

# Environmental pharmacology: A new discipline

Drugs are prescribed for various medical conditions and, at times, consumed for many non-medical reasons. Innumerable incidents have been reported where drugs have harmed rather than helped. There is also a growing concern among scientists and environmentalists about the impact of drug production on the environment. In many countries, low levels of medicines have been detected in sewage treatment plant (STP) effluents, surface water, sea water, ground water and drinking water. The effects of some drugs on aquatic organisms have been investigated in acute toxicity assays. However, the chronic toxicity and potential subtle effects are only marginally known.<sup>[1]</sup>

Diclofenac has been found to threaten the ecological balance as it adversely affects vultures, nature's scavengers, whose numbers are noticeably declining.<sup>[2]</sup> The vulture population has plummeted in the past decade, fuelling fears that the bird is on the verge of extinction. One of the reasons attributed to the decline is diclofenac sodium consumption. Commonly prescribed by veterinarians, it is found in the carcasses of cattle on which vultures feed, leading to visceral gout and renal failure.<sup>[3]</sup>

An alarming decline in the number of vultures poses the threat of outbreak of epidemics because of decaying carcasses. The declining vulture population has led to an increase in the number of feral dogs which pose a range of disease threats such as rabies.<sup>[4]</sup>

Investigations, which began in 2000, were prompted by reports of a 95 per cent drop in the number of Asian white-backed vultures (*Gyps bengalensis*), Indian vultures (*Gyps indicus*) and slender-billed vultures (*Gyps tenuirostris*).<sup>[5]</sup> All three species are now listed as critically endangered by the World Conservation Union, the international environmental agency in Switzerland. Vultures are a keystone species and their decline is certain to adversely affect other wildlife, domestic animals and human beings. The Peregrine Fund has appealed to governments of all countries with vulture populations and to the manufacturers of diclofenac, to stop the use of this drug in livestock.<sup>[6]</sup> It is believed that the recovery of vulture populations in southern Asia will not be effective until their exposure to diclofenac has been removed.

The decline in the vulture population has also threatened the traditions of Parsis, a sect of Zoroastrians who traditionally expose human corpses to the elements. In Mumbai, it is reported that Parsis have stopped leaving human corpses in the 'Towers of Silence' because the birds that once quickly consumed the carcasses are now vanishing.<sup>[7]</sup> Meloxicam could be an alternative medicine for veterinary use in India.<sup>[8]</sup>

A study by the United States Geological Survey has found traces of many different drugs and personal care products including steroids, insect repellents and so on in the American

water supply.<sup>[9]</sup> The effects of these traces are still unknown, but the concern is about the unexpected! So much cocaine is being used in London that traces of the narcotic have been detected in River Thames. An estimated 2 kilos of cocaine gets into the river every day after it has passed through user's bodies and sewage plants. The Thames investigation, the first of its kind in Britain, was conducted by scientists using the latest technology. It is regarded as the most accurate large-scale drug-detection method available.<sup>[10]</sup>

Very little is known about the long-term effects of drugs on aquatic organisms. One laboratory study suggested that antidepressants like fluoxetine could trigger spawning in some shellfish<sup>[9]</sup>, thereby disturbing the ecological balance. For investigated drugs, the chronic lowest observed effect concentrations (LOEC) in standard laboratory organisms are about twice higher than maximal concentrations in STP effluents. For diclofenac, the LOEC for fish toxicity was in the range of waste water concentrations, whereas the LOEC for propranolol and fluoxetine for zooplankton and benthic organisms were closer to the maximal measured STP effluent concentrations. In surface water, concentrations were lower and so were the environmental risks. However, targeted ecotoxicological studies are lacking almost entirely and such investigations are required to focus on the subtle environmental effects of drug use. This will allow a comprehensive risk assessment of pharmaceuticals in the future.<sup>[11]</sup>

Questions remain regarding the drugs and their exact concentration in the aquatic environment. There is no clarity about the mode of action of these compounds in humans and lower animals. We need to monitor the effects of drugs not only as a good medical practice, but also to safeguard our environment. Like pharmacovigilance and pharmaco-epidemiology, there is a crying need for Pharmacoenvironmentology, the study of drug interaction with the environment in terms of benefit and risk.

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### Drugs approved by the FDA in the year 2006 (till June 2006)

No.	Brand Name	Generic Name	Company	Approved on Date	Indication
1	<b>Rotateq</b> pale yellow, clear oral suspension	Rotavirus vaccine, live oral pentavalent	Merck	February 2006	Rotavirus gastroenteritis in infants and children
2	<b>Ranexa</b> film-coated extended release tablets	Ranolazine	CV Therapeutics	January 2006	Chronic angina not respond to prior angina therapy
3	<b>Sutent</b> hard gelatin oral capsules	Sunitinib	Pfizer	January 2006	Renal cell carcinoma (RCC), Gastro-intestinal Stromal Tumors (GIST)
4	<b>Amitiza</b> gelatin oral capsules	Lubiprostone	Sucampo/Takeda	January 2006	Chronic idiopathic constipation
5	<b>Myozyme</b> sterile, nonpyrogenic, white to off-white lyophilized cake/ powder for I.V. infusion	Alglucosidase alfa	Genzyme	April 2006	Pompe disease [human enzyme acid a-glucosidase (GAA) deficiency]
6	<b>Dacogen</b> sterile lyophilized white to almost white powder for I.V. infusion	Decitabine	MGI Pharma	May 2006	Myelodysplastic Syndromes
7	<b>Chantix</b> oral capsules	Varenicline	Pfizer	May 2006	Smoking Cessation

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