NO, CO, and H_2S: Toxic gases we can't live without

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Cellular signaling is accomplished through chemical messengers with sizes varying from diatomic gases to large protein growth factors. The smallest chemical messengers are set of signaling gases called gasotransmitters, and these three gases (hydrogen sulfide (H_2S), nitric oxide (NO), and carbon monoxide) play important roles in nearly every organ and system in the body. As such, all three gasotransmitters have significant therapeutic potential, but thus far only NO has been thoroughly studied in this role. We focus on expanding the study and therapeutic use of both CO and H_2S by synthesizing new small molecules and materials for their delivery. The challenge in translating this therapeutic potential into useful delivery strategies lies in mimicking the endogenous production of H_2S and CO, which is slow and sustained at the nM level. New materials that enable the controlled delivery of gasotransmitters over a period of several hours are presented, including small molecules, peptides, and polymers that release CO and H_2S in response to specific triggers.