


# Chapter 13

## ROS and Precision Medicine in Lifestyle Diseases: Personalized Approaches

**Pawan Gupta**

 <https://orcid.org/0000-0001-7201-1356>

*Department of Pharmaceutical  
Chemistry, Shri Vile Parle Kelavani  
Mandal's Institute of Pharmacy, Dhule,  
India*

**Yogesh Chaudhari**

*Department of Pharmaceutical  
Chemistry, Shri Vile Parle Kelavani  
Mandal's Institute of Pharmacy, Dhule,  
India*


**Abhinav Joseph**

*School of Chemical Engineering and  
Physical Sciences, Lovely Professional  
University, India & St. John's College,  
Agra, India*

**Sukrat Sinha**


*Department of Zoology, University of  
Delhi, India*

**Ansari Rashid**

 <https://orcid.org/0009-0000-0089-4153>

*Department of Pharmacology, Sanjay  
Education Society's Institute of  
Pharmacology, India*

**Pranav Kumar Prabhakar**

 <https://orcid.org/0000-0001-8130-1822>

*Lovely Professional University, India &  
Nagaland University, India*

### ABSTRACT

*The body's cells produce highly reactive substances known as reactive oxygen species (ROS). Though ROS are important in immunological responses as well as metabolic pathways. However, high concentrations bring about oxidative stress, which lead to many lifestyle diseases such as diabetes, heart diseases, etc. This chapter examines involvement of the ROS in mechanism of disease initiation, and how the dynamic*

DOI: 10.4018/979-8-3693-7919-6.ch013

*nature of the individual ROS might open the options for personalized treatment. Moreover, it is also examined how differences in genotype with respect to important enzymes, could influence life style diseases. Interactions with genes in explaining responses to drug therapy are exemplified in the context of diabetes, cancer, and inflammatory diseases. These findings offer contributions to controlling oxidative stress and related disorders through growing approaches for templated strategies from within a better awareness of ROS and other genetic factors.*

## **1. INTRODUCTION:**

Reactive Oxygen Species (ROS) are collectively reactive molecules which can be generated by various forms of cells in the body. These molecules include; hydrogen peroxide ( $H_2O_2$ ), hydroxyl radical ( $OH^-$ ), singlet oxygen and super oxide ( $O^{2-}$ ), (Berdard & Krause, 2007). These molecules although unstable, participate in a vast array of biological processes. ROS take part in pathogen resistance, cellular signalling, and homeostasis. However, their reactive nature makes them potentially lethal. In most cases, ROS can harmfully affect the cellular proteins, lipids and nucleic acids when the body's antioxidant defences fail to sufficiently scavenge them leading to oxidative stress and disease advancement, (Nathan & Cunningham-Bussel, 2013).

ROS are mainly produced during normal metabolic processes, mainly within the mitochondrial respiratory chain during the production of ATP. Enzymes such as NADPH oxidase also contribute to ROS production during immune responses and cellular metabolism. Although ROS are naturally generated under conditions that require high energy such as exercising or during immune responses. However high levels of ROS can overcome the body antioxidant system. Imbalance between ROS production and neutralization is responsible for the phenomenon being referred to as oxidative stress, which is assumed to contribute to the development of lifestyle diseases, (Yang & Lian, 2020).

Many lifestyle diseases, including cardiovascular diseases (CVDs), metabolic disorders, (like diabetes, arthritis, cancer), respiratory and neurodegenerative disorders, are associated with metabolic imbalances, chronic inflammation or cellular dysfunction, where ROS possess a dual role. On one hand, ROS are involved in the regulation of the metabolic processes happening in cells and immune reactions. On the other hand, the increased ROS production leads to tissue damage, chronic inflammation, and development of complications such as hypertension, heart failure, and neurodegeneration. In cancer for instance, ROS at lower level can promote tumour growth and metastasis through changing signalling pathways whereas at higher levels, it can cause oxidative stress that results in cell death, (Nakamura & Takada, 2021).

32 more pages are available in the full version of this document, which may be purchased using the "Add to Cart" button on the publisher's webpage: [www.igi-global.com/chapter/ros-and-precision-medicine-in-lifestyle-diseases/378824](http://www.igi-global.com/chapter/ros-and-precision-medicine-in-lifestyle-diseases/378824)

## Related Content

---

### User and Data Classification for a Secure and Practical Approach for Patient-Doctor Profiling Using an RFID Framework in Hospital

Masoud Mohammadian and Ric Jentzsch (2015). *Healthcare Administration: Concepts, Methodologies, Tools, and Applications* (pp. 1101-1122).

[www.irma-international.org/chapter/user-and-data-classification-for-a-secure-and-practical-approach-for-patient-doctor-profiling-using-an-rfid-framework-in-hospital/116267](http://www.irma-international.org/chapter/user-and-data-classification-for-a-secure-and-practical-approach-for-patient-doctor-profiling-using-an-rfid-framework-in-hospital/116267)

### Medical Practical Knowledge Circulation Based on Purpose-Oriented Service Modeling

Taisuke Ogawa, Mitsuru Ikeda, Muneou Suzuki and Kenji Araki (2015). *Healthcare Administration: Concepts, Methodologies, Tools, and Applications* (pp. 484-509).

[www.irma-international.org/chapter/medical-practical-knowledge-circulation-based-on-purpose-oriented-service-modeling/116230](http://www.irma-international.org/chapter/medical-practical-knowledge-circulation-based-on-purpose-oriented-service-modeling/116230)

### The Patient/Provider Relationship in Emergency Medicine: Organization, Communication, and Understanding

Julita Soczywko and Dorota Rutkowska (2018). *Healthcare Administration for Patient Safety and Engagement* (pp. 74-105).

[www.irma-international.org/chapter/the-patient-provider-relationship-in-emergency-medicine/197555](http://www.irma-international.org/chapter/the-patient-provider-relationship-in-emergency-medicine/197555)

### Challenges Facing Health Service Delivery in Developing Countries and Solution Approaches: The Case of Benin, a West-African Developing Country

Thierry O. C. Edoh, Pravin Amrut Pawar and Laura Y. Loko (2018). *Handbook of Research on Emerging Perspectives on Healthcare Information Systems and Informatics* (pp. 515-559).

[www.irma-international.org/chapter/challenges-facing-health-service-delivery-in-developing-countries-and-solution-approaches/205142](http://www.irma-international.org/chapter/challenges-facing-health-service-delivery-in-developing-countries-and-solution-approaches/205142)

## Patients' Medication Errors: How Patients' Inadequate Information about their Prosthetic Heart Valve Diseases Affects their Healthcare

Vahideh Zarea Gavgani, Mina Mahami Oskoueiand Rezvanyieh Salehi (2015).

*Healthcare Administration: Concepts, Methodologies, Tools, and Applications* (pp. 1081-1087).

[www.irma-international.org/chapter/patients-medication-errors/116265](http://www.irma-international.org/chapter/patients-medication-errors/116265)