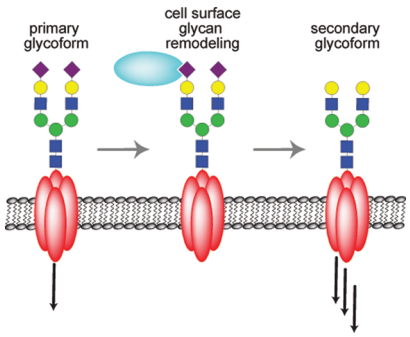
In this ISSUE

Redecorating the Cell

The cell surface is covered in carbohydrates in the form of glycoproteins and glycolipids. While the pathways responsible for the generation and trafficking of these glycoconjugates have been intensely investigated, the dynamic nature of the glycan architecture on the cell surface is just beginning to be appreciated. Parker *et al.* (DOI: 10.1021/cb9002514) review recent insight into the enzymes responsible for dynamically redecorating the carbohydrate structure on the cell surface and the signaling pathways that are affected as a result.

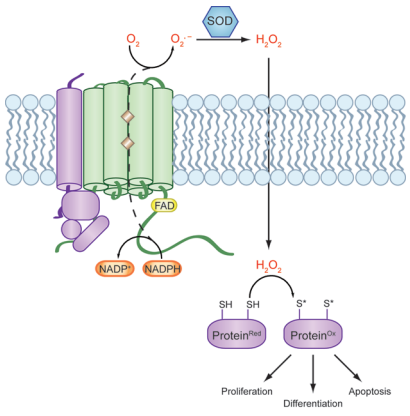
Various enzymes have been found to alter cell surface glycan structure, either by removing entire carbohydrate residues or by altering their structure. Examples include extracellular sialidases, fucosidases, deacetylases and sulfatases, and their activities have been linked to signaling pathways that regulate diverse processes, including microbial infection, cancer, embryonic development, the immune system, and the nervous system. Thus, in addition to furthering our understanding of many fundamental biological processes, insight into the structure, function, and regulation of cell surface carbohydrates also has promising therapeutic implications.



Reactive Oxygen Species: Friend and Foe

Once thought to possess only cytotoxic properties that contributed to aging, cancer, and other diseases, reactive oxygen species (ROS) such as hydrogen peroxide are now recognized as important signaling molecules in healthy cells. One important mechanism by which hydrogen peroxide signals is through chemoselective oxidation of cysteine residues in target proteins. Paulsen *et al.* (DOI: 10.1021/cb900258z) review recent developments in methods to detect ROS and cysteine oxidation and present resulting mechanistic insight into ROS-mediated signaling processes.

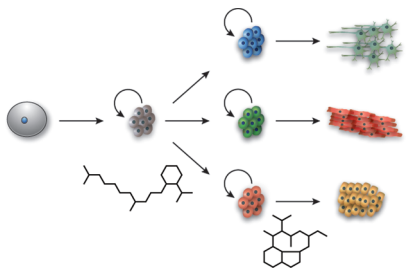
ROS studies have been greatly facilitated by several recent advances. For example, innovative reagents, including caged compounds, ratiometric sensors, nanoparticles, and protein-based systems, have improved the chemoselectivity and reduced background noise in ROS detection. In addition, investigation into the formation and reactivity of different forms of cysteine oxidation, including disulfides, sulfenic acids, and sulfinic acids, have shed light on the mechanisms that govern ROS signaling. These advances have helped distinguish between the beneficial and deleterious actions of ROS, guiding therapeutic efforts that exploit their properties.



Small Molecules Guide Big Decisions

From a single fertilized cell, over 400 distinct cell types emerge to form the human body. Small molecules that can modulate this incredibly complex process of cell differentiation have emerged as powerful tools for understanding cell fate mechanisms. In addition, such compounds are potential therapeutic agents for diverse conditions ranging from cancer to degenerative diseases. Firestone *et al.* (DOI: 10.1021/cb900249y) review recent progress in identifying small molecules that modulate cell fate.

Small molecules can affect cell fate by perturbing the numerous developmental pathways and processes that regulate cell differentiation. For example, the hedgehog, Wnt, transforming growth factor-β, fibroblast growth factor, and Notch signaling pathways are strongly linked to cell fate and have thus been key targets for small molecule discovery. Compounds that affect other key processes, such as the cell cycle or chromatin remodeling, have also provided insight into cell fate mechanisms. Finally, development of cell-based screening technologies designed to search for small molecules that promote stem cell self-renewal or reprogramming has been another important step forward in this area of research.



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