

### In this review:

#### A. Recent articles with abstracts

O/A denotes an open access article or journal

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Bull, A.T. and Stach, J.E.M. **Marine actinobacteria: new opportunities for natural product search and discovery.** *Trends in Microbiology* 15(11): 491-499, 2007.

**Notes:** It is widely accepted that new drugs, especially antibiotics, are urgently required, and that the most propitious source remains natural products. We argue that in exploring new sources of bioactive natural products the marine environment warrants particular attention, in view of the remarkable diversity of microorganisms and metabolic products. Recent reports of new chemical entities and first-in-class drug candidates, and confirmation of indigenous marine actinobacteria, make exciting discoveries even more likely given the unrivalled capacity of this class of bacteria to produce exploitable natural products.

Chelossi, E., Pantile, R., Pronzato, R., Milanese, M., and Hentschel, U. **Bacteria with antimicrobial properties isolated from the Mediterranean sponges *Chondrilla nucula* and *Petrosia ficiformis*.** *Aquatic Microbial Ecology* 49(2): 157-163, 2007.

**Notes:** Bacteria were isolated seasonally from the Mediterranean sponges *Chondrilla nucula* and *Petrosia ficiformis* and screened for antibacterial activities. Selected isolates were taxonomically identified by 16S rRNA gene sequencing. A total of 416 different bacterial strains were isolated, 60 (14.4%) of which displayed variable degrees of antimicrobial activity. Of the bioactive strains, 58.3% were able to inhibit *Staphylococcus aureus*, 6.7% were active against *Bacillus subtilis*, 11.7% against both *Enterococcus faecalis* and *Escherichia coli*, 38.3% against *Pseudoalteromonas atlantica* and 33.3% against *Pseudomonas elongata*. 16S rRNA gene sequence analysis showed that 2 isolates, 1 from seawater samples and 1 from *P. ficiformis*, were most closely related to *Bacillus subtilis* (99% similarity) and that another isolate from *P. ficiformis* was most closely related to a previously described sponge-associated *Alphaproteobacterium* NW001 (98% similarity). Two isolates from *C. nucula* were most closely related to *Brachybacterium paraconglomeratum* (99% similarity) and *Shewanella algae* (89% similarity). The high percentage of bioactive isolates derived from the 2 sponges suggests that marine microorganisms, whether animal-associated or planktonic, are promising sources for drug discovery.

Guo, J.Y., Wu, F.C., Mai, B.X., Luo, X.J., and Zeng, E.Y. **Polybrominated diphenyl ethers in seafood products of South China.** *Journal of Agricultural and Food Chemistry* 55(22): 9152-9158, 2007.

**Notes:** South China is probably one of the heaviest polybrominated diphenyl ether (PBDE) polluted regions in the world, thanks to the presence of huge and rapidly growing electronics manufacturing industries, as well as several of the world's largest e-waste recycling sites in the region. In the present work, a wide variety of nonfish seafood products collected from

South China was analyzed for PBDE residues. The concentrations of PBDEs in seafood products were highly species-specific, and the magnitude of PBDE pollution was moderate in South China compared to the global levels. Congener patterns of PBDEs in seafood samples suggested that seafood products are prone to accumulating low-brominated congeners, and possible metabolic debromination of BDE-99 to BDE-47 could occur in certain organisms, such as crabs and mantis shrimp. Generally, the congener profile was dominated by BDE-209, and to a lesser extent by BDE-47 and BDE-99, which was consistent with the fact that Deca-BDE is mass-produced in China and with previous sediment results from the same area. The occurrence of BDE-209 in aquatic species from South China suggests that BDE-209 appears to be more bioavailable than previously thought, and the environmental fate and safety of BDE-209 require further investigation and call for a thorough reassessment.

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Bonilla, T.D., Nowosielski, K., Cuvelier, M., Hartz, A., Green, M., Esiobu, N., McCorquodale, D. S., Fleisher, J.M., and Rogerson, A. **Prevalence and distribution of fecal indicator organisms in South Florida beach sand and preliminary assessment of health effects associated with beach sand exposure.** *Marine Pollution Bulletin* 54(9): 1472-1482, 2007.

**Notes:** Fecal indicator levels in nearshore waters of South Florida are routinely monitored to assess microbial contamination at recreational beaches. However, samples of sand from the surf zone and upper beach are not monitored which is surprising since sand may accumulate and harbor fecal-derived organisms. This study examined the prevalence of fecal indicator organisms in tidally-affected beach sand and in upper beach sand and compared these counts to levels in the water. Since indicator organisms were statistically elevated in sand relative to water, the study also considered the potential health risks associated with beach use and exposure to sand. Fecal coliforms, *Escherichia coli*, enterococci, somatic coliphages, and F+-specific coliphages were enumerated from sand and water at three South Florida beaches (Ft. Lauderdale Beach, Hollywood Beach, and Hobie Beach) over a 2-year period. Bacteria were consistently more concentrated in 100 g samples of beach sand (2-23 fold in wet sand and 30-460 fold in dry sand) compared to 100 ml samples of water. Somatic coliphages were commonly recovered from both sand and water while F+-specific coliphages were less commonly detected. Seeding experiments revealed that a single specimen of gull feces significantly influenced enterococci levels in some 3.1 m<sup>2</sup> of beach sand. Examination of beach sand on a micro-spatial scale demonstrated that the variation in enterococci density over short distances was considerable. Results of multiple linear regression analysis showed that the physical and chemical parameters monitored in this study could only minimally account for the variation observed in indicator densities. A pilot epidemiological study was conducted to examine whether the length of exposure to beach water and sand could be correlated with health risk. Logistic regression analysis results provided preliminary evidence that time spent in the wet sand and time spent in the water were associated with a dose-dependent increase in gastrointestinal illness.

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Ma, Q.-L., Teter, B., Ubeda, O.J., Morihara, T., Dhoot, D., Nyby, M.D., Tuck, M.L., Frautschy, S.A., and Cole, G.M. **Omega-3 fatty acid docosahexaenoic acid increases SorLA/LR11, a sorting protein with reduced expression in sporadic Alzheimer's disease (AD): Relevance to AD prevention.** *Journal of Neuroscience* 27(52): 14299-14307, 2007.

**Notes:** Environmental and genetic factors, notably ApoE4, contribute to the etiology of late-onset Alzheimer's disease (LOAD). Reduced mRNA and protein for an apolipoprotein E (ApoE) receptor family member, SorLA (LR11) has been found in LOAD but not early-onset AD, suggesting that LR11 loss is not secondary to pathology. LR11 is a neuronal sorting protein that reduces amyloid precursor protein (APP) trafficking to secretases that generate  $\beta$ -amyloid (A $\beta$ ). Genetic polymorphisms that reduce LR11 expression are associated with increased AD risk. However these polymorphisms account for only a fraction of cases with LR11 deficits, suggesting involvement of environmental factors. Because lipoprotein receptors are typically lipid-regulated, we postulated that LR11 is regulated by docosahexaenoic acid (DHA), an essential  $\omega$ -3 fatty acid related to reduced AD risk and reduced A $\beta$  accumulation. In this study, we report that DHA significantly increases LR11 in multiple systems, including primary rat neurons, aged non-Tg mice and an aged DHA-depleted APPsw AD mouse model. DHA also increased LR11 in a human neuronal line. *In vivo* elevation of LR11 was also observed with dietary fish oil in young rats with insulin resistance, a model for type II diabetes, another AD risk factor. These data argue that DHA induction of LR11 does not require DHA-depleting diets and is not age dependent. Because reduced LR11 is known to increase A $\beta$  production and may be a significant genetic cause of LOAD, our results indicate that DHA increases in SorLA/LR11 levels may play an important role in preventing LOAD.

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Ibelings, B.W. and Chorus, I. **Accumulation of cyanobacterial toxins in freshwater "seafood" and its consequences for public health: A review.** *Environmental Pollution* 150(1): 177-192, 2007.

**Notes:** This review summarizes and discusses the current understanding of human exposure to cyanobacterial toxins in "seafood" collected from freshwater and coastal areas. The review consists of three parts: (a) the existing literature on concentrations of cyanobacterial toxins in seafood is reviewed, and the likelihood of bioaccumulation discussed; (b) we derive cyanotoxin doses likely to occur through seafood consumption and propose guideline values for seafood and compare these to guidelines for drinking water; and (c) we discuss means to assess, control or mitigate the risks of exposure to cyanotoxins through seafood consumption. This is discussed in the context of two specific procedures, the food specific HACCP-approach and the water-specific Water Safety Plan approach by the WHO. Risks of exposure to cyanotoxins in food are sometimes underestimated. Risk assessments should acknowledge this and investigate the partitioning of exposure between drinking-water and food, which may vary depending on local circumstances.

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Burger, J., Gochfeld, M., Shukla, T., Jeitner, C., Burke, S., Donio, M., Shukla, S., Snigaroff, R., Snigaroff, D., Stamm, T., and Volz, C. **Heavy metals in Pacific Cod (*Gadus macrocephalus*) from the Aleutians: Location, age, size, and risk.** *Journal of Toxicology and Environmental Health Part A* 70(22): 1897-1911, 2007.

**Notes:** Considerable attention has been devoted to the risks from mercury (Hg) and polychlorinated biphenyls (PCB) to high-level predators (including humans) who consume freshwater fish. Although the U.S. Food and Drug Administration (FDA) issued advisories because of Hg for four marine fish species, there are few data on lead (Pb), cadmium (Cd), or other metals in Bering Sea fish generally, or on the risk these levels pose to the fish themselves or to consumers of marine fish. Levels of arsenic (As), Cd, chromium (Cr), Pb, Hg, and selenium (Se) levels were examined in muscle and liver of 142 Pacific Cod (*Gadus macrocephalus*) collected in 2004 at Nikolski, Adak, Amchitka, and Kiska Islands in the Aleutian Chain (Alaska) in the Bering Sea/North Pacific Ocean, a major source of commercial fishing. One key objective was whether there were location, age, gender, and size effects on tissue concentration that might pose a risk to the fish or their predators (including humans). All fish were measured and weighed, and a subset was aged by examining otolith layers. As was higher in liver than in muscle (geometric mean 2420 versus 1590 ng/g or ppb wet weight), as were Cd (GM 224 versus 1.92) and Se (GM 1380 versus 165). Conversely, Cr was higher in muscle (76.8 versus 45 ppb), as were Pb (23.7 vs 12 ppb) and surprisingly Hg (128 versus 82 ppb). Adak, until recently a large military base, had the highest levels of As, Hg, and Se, while Amchitka had the highest Pb levels, but Nikolski, which generally had the lowest levels, had relatively high Pb in liver. In general, interisland differences were significant for most metals in muscle, but only for Cr in liver. Weight and length were positively related to age, but age tended to explain more of the variance in metal levels. The multiple regression relationships differed by tissue in an unanticipated manner. Location contributed significantly to the models for muscle Cd, Pb, Hg, and Se, but not for liver levels. Conversely the length by weight interaction entered all of the liver models but none of the muscle models. Se and Hg were positively but weakly correlated in both liver ( $\tau = +0.16$ ) and muscle tissue ( $\tau = 0.12$ ). Hg was positively correlated with length, weight, and age in muscle, but not in liver. As showed a significant negative correlation with size variable in both tissues, and Cr was negatively correlated in muscle. Cd was positively correlated with Hg, Se, and As. Between liver and muscle there were significant positive correlations for Hg ( $\tau = .24$ ), As ( $\tau = .407$ ), and Cr ( $\tau = 0.17$ ), but not for Pb, Cd, or Se. In this study, the only metals that might pose a risk to cod-eating predators is Hg, as well as some of the higher values of Pb at Amchitka and Nikolski. The U.S. Environmental Protection Agency (EPA) reference dose (RfD) (not available for lead) was used to evaluate the risk to people consuming an 8-ounce (228g) meal of cod once per day and once per week, and to calculate risk using the levels found in this study. If a subsistence fisher from one of the Aleut villages ate one meal of cod per week for As, or one meal per day for Hg, they would exceed the U.S. EPA reference dose for As and Hg (set at a level to be without adverse effect for any person with this average daily exposure).

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Graczyk, T.K., Majewska, A.C., and Schwab, K.J. **The role of birds in dissemination of human waterborne enteropathogens.** *Trends in Parasitology* 24(2): 55-59, 2008.

**Notes:** Cryptosporidiosis, giardiasis and microsporidiosis are serious human diseases of waterborne origin; their etiologic agents and a substantial fecal coliform load can enter surface, drinking and recreational water resources from aquatic birds. The aim of this article is to present interactions between waterfowl and these waters that imply a negative public health impact, reinforcing the need for either better water-quality indicators or for water monitoring specifically for *Cryptosporidium*, *Giardia*

and microsporidia. Where justifiable, the presence of waterfowl should be supported; however, management of drinking and recreational water resources needs to be improved by incorporating effective protection measures for pathogens linked to these birds.

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Sahuquillo, I., Lagarda, M.J., Silvestre, M.D., and Farre, R. **Methylmercury determination in fish and seafood products and estimated daily intake for the Spanish population.** *Food Additives and Contaminants* 24(8): 869-876, 2007.

**Notes:** The mercury content of 25 samples of fish and seafood products most frequently consumed in Spain was determined. A simple method comprising cold vapour and atomic absorption spectrometry was used to determine separately inorganic and organic mercury. In all samples inorganic mercury content was below 50  $\mu\text{g kg}^{-1}$ . There was wide variability, among not only the mercury levels of different fish species, but also for different samples of the same species - with the methylmercury content ranging from below 54 to 662  $\mu\text{g kg}^{-1}$ . The highest mean methylmercury content was found in fresh tuna. Based on an average total fish consumption of 363 g/person week<sup>-1</sup>, the methylmercury intake was estimated to be 46.2  $\mu\text{g/person week}^{-1}$ . Therefore, the mercury intake of Spanish people with a body weight  $\leq 60$  kg is lower than the joint FAO/WHO Expert Committee on Food Additives (JECFA) provisional tolerable weekly intake (PTWI) of 1.6  $\mu\text{g kg}^{-1}$  body weight, but exceeds the US National Research Council (NRC) limit of 0.7  $\mu\text{g kg}^{-1}$  body weight week<sup>-1</sup> based on a benchmark dose.

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Lorber, M. **Exposure of Americans to polybrominated diphenyl ethers.** *Journal of Exposure Analysis and Environmental Epidemiology* 18(1): 2-19, 2008. **O/A**

**Notes:** Polybrominated diphenyl ethers, PBDEs, are a class of brominated flame retardants that, like other persistent organic pollutants (POPs), have been found in humans, wildlife, and biota worldwide. Unlike other POPs, however, the key routes of human exposure are not thought to be food and fish, but rather are from their use in household consumer products, and to the high levels of PBDEs found in house dust. The exposure of Americans to PBDEs was systematically evaluated in this study. First, exposure media data on PBDE congeners were compiled. Then, an adult intake dose was derived using exposure factors in combination with these data. The exposure pathways evaluated included food and water ingestion, inhalation, and ingestion and dermal contact to house dust. These intakes were converted to a body burden using a simple pharmacokinetic (PK) model. The predicted body burdens were compared with representative profiles of PBDEs in blood and milk. The adult intake dose of total PBDEs was estimated to be 7.7 ng/kg body weight/day, and children's estimated intakes were higher at 49.3 ng/kg/day for ages 1-5, 14.4 ng/kg/day for 6-11, and 9.1 ng/kg/day for 12-19. The much higher dose for the child age 1-5 was due to the doubling of dust ingestion from 50 to 100 mg/day. The predicted adult body burden of total PBDEs was 33.8 ng/kg lipid weight (lwt), compared to representative measurements in blood and milk at 64.0 and 93.7 ng/g lwt, respectively. Most of this apparent underprediction in total concentration was due to an underprediction of the key congener, BDE 47. The value for BDE 47 half-life in the body was identified as the variable most likely in error in this exercise. Other congener predictions compared well with measurements, suggesting general validity with the approach. An important finding from this assessment is that the food intake estimate of about 1.3 ng/kg/day (of the 7.7 ng/kg/day total) cannot explain current US body burdens; exposures to PBDEs in house dust accounted for 82% of the overall estimated intakes.

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Lebarbenchon, C., Brown, S.P., Poulin, R., Gauthier-Clerc, M., and Thomas, F. **Evolution of pathogens in a man-made world.** *Molecular Ecology* 17(1): 475-484, 2008.

**Notes:** Human activities have resulted in substantial, large-scale environmental modifications, especially in the past century. Ecologists and evolutionary biologists are increasingly coming to realize that parasites and pathogens, like free-living organisms, evolve as the consequence of these anthropogenic changes. Although this area now commands the attention of a variety of researchers, a broad predictive framework is lacking, mainly because the links between human activities, the environment and parasite evolution are complex. From empirical and theoretical examples chosen in the literature, we give an overview of the ways in which humans can directly or indirectly influence the evolution of different traits in parasites (e.g. specificity, virulence, polymorphism). We discuss the role of direct and indirect factors as diverse as habitat fragmentation, pollution, biodiversity loss, climate change, introduction of species, use of vaccines and antibiotics, ageing of the population, etc. We also present challenging questions for further research. Understanding the links between anthropogenic changes and parasite evolution needs to become a cornerstone of public health planning, economic development and conservation biology.

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Jewett, S.C. and Duffy, L.K. **Mercury in fishes of Alaska, with emphasis on subsistence species.** *The Science of the Total Environment* 387(1-3): 3-27, 2007.

**Notes:** In the north, the presence of mercury (Hg) in food leading to chronic exposure is a scientific, economic and political issue. Guidelines have been established for the safe consumption of fish containing Hg, however, adherence to these guidelines must be weighed against the health benefits of consuming fish, such as from the omega-3 polyunsaturated fatty acids, vitamins and minerals. Alaskan Natives generally consume much more fish than the national average. This review summarizes and synthesizes the significant amount of data that has been generated on Hg in Alaska fish, particularly those consumed by Alaskans. Also included are a review of the benefits of eating fish, human health concerns relating to Hg toxicity and various risk assessment guidelines for food consumption. Emphasis was placed on methylmercury (MeHg), the most toxic form to humans. Hg concentrations were examined in 17 freshwater fish species and 24 anadromous and marine fish species, for a total of 2692 specimens. For freshwater fish the greatest database was on northern pike (*Esox lucius*). For anadromous and marine fish the greatest database was on Pacific halibut (*Hippoglossus stenolepis*) and the five species of Pacific salmon (*Oncorhynchus* spp.). Overall, most fish had muscle Hg concentrations of  $\leq 1$  mg kg<sup>-1</sup> (wet wt.), within the USFDA's Action Level and Alaska's guideline for safe concentrations of MeHg in edible fish. Pacific salmon, the most commonly consumed fish group, had exceptionally low ( $\leq 0.1$  mg kg<sup>-1</sup>) Hg concentrations. Pacific halibut muscle Hg content was less than 0.3 mg kg<sup>-1</sup>. Northern pike, a piscivorous (fish-eating) and long-lived fish, contained the highest muscle Hg values, often exceeding the state's guidelines for food consumption. A discussion of the safe consumption level for pike is included.

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Falco, G., Llobet, J.M., Bocio, A., and Domingo, J.L. **Exposure to hexachlorobenzene through fish and seafood consumption in Catalonia, Spain.** *The Science of the Total Environment* 389(2-3): 289-295, 2008.

**Notes:** The concentrations of hexachlorobenzene (HCB) were analyzed by HRGC/HRMS in 42 composite samples of the 14 most consumed marine species (sardine, tuna, anchovy, mackerel, swordfish, salmon, hake, red mullet, sole, cuttlefish, squid, clam, mussel, and shrimp) in Catalonia, Spain. The daily intake of HCB associated with this consumption was also estimated for four age groups of the population of Catalonia: children, adolescents, adults and seniors, which were in turn divided according to sex. The highest HCB levels were found in salmon and mackerel: 1.68 and 0.80 ng/g of wet weight, respectively, whereas the lowest HCB levels were found in cuttlefish, mussel, and shrimp (0.02, 0.03, and 0.04 ng/g of wet weight, respectively). In general terms, these results are within the range of data reported in recent years by a number of authors. The highest and lowest HCB intake (ng/day) corresponded to female adults (13.3) and girls (4.0), respectively. For most age/sex groups, salmon and sole were the species showing the highest contribution to HCB intake. When HCB intake was calculated according to the average body weight of the individuals in each group, the highest and lowest values corresponded to boys (0.32 ng/kg/day) and female adolescents (0.14 ng/kg/day). For all groups, HCB intake from fish and seafood consumption was considerably lower than the WHO tolerable daily intake (TDI), for non-cancer effects and for neoplastic effects in humans.

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Baird, S.J.S., Bailey, E.A., and Vorhees, D.J. **Evaluating human risk from exposure to alkylated PAHs in an aquatic system.** *Human and Ecological Risk Assessment* 13(2): 322-338, 2007.

**Notes:** Polycyclic aromatic hydrocarbons (PAHs) are a large class of organic chemicals typically found as mixtures in the aquatic environment from natural, petrogenic, and pyrogenic sources. People can be exposed to PAHs through ingestion or dermal contact with contaminated sediments or through ingestion of fish and shellfish exposed to contaminated sediments. Although more than 100 PAHs have been identified, human exposure and risk are commonly evaluated for 18 individual PAHs. Other PAHs, such as alkylated PAHs, likely contribute to biological activity of environmental PAH mixtures; however, insufficient toxicity data are available to quantify their potential risk. This article presents an initial evaluation of the potential for human health risk from exposure to alkylated PAHs in sediment and fish. Individual alkylated PAHs have been observed to have potentially mutagenic, tumor-promoting, or carcinogenic activity. However, except for 1- and 2-methylnaphthalene, insufficient toxicity data are available to quantify toxicity or cancer risk from exposure to individual alkylated PAHs or mixtures of alkylated PAHs. This article describes a proposed strategy to better understand the potential human health risk

from exposure to alkylated PAHs. Implementation of this strategy will contribute to evaluations of human exposure to complex PAH mixtures in the environment.

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Colborn, T. and Carroll, L.E. **Pesticides, sexual development, reproduction, and fertility: Current perspective and future direction.** *Human and Ecological Risk Assessment* 13(5): 1078-1110, 2007.

**Notes:** Improvements in chemical analytical technology and non-invasive sampling protocols have made it easier to detect pesticides and their metabolites at very low concentrations in human tissues. Monitoring has revealed that pesticides penetrate both maternal and paternal reproductive tissues and organs, thus providing a pathway for initiating harm to their offspring starting before fertilization throughout gestation and lactation. This article explores the literature that addresses the parental pathway of exposure to pesticides. We use DDT/DDE as a model for chemicals that oftentimes upon exposure have no apparent, immediate health impacts, or cause no obvious birth defects, and are seldom linked with cancer. Their health effects are overlooked because they are invisible and not life threatening - but might have significant health, social, and economic impacts at the individual and population levels. The purpose of this article is to demonstrate the necessity to develop new approaches for determining the safety of pesticides and the need for innovative regulatory policy to protect human and environmental health.

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Kim, S. and Aga, D.S. **Potential ecological and human health impacts of antibiotics and antibiotic-resistant bacteria from wastewater treatment plants.** *Journal of Toxicology and Environmental Health Part B* 10(8): 559-573, 2007.

**Notes:** The occurrence of antibiotics and other pharmaceuticals in the environment has become an increasing public concern as recent environmental monitoring activities reveal the presence of a broad range of persistent pharmaceuticals in soil and water. Studies show that municipal wastewater treatment plants (WWTPs) are important point sources of antibiotics and antibiotic-resistant bacteria in the environment. The fate of antibiotics and other pharmaceuticals in WWTPs is greatly influenced by the design and operation of treatment systems. Because knowledge on the fate of antibiotics and resistant bacteria in WWTPs is important in estimating their potential impacts on ecology and human health, investigations on occurrence, treatment, and observed effects are reviewed in this article. In addition, human health risk assessment protocols for antibiotic and resistant bacteria are described. Although data on other pharmaceutical compounds are also presented, discussion is focused on antibiotics in the environment because of the potential link to increased emergence of resistance among pathogenic bacteria. The applications of modern analytical methods that facilitate the identification of novel transformation products of pharmaceuticals in environmental matrices are also included to illustrate that the disappearance of the parent pharmaceuticals in WWTPs does not necessarily equate to their complete removal.

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Wang, R.Y. and Needham, L.L. **Environmental chemicals: From the environment to food, to breast milk, to the infant.** *Journal of Toxicology and Environmental Health Part B* 10(8): 597-609, 2007.

**Notes:** Food is a source of exposure to many environmental chemicals found in human milk and other biological specimens. Ingestion of foods containing high amounts of animal fat is the main route of human exposure to lipophilic chemicals, such as persistent organic pollutants, which tend to bioaccumulate in the lipid compartment. Bioaccumulation results in increased exposure of these chemicals for humans, but particularly to breastfeeding infants, who are at the top of the food chain. The extent to which food contributes to a person's overall exposure depends on individual dietary habits and the concentrations of chemical residues in the food. These, in turn, are affected by (1) application methods, (2) properties and amounts of the chemical, and (3) preparation, handling, and the properties of the food. Once the food is ingested by the lactating woman, the chemical's pharmacokinetics and the transport mechanisms producing the movement of solutes across mammary alveolar cells determine the passage of chemicals from the blood to the milk. Thus, several factors affect the presence in human milk of environmental chemicals from dietary sources.

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Burger, J. and Gochfeld, M. **Risk to consumers from mercury in Pacific cod (*Gadus macrocephalus*) from the Aleutians: Fish age and size effects.** *Environmental Research* 105(2): 276-284, 2007.

**Notes:** While there has been considerable attention devoted to the risks to high level consumers from mercury in freshwater fish, relatively little attention has been devoted to saltwater fish. Although the U.S. Food and Drug Administration has issued advisories based on mercury for four saltwater species or groups of fish, there are few data on mercury levels generally, or on the risk these levels pose to the fish themselves or to consumers of marine fish. We examined total mercury levels in liver and muscle of Pacific cod (*Gadus macrocephalus*) collected from the northern Pacific and Bering Sea waters around Nikolski, Amchitka, and Kiska Islands in the Aleutian Chain (Alaska). We were interested in whether there were differences in mercury levels as a function of location, weight, length, and age of the fish, and what risk mercury posed to the food chain, including people. Fish were aged by examining otoliths, and we measured selenium because of its reported protective effects against mercury. Regression models indicated that 27% of the variation in levels of mercury was due to tissue examined and age, while 67% of the variation in levels of selenium was due to tissue, length, and age. Mercury levels were significantly higher in the muscle than the liver, and the reverse was true for selenium. Mercury levels were negatively correlated with selenium levels, and positively correlated with length, weight, and age. There were no gender differences in mercury or selenium levels. The mean levels of mercury in muscle (0.17 ppm wet weight) are within the range known to cause adverse effects in sensitive birds and mammals. Only 4% of the Pacific cod samples had mercury levels above 0.5 ppm, the action level promulgated by many states and countries, and none were above the 1 ppm action level of the U.S. FDA.

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Belpomme, D., Irigaray, P., Hardell, L., Clapp, R., Montagnier, L., Epstein, S., and Sasco, A.J. **The multitude and diversity of environmental carcinogens.** *Environmental Research* 105(3): 414-429, 2007.

**Notes:** We have recently proposed that lifestyle-related factors, screening and aging cannot fully account for the present overall growing incidence of cancer. In order to propose the concept that in addition to lifestyle related factors, exogenous environmental factors may play a more important role in carcinogenesis than it is expected, and may therefore account for the growing incidence of cancer, we overview herein environmental factors, rated as certainly or potentially carcinogenic by the International Agency for Research on Cancer (IARC). We thus analyze the carcinogenic effect of microorganisms (including viruses), radiations (including radioactivity, UV and pulsed electromagnetic fields) and xenochemicals. Chemicals related to environmental pollution appear to be of critical importance, since they can induce occupational cancers as well as other cancers. Of major concerns are: outdoor air pollution by carbon particles associated with polycyclic aromatic hydrocarbons; indoor air pollution by environmental tobacco smoke, formaldehyde and volatile organic compounds such as benzene and 1,3 butadiene, which may particularly affect children, and food pollution by food additives and by carcinogenic contaminants such as nitrates, pesticides, dioxins and other organochlorines. In addition, carcinogenic metals and metalloids, pharmaceutical medicines and cosmetics may be involved. Although the risk fraction attributable to environmental factors is still unknown, this long list of carcinogenic and especially mutagenic factors supports our working hypothesis according to which numerous cancers may in fact be caused by the recent modification of our environment.

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Parkinson, A.J., Bruce, M.G., Zulz, T. and International Circumpolar Surveillance Steering Committee. **International Circumpolar Surveillance, an Arctic network for the surveillance of infectious diseases.** *Emerging Infectious Diseases* 14(1): 18-24, 2008. **O/A**

**Notes:** Peoples of the Arctic and sub-Arctic regions live in social and physical environments that differ substantially from those of their more southern-dwelling counterparts. The cold northern climate keeps people indoors, amplifying the effects of household crowding, smoking, and inadequate ventilation on person-to-person spread of infectious disease. The emergence of antimicrobial drug resistance among bacterial pathogens, the reemergence of tuberculosis, the entrance of HIV into Arctic communities, and the specter of pandemic influenza or the sudden emergence and introduction of new viral pathogens such as severe acute respiratory syndrome are of increasing concern to residents, governments, and public health authorities. The International Circumpolar Surveillance system is a network of hospital, public health agencies, and reference laboratories throughout the Arctic linked together to collect, compare, and share uniform laboratory and epidemiologic data on infectious diseases and assist in the formulation of prevention and control strategies.

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Salb, A.L., Barkema, H.W., Elkin, B.T., Thompson, R.C.A., Whiteside, D.P., Black, S.R., Dubey, J.P., and Kutz, S.J. **Dogs as sources and sentinels of parasites in humans and wildlife, Northern Canada.** *Emerging Infectious Diseases* 14(1): 60-63, 2008. O/A

**Notes:** A minimum of 11 genera of parasites, including 7 known or suspected to cause zoonoses, were detected in dogs in 2 northern Canadian communities. Dogs in remote settlements receive minimal veterinary care and may serve as sources and sentinels for parasites in persons and wildlife, and as parasite bridges between wildlife and humans.

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Sjölund, M., Bonnedahl, J., Hernandez, J., Bengtsson, S., Cederbrant, G., Pinhassi, J., Kahlmeter, G., and Olsen, B.

**Dissemination of multidrug-resistant bacteria into the Arctic.** *Emerging Infectious Diseases* 14(1): 70-72, 2008. O/A

**Notes:** We show that *Escherichia coli* isolates originating from Arctic birds carry antimicrobial drug resistance determinants. This finding implies that dissemination of drug-resistant bacteria is worldwide. Resistance genes can be found even in a region where no selection pressure for resistance development exists.

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Meng, X.-Z., Zeng, E.Y., Yu, L.-P., Mai, B.-X., Luo, X.-J., and Ran, Y. **Persistent halogenated hydrocarbons in consumer fish of China: regional and global implications for human exposure.** *Environmental Science and Technology* 41(6): 1821-1827, 2007.

**Notes:** Concentrations of persistent halogenated hydrocarbons (PHHs) were determined in 13 consumer fish species (a total of 390 individuals) collected from a major fish-farming region of China. The potential health risks of PHHs associated with consumption of fish from China was also systematically assessed regionally and globally. In all fish samples, DDTs, HCHs, PCBs, and PBDEs were the predominant PHH residues, with the median levels (ranges) being 6.0 (0.14-698.9), 0.50 (0.13-24.06), 0.10 (<0.02-7.65), and 0.15 (<0.0012-3.85) ng/g wet weight, respectively. The upperbound (90th percentile) values of estimated daily intakes of DDT, HCHs, PCBs, and PBDEs via fish consumption were 45.5, 1.35, 0.46, and 0.30 ng/kg bw/d (urban), and 15.9, 0.47, 0.16, and 0.10 ng/kg bw/d (rural). Globally, the upperbound outflows via fishery exportation of DDT, HCHs, PCBs, and PBDEs were 185, 5.51, 1.86, and 1.22 kg, respectively, in 2005. Japan was the largest recipient of PHHs, followed by Korea and the United States. Fish consumption assessments indicated that consumption of freshwater farmed and wild marine fish generally does not subject consumers to significant health risk as far as PHHs are concerned, while limited consumption of seawater farmed fish is advised.

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Boehm, A.B. **Enterococci concentrations in diverse coastal environments exhibit extreme variability.** *Environmental Science and Technology* 41(24): 8227-8232, 2007.

**Notes:** Fecal indicator bacteria (FIB) concentrations in a single grab sample of water are used to notify the public about the safety of swimming in coastal waters. If concentrations are over a single-sample standard, waters are closed or placed under an advisory. Previous work has shown that notification errors occur often because FIB vary more quickly than monitoring results can be obtained (typically 24 h). Rapid detection technologies (such as quantitative polymerase chain reaction) that allow FIB quantification in hours have been suggested as a solution to notification errors. In the present study, I explore variability of enterococci (ENT) over time scales less than a day that might affect interpretation of FIB concentrations from a single grab sample, even if obtained rapidly. Five new data sets of ENT collected at 10 and 1 min periodicities for 24 and 1 h, respectively, are presented. Data sets are collected in diverse marine environments from a turbulent surf zone to a quiescent bay. ENT vary with solar and tidal cycles, as has been observed in previous studies. Over short time scales, ENT are extremely variable in each environment even the quiescent bay. Changes in ENT concentrations between consecutive samples (1 or 10 min apart) greater than the single-sample standard (104 most probable number per 100 mL) are not unusual. Variability, defined as the change in concentration between consecutive samples, is not distinct between environments. ENT change by 60% on average between consecutive samples, and by as much as 700%. Spectral analyses reveal no spectral peaks, but power-law decline of spectral density with frequency. Power-law exponents are close to 1 suggesting ENT time series share properties with 1/f noise and are fractal in nature. Since fractal time series have no characteristic time scale associated with them, it is not obvious how the fractal nature of ENT can be exploited for adaptive sampling or management. Policy makers, as well as scientists designing field campaigns for microbial source tracking and epidemiology studies, are cautioned that a single sample of water



reveals little about the true water quality at a beach. Multiple samples must be taken to gain a snapshot into the patchy structure of microbial water quality and associated human health risk.

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Corbett, J.J., Winebrake, J.J., Green, E.H., Kasibhatla, P., Eyring, V., and Lauer, A. **Mortality from ship emissions: A global assessment.** *Environmental Science and Technology* 41(24): 8512-8518, 2007.

**Notes:** Epidemiological studies consistently link ambient concentrations of particulate matter (PM) to negative health impacts, including asthma, heart attacks, hospital admissions, and premature mortality. We model ambient PM concentrations from oceangoing ships using two geospatial emissions inventories and two global aerosol models. We estimate global and regional mortalities by applying ambient PM increases due to ships to cardiopulmonary and lung cancer concentration-risk functions and population models. Our results indicate that shipping-related PM emissions are responsible for approximately 60,000 cardiopulmonary and lung cancer deaths annually, with most deaths occurring near coastlines in Europe, East Asia, and South Asia. Under current regulation and with the expected growth in shipping activity, we estimate that annual mortalities could increase by 40% by 2012.

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Lyons, M.M., Lau, Y.T., Carden, W.E., Ward, J.E., Roberts, S.B., Smolowitz, R., Vallino, J., and Allam, B. **Characteristics of marine aggregates in shallow-water ecosystems: Implications for disease ecology.** *EcoHealth* 4(4): 406-420, 2007.

**Notes:** Marine aggregates were evaluated for their potential role in the ecology of aquatic pathogens using underwater video surveys coupled with direct collection of aggregates in modified settling cones. Six locations, two each in New York, Connecticut, and Massachusetts, were surveyed over 8 months to explore differences in the characteristics of aggregates found in habitats populated by clams (*Mercuraria mercenaria*) and oysters (*Crassostrea virginica*). Microaggregate (< 500 µm) concentrations were always greater than macroaggregate (> 500 µm) concentrations, but peak concentrations of macroaggregates and microaggregates, mean size of particles, and volume fraction of aggregated material varied among the six shallow-water habitats. Concentrations (colony-forming units per ml) of total heterotrophic bacteria (THB) and total mesophilic pathogenic bacteria (MPB) from samples of aggregates were significantly different among the four locations bordering Long Island Sound (LIS). The highest concentrations and enrichment factors in aggregates were observed in August for THB and in June for MPB. Significant correlations were detected for salinity and the concentrations and enrichment factors of THB in aggregates and for the concentrations and percentages of MPB in seawater samples. Significant correlations were also detected for temperature and the concentrations of MPB in aggregates and the enrichment factors for THB and MPB (marginal significance). Bacterial species identified in association with aggregates included: *Vibrio cholerae*, *V. parahaemolyticus*, *V. vulnificus*, *V. alginolyticus*, *Aeromonas hydrophila*, *Pseudomonas aeruginosa*, *Escherichia coli*, and *Mycobacteria* sp. These results have important implications for the way in which aquatic pathogens are collected, quantified, and monitored for risk-based surveillance in shallow-water ecosystems.

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Wernham, A. **Inupiat health and proposed Alaskan oil development: Results of the first integrated Health Impact Assessment/Environmental Impact Statement for proposed oil development on Alaska's North Slope.** *EcoHealth* 4(4): 500-513, 2007.

**Notes:** We report on the first Health Impact Assessment (HIA) for proposed oil and gas development in Alaska's North Slope region. Public health is not generally analyzed in the Environmental Impact Statement (EIS) process in the U.S. We conducted an HIA for proposed oil development within the National Petroleum Reserve - Alaska in response to growing concerns among North Slope Inupiat communities regarding the potential impacts of regional industrial expansion on their health and culture. We employed a qualitative HIA methodology, involving a combination of stakeholder input, literature review, and qualitative analysis, through which we identified potential health effects. The possible health outcomes identified include increases in diabetes and related metabolic conditions as a result of dietary change; rising rates of substance abuse, domestic violence, and suicide; increased injury rates; more frequent asthma exacerbations; and increased exposure to organic pollutant, including carcinogens and endocrine disruptors. There are also potential benefits, including funding for infrastructure and health care; increased employment and income; and continued funding of existing infrastructure. Based on these findings, we recommend a series of public health mitigation measures. This project represents the first formal effort to include a systematic assessment of public health within the U.S. EIS process. The inclusion of public health concerns within

an EIS may offer an important and underutilized avenue through which to argue for environmental management strategies that focus on public health, and may offer communities a stronger voice in the EIS process.

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Patz, J.A., Gibbs, H.K., Foley, J.A., Rogers, J.V., and Smith, K.R. **Climate change and global health: Quantifying a growing ethical crisis.** *EcoHealth* 4(4): 397-405, 2007.

**Notes:** Climate change, as an environmental hazard operating at the global scale, poses a unique and "involuntary exposure" to many societies, and therefore represents possibly the largest health inequity of our time. According to statistics from the World Health Organization (WHO), regions or populations already experiencing the most increase in diseases attributable to temperature rise in the past 30 years ironically contain those populations least responsible for causing greenhouse gas warming of the planet. Average global carbon emissions approximate one metric ton per year (tC/yr) per person. In 2004, United States per capita emissions neared 6 tC/yr (with Canada and Australia not far behind), and Japan and Western European countries range from 2 to 5 tC/yr per capita. Yet developing countries' per capita emissions approximate 0.6 tC/yr, and more than 50 countries are below 0.2 tC/yr (or 30-fold less than an average American). This imbalance between populations suffering from an increase in climate-sensitive diseases versus those nations producing greenhouse gases that cause global warming can be quantified using a "natural debt" index, which is the cumulative depleted CO<sub>2</sub> emissions per capita. This is a better representation of the responsibility for current warming than a single year's emissions. By this measure, for example, the relative responsibilities of the U.S. in relation to those of India or China is nearly double that using an index of current emissions, although it does not greatly change the relationship between India and China. Rich countries like the U.S. have caused much more of today's warming than poor ones, which have not been emitting at significant levels for many years yet, no matter what current emissions indicate. Along with taking necessary measures to reduce the extent of global warming and the associated impacts, society also needs to pursue equitable solutions that first protect the most vulnerable population groups; be they defined by demographics, income, or location. For example, according to the WHO, 88% of the disease burden attributable to climate change afflicts children under age 5 (obviously an innocent and "nonconsenting" segment of the population), presenting another major axis of inequity. Not only is the health burden from climate change itself greatest among the world's poor, but some of the major mitigation approaches to reduce the degree of warming may produce negative side effects disproportionately among the poor, for example, competition for land from biofuels creating pressure on food prices. Of course, in today's globalized world, eventually all nations will share some risk, but underserved populations will suffer first and most strongly from climate change. Moreover, growing recognition that society faces a nonlinear and potentially irreversible threat has deep ethical implications about humanity's stewardship of the planet that affect both rich and poor.

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Kordas, K., Lonnerdal, B., and Stoltzfus, R.J. **Interactions between nutrition and environmental exposures: Effects on health outcomes in women and children.** *Journal of Nutrition* 137(12): 2794-2797, 2007.

**Notes:** Exposure to environmental chemicals is increasing globally. Nutritional status may modify susceptibility to chemical exposures. However, there are a large number of toxicants, and malnutrition takes many forms including deficiency and excess. Thus, the relation between environmental exposures and nutritional status is complex. The symposium on "Heavy Metal Exposures in Women and Children, the Role of Nutrients," presented at Experimental Biology 2007 examined interactions among nutritional status, nutrients, and heavy metals in vulnerable populations. The aim was to encourage nutritionists to consider environmental exposures in nutrition research. This introductory article highlights examples of nutrient-toxicant interactions.

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Myers, G.J., Davidson, P.W., and Strain, J.J. **Nutrient and methyl mercury exposure from consuming fish.** *Journal of Nutrition* 137(12): 2805-2808, 2007.

**Notes:** There is controversy about the risks and benefits of consuming fish. Fish consumption provides nutrients, some of which are essential for brain growth and development. All fish, however, contain methyl mercury (MeHg), a known neurotoxicant. The toxic effect of MeHg seems most damaging during brain development, and thus, prenatal exposure is of greatest concern. At present the level of prenatal exposure associated with risk to a child's neurodevelopment is not known. Balancing the rewards and possible risks of fish consumption presents a dilemma to consumers and regulatory authorities. We

review the nutrients in fish that are important in brain development and the current evidence of risk from MeHg at exposure levels achieved by consuming fish. We then review the findings from a large prospective cohort study of a population that consumes fish daily, the Seychelles Child Development Study. The MeHg content of the fish consumed in the Seychelles is similar to that of ocean fish available in industrialized countries, so they represent a sentinel population for any risk from fish consumption. In the Seychelles, evaluations of the children through 9 y of age show no consistent pattern of adverse associations with prenatal MeHg exposure. Recent studies in the Seychelles have focused on nutrients in fish that might influence a child's development, including long-chain polyunsaturated fatty acids, iodine, iron, and choline. Preliminary findings from this study suggest that the beneficial influence of nutrients from fish may counter any adverse effects of MeHg on the developing nervous system.

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Wright, R.O. and Baccarelli, A. **Metals and neurotoxicology.** *Journal of Nutrition* 137(12): 2809-2813, 2007.

**Notes:** Metals are ubiquitous and play a critical role in neurobiology. Transition metals are important because they alter the redox state of the physical environment. Biologically, transition metals catalyze redox reactions that are critical to cellular respiration, chemical detoxification, metabolism, and even neurotransmitter synthesis. Many metals are both nutrients and neurotoxicants, such as iron, zinc, copper, and manganese. Other metals, such as lead and cadmium, are metabolized similarly to these metals, particularly iron. Iron metabolism and genes that regulate iron metabolism may be the key to understanding metal toxicity. Finally, recent evidence demonstrates that early life exposures may program later life and adult disease phenotypes via processes of epigenetics. Parallel work in metals demonstrates that epigenetics may be a critical pathway by which metals produce health effects.

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