





Proceedings of the International One Health Conference [†]

Margherita Ferrante ^{1,‡}, Gea Oliveri Conti ^{1,‡}, Domenico Vito ^{2,*,‡}, Gabriela Fernandez ^{2,‡}, Carol Maione ^{2,3,‡}, Paolo Lauriola ^{4,‡}, Prisco Piscitelli ^{5,‡}, Melissa Jiménez Gómez Tagle ^{6,‡} and Carlos Dora ^{7,‡}

- ¹ Department of Medical, Surgical and Advanced Technologies “G.F. Ingrassia”, University of Catania, 95131 Catania, Italy; marfer@unict.it (M.F.); olicoge@unict.it (G.O.C.)
- ² Metabolism of Cities Living Lab (MOC-LLAB), Center for Human Dynamics in the Mobile Age, San Diego State University, San Diego, CA 92182, USA; gfernandez@sdsu.edu (G.F.); carole.maione@polimi.it (C.M.)
- ³ Department of Management, Economics and Industrial Engineering, Politecnico di Milano, 20156 Milan, Italy
- ⁴ International Society of Medical Doctors (ISDE), Rete Italiana MediciSentinella per l’Ambiente, 52100 Arezzo, Italy; paolo.lauriola@gmail.com
- ⁵ Società Italiana Medicina Ambientale (SIMA), 20123 Milan, Italy; priscofreedom@hotmail.com
- ⁶ YOUNGO, New York, NY 10017, USA; meljgt8@gmail.com
- ⁷ International Society for Urban Health, New York, NY 10003, USA; carlos.f.dora@gmail.com
- * Correspondence: domenico.vito@polimi.it
- [†] Presented at the International One Health Conference 2022, Catania, Italy, 27–28 September 2022.
- [‡] Scientific Committee International One-Health Conference 2022.

Abstract: Health is a key aspect of our modern society that requires a multidisciplinary approach and that needs to bring together professionals, academics and decision makers in order to bridge the gap between current scientific knowledge and policies. The International One Health Conference: A systemic approach to manage urban and natural resources (One-Health 22) was held on 27–28 September 2022 in Catania (Italy) and aimed to share and discuss systemic approaches to One Health to efficiently manage urban and natural resources. The One health conceptual framework and its applications in the urban resilience domain and health care sector have been at the core of the congress’ dialogues. The Conference activated synergic dialogues among disciplinary research fields and action domains among researchers, experts and students.

Keywords: One-Health; systemic; SDGs



Citation: Ferrante, M.; Conti, G.O.; Vito, D.; Fernandez, G.; Maione, C.; Lauriola, P.; Piscitelli, P.; Jiménez Gómez Tagle, M.; Dora, C. Proceedings of the International One Health Conference. *Med. Sci. Forum* **2023**, *19*, 14. <https://doi.org/10.3390/msf2023019014>

Academic Editor: Umberto Aguglia

Published: 25 October 2023



Copyright: © 2023 by the authors. Licensee MDPI, Basel, Switzerland. This article is an open access article distributed under the terms and conditions of the Creative Commons Attribution (CC BY) license (<https://creativecommons.org/licenses/by/4.0/>).

1. Introduction

The COVID-19 pandemic has challenged health systems worldwide, raising the need to implement and integrate paradigms such as Planetary Health and One Health. The human, animal, and environmental interface has stricken the globe with threatening outcomes, a turning point to develop innovative and integral health actions.

Health is a key aspect of our modern society that requires a multidisciplinary approach and that needs to bring together professionals, academics, and decision makers in order to bridge the gap between current scientific knowledge and policies.

There are several frameworks that allow medical professionals to prioritize health. Above all, the Health in All Policy (HiAP) [1–6] is an approach to public policy that systematically takes into account the health implications of decisions, seeks synergies, and avoids harmful health impacts in order to improve population health and health equity.

The HiAP is in line with the Sustainable Development Goals (SDGs) framework especially at the urban level, as demonstrated by Ramirez-Rubio et al. [1].

Cities are also one of the key centers of anthropization where emissions related to transport, energy, and food sectors are more concentrated.

Indeed, it is essential to build partnerships and promote, at the city level, impactful policies to mitigate the energy transport and food determinants of climate change.

Action in this direction is not only a way to implement the Paris Agreement toward a net zero society by 2050 as promoted after COP26 in Glasgow.

Enhancing impact through stronger linkages in the implementation of the Paris Agreement and the Sustainable Development Goals (SDGs) can unleash the climate mitigation co-benefits or side-effects on poverty and inequality [6].

The study of Campagnolo et al. [7] found that a full implementation of the emission reduction contributions, stated in the NDCs, projected to slow down the effort to reduce poverty by 2030 (+4.2% of the population below the poverty line compared to the baseline scenario), especially in countries that have proposed more stringent mitigation targets and suffer higher policy costs.

The international One Health Conference 2022 (One-Health 2022) was held in Catania from 27 to 28 September 2022 in hybrid form to share and debate on experiences of systemic approaches to One Health and to possibly envision a better systemic approach to manage urban and natural resources.

The international conference received contributions from more than 246 authors from around the world with more than 40 scientific works from more than 20 different research institutions and that involved universities, research centers, NGOs, and local authorities in a common effort.

Relevant guests and keynotes were invited during the opening sessions such as Maria Neira, Director Department of Environment, Climate Change and Health World Health Organization WHO; Carlo Dora, President ISUH; Marina Romanello, Executive Director at The Lancet Countdown, The Lancet Commission Countdown; Peter Van der Hazel, ISDE International; Mark J Nieuwenhuijsen, Barcelona Institute for Global Health (ISGlobal); Mohamed Banni, Full Professor and Researcher at the University of Sousse; Antonio Moreda Piñeiro, Full Professor and Researcher at Santiago de Compostela—USC; Ingrid Coetzee, ICLEI Local Governments for Sustainability.

The conference aimed to activate synergic dialogues through disciplinary research fields and action domains among researchers, experts, and students.

The One Health conceptual framework and the possible contribution to the One Health approach in the urban resilience enhancement have been the core of the congress dialogues.

To address the multidisciplinary field of One Health, we subdivided our discussions in four main domains.

In domain 1, One Health, antimicrobial resistance, and epidemiological models, we addressed the integrated concept of human health, animal health, and Planetary Health, and the problems of growing antimicrobial resistance and epidemiological models for the study of the health effects of urbanization and climate change, highlighting the importance of the One Health approach in the urban areas (Italy, Kenya) and the importance of the One Health approach in the ecological transition (Italy). Some hot topics show the promotion of safe food to consumers (Tanzania), COVID-19 Epidemic spread, Green Areas (Italy and Spain), COVID-19 societal effects and perceptions (Italy), the legal issue of climate change, sustainable health, and the COVID-19 pandemic (Nigeria).

In domain 2, One Health in transition cities, big data, and urban metabolism, we treated the topics for building a new environment under a One Health vision such as net zero, decarbonization, healthy cities (Germany), C40 Network Connection and Ren21, big data analytics for epidemiology and environmental monitoring (Italy), Citizen science, Nature-based solutions (multidimensional approach), Air quality and healthier cities (Italy, Canada, Germany), and metabolism of cities and implications on health (Bolivia).

In domain 3, One Health as a part of adaptation and human rights, we dealt with the following topics: Health as a part of adaptation (Greece), Resilient health care systems, Community health and resilience (Italy), Child and maternal health as elements of resilience, human rights and health (Letonia), Health strategies and application for minorities and disadvantaged people (Italy, Malaysia), and SDG 3 and related SDGs.

In domain 4, the One Health vision on environmental hazards, toxicology, and epigenetics, we treated at first the effects of environmental hazards on humans with the following

domain topics: toxicology (Greece, Italy) and microplastics (Italy, Tunisie). Then, we faced Ecosystemic effects of environmental hazards with the following domain topics: Effects on animals and fauna (Italy, USA), microplastic accumulation (Italy, USA, Tunisie, Turkey), Exposomics (Italy, China), and Epigenomics (Italy).

We show here the Proceedings of the conference that collected all presented submissions.

The contributions were oral communications as well posters, also giving opportunity to young researchers to highlight their work.

The results of the conference also had the chance to be addressed in important decision-making venues like COP27 in Sharm el Sheik in November 2022.

2. Poster Session

2.1. *Study of Malaria Morbi-Mortality Variation Associated with Climate Change from 2010 to 2019 in Niger*

Zeinabou Maman Noura ¹, Mamane Daou ¹, Laminou Ibrahim Mamane ², Maman Bachir ², Alasan Goni ³, Haboubacar Maman Manzo ⁴, Eric Omar Adéhossi ¹, Abdou Moumouni de Niamey ⁵ and Boubacar Kaouge ⁶

¹ Niger Faculté des Sciences de la Santé/Université Abdou Moumouni de Niamey

² Niger Centre de Recherche Médicale et Sanitaire (CERMES)

³ Niger Direction de la Surveillance et Riposte aux Epidémies

⁴ Niger Université Boubacar Ba de Tillabéri

⁵ Hôpital Général de Référence de Niamey

⁶ Niger Direction de la Météorologie Nationale

Climate change represents a great risk directly or indirectly to human health. Malaria is a vector-borne disease that is also part of climate-sensitive disease. Its epidemiology can be modified by the effects of climate change through some climatic factors as temperature or humidity. This study of the morbi-mortality associated with climate change in Niger from 2010 to 2019 was conducted to understand these health and climatic events.

The sites of study were Agadez and Niamey regions. It was a transversal descriptive study with the analytical aim to use retrospective data from 2010 to 2019 (10 years). The population of study constituted health data made with assumptive cases of malaria, which included 2,145,037 confirmed cases of malaria and 2545 cases of deaths due to malaria collected at the National System of Sanitary Information; and climatic data made with averages of temperature, humidity, evaporation, and accumulated precipitation collected at National Meteorological Direction. The coefficient of correlation r was calculated between climatic and health data.

Results: Even if we intend to lower the morbidity in Agadez's region, we find a clear uptrend of mortality. We also find some moderate correlations between morbidity–mortality and climatic factors that are exacerbated by flood due to climate change: average of maximal temperature–morbidity $r = 0.5$; average of maximal humidity–morbidity $r = -0.5$; maximal evaporation–mortality $r = -0.5$.

The period of study, which is relatively short, did not allow them to elucidate the responsibility of climate change in the worsening of the transmission of malaria. However, some important events have arisen from climate change, which have already had some effect on malaria, due to floods. It is also important to emphasize these effects, the change of profile, and/or epidemics that cause these extreme events in the region of Agadez.

2.2. *Effects of TiO₂-NPs on Gallus Gallus Domesticus Chorionallantoic Membrane (CAM)r*

Elena Maria Scalisi ¹, Roberta Pecoraro ¹, Antonio Salvaggio ², Giuliana Impellizzeri ³ and Maria Violetta Brundo ¹

¹ N1 University of Catania, Catania, Italy

² Experimental Zooprophyllactic Institute of Sicily "A. Mirri", Palermo, Italy

³ CNR-IMM, Catania, Italy

Nanotechnology has become a billion-dollar industry worldwide that has revolutionized the world we live in, the global economy, and everyday life. The manufacture of titanium dioxide nanoparticles (TiO₂-NPs) has expanded the range of TiO₂ utility that is among the engineered metal oxide nanoparticles that are manufactured more in the world (Sharma et al., 2019) due to their application in our daily life (health, food, water treatment, electronics, cosmetics, etc.). However, their constant use increases the possibility of chronic exposure and their internalization, because the nanoparticles (NPs) in the blood system can pass through biological membranes and affect the physiology of any cell in the body, accumulate in organs, and cause systemic vascular dysfunction, inducing damage in endothelial cells (Abukabda et al., 2017). We investigated the impact of TiO₂-NPs synthesized using the sol–gel technique on angiogenesis using the chick Chorioallantoic Membrane (CAM) as a model. As CAM is highly vascularized, it is an ideal indicator of the anti- or pro-angiogenic properties of test compounds. TiO₂-NPs were supplied by the CNR of Catania; thus, solutions of 0.4 mg/mL and 0.04 mg/mL were inoculated into the fertilized chick eggs using an insulin syringe and placed in an incubator. On the 6th, 9th, and 12th day after incubation, a window was made in the shell to visualize the underlying CAM vessels, and then taken and fixed for histological analyses. We observed that TiO₂-NPs did not reduce the growth of blood vessels, which did not lose their structural organization even if the basal lamina appeared discontinuous specifically at the concentration of 0.4 mg/L.

2.3. Ecotoxicity Analysis on the Urban WWTP Water Samples for the Monitoring of Wastewater Quality Released in Sea Water

Paola Rapisarda, Antonio Cristaldi, Claudia Favara, Maria Fiore, Maria Castrogiovanni, Gea Oliveri Conti, Margherita Ferrante and Eloise Pulvirenti

Department of Environmental and Food Hygiene Laboratory, Medical, Surgical Sciences and Advanced, Technologies “G.F. Ingrassia”, University of Catania, Italy

The treatment of wastewater is a key process for safeguarding the environment and, consequently, for the health of flora and fauna.

The aim of this study was to evaluate the acute toxicity of both inlet and outlet wastewater (WW) collected from two urban Wastewater Treatment Plants (WWTPs) of the city of Catania (Sicily, Italy), applying the *Vibrio fischeri* ecotoxicological assay.

This monitoring study permitted the verification of the efficacy and the outlet quality of WWs disposed into sea water 2.

Sixty-one samples were collected from 2019 to 2022 and an acute toxicity test with *V. fischeri* bioluminescent bacteria (APAT CNR IRSA 8030 MICROTOX) was performed. Acute toxicity is expressed as a response to the inhibition of natural bioluminescence emitted by *V. fischeri*, and it was detected by a Microtox model 500 analyzer according to UNI-EN-ISO 17025:2018 at three times: 0, 5 and 15 min.

Our findings showed toxicity below the limit reported in Italian Legislative Decree 152/06 for all outlet samples. This study showed that only 10 inlet samples exceeded the Decree limit. The higher levels of toxicity recorded in these samples could be a result of the effect of toxicity due to the mixture of different metals that was singularly below the limit. The results confirm the efficiency of WWTP.

Therefore, the *V. fischeri* ecotoxicological assay is a useful tool for the evaluation of the mix toxicity of several pollutants that significantly underline the total toxicity of the studied matrices expressing the true effect of complex mixtures on the environment and its fauna.

2.4. Identification of Circulating Non-SARS-CoV-2 Coronaviruses: An Important Tool for Prevention and Control of Future Coronavirus Disease Outbreaks

Olajumoke Joseph and Olatunde Dahunsi

Microbiology Programme, College of Agriculture, Engineering and Science, Bowen University, Iwo, Nigeria

Coronaviruses (CoVs), which are responsible for the current SARS-CoV-2 pandemic, are currently being researched all over the world. This zoonotic pathogen, which has been found to naturally occur in bats and some other animals, has been mainly implicated in about 15–30% of respiratory tract infections among humans, yearly. The pathogen has a high rate of genetic recombination due to the lack of a proofreading mechanism by the RNA-dependent RNA Polymerase (RdRP), leading to the frequent generation of new strains of CoVs. Studies have shown that CoVs are ubiquitous and endemic in most communities globally, while some other reports have questioned the role of co-infections with other CoV species during the SARS-CoV-2 pandemic. Although several groundbreaking discoveries have been made, there is still a need to identify the non-SARS-CoV-2 coronavirus strains involved in the respiratory disease of patients that tested negative for SARS-CoV-2. Increased surveillance will help to determine the breadth of diversity of CoVs and early identification of highly pathogenic strains, which will in turn significantly improve the preparedness for future outbreaks of CoV-related diseases. Hence, this study proposes the investigation of the circulating non-SARS-CoV-2 coronavirus strains among individuals attending the State Hospital Ota–Ogun State, Nigeria, using molecular biology techniques. The nucleotide sequence data of the isolates from this study will be submitted to GenBank, and public health authorities will be notified of CoV isolates that may be of concern.

2.5. Toxicological Effects of Polystyrene Nanoplastics on the Early Life Stages of Danio Rerio: An In Vivo and In Silico Approach

Martina Contino ¹, Greta Ferruggia ¹, Roberta Pecoraro ¹, Elena Maria Scalisi ¹, Gianfranco Cavallaro ², Carmela Bonaccorso ², Cosimo Gianluca Fortuna ², Antonio Salvaggio ³, Fabiano Capparrucci ⁴, Teresa Bottari ⁵ and Maria Violetta Brundo ¹

¹ Department of Biological, Geological and Environmental Sciences, University of Catania, Via Androne, 81, 95124 Catania, Italy

² Department of Chemical Sciences, Viale Andrea Doria 6, 95125 Catania, Italy

³ Experimental Zooprophyllactic Institute of Sicily “A. Mirri”, Via Gino Marinuzzi, 3, 90129 Palermo, Italy

⁴ Department of Chemical, Biological, Pharmaceutical, and Environmental Science, University of Messina, 98166 Messina, Italy

⁵ Institute for Marine Biological Resources and Biotechnology (IRBIM), National Research Country (CNR), 98122 Messina, Italy

The environmental diffusion of nanoplastics requires investigation to clarify their possible effects on living organisms and especially on the early stages of embryonic development, which are more sensitive to the presence of pollutants. The aim of the present experiment was to assess the *in vivo* effects of amino-modified polystyrene nanoplastics (PS-NPs) with diameters of 100 nm and 50 nm on the embryonic development of *Danio rerio* through a ZFET (OECD, 2013). In particular, the *in vivo* analysis focused on the localization of PS-NPs, hatching rate, viability, and occurrence of malformations. In addition, an *in silico* analysis was performed to test the ability of PS-NPs to act as endocrine disruptors. For this purpose and based on the location of the PS-NPs, the following receptors were chosen: CNTN4/APLP2, Grp126/Adgrg6, STRA6.

From the results obtained, PS-NPs with a smaller diameter were able to pass through the chorion and be adsorbed by the embryo, while PS-NPs with a larger diameter were captured by the larvae from the moment of hatching. Furthermore, although the results showed no significant differences in viability, they highlighted an increase in the rate of malformations, especially at the level of the tail, and a decrease in the hatching rate. Finally, *in silico* analysis showed that PS-NPs had an affinity with the analyzed receptors, especially for Grp126/Adgrg6, followed by STRA6 and CNTN4/APLP2. These results demonstrate how PS-NPs could act as endocrine disruptors, leading to abnormalities in embryonic development.

2.6. Antimicrobial Resistance in Water Used for Human Consumption: A Literature Review

Silvia Bonetta ¹, Ileana Federigi ², Marina Tesauro ³, Francesco Bagordo ⁴, Sara Bonetta ⁵, Michela Consonni ³, Gea Oliveri Conti ⁶, Osvalda De Giglio ⁷, Giusy Diella ⁷, Margherita Ferrante ⁶, Alfina Grasso ⁶, Manuela Macri ¹, Maria Teresa Montagna ⁷, Marco Verani ² and Annalaura Carducci ²

¹ Department of Life Sciences and Systems biology, University of Torino, Torino, Italy

² Department of Biology, University of Pisa, Pisa, Italy

³ Department of Biomedical, Surgical and Dental Sciences, University of Milano, Milano, Italy

⁴ Department of Pharmacy-Pharmaceutical Science, University of Bari Aldo Moro, Bari, Italy

⁵ Department of Public Health and Pediatrics, University of Torino, Torino, Italy

⁶ Department of Medical Sciences, Surgical and Advanced Technologies, University of Catania, Catania, Italy

⁷ Interdisciplinary Department of Medicine, University of Bari Aldo Moro, Bari, Italy

The presence of antimicrobial-resistant bacteria (ARB) or resistance genes (ARG) in raw water used as drinking water supply is widely reported in the literature, and antibiotics are emerging pollutants monitored in groundwater and surface water. However, to date, the role of drinking water as a potential route of transmission of antimicrobial resistance (AMR) is still poorly investigated. In this work, this topic was analyzed through a bibliographic review. References were identified through three databases (Scopus, WOS, Pubmed and Medline), with keywords related to AMR (ARB, ARG, antibiotic, antimicrobial) and treated water (treated water, potable water, tap water). The research was carried out without time limits and, among the results obtained, only the monitoring studies of tap water were selected and then classified according to the year of publication, geographical area, and resistance target considered.

A total of 120 manuscripts were selected, with a constant temporal trend from 1982 to 2005 and a following high increase. The geographical distribution indicates the predominance of the works carried out in Asia (47.5%), followed by Europe and Africa. In most cases, the monitoring aimed to only investigate either ARB (35.8%), antibiotics (22.5%), or ARG (16.7%) and the combination of ARB and ARG (16.7%). In the reviewed papers, bacteria of environmental origin were mainly monitored (e.g., *Pseudomonas* spp., *Aeromonas* spp.), which were mainly resistant to β -lactam antibiotics (e.g., penicillins and first-generation cephalosporins) but also showed resistance to disinfectants (hypochlorite). In some studies conducted in developing countries, tap water showed enterobacteria (total coliforms, *Escherichia coli*, *Salmonella* spp.), resistant to penicillins, but also macrolides (erythromycin) and tetracyclines. Antimicrobials were detected in 86.5% (32/37) of the manuscripts: the categories of quinolones and sulfonamides were the most frequent among antibiotics and triclosan among disinfectants. Drinking water treatments, although different according to geographic area, have the goal of achieving a high microbiological and chemical quality of drinking water. However, the present work shows the detection of ARBs, ARGs, and antibiotics/antimicrobials in treated waters around the world. These results highlight the importance of investigating AMR not only in the clinical setting but also in the aquatic environments: the consumption of tap water could lead to exposure through the gastrointestinal tract to antibiotics, ARBs, and ARGs, thus contributing to the spread of antibiotic resistance and potentially causing a direct impact on human health.

2.7. Pedestrian and Bicycle Safety Visualization in Chula Vista, California

Gabriela Fernandez, Arash Jahangiri, Sahar Ghanipoor Machiani, Ming-Hsiang Tsou, Bitu Etaati and Christian Mejia

Metabolism of Cities Living Lab (MOC-LLAB), Center for Human Dynamics in the Mobile Age, San Diego, State University, San Diego, CA, USA

Frequent vehicle collisions involving pedestrians or bicyclists indicate that there are opportunities to improve safe walking or biking. Concerns for child safety are among the

strongest impediments to children walking or biking to school, but for some, walking or bicycling to school is a necessity due to financial or other circumstances. In fact, walking or biking to school is more than twice as common among students from low-income households than students from higher-income households. Creating safe routes is one key mechanism to achieve social equity goals by providing safe opportunities to walk and bike regardless of a community's socioeconomic composition. The Safe Routes to School (SR2S) program is a federally funded initiative developed by the US Department of Transportation (DOT) since 2005 to foster opportunities for students to walk and bike to school safely and routinely. It is important to understand how this program can be evaluated and especially how socially vulnerable communities benefit from this program. This project will select 2–5 schools located in socially vulnerable communities in San Diego County to evaluate the impacts of the Safe Routes to School programs for each school and identify accident (injuries and fatalities) hot spots for the future routing improvement; develop and design an SR2S web-based visualization tool for easy road safety monitoring and reporting; conduct VR educational road safety training for children; and strengthen community collaboration across San Diego County. The project is supported by the Safe-D Safety Through Disruption (Project Number: 06-011), University Transportation Centers Program; PI. Dr Gabriela Fernandez, Dr. Arash Jahangiri, Dr. Sahar Ghanipoor-Machiani, Dr. Ming-Hsiang Tsou, Bita Etaati, and Christian Mejia.

2.8. Occurrence and Distribution of Microplastics ($\leq 10 \mu\text{m}$) in Marine Sponges from the Southern Mediterranean Coasts

Imad Krikech^{1,2,3}, Eloise Pulvirenti⁴, Gaël Le Pennec², Mohammed Ezziyyani¹, Gea Oliveri Conti⁴, Margherita Ferrante⁴ and Tiziana Cappello³

¹ Department of Life Sciences, Polydisciplinary Faculty of Larache, Abdelmalek Essaadi University, 745 BP, 92004 Larache, Morocco

² Laboratoire de Biotechnologie et de Chimie Marines, Université de Bretagne Sud, EA 3884-IUEM, BP 92116, 56321 CS, Lorient, Brittany, France

³ Department of Chemical, Biological, Pharmaceutical and Environmental Sciences, University of Messina, Viale F. Stagno d'Alcontres 31, 98166 Messina, Italy

⁴ Department of Medical, Surgical Sciences and Advanced Technologies "G.F. Ingrassia", University of Catania, Italy

Microplastics (MPs) are ubiquitous in the marine environment and widely acknowledged as emerging pollutants due to the multi-faceted threats they exert on marine habitats and ecosystems. Despite the growing research efforts to monitor and assess risks of microplastic pollution in diverse environments, our understanding of their toxicological impact on benthic invertebrates is still limited. Sponges (phylum Porifera) are particularly at risk of MP uptake due to their worldwide distribution, filter-feeding strategy, and sedentary lifestyle. In this work, MP concentrations were assessed in *Petrosia ficiformis*, one of the most widespread sponge species in the Moroccan Mediterranean Sea (Krikech et al., 2022). Sponge samples were collected at Tangier (TNG) and Belyounech (BEL), two Moroccan sites with different levels of anthropogenic disturbances, to determine whether this species can incorporate foreign particles ($<10 \mu\text{m}$) and reflect their possible sources. MP extraction and analysis were performed by applying an innovative Italian-patented methodology (n. 10201800003337, 7 March 2018) coupled to SEM-EDX detection, respectively. The median (IQR) level of MPs was 2.39×10^5 and 1.86×10^5 in BEL and TNG, respectively. Moreover, the median (IQR) diameter of MPs was 3.08 and $2.72 \mu\text{m}$ in BEL and TNG, respectively. Overall, this work provided the first evidence and an important baseline for the uptake of small microplastic particles in the Mediterranean sponge *P. ficiformis*. Ongoing studies, with more sampling sites and sponge species, are underway to further elucidate the behavior and the effects of MPs in Mediterranean sponges.

2.9. The ShazzAn Project for the One Health Approach Implementation through the Biochemical Decarbonization

Claudia Favara ¹, Gea Oliveri Conti ¹, Eloise Pulvirenti ¹, Antonio Cristaldi ¹, Chiara Copat ¹, Alfina Grasso ¹, Paola Rapisarda ¹, Maria Castrogiovanni ¹, Mimmo Scollo ², Luciano Falqui ² and Margherita Ferrante ¹

¹ Department of Environmental and Food Hygiene Laboratory, Medical, Surgical Sciences and Advanced Technologies “G.F. Ingrassia”, University of Catania, Italy

² Plastica Alfa S.r.l. Contrada Balchino, 95041 Caltagirone, Catania, Italy

The need to reduce or convert CO₂ emissions is a pillar of the Paris Agreement for the reduction in greenhouse gases in order to combat climate change and global warming. Therefore, it is important to investigate the applicability of industrial symbiosis for the achievement and implementation of biotechnological systems for obtaining, among other things, results also applicable for cancer prevention. The “ShazzAn” project aims to evaluate miRNA-based biomolecular systems to produce Astaxanthin, in plants that transform CO₂, biochemically converting it into algal biomass (*Haematococcus pluvialis*) and producing this bioactive molecule for its application in oncoprevention. Astaxanthin has shown important capabilities in the fight against free radicals and oxidative stress, and photoprotective capacity, and is therefore a considerable utility in the treatment and prevention of skin diseases and chronic degenerative diseases from cardiovascular to oncological ones. The system will be directly managed by microRNA expression. The objectives of this project launched in partnership with a Sicilian company leader in the biotechnology sector are to evaluate the miRNome of the algal species to guide the metabolism of the species in favor of an overproduction of Astaxanthin and to characterize other components such as lipids and enzymes to test its biological activity for use in cancer prevention therapy. The metabolite will be extracted by solid/liquid extraction for its study using the Trolox-equivalent antioxidant capacity test (TEAC), antioxidant activity using DPPH, and MTT cell viability assays. The aim is to lower the CO₂ footprint of the industrial sector in the province of Catania.

2.10. Emerging Organic Pollutants Adsorbed to Plastic Debris in Marine Environment: A Systematic Review of Analytical Methods, Occurrence, and Characteristics

Hongrui Zhao, Ileana Federigi, Marco Verani and Annalaura Carducci

Laboratory of Hygiene and Environmental Virology, Department of Biology, University of Pisa, Via S. Zeno 35/39, 56127 Pisa, Italy

Plastic pollution has become one of the most serious environmental problems, and microplastics (MPs, particles < 5 mm in size) may behave as vehicles of organic pollutants, causing detrimental effects on the environment. Studies on MP-sorbed organic pollutants lack methodological standardization, which results in low comparability and replicability. In this work, we reviewed 40 field studies of MP-sorbed organic contaminants using PRISMA guidelines 1, for acquiring information on sampling and analytical protocols.

Our results showed a great heterogeneity of methods for sample collection, MP extraction, and instruments for chemical identification. Cross-contamination control during MP analysis was rarely considered (13% of the reviewed studies), indicating an urgent need for more stringent quality control in MP research.

The MP-sorbed chemicals most frequently detected were polychlorinated biphenyls (PCBs), polycyclic aromatic hydrocarbons (PAHs), and organochlorine pesticides (OCPs). The papers were scored for reliability following a checklist for data evaluation 2,3, with a total score from 15—worst to 27—best. Most of them showed good reliability, with 26 papers (65%) scoring 20 or higher.

Then, to improve the reliability of MP monitoring studies, a standardized protocol for the detection of MPs and MP-sorbed chemicals was developed. This paper can be used as guidelines for planning monitoring studies on MP-sorbed chemicals.

2.11. Preparation of a Broad-Specificity Monoclonal Antibody for Aristolochic Acids and Development of Indirect Competitive Enzyme-Linked Immunosorbent Assay in Flour and Soil Samples

Xiaonan Wang, Kai Wen and Zhanhui Wang

China College of Veterinary Medicine, China Agricultural University, No. 2 Yuanmingyuan West Road, Beijing 100193, China

Aristolochic acids (AAs) are recognized as an emerging class of environmental contaminants in soil and flour samples, which pose a significant hazard to food safety and human health. Antibody-based immunoassays are the most frequently used platform for contaminant detection. However, the antibodies for AAs suffer from low affinity and a failure of recognition of the family of AAs. In the present study, we prepared a broad-specific monoclonal antibody (mAb) 5H5 with a highly and uniform affinity for AAs through the help of computational chemistry by fully exposing the AA's common structures of methoxy and hydroxyl groups. The mAb-5H5-exhibited half inhibitory concentrations of AAA, AAB, AAC, and AAD were 0.03, 0.06, 0.05, and 0.02 ng/mL, respectively. The ELISA based on the broad-specificity mAb 5H5 had detection limits of 0.04–0.11 µg/kg and 0.02–0.06 µg/kg in flour and soil samples, respectively. Molecular docking was performed and found that the spacious cavity of mAb 5H5 could accommodate multiple conformations of AAs, plus the specific hydrogen bonds were formed by ASN62 and GLY64 of scFV 5H5 to the nitro group of AAs, which explain the broad-specificity profile of mAb 5H5. The study not only first provided a rapid screening method for the family of AAs in food grains and soil, but also a hapten rational design strategy and antibody molecular interaction support for other structurally similar analogs.

2.12. Antibiotic Resistance in *Pseudomonas Aeruginosa* and *Pseudomonas* spp. in Dental Unit Water

Marina Tesaro, Michela Consonni, Giovanni Lodi and Roberto Mattina

Department of Biomedical, Surgical and Dental Sciences, University of Milan, Italy

Dental Unit Waterlines (DUWLs) may be contaminated by water-borne micro-organisms but also by germs in patients' oral cavities. *Pseudomonas* spp. and particularly *Pseudomonas aeruginosa* are considered among the major causes of hospital-acquired infections and frequently detected in DUWLs.

Investigating the presence of *Pseudomonas aeruginosa* and *Pseudomonas* spp. strains in DUWLs and evaluating their resistance to six antibiotics at a public dental clinic in Milan, Italy were the aims of the study.

Monitoring included sampling water from 44 DUs in service and four controls on three floors. Samples were processed according to UNI EN 12780:2002. A qualitative PCR for the identification of *P. aeruginosa* and of *Pseudomonas* spp. was performed on the extracted DNA samples. To test antibiotic resistance, the E-test (BioMerieux) was chosen.

P. aeruginosa was found in 10/44 DUs (22.7%) and 2/4 (50%) controls, while *Pseudomonas* spp. was found in 23/44 (52.3%) and 3/4 (75%), both with a range of 2–1000 CFU/L. A total of 94/136 strains (69.1%) were sensitive to all tested antibiotics, respectively: 49/70 (70%) for *P. aeruginosa* and 45/66 (68%) for *Pseudomonas* spp.

A total of 21/70 (30%) strains of *P. aeruginosa* and 21/66 strains (31.8%) of *Pseudomonas* spp. were resistant, mainly to Colistin.

The percentage of multi-resistance decreased from 5.7 and 7.5 for two antibiotics to 2.9 and 1.5 for three antibiotics, respectively, in *P. aeruginosa* and *Pseudomonas* spp., to 0 for four, five, and six antibiotics.

Applying the Water Safety Plan and adopting disinfection procedures on DUWLs, water treatments and maintenance of the entire water network of the hospital are necessary measures.

3. Other Oral Communications

3.1. One Health and Antimicrobial Resistance (and Epidemiological Models)

3.1.1. One Health Approach in the Ecological Transition

Gea Oliveri Conti and Margherita Ferrante

Department of Medical, Surgical Sciences and Advanced Technologies “G.F. Ingrassia”, University of Catania, Italy

The One Health approach supports the delicate interdependence between humans and the planet. Maintaining global health will permit the achievement of the common goal of “Planetary Health”. In April 2022, the National Health Prevention System from environmental and climate risks was established by the Italian government. The close connection of public health among veterinary medicine, urban planning, and environmental protection plays a decisive role in promoting healthy lifestyles, in the production of healthy foods, and in the prevention of numerous chronic and infectious diseases.

This approach also becomes a fundamental driver for the pursuit of the ecological transition; in fact, the city must be both an object and subject of the ecological transition. Especially, Antibiotic resistance (ABR) is a critical One Health issue and risk factor for global health. The persistence and spread of resistant microbial species, and the association of determinants at the human–animal–environment interface can alter microbial genomes, resulting in resistant superbugs in various environmental niches. Several countries have implemented action plans based on the One Health approach to limit and combat antibiotic-resistant microbes, following the Commitment Food and Agriculture Organization (FAO)–World Organization for Animal Health (OIE) and World Health Organization (WHO) guidelines. Recycling waste, raising awareness, education about human and veterinary antibiotic use, and the promotion of policy, advocacy, and antimicrobial stewardship represent fundamental steps for environment and human protection.

3.1.2. COVID-19 Epidemic Spread and Green Areas of Italy and Spain between 2020 and 2021: An Observational Multi-Country Retrospective Study

Andrea Falco ^{1,2}, Prisco Piscitelli ², Domenico Vito ², Federico Pacella ², Cristina Franco ¹, Paolo Ambrosino ¹, Javier Arias ³ and Alessandro Miani ^{2,4}

¹ Department of Sciences and Technology, University of Sannio, Benevento, Italy

² Italian Society of Environmental Medicine, Milan, Italy

³ Medical School, Complutense University, Madrid, Spain

⁴ Department of Environmental Sciences and Policy, University of Milan, Italy

Environmental pollution has produced a variety of alterations in the daily life of human beings either by or from contact with microorganisms, viruses, or bacteria. That causes a wide spectrum of oral pathologies to emerge or manifest. The immune system is faced with unknown situations, never before faced. Due to a pathogen never seen before from the objective of the conjuncture (field that generates the pathogen), or also due to the excessive flow of people—refugees, immigrants, war, decreased hygiene diagnostic methods do not even detect this new biological state of the patient. The signs and symptoms of COVID-19 in the oral cavity are seen as evidence (hyposalivation, xerostomia, ageusia, hypogeusia, dysgeusia, herpetic lesions, and candidiasis). This, as a conclusion, determines a new era of diagnosis, as well as implementing new population monitoring standards to create safety and hygiene protocols.

3.1.3. Antimicrobial Resistance Surveillance Curriculum Development, One Health Approach: A Kenyan Experience

Sheila Chebore ¹, David Mungai ¹, Susan Githii ² and Jedidah Kahura ³

¹ Infectious Diseases Detection and Surveillance project of USAID (IDDS), Detection and Response AMR Project (DARE AMR), Kenya

² National Antimicrobial Stewardship Interagency Committee (NASIC), Kenya

³ National Public Health Laboratory, Kenya

Antimicrobial resistance (AMR) is an increasingly severe threat to global public health that requires action across different sectors. The introduction of antimicrobials revolutionized the ability to treat infectious diseases. However, the selection of appropriate antimicrobials is increasingly becoming a global challenge due to the emergence of drug resistance. The ministries developed an AMR policy and National Action Plan. The lack of a holistic in-service health worker training curriculum course for data generation, control, and management of AMR has slowed down the implementation process. A curriculum targeting all AMR stakeholders was proposed.

A draft of the AMR curriculum was developed with the support of One Health stakeholders, shared to a team of experts for review inputs. IDDS organized for a day's stakeholders meeting for further inputs before another five-day workshop to develop the curriculum, facilitator, and participant manuals. Finally, a validation workshop was held to finalize the documents for political approval. The curriculum development process included experts review inputs, stakeholders' meetings and workshops, and content validation. An official launch by the One Health ministries was made in November 2020. For the roll out, implementation training was provided to 25 Trainers who were at the national level and 200 human and animal health workers in five IDDS-supported sensitized counties, and 15 participants from five sites were trained on data analysis and use. A multi-disciplinary training curriculum was developed to standardize training and mentorship for AMR detection and surveillance. This will guide the systematic strengthening of knowledge and skills development for AMR prevention and containment with the One Health approach.

3.2. One Health in Transition Cities, Big Data, and Urban Metabolism

Preliminary Data on the Effects of PM2.5 on Olfactory Ensheathing Cells (OECs)

Antonio Cristaldi ¹, Rosalia Pellitteri ², Paola Dell'Albani ², Gea Oliveri Conti ¹, Chiara Copat ¹, Alfina Grasso ¹, Maria Fiore ¹, Giusy Milletari ¹, Sebastiano Cavallaro ² and Margherita Ferrante ¹

¹ LIAA—Laboratorio di Igiene Ambientale e degli Alimenti, Dipartimento di Scienze Mediche, Chirurgiche e Tecnologie Avanzate "G.F. Ingrassia", Università degli Studi di Catania, Italy

² Istituto per la Ricerca e l'Innovazione Biomedica, Consiglio Nazionale delle Ricerche, Catania, Italy

Exposure to PM2.5 represents a risk factor for public health. Several studies showed that the olfactory mucosa is involved in neurodegenerative processes induced by PM2.5. We evaluated the effect of PM2.5 to induce cytotoxicity and reduced the viability of in vitro cultures of OECs. PM2.5 samples were collected in a high-vehicular-traffic area of Catania (Italy).

The gravimetric determination of PM2.5, determination of trace elements, and determination of 16 PAHs were performed for each sample. A methodology was developed to ensure the sterility of the culture medium (DMEM) spiked with PM2.5. An MTT assay was performed to evaluate the PM2.5 effect on the OEC viability. Forty samples were analyzed. PM2.5 showed an annual, maximum, and minimum mean value of 16.9, 27.1, and 7.8 $\mu\text{g}/\text{m}^3$, respectively. Heavy metals and PAHs showed the highest values in winter, although below the limits reported by Italian Legislative Decree 152/2007 for As (6 ng/m^3), Cd (5 ng/m^3) and Ni (20 ng/m^3), by Ministerial Decree 60/2002 for Pb (0.5 $\mu\text{g}/\text{m}^3$), and Legislative Decree 155/10 for Benzo(a)pyrene (1 ng/m^3). After in vitro tests on OECs, the samples with the greatest amount of PM2.5 and with the highest values of Cr, Cu, Mn, Ni, Pb, V, naphthalene, pyrene, and dibenzo(a,h)anthracene showed a reduction in cell viability of 44%, 62%, and 67% after 24, 48, and 72 h of exposure, respectively. The next steps will see the evaluation of genomic, mitochondrial damage, oxidative stress, and interference in protein expression levels, in order to indicate new lines of preventive intervention for neurodegenerative diseases.

3.3. One Health as Part of Adaptation and Human Rights

Primary Health Care Assessment: Vital Signs Profile for Malaysia

Rachel Koshy¹, Nazrila Hairizan Nasir², Samsiah Awang³ and Kamaliah Mohamad Noh^{1,4}

¹ Family Health Development Division, Ministry of Health Malaysia, Malaysia

² Office of Deputy Director-General of Health, Ministry of Health Malaysia, Malaysia

³ Institute for Health Systems Research, Ministry of Health Malaysia, Malaysia

⁴ Independent Public Health Consultant formerly with Medical Faculty, University of Cyberjaya, Malaysia

Malaysia collaborated as a “trailblazer” country with PHCPI (Primary Health Care Performance Initiative) to populate the Primary Health Care (PHC) Vital Signs Profile (VSP).

This provided a reflection of the state of the PHC system and identified the strengths, weaknesses, challenges, and priority areas for improvement. The VSP is based on the PHCPI Conceptual Framework and measures four domains of the PHC system. The first phase measured finance, performance, and equity domains followed by the second phase on the system capacity using the progression model. The Malaysian VSP in 2021 showed that PHC spending was 35% of the Current Health Expenditure. In the performance domain, 98% of the population had access to health care, while 84% of clients received quality service at the point of care in public health facilities. In equity, there was no major gap in the under-five mortality occurring in the urban and rural areas. Malaysia’s PHC capacity was strongest in the two categories of drugs and supplies and funds management. The system was also strong in facility infrastructure, information systems, and the workforce. The system was weak in the empanelment of the population, where Malaysia was yet to have the legal mandate or the financing mechanism to enable this part. The PHC VSP was an important measurement tool, and recognizing data gaps provided evidence for the Ministry of Health and relevant stakeholders to strengthen the system and the need for further studies.

3.4. One Health Vision on Environmental Hazards, Toxicology and Epigenetics

3.4.1. Exposure to Metallic Nanoparticles Can Modulate Gut Metabolome and Microbiome in In Vitro Digestion Model

Filippo Vaccari¹, Leilei Zhang¹, Gianluca Giuberti¹, Alfina Grasso², Francesca Bandini¹, Pascual García-Pérez¹, Chiara Copat³, Luigi Lucini¹, Margherita Ferrante² and Edoardo Puglisi¹

¹ Department for Sustainable Food Process, Università Cattolica del Sacro Cuore, 29122 Piacenza, Italy

² Department of Medical, Surgical Sciences and Advanced Technologies Università degli Studi di Catania, Piazza dell’Università 2, 95131 Catania, Italy

³ Department of Agriculture, Food and Environment Università degli Studi di Catania, Piazza dell’Università 2, 95131 Catania, Italy

Metallic nanoparticles (MNPs) are becoming widespread contaminants in many food products and have caused a fast-growing concern regarding their possible effects on human and animal health. The present work aims to assess the impact of three different MNPs, Zinc oxide (ZnO), Titanium dioxide (TiO₂), and Silver (Ag), on the gut metabolome and microbiome after an in vitro static digestion procedure. Water samples spiked with two different concentrations of each MNP were subjected to an in vitro gastrointestinal digestion and large intestine fermentation, to simulate the normal course of MNPs in the human body. The impact of MNPs on gut microbiome and metabolic profile was determined through a high-throughput sequencing (HTS) of 16S rDNA and untargeted metabolomics approach. Data integration analysis, based on a multifactorial statistical analysis, was then applied to correlate two datasets. MNP-contaminated water was able to modulate specific microbial genera such as *Blautia*, *Roseburia*, *Ruminococcus*, *Bifidobacterium*, and *Lactobacillus*. Metabolomics analysis provided significant evidence of MNPs on the

modulation of the gut microbiota metabolic profile. Specifically, the highest levels of Ag and ZnO nanoparticles promoted a similar profiling to the control, whereas all the lowest levels of MNPs exhibited a more differentiated profile. Data integration analysis revealed a high correlation coefficient ($r = 0.87$) between the two omics, reporting treatments with a lower concentration of MNPs as the most impacting factors in the correlation analysis. The accumulation of amines, cholic acids, and other metabolites was positively correlated with genera of *Faecalibacterium*, *Anaeromassilibacillus*, *Escherichia*, and *Blautia* under a low concentration of MNPs, confirming their metabolome and microbiome modulation capacity.

Acknowledgments: Part of this research was supported by the project “Impacts of environmental risk factors on oncologic, cardiorespiratory and neurodegenerative diseases”, financed by Università Cattolica del Sacro Cuore within the D3.2 2021 funding scheme.

3.4.2. Cadmium Triggers Apoptotic and Ferroptotic Cell Death in Human L02 Cells by Inhibiting ATF-5-Mediated Mitochondrial Unfolded Protein Response

Chongshan Dai, Shusheng Tang and Zhanhui Wan

China College of Veterinary Medicine, China Agricultural University, No.2 Yuanmingyuan West Road, Beijing 100193, China

Cadmium (Cd) exposure could cause hepatotoxicity in humans and animals; however, the underlying molecular mechanisms remain unclear. In the present study, results from transcriptomics showed that cadmium exposure (at 5 μM for 24 h) significantly upregulated the ferroptosis, MAPK, and apoptosis pathways in human L02 cells. The protein expressions as the biomarkers of these pathways (i.e., GPX4, SLC7A11, COX2, p-JNK, Bax, Bcl-2, and p-38) were confirmed in Cd-treated L02 cells and liver tissue of mouse. Moreover, Cd exposure also significantly inhibited the expression of ATF5, CLPP, and Hsp60 proteins, indicating the inhibition of mitochondrial unfolded protein response (UPR). Pharmacology activation of ATF5 significantly reduced Cd-induced apoptosis and ferroptosis, but ferroptosis inhibitor Fer-1 and antioxidant NAC treatments both partly inhibited Cd-induced cell death in L02 cells. Furthermore, inhibition of the JNK pathway markedly inhibited the expression of the ATF5 protein, and exacerbated Cd-induced apoptosis and ferroptosis. In conclusion, for the first time, our study reveals that Cd could trigger the inhibition of mitochondrial UPR to induce apoptosis and ferroptosis. Our study highlights a new insight for the underlying molecular mechanisms of Cd-induced toxic effects and promotes drug discovery.

3.4.3. Local Solutions Available on Marine Litter and Plastic Pollution in Lake Victoria

Pauline Owiti, Rahmina Poullete and Miriam Kinuthia

The Polly Foundation, Nairobi, Kenya

Marine litter is a global environmental problem that threatens both the health of people and the marine biota. Due to its longevity and myriad detrimental consequences on species, including internal damage after ingestion, physical entanglement, and growth alterations, plastic, the most prevalent component of marine litter, is of particular concern. In addition to exposing organisms to hazardous substances, plastic can also absorb environmental contaminants and manufacturing-related additives. Additionally, there are currently no reports of microplastic pollution in African lakes, and in comparison to other parts of the world, less is known about the presence of microplastics in African waterways like Lake Victoria and their consequences on fauna. People who live close to Lake Victoria are concerned that their source of income is deteriorating and turning into a septic tank. In recent years, a number of people have come together to highlight the challenge of plastic pollution and to pinpoint important regional plastic solutions. I would like to discuss potential solutions of how local people in Kisumu, Kenya are creating their own ways for decreasing marine plastic pollution at the technical level. These groups have come up with ways to lessen the amount of plastic pollution in the lake. One important area they are focusing on is the creation of environmentally friendly goods manufactured from

water hyacinth, an aquatic weed that may be used in place of plastic containers by lakeside houses and fishermen. Due to their biodegradability, these items aid in lowering water contamination that results from the disposal of plastics. Additionally, they have started a campaign dubbed #LetLakeVictoriaBreatheAgain. The campaign's objective is to clean up, preserve, and safeguard the lake's ecosystem and biodiversity from pollution. There are many other types of pollutants that are harming Lake Victoria. The lake has been contaminated by industrialization, agriculture, typical garbage disposal practices, and sewage. Poor waste management and hygienic conditions in the area around the lake have allowed dangerous pollutants to overflow into the water basin, resulting in several cholera epidemics. The #LetLakeVictoriaBreatheAgain campaign cleans up Lake Victoria by raising awareness of the risks of plastic pollution; conducting research and gathering data to determine its extent; utilizing technology to make data collection and monitoring more effective; engaging the media to raise awareness; and empowering youth to start their own ecofriendly businesses.

The purpose of this session is to spread knowledge on local plastic solutions that may be implemented in other regions of the world suffering comparable problems, so aiding with the reduction in the ongoing issues of aquatic life mortality and water pollution. Additionally, this unique conversation aims to encourage knowledge sharing and experiences in the area of lowering plastic pollution and disseminating alternatives to plastic to a larger community.

Overall, this discussion will offer a range of options for dealing with marine debris and plastics, as well as mainly promote further investigation into the effects of plastic substitutes created by any substance at all levels. Through this platform, the subject will also promote a discussion forum to more fully comprehend all possible consequences of marine litter on marine organisms as well as the overall marine environment and communities, as well as to suggest novel preventative techniques.

3.4.4. Short-Term Exposure to Polystyrene Microplastics (PS-MPs) in Marine Mussels: Does It Induce Pro-Oxidant and Neurotoxic Effects?

Giuseppe De Marco ¹, Margherita Ferrante ², Mariachiara Galati ¹, Tiziana Cappello ¹, Gea Oliveri Conti ² and Maria Maisano ¹

¹ Department of Chemical, Biological, Pharmaceutical and Environmental Sciences, University of Messina, 98166 Messina, Italy

² Department of Medical, Surgical Sciences and Advanced Technologies "G.F. Ingrassia", University of Catania, Italy

The constant use of plastics adopted by modern society leads to their profuse release into the environment, especially marine ones. Once in the sea, plastics can be subjected to degradation processes, resulting in the formation of microplastics (MPs), highly persistent and hazardous for aquatic biota. Whilst the harmful effects due to long-term exposure to MPs in aquatic organisms are well known, the impacts provoked by a short period of exposure need to be fully understood. Therefore, Mediterranean mussels *Mytilus galloprovincialis*, filter-feeding organisms of ecological and commercial relevance, were exposed for three days (72 h) to 3 µm polystyrene MPs (PS-MPs, 50 particles/mL). The gills were chosen as the "first exposure" tissue and sampled at different time points (T0, T24, T48, T72). After measuring the uptake of MPs into mussel gills, a battery of biochemical endpoints was applied to evaluate the effects of PS-MPs on the antioxidant (superoxide dismutase, SOD; catalase, CAT; lipid peroxidation, LPO), biotransformation (glutathione S-transferase, GST), and cholinergic neurotransmission (acetylcholinesterase, AChE) systems. In detail, a significant rise in the SOD and CAT activity was recorded, especially at T48 and moderately at T72, while GST activity seemed to be equally enhanced at T48 and T72. A high level of LPO, likely as an effect of antioxidant enzyme enhancement, was noticed only at T48. Interestingly, a moderate alteration was observed in the AChE activity throughout the experimental trial. Overall, these results provide novel insights into the biological responses elicited by mussels challenged by a short-term exposure to PS-MP.

3.4.5. Impacts of Environmental Microplastics and Benzo[a]pyrene on Cellular and Molecular Responses of *Hediste Diversicolor*

Siwar Abouda ¹, Omayma Missawi ¹, Tiziana Cappello ², Giuseppe De Marco ², Maria Maisano ² and Mohamed Banni ¹

¹ Laboratory of Agrobiodiversity and Ecotoxicology, Higher Institute of Agronomy, University of Sousse, Nahd Khalifa Al-Qarawi, RJQ4+5WW, Tunisia

² Department of Chemical, Biological, Pharmaceutical and Environmental Sciences, University of Messina, Messina 98166, Italy

Nowadays, marine ecosystems are under severe threat from the simultaneous presence of multiple stressors including pollution from microplastics (MPs, <5 mm) and polycyclic aromatic hydrocarbons (PAHs) such as benzo[a]pyrene (B[a]P). Although the ecotoxicological effects of each of these pollutants are currently evident, few works have studied the combined effect of these contaminants essentially with the possible adsorption and resorption of PAHs on MP surfaces. In this context, the main objective of our study was to assess the toxicity of environmental MPs (<30 µm) and B[a]P in the seaworm “*Hediste diversicolor*”. By exploring their tissue accumulations, their effects on histological structures, their cytotoxic and genotoxic effects, their influences on some parameters of oxidative and neuronal status as well as on the gene expression of some enzymes involved in the antioxidant system. The results obtained showed that exposure to MPs and B[a]P alone, or combined, caused alterations in the histological structures of the worms and a cytotoxicity in coelomic fluid cells. Our data also revealed a change in parameters associated with antioxidant processes and the neuronal system, which resulted in an increase in catalase activities and MDA levels, and an inhibition of GST activities as well as in AChE activities. At the genomic level, the contaminations caused genotoxicity and compensatory responses reflected by gene overexpression of antioxidant enzymes (CAT and GST).

Overall, this study highlights the ecological risk associated with the ingestion and accumulation of these pollutants by biota threatening their vital functional parameters.

3.4.6. Early Mechanisms of Polystyrene Microplastic (PS-MP) Cytotoxicity Assessed in Marine Mussels after Short-Term Exposure

Tiziana Cappello ¹, Gea Oliveri Conti ², Giuseppe De Marco ¹, Margherita Ferrante ² and Angela Mauceri ¹

¹ Department of Chemical, Biological, Pharmaceutical and Environmental Sciences, University of Messina, 98166 Messina, Italy

² Department of Medical, Surgical Sciences and Advanced Technologies “G.F. Ingrassia”, University of Catania, Italy

The reality we live in is a plasticized world, in which plastic invades our daily lives due to its excessive use in multiple fields (i.e., packaging, textile, electrical, construction). The irrational production, inappropriate disposal, and inadequate recycling management have made the ocean a major landfill for global plastic waste, which undergo fragmentation into microplastics (MPs), posing hazardous risks to all life forms. Despite MP toxicity having been highly explored in biota, understanding the early mechanisms of MP toxicity remains a challenge. Therefore, a short-term exposure (72 h with daily time-points) to 3 µm polystyrene MPs (PS-MPs, 50 particles/mL) was conducted on Mediterranean mussels *Mytilus galloprovincialis*, filter-feeding bivalves of high ecological and commercial value. The bioaccumulation of PS-MPs in mussel gills, selected as the target organ being involved in filtering activity, increased exponentially with time up to T48, and then moderately dropped at T72. The high-throughput Nuclear Magnetic Resonance (NMR)-based metabolomics revealed multiple metabolic disturbances. Specifically, an altered protein metabolism with reduced levels of amino acids was recorded, likely due to the activation of defensive strategies. The decreased concentration of glycine at T48 and T72 may be attributed to the occurrence of oxidative stress. Changes in energy metabolism were also noticed, together with an increase in acetoacetate, a product of metabolism of fatty acid

oxidation. It should be noted that disturbances in the osmoregulatory processes were found, as well as altered cholinergic neurotransmission. Overall, the early mechanisms of cytotoxicity exposure to MPs and B[a]P alone, or combined, caused alterations in the histological structures of the worms and a cytotoxicity in coelomic fluid cells. Our data also revealed a change in parameters associated with antioxidant processes and the neuronal system, which resulted in an increase in catalase activities and MDA levels, and an inhibition of GST activities as well as in AchE activities. At the genomic level, the contaminations caused genotoxicity and compensatory responses reflected by gene overexpression of antioxidant enzymes (CAT and GST). Overall, the early mechanisms of cytotoxicity of PS-MPs exposure were discerned, highlighting the urgency to enhance the proper disposal and recycling of plastic waste.

Author Contributions: Writing—original draft preparation: D.V. and M.F.; writing—review and editing: M.F., G.O.C., G.F., C.M., P.L., P.P., M.J.G.T. and C.D. project administration: D.V. All authors have read and agreed to the published version of the manuscript.

Funding: The publication of these proceedings received no external funding.

Institutional Review Board Statement: Not applicable.

Informed Consent Statement: Informed consent was obtained from all subjects involved in the study.

Data Availability Statement: The data presented in this study are available on request from the corresponding author.

Conflicts of Interest: The authors declare no conflict of interest.

References

1. Ramirez-Rubio, O.; Daher, C.; Fanjul, G.; Gascon, M.; Mueller, N.; Pajín, L.; Nieuwenhuijsen, M.J. Urban health: An example of a “health in all policies” approach in the context of SDGs implementation. *Glob. Health* **2019**, *15*, 87. [[CrossRef](#)] [[PubMed](#)]
2. Leppo, K.; Ollila, E.; Pena, S.; Wismar, M.; Cook, S. *Health in All Policies-Seizing Opportunities, Implementing Policies*; Sosiaali-ja Terveysministeriö: Helsinki, Finland, 2013.
3. Guglielmin, M.; Muntaner, C.; O’Campo, P.; Shankardass, K. A scoping review of the implementation of health in all policies at the local level. *Health Policy* **2018**, *122*, 284–292. [[CrossRef](#)] [[PubMed](#)]
4. Greer, S.L.; Falkenbach, M.; Siciliani, L.; McKee, M.; Wismar, M.; Figueras, J. From Health in All Policies to Health for All Policies. *Lancet Public Health* **2022**, *7*, e718–e720. [[CrossRef](#)] [[PubMed](#)]
5. WHO; OIE. *One Health*; World Health Organization: Geneva, Switzerland, 2017.
6. Gomez-Echeverri, L. Climate and development: Enhancing impact through stronger linkages in the implementation of the Paris Agreement and the Sustainable Development Goals (SDGs). *Philos. Trans. R. Soc. A* **2018**, *376*, 20160444. [[CrossRef](#)] [[PubMed](#)]
7. Campagnolo, L.; Davide, M. Can the Paris deal boost SDGs achievement? An assessment of climate mitigation co-benefits or side-effects on poverty and inequality. *World Dev.* **2019**, *122*, 96–109. [[CrossRef](#)]

Disclaimer/Publisher’s Note: The statements, opinions and data contained in all publications are solely those of the individual author(s) and contributor(s) and not of MDPI and/or the editor(s). MDPI and/or the editor(s) disclaim responsibility for any injury to people or property resulting from any ideas, methods, instructions or products referred to in the content.