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Evolution of Toxicology in India: From Safety Concerns to Comprehensive Science

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Editorial

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Abbreviations: ICMR: Council of Medical Research; NIOH: National Institute of Occupational Health; CDRI: Central Drug Research Institute; CIB&RC: Central Insecticides Board and Registration Committee; NEERI: National Environmental Engineering Research Institute.

Introduction

Toxicology, the study of the adverse effects of chemicals and substances on living organisms, has come a long way in India. From traditional knowledge of medicinal plants and their toxic properties to cutting-edge research on environmental toxins and chemical safety, the evolution of toxicology in India has been marked by significant advancements and a growing awareness of the importance of public health and safety.

Ancient Roots of Toxicology

The roots of toxicology in India can be traced back to ancient times when traditional healing systems like Ayurveda, Siddha, and Unani medicine incorporated knowledge of medicinal plants and their toxic properties. Ayurveda, one of the oldest holistic healing systems in the world, emphasized the importance of identifying toxic substances and their effects on the human body.

Traditional healers and Vaidyas were well-versed in distinguishing between toxic and non-toxic substances, enabling them to use herbal remedies safely. They also had an understanding of antidotes and methods to counteract the effects of poisoning. The ancient Indian texts, such as the Charaka Samhita and Sushruta Samhita, provided insights into toxicology and contributed to the early development of this science in the region.

Colonial Influence and Modern Toxicology

The 19th century marked a significant shift in toxicology with the advent of British colonial rule in India. The British introduced modern medical education and established medical colleges, which laid the foundation for the formal study of toxicology in the country.

The establishment of the Calcutta Medical College in 1835, followed by other medical institutions, led to the systematic study of toxic substances and their effects on human health. The colonial administration recognized the importance of understanding toxicology to address concerns related to poisoning, food safety, and occupational hazards.

Emergence of Research Institutions

The post-independence era saw the establishment of research institutions dedicated to toxicology. The Indian Council of Medical Research (ICMR) played a pivotal role in promoting toxicology research and addressing public health issues related to chemical exposure.

In 1978, the National Institute of Occupational Health (NIOH) was set up in Ahmedabad to address occupational health hazards and industrial toxicology. The Central Drug Research Institute (CDRI) in Lucknow focused on drug development and safety evaluation, including toxicological studies. Poison Information Centres Parmar P, et al. [1] are also present in various parts of India.

Focus on Environmental Toxicology

As India experienced rapid industrialization and urbanization, concerns about environmental pollution and toxic substances grew. The need to understand the impact of industrial waste, pesticides, and air pollutants Parmar P, et al. [2,3] on human health led to the establishment of the National Environmental Engineering Research Institute (NEERI) in Nagpur in 1958.

Environmental toxicology gained prominence as a field of study, addressing issues such as water pollution, air quality, and hazardous waste management. Government agencies and research institutions collaborated to monitor and assess environmental contaminants and their effects on ecosystems and human health.

Regulatory Framework and Chemical Safety

With the increasing use of chemicals in various industries and consumer products, the importance of chemical safety and regulation became evident. The enactment of the Insecticides Act in 1968 and the establishment of the Central Insecticides Board and Registration Committee (CIB&RC) marked a significant step towards regulating the use of pesticides and ensuring their safety.

In 1985, the Bhopal gas tragedy brought attention to the need for a comprehensive regulatory framework for industrial safety and the handling of hazardous chemicals. The establishment of the Ministry of Environment and Forests (MoEF) in 1985 and the Ministry of Chemicals and Fertilizers (MoCF) in 1987 further strengthened the focus on chemical safety and environmental protection.

Advancements in Toxicological Research

Over the years, India has witnessed significant advancements in toxicological research. Universities and research institutions have collaborated with international organizations and research centers to conduct cutting-edge studies in various domains of toxicology.

Research in toxicogenomics, nanotoxicology, and molecular toxicology has provided new insights into the mechanisms of toxicity at the cellular and molecular levels. The application of computational toxicology and in silico models has enabled faster and cost-effective risk assessments of chemicals. Snake bite Chaudhary A, et al. [4], substance abuse Parmar P [5], illicit drug trafficking Parmar P, et al. [6], aluminium phosphide Parmar P, et al. [7] etc. are still challenge in India.

Challenges and Opportunities

While toxicology has made remarkable progress in India, certain challenges persist. Limited funding, infrastructure, and manpower are some of the barriers faced by toxicologists and researchers. The translation of research findings into policy and practice remains a crucial challenge.

There is a need for interdisciplinary collaboration between toxicologists, environmental scientists, public health experts, and policymakers to address complex issues related to chemical safety and environmental health.

Promoting Public Awareness

Public awareness plays a vital role in promoting chemical safety and environmental protection. Educating the public about the potential hazards of toxic substances, safe handling practices, and the importance of responsible waste disposal is essential. Use of e learning Rathod G, et al. [8], social media Parmar P, et al. [9], teaching via google sites Parmar P, et al. [10], etc. are important tools to use for spreading awareness.

Government agencies, educational institutions, and non-governmental organizations (NGOs) should work together to disseminate information about toxicology and its relevance to everyday life. This can empower citizens to make informed choices and contribute to a safer and healthier environment. Ethical issues Bansal AK, et al. [11,12] related to poisoning cases must be dealt with evidence based Parmar P [13,14] and humanitarian approach Parmar P, et al. [15,16].

Conclusion

The evolution of toxicology in India reflects the nation's commitment to promoting public health and safety. From ancient wisdom in traditional healing systems to modern research institutions and regulatory frameworks, toxicology has come a long way in addressing the challenges posed by toxic substances and environmental pollutants.

On National Sports Day, let us celebrate the achievements of Indian toxicologists and researchers who have made significant contributions to the field. Let us also recognize the importance of toxicology in safeguarding public health, protecting the environment, and creating a sustainable

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