Review Article

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NO, CO and H_2S based pharmaceuticals in the mission of vision (eye health): a comprehensive review

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Abstract: A set of well defined signaling molecules responsible for normal functioning of human physiology including nitric oxide along with carbon monoxide and hydrogen sulphide are referred as "gasotransmitters". Due to their involvement in almost every system of a human body, the care of highly sensitive organs using these molecules as drugs represents highly fascinating area of research. In connection with these interesting aspects, the applied aspects of these gaseous molecules in maintaining healthy eye and vision have been targeted in this review. Several examples of eye-droppers including NORMs like latanoprost and nipradiol, CORMs like CORM-3 and CORM-A1, and Hydrogen sulfide releasing system like GYY4137 have been discussed in this context. Therefore the relation of these trio-gasotransmitters with the ophthalmic homeostasis on one hand, and de-infecting role on the other hand has been mainly highlighted. Some molecular systems capable of mimicking gasotransmitter action have also been introduced in connection with the titled theme.

Keywords: CORMs; H_2S-donors; NORMs; ophthalmic diseases.

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Introduction

The scientific recognition of carbon monoxide (CO) and hydrogen sulphide (H_2S) as bio-conjugated molecules sharing similar functional role as nitric oxide (NO) resulted in coining the term "gasotransmitters" for these molecules based on size, lipophilic character, half-life and several other features (Allan and Morris, 2014; Wang, 2004). Even though these gases share a number of common features, they also possess dissimilar characteristics and display noteworthy interactions, which complicate the interpretation of their physiological activities.

In the late 1990s, the scientific community saw a very unusual phenomenon, the conversion of nitric oxide from harmful gases into an important chemical messenger. The well defined signal transduction remarks put the entire scientific community in surprise (Ignarro, 1989; Ignore et al., 1987; Koshland, 1992). Currently, the Nobel prized NO is considered as noble treatment for so many diseases (Butler et al. 2003; Ignarro, 2000; Kalsner, 2000; Vincent, 2010). The role it plays from immune-modulation to memory consolidation is in high regards with respect to nitrosyls chemistry (Bowman et al., 2011; Burke et al., 2013; Fang, 2004; King et al., 2007; Lundberg et al. 2004; Maurya and Mir, 2014; Moncada et al., 1998).

Carbon monoxide (CO) has long been known as a dangerous gas for mammals and is called as a "silent killer" (Wu et al., 2005). Carbon monoxide, when inhaled enters the bloodstream, forms carboxyhaemoglobin (COHb) at a rate 240 times greater than oxygen (Douglas et al., 1927).This reduces the oxygen transport ability and results in hypoxia (Weaver 1999). Biologically, CO is considered as a by-product of heme oxygenase (HO) metabolism (Sjostrand, 1970) and in the early stage of its biological exploration, CO was found as a chronic neuro-transmitting agent (Verma et al., 1993). Therefore, the further studies have altered the general perception of CO as a harmful molecule (Rodgers et al., 1994). CO has now become an important molecule in the physical monitoring of many organ systems. In the last few decades,