratory Protective Device, Respiratory Protective Equipment, Protective Device, Personal Protective Equipment, COVID-19, Coronavirus, and SARS-CoV-2. The quality of the included studies was also assessed using the Newcastle-Ottawa scale. *Results* A total of 137 articles met the eligibility criteria. Fifty articles had a quality score of less than 7 (good quality). A total of 21 studies had a fit test pass rate of less than 50%. 26 studies on disposable respirators and 11 studies on reusable respirators had an FF of less than 50 and less than 200, respectively. The most influential factors include respirator brand/model, style, gender, ethnicity, facial dimensions, facial hair, age, reuse, extensive movement, seal check, comfort and usability assessment, and training. *Conclusion* 37.36% of the disposable respirator studies and 43% of the reusable respirator studies did not report fit test results. 67.86% of the disposable respirator studies had a fit test pass rate greater than 50%, and 35.84% of these studies had an FF greater than 100. Also, 85.71% of the reusable respirator studies had a fit test pass rate greater than 50%, and 52.77% of these studies had an FF greater than 1000. Overall, the fit test pass rate was relatively acceptable. Newly developed or modified respirators must undergo reliable testing to ensure the protection of HCWs. Subject and respirator characteristics should be considered when implementing fit testing protocols. An optimal fit test panel should be developed prior to respirator design, certification, procurement decisions, and selection procedures.

- **Protection respiratoire : Ebola**

Flinn JB, Britton AD, Garland J, Cuzzolina J, Biddinger PD, Mukherjee V, et al.

**Rebuilding for Tomorrow's Outbreak: The State of Special Pathogen Preparedness in the USA in the Wake of COVID-19.**

Curr Infect Dis Rep. 2023:10.

<https://link.springer.com/article/10.1007/s11908-023-00821-9>

*Purpose of Review* Special pathogens require unique planning care capabilities within healthcare facilities and can pose significant public health threats. Outbreaks have continued to emerge through the COVID-19 pandemic and serve as reminders of the need to have tiered levels of readiness and resources supporting all healthcare settings. *Recent Findings* Recent outbreaks of Marburg virus, Sudan virus, Lassa virus, and Nipah virus are examples of low-incidence pathogens that carry disproportionately high potential consequences for healthcare worker safety and public health. While the COVID-19 pandemic has increased awareness of the potential impacts of emerging infectious diseases on communities, it has also introduced new challenges in hospital special pathogen preparations, including high staff turnover, high patient volumes, fatigue, and financial challenges. *Summary* All healthcare organizations must act to ensure they can promptly identify suspected special pathogen patients using the "identify, isolate, inform" paradigm. A subset of healthcare facilities networked across the nation must have higher level special pathogen capabilities to ensure access to high quality and safe care is available to all. Preparing for special pathogens involves use of non-traditional personal protective equipment (PPE), specialized PPE doffing protocols, and complex resources and protocols supporting laboratory testing and waste management. Because of known and persistent gaps in special pathogen readiness, the US healthcare system continues to invest in the development of the National Special Pathogens System supported by the Administration for Strategic Preparedness and Response.

- **Zoonoses : pathologies émergentes**

Jacob AT, Ziegler BM, Farha SM, Vivian LR, Zilinski CA, Armstrong AR, et al.

**Sin Nombre Virus and the Emergence of Other Hantaviruses: A Review of the Biology, Ecology, and Disease of a Zoonotic Pathogen.**

Biology. 2023;12(11).

<https://doi.org/10.3390/biology12111413>

*Sin Nombre virus (SNV) is an emerging virus that was first discovered in the Four Corners region of the United States in 1993. The virus causes a disease known as Hantavirus Pulmonary Syndrome (HPS), sometimes called Hantavirus Cardiopulmonary Syndrome (HCPS), a life-threatening illness named for the predominance of infection of pulmonary endothelial cells. SNV is one of several rodent-borne hantaviruses found in the western hemisphere with the capability of causing this disease. The primary reservoir of SNV is the deer mouse (Peromyscus maniculatus), and the virus is transmitted primarily through aerosolized rodent excreta and secretions. Here, we review the history of SNV emergence and its virus biology and relationship to other New World hantaviruses, disease, treatment, and prevention options.*

Kumar A, Borkar SK, Choudhari SG, Mendhe HG, Bankar NJ.

**Recent Outbreak of Monkeypox: Implications for Public Health Recommendations and Crisis Management in India.**

Cureus J Med Sci. 2023;15(9):7.

[https://assets.cureus.com/uploads/review\\_article/pdf/159861/20231021-29351-1454ah3.pdf](https://assets.cureus.com/uploads/review_article/pdf/159861/20231021-29351-1454ah3.pdf)

*Monkeypox is a rare and self-limiting disease that was eradicated globally through vaccination approximately forty years ago, following the eradication of smallpox. The purpose of this article is to*

*explore the implications of the recent monkeypox outbreak on public health recommendations and crisis management in India. An overview of the consequences of the current monkeypox epidemic on public health, epidemiology, clinical findings, management, challenges, and existing strategies for this disease, along with recommendations are discussed. It is crucial to develop evidence-based recommendations for the diagnosis and treatment of monkeypox, as well as early case identification and contact tracing. To prevent the spread of infection, travelers from affected countries should be subjected to health testing and quarantine. In order to successfully control the outbreak, a multidisciplinary team should be established to manage the monkeypox virus at tertiary care facilities, and health workers with occupational exposure to the virus should be assessed and given management plans.*

Tran V, Inward RPD, Gutierrez B, Nguyen N, Nguyen P, Rajendiran I, et al.

### **Reemergence of Cosmopolitan Genotype Dengue Virus Serotype 2, Southern Vietnam.**

Emerging Infectious Disease journal. 2023;29(10):2180.

[https://wwwnc.cdc.gov/eid/article/29/10/23-0529\\_article](https://wwwnc.cdc.gov/eid/article/29/10/23-0529_article)

<https://wwwnc.cdc.gov/eid/article/29/10/pdfs/23-0529.pdf>

*We performed phylogenetic analysis on dengue virus serotype 2 Cosmopolitan genotype in Ho Chi Minh City, Vietnam. We document virus emergence, probable routes of introduction, and timeline of events. Our findings highlight the need for continuous, systematic genomic surveillance to manage outbreaks and forecast future epidemics.*

Uren AM, Harris J, Slinko V, Vosti F, Young M.

### **Q fever infection is a preventable risk associated with pet food manufacturing.**

Annals of work exposures and health. 2023;4.

<https://academic.oup.com/annweh/advance-article-abstract/doi/10.1093/annweh/wxad068/7377595?redirectedFrom=fulltext>

*Objective This paper highlights the occupational risk of Q fever from exposure to raw animal products in the context of multiple notified Q fever cases from 2020 to 2023 linked to four pet food manufacturing facilities in South-East Queensland, Australia. Methods The Queensland Government Notifiable Conditions System was used to identify Q fever cases linked to pet food manufacturing in the Metro North and Gold Coast Hospital and Health Service areas of Brisbane, Australia. Data on each case from routine public health follow-up were collected and descriptively analysed. Results Between 2020 and 2023, 12 confirmed Q fever infections (17% of total cases) were linked to four pet food manufacturing facilities. Eleven cases reported direct or environmental exposure to raw meat and animal products. None were previously vaccinated for Q fever. Conclusion These cases demonstrate the increased risk of Q fever infection as part of the pet food manufacturing process, highlighting an underappreciated preventable occupational risk, which can be mitigated with the use of pre-screening and vaccination of workers. All occupations should conduct workplace-based risk assessments to identify risks such as Q fever to prevent adverse negative health outcomes.*

Yinda CK, Morris D, Fischer R, Gallogly S, Weishampel Z, Port J, et al.

### **Stability of Monkeypox Virus in Body Fluids and Wastewater.**

Emerging Infectious Disease journal. 2023;29(10):2065.

[https://wwwnc.cdc.gov/eid/article/29/10/23-0824\\_article](https://wwwnc.cdc.gov/eid/article/29/10/23-0824_article)

<https://wwwnc.cdc.gov/eid/article/29/10/pdfs/23-0824.pdf>

*An outbreak of human mpox infection in nonendemic countries appears to have been driven largely by transmission through body fluids or skin-to-skin contact during sexual activity. We evaluated the stability of monkeypox virus (MPXV) in different environments and specific body fluids and tested the effectiveness of decontamination methodologies. MPXV decayed faster at higher temperatures, and rates varied considerably depending on the medium in which virus was suspended, both in solution and on surfaces. More proteinaceous fluids supported greater persistence. Chlorination was an effective decontamination technique, but only at higher concentrations. Wastewater was more difficult to decontaminate than plain deionized water; testing for infectious MPXV could be a helpful addition to PCR-based wastewater surveillance when high levels of viral DNA are detected. Our findings suggest that, because virus stability is sufficient to support environmental MPXV transmission in healthcare settings, exposure and dose-response will be limiting factors for those transmission routes.*

- **Légionellose**

Optenhövel M, Mellmann A, Kuczius T.

### **Occurrence and prevalence of Legionella species in dental chair units in Germany with a focus on risk factors.**

European Journal of Clinical Microbiology & Infectious Diseases. 2023:10.

<https://link.springer.com/content/pdf/10.1007/s10096-023-04659-w.pdf>

*Purpose Water-bearing instruments and treatments in dental units produce aerosols originating from the dental unit waterlines (DUWLs), which are often microbially contaminated. Particularly, the presence of Legionella mainly realized as aerosols leads to a risk of infection in patients and dental staff. Methods Here, we record the general bacteriological status of DUWLs in Germany and investigated the prevalence of Legionella spp., with a focus on identification and occurrence of distinct species considering the various aspects of dental practice such as dental chair equipment, disinfection methods, and temperatures. Results Out of 3789 water samples of 459 dental practices, collected in the years 2019 and 2020, 36.4% were Legionella positive with predominance of L. anisa (97.89%) identified by MALDI-TOF biotyping. L. pneumophila was detected very rarely. Risk factor analysis revealed that temperatures >20 degrees C are a significant factor for increased Legionella colonization. Conclusion In order to minimize the risk of infection, routine monitoring of the water quality in dental chair units is recommended with regard to general microbiological loads and to the presence of Legionella as opportunistic pathogen as well as the regular application of routine disinfection procedures.*

- **Endotoxines**

Daae HL, Graff P, Foss OAH, Kofoed VC, Afanou AK, Frederiksen MW, et al.

**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.

*This cross-sectional study aims to obtain knowledge about workers' exposure to airborne dust, bacterial and fungal species, endotoxin, biofilm formation, and hydrogen sulfide (H<sub>2</sub>S) 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/m<sup>3</sup>), bacteria ( $3.8 \times 10^4$  colony forming units (CFU)/m<sup>3</sup> and  $9.8 \times 10^4$  DNA copies/m<sup>3</sup>), or fungi ( $1.4 \times 10^7$  CFU/m<sup>3</sup> and 3,600 copies/m<sup>3</sup>). The exposure levels to endotoxin, bacteria, and peaks of H<sub>2</sub>S 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.*

## Biotechnologies

- Nouveaux procédés

Fooladi S, Rabiee N, Iravani S.

### **Genetically engineered bacteria: a new frontier in targeted drug delivery.**

Journal of Materials Chemistry B. 2023;11(42):10072-87.

<https://pubs.rsc.org/en/content/articlelanding/2023/TB/D3TB01805A>

*Genetically engineered bacteria (GEB) have shown significant promise to revolutionize modern medicine. These engineered bacteria with unique properties such as enhanced targeting, versatility, biofilm disruption, reduced drug resistance, self-amplification capabilities, and biodegradability represent a highly promising approach for targeted drug delivery and cancer theranostics. This innovative approach involves modifying bacterial strains to function as drug carriers, capable of delivering therapeutic agents directly to specific cells or tissues. Unlike synthetic drug delivery systems, GEB are inherently biodegradable and can be naturally eliminated from the body, reducing potential long-term side effects or complications associated with residual foreign constituents. However, several pivotal challenges such as safety and controllability need to be addressed. Researchers have explored novel tactics to improve their capabilities and overcome existing challenges, including synthetic biology tools (e.g., clustered regularly interspaced short palindromic repeats (CRISPR) and bioinformatics-driven design), microbiome engineering, combination therapies, immune system interaction, and biocontainment strategies. Because of the remarkable advantages and tangible progress in this field, GEB may emerge as vital tools in personalized medicine, providing precise and controlled drug delivery for various diseases (especially cancer). In this context, future directions include the integration of nanotechnology with GEB, the focus on microbiota-targeted therapies, the incorporation of programmable behaviors, the enhancement in immunotherapy treatments, and the discovery of non-medical applications. In this way, careful ethical considerations and regulatory frameworks are necessary for developing GEB-based systems for targeted drug delivery. By addressing safety concerns, ensuring informed consent, promoting equitable access, understanding long-term effects, mitigating dual-use risks, and fostering public engagement, these engineered bacteria can be employed as promising delivery vehicles in bio- and nanomedicine. In this review, recent advances related to the application of GEB in targeted drug delivery and cancer therapy are discussed, covering crucial challenging issues and future perspectives. Genetically engineered bacteria have emerged as an exciting frontier in targeted drug delivery.*

Możejko-Ciesielska J, Ray S, Sankhyan S.

### **Recent Challenges and Trends of Polyhydroxyalkanoate Production by Extremophilic Bacteria Using Renewable Feedstocks.**

Polymers (Basel). 2023;15(22).

<https://doi.org/10.3390/polym15224385>

*Polyhydroxyalkanoates (PHAs) are biodegradable polymers with immense potential in addressing the global plastic pollution crisis and advancing sustainable bioplastics production. Among the various microbes known for PHA production, extremophilic bacteria possess unique capabilities to thrive under extreme conditions, making them attractive candidates for PHA synthesis. Furthermore, the utilization*



*of renewable feedstocks for PHA production aligns with the growing demand for sustainable bioplastic alternatives. A diverse range of extremophilic bacteria, especially halophiles and thermophiles, has provided cost-competitive platforms for producing customized PHA polymers. Extremophilic bacteria offer unique advantages over mesophiles due to their contamination resistance, high cell density growth, and unique culture conditions. The current status of Halomonas spp. as a chassis further allows exploration of metabolic engineering approaches to overcome the challenges associated with current industrial biotechnology. This article especially focuses on extremophilic bacteria and explores recent advances in utilizing renewable feedstocks such as lignocellulosic biomass, agro-industrial residues, and waste streams for PHA production. The integration of biorefinery concepts and circular economy principles in PHA manufacturing is also examined. This review is an attempt to provide an understanding of renewable substrates as feedstocks and emerging trends in PHA production by extremophilic bacteria. It underscores the pivotal role of extremophiles and sustainable feedstock sources in advancing the feasibility and eco-friendliness of PHAs as a promising biopolymer alternative.*

Prabakaran S, Rupesh KJ, Keeriti IS, Sudalai S, Pragadeeswara Venkatamani G, Arumugam A.

**A scientometric analysis and recent advances of emerging chitosan-based biomaterials as potential catalyst for biodiesel production: A review.**

Carbohydrate polymers. 2024;325:121567.

<https://doi.org/10.1016/j.carbpol.2023.121567>

*Chitosan is a widely available polymer with a reasonably high abundance, as well as a sustainable, biodegradable, and biocompatible material with different functional groups that are used in a wide range of operations. Chitosan is frequently employed in widespread applications such as environmental remediation, adsorption, catalysts, and drug formulation. The goal of this review is to discuss the potential applications of chitosan and its chemically modified solids as a catalyst in biodiesel production. The existing manuscripts are integrated based on the nature of materials used as chitosan and its modifications. A short overview of chitosan's structural characteristics, properties, and some ideal methods to be considered in catalysis activities are addressed. This article includes an analysis of a chitosan-based scientometric conducted between 1975 and 2023 using VOS viewer 1.6.19. To identify developments and technological advances in chitosan research, the significant scientometric features of yearly publication results, documents country network, co-authorship network, documents funding sponsor, documents institution network, and documents category in domain analysis were examined. This review covers a variety of organic transformations and their effects, including chitosan reactions against acids, bases, metals, metal oxides, organic compounds, lipases, and Knoevenagel condensation. The catalytic capabilities of chitosan and its modified structures for producing biodiesel through transesterification reactions are explored in depth.*

Sharma S, Shaikh S, Mohana S, Desai C, Madamwar D.

**Current trends in bioremediation and bio-integrated treatment of petroleum hydrocarbons.**

Environmental Science and Pollution Research. 2023:20.

<https://link.springer.com/article/10.1007/s11356-023-30479-8>

*Petroleum hydrocarbons and their derivatives constitute the leading group of environmental pollutants worldwide. In the present global scenario, petroleum and natural gas production, exploration, petroleum refining, and other anthropogenic activities produce huge amounts of hazardous petroleum wastes that accumulate in the terrestrial and marine environment. Due to their carcinogenic, neurotoxic, and mutagenic characteristics, petroleum pollutants pose severe risks to human health and*



*exert ecotoxicological effects on the ecosystems. To mitigate petroleum hydrocarbons (PHs) contamination, implementing "green technologies" for effective cleanup and restoration of an affected environment is considered as a pragmatic approach. This review provides a comprehensive outline of newly emerging bioremediation technologies, for instance; nanobioremediation, electrokinetic bioremediation, vermiremediation, multifunctional and sustainably implemented on-site applied biotechnologies such as; natural attenuation, biostimulation, bioaugmentation, bioventing, phytoremediation and multi-process hybrid technologies. Additionally, the scope of the effectiveness and limitations of individual technologies in treating the petroleum hydrocarbon polluted sites are also evaluated.*

Suja E, Gummedi SN.

**Advances in the applications of Bacteriophages and phage products against food-contaminating bacteria.**

Critical reviews in microbiology. 2023:26.

<https://doi.org/10.1080/1040841x.2023.2271098>

*Food-contaminating bacteria pose a threat to food safety and the economy by causing foodborne illnesses and spoilage. Bacteriophages, a group of viruses that infect only bacteria, have the potential to control bacteria throughout the "farm-to-fork continuum". Phage application offers several advantages, including targeted action against specific bacterial strains and minimal impact on the natural microflora of food. This review covers multiple aspects of bacteriophages applications in the food industry, including their use as biocontrol and biopreservation agents to fight over 20 different genera of food-contaminating bacteria, reduce cross-contamination and the risk of foodborne diseases, and also to prolong shelf life and preserve freshness. The review also highlights the benefits of using bacteriophages in bioprocesses to selectively inhibit undesirable bacteria, such as substrate competitors and toxin producers, which is particularly valuable in complex microbial bioprocesses where physical or chemical methods become inadequate. Furthermore, the review briefly discusses other uses of bacteriophages in the food industry, such as sanitizing food processing environments and detecting specific bacteria in food products. The review also explores strategies to enhance the effectiveness of phages, such as employing multi-phage cocktails, encapsulated phages, phage products, and synergistic hurdle approaches by combining them with antimicrobials.*

## Organismes français et internationaux - Actualités

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

- **Infections bactériennes (hors zoonoses)**

ECDC, [Rapid spread of highly drug-resistant Klebsiella pneumoniae in Greek hospitals](#), 24/11/2023.

HCSP, [Dépistage biologique de la syphilis guérie chez les donneurs de sang](#), 05/11/2023.

Santé Publique France, [Bilan de la surveillance des infections à Campylobacter en France en 2022](#), 15/11/2023.

- **Infections virales, dont COVID-19 (hors zoonoses)**

OMS,

[Disease Outbreak News. Variole simienne – République Démocratique du Congo](#), 23/11/2023.

[Déclaration de l'OMS sur les foyers épidémiques signalés de maladies respiratoires chez les enfants dans le nord de la Chine](#), 22/11/2023.

COVARs, [Avis du Comité de veille et d'anticipation des risques sanitaires \(COVARs\) du 7 novembre 2023 sur le syndrome post-covid, ses enjeux médicaux, sociaux et économiques et les perspectives d'amélioration de sa prise en charge](#), 07/11/2023.

DGS Urgent, [Recommandations sanitaires dans le cadre de l'épidémie de rougeole touchant l'Ardèche et la Drôme depuis septembre 2023](#), 16/11/2023.

HAS, [Prise en charge des personnes infectées par les virus de l'hépatite B, C ou D. Recommandation de bonne pratique](#), 03/10/2023.

Santé Publique France,

[Bulletin national d'information SOS Médecins](#), 22/11/2023.

[Infections respiratoires aiguës \(grippe, bronchiolite, COVID-19\). Bulletin](#), 22/11/2023.

[Gastro-entérites aiguës. Bulletin](#), 21/11/2023.

[Comment évolue l'adhésion des Français aux mesures de prévention contre les virus de l'hiver ?](#), 08/11/2023.

- **Maladies à prions**

HCSP, [Avis relatif à la conduite à tenir face aux accidents d'exposition aux prions et aux propagons et dans le cadre des soins comportant des actes invasifs](#), 30/10/2023.

- **Résistance aux antimicrobiens**

ECDC, [Reducing antimicrobial resistance: is the EU progressing towards the 2030 targets ?](#), 17/11/2023.

- **Zoonoses**

HCSP, [Ajout du Maroc sur la liste des pays à risque de West Nile virus pour les dons de produits issus du corps humain](#), 14/11/2023.

Santé Publique France, [Chikungunya, dengue et zika - Données de la surveillance renforcée en France métropolitaine en 2023](#), 27/11/2023.