

**Cochlear Implants: New and Future Directions.** Sandra DeSaSouza (ed.). Springer Nature Pte Ltd, Singapore. 2022. 514 pages. Hardcover: US\$ 179.99.

Today cochlear implantation dramatically impacts thousands of profoundly deaf children and adults worldwide. It is arguably the biggest success story regarding surgical interventions. This book is all about changing the lives of people who are deaf or hard of hearing with technology. It is a compilation of various aspects of cochlear implants (CIs) from their inception to recent advances culminating in their clinical use. The book also covers future horizons. It is written by leading CI experts worldwide. Many have pioneered their own technique; others are well-known audiologists, clinical engineers and researchers. This book discusses the exciting area of medical bionics and biomedical engineering. The future of CIs relies on imparting spoken language to children with severe to profound sensory neural deafness, which is why this book is a must-read.

The book has 24 chapters. The first three chapters deal with the history of CI development. It all began with the production of electrical stimulation of hearing, following which the first CI was developed. Many clinical trials were carried out for centuries until FDA approved a CI in 1986. It is interesting to read about Benjamin Franklin's electrical stimulation of hearing. Franklin, an American polymath, was a writer, scientist, inventor, statesman, diplomat, printer, publisher and philosopher. He was the first to suggest that electricity could produce hearing sensations in deaf people. This was followed by many pioneers who finally developed the first CI.

India was also a part of CI history when cochlear implantation began in 1987 using mono- and multi-electrode systems. The

evolution of implant technology took 35 years, during which the companies modified the implants with clinical support. The chapter on the history of CI in India elaborates on how and when the technology reached the subcontinent. The technology was brought to India, and doyens subsequently performed CI surgery in different regions in the country. In fact, CI programmes were set up in almost every city in India. Unfortunately, medical insurance companies did not cover CI surgery then and do not cover it even now. However, the Government is supporting many CI programmes state-wise by funding surgery costs, hospitalization, rehabilitation, etc.

The chapters following the historical aspect of CIs deal with medical and surgical issues. Surgical anatomy of the temporal bone present at the base of the skull, along with CT and MRI scans, is discussed. Chapter 5 explains the working principles of CI. The cochlea is a part of the inner ear that converts sound waves into nerve signals, which the brain process as hearing. It has sensory cells known as hair cells that detect sound waves.

CI consists of an externally worn audio processor behind the ear and an implant, which is surgically placed under the skin on the surface of the mastoid bone, part of the temporal bone. For people with severe to profound hearing loss, most of these hair cells do not function, and hence they are unable to send nerve signals properly. The audio processor detects the sound, digitally converts it into coded electrical signals and transmits the signals through the skin to the implant by a communication coil. The implant translates these signals into electrical pulses, which are then transmitted to specific locations of the cochlea to perceive and hear the sounds.

Today, an array of CIs is in clinical use worldwide. The selection of potential candidates has changed over the years and varies from country to country depending upon the socio-economic factors. Earlier, the initial subjects for implantations were profoundly deaf in both the ears. This is now determined using audiological, medical, radiological and psychological variables.

For better audiological and surgical outcomes, the book provides an overview of two state-of-the-art research techniques in the field of CI. Prognosis and machine learning have the potential to take CI research in new and exciting directions.

The next few chapters of the book focus on varied CI surgical techniques, that could be useful to experts. Doyens and pioneers

in the field of CI surgery have penned these chapters. Some techniques include tympanotomy, cochleostomy, Veria technique and CI surgery using the round window approach. Also included in Chapter 11 is the classification and management of inner-ear malformations (IEMs). There are a variety of IEMs, and hence classification is an important aspect of cochlear implantations and management.

Hearing comprises speech understanding and acoustic source localization. For children, hearing is needed to develop spoken language skills. CIs in both ears using modern speech-coding strategies significantly improve hearing and quality of life. Amongst the many surgical techniques, subtotal petrosectomy is considered to be efficient and reliable at present. The procedure helps eradicate middle ear/mastoid disease and provides a safe and stable environment for cochlear implantation.

With newer indications, there has been unilateral cochlear implantation for single-sided deafness, which would benefit both children and adults. Chapter 14 mentions that CIs in unilaterally deaf patients would improve hearing in noise, better sound localizations and improved quality of life. Hearing preservation in implants with residual hearing loss is an achievable goal in children, adults and the elderly. Endoscopic-assisted cochlear implantation is advised for complex anatomy. Details are included in the chapters that also emphasize explanation (removal of the implant), reimplantation and complications of CI surgery.

Chapter 17 highlights robot-assisted CI surgery, which is an effective tool for improving the accuracy of cochlear implantation. This is the most recent procedure that has gained popularity in ear surgery for direct cochlea access, cochleostomy and precise insertion of electrodes. Image-guided CI surgery with recent advances is also included in this chapter.

The next chapter deals with the potential damage to the delicate inner ear structures because of electrode insertion into the cochlea. The term 'soft surgery' to preserve inner ear structures was coined in 1993. Research has progressed further onto structural preservation of the inner ear during cochlear implantation.

Similar to the selection of patients for cochlear implantation in adults, chapter 19 discusses the criteria, considerations and other medical and surgical issues for cochlear implantation in children. This is a success story in children with profound hearing loss. Timely insertion of CI allows children

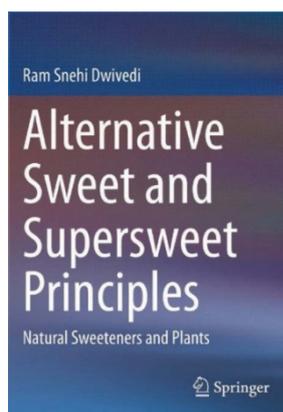
to retrieve hearing, learn to speak and attend a regular school.

CI is the treatment of choice for adults and children with severe to profound sensory neural hearing loss. Despite the technological improvement, complications may arise leading to explantation followed by reimplantation. Every surgery can have complications. Similarly, CI surgery has side effects like vertigo, tinnitus, facial nerve injury, etc.

Recent trends in CI and rehabilitation are worth a reading in this book. Chapter 23 on implant reliability is relevant for counselling patients and implant manufacturers. Latest advances and future horizons are the subject matter of the last chapter. Personalized CI treatment is the future, which could include genetic testing, robotic-assisted CI surgery and electrode insertion along with the addition of pharmaceutical agents. Stem cell-based CI treatment is an emerging research field that would help regenerate lost sensory cells.

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**Alternative Sweet and Supersweet Principles: Natural Sweeteners and Plants.** Ram Snehi Dwivedi. Springer Nature Singapore Pte Ltd. 2022. 773 pages. Price Amazon Hardcover: ₹ 11,242.00. Kindle edition: ₹ 7476.00.

This unique book depicts the non-saccharide supersweet (NSSS) principle, 30–10,000 times sweeter than sucrose and their sour-

ces, and the non-sacchariferous supersweet (NSSS) plants, of which many are growing wildly and are on the verge of extinction. Both NSSS plants and principles are deterrents to lethal human diseases. Few NSSS plants are the richest source of green energy ethanol, whereas all the NSSS plants have a high potential for carbon sequestration and thereby help in maintaining a good eco-friendly environment.

Ram Snehi Dwivedi is a well-known plant physiologist with 25 years of research experience on natural sweet and supersweet principles and plants. The latest information on 40 natural NSSS principles and their source plants and 19 natural saccharide sweet and source plants is provided in this compilation. A book on alternative natural sweeteners, especially is zero or negligible energy is timely and useful in light of the fast burgeoning population, decreasing cultivable land, the ever-increasing demand for sugar, green ethanol and the well-known risk of sugar consumption. Every year more than 5 million people die due to diabetes and diabetes-associated ailments like cardiovascular diseases, kidney disorders, liver cancer, etc. The use of NSSS principles and plants to avoid this is discussed in this book.

The book is comprised of 18 chapters. The first chapter, i.e. 'Introduction', discusses sweeteners and hedonics, with a general appraisal of sweet and supersweet natural principles and plants, zero-energy nutrition and health limitations, regulatory status of naturally sweet and NSSS principles and plants, scope and future prospects. Chapter 2 deals with the search for sweeteners, their general classification, synthesis and saccharide plants and animal interphases. It also reviews the identification of sweeteners with special reference to religion, e.g. Christianity, Hinduism, Buddhism, Islam, etc. Chapter 3 is on the molecular basis of sweetness, recent concepts, an ideal sweetener, and saccharide and NSSS principles qualifying it. Chapter 4 is about saccharide sweet (SS) principles, classification and structural details of SS sweeteners and plants. Chapter 5 discusses NSSS principles, their general characteristics, outline of synthesis, classification, ecological significance and eco-friendly adherence. Chapters 6–15 are devoted to details about natural NSSS principles, which are chemically

monoterpenoids, diterpenoids, triterpenoids, sesquiterpenoids, dihydrochalcone and flavonoids, dihydroisochoumarin, steroidal saponin and sweet amino acids. Besides, super sweet and test-modifying principles are also proteins, cynarine, gymnemic acid and ziziphin. However sweetness-impairing and test-modifying nature of *Moringa oleifera* (drumstick) seeds are still unknown. Chapter 16 enlists new ideas in the literature on eco-physiological differences between sacchariferous sweet and NSSS plants and principles. Chapter 17 reviews the literature regarding molecular approaches to NSSS plants and principles. The last chapter (18) deals with the commercial production of natural NSSS sweeteners.

Each SS and NSSS principle has been reviewed in detail under the following sections: (I) Physical and chemical characteristics, (II) Molecular and structural formula variabilities, (III) Sweetness, (IV) Biological activities (medicinal utilities with reference lethal diseases), (V) Safety dose and limitations, (VI) Legal status and (VII) Source plants. Each source plant is discussed under (I) Origin and distribution, (II) Etymology, (III) Botanical characteristics supported by B/W photographs, (IV) Propagation and cultivation, (V) Varieties/ecotype/chemotype, (VI) Sweet sink and yield, (VII) Pharmacognosy and pharmacological constituents, (VIII) Medicinal values with special reference to lethal diseases, (IX) Commercial utilities, (X) Culinary use and (XI) Regulatory status.

Exhaustive information on SS and NSSS principles and plants, and references, including studies as recent as 2021, make this book a ready reference for students, researchers, and practitioners in the field of food science, nutrition, ayurveda, chemotaxonomy, naturopathy, biochemistry, plant physiology and plant breeding. It will also be of interest to the industry and alternative sweeteners manufacturers. I compliment the author for his efforts to bring out this comprehensive book.

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