WNT5A is a gene that encodes a protein belonging to the WNT family, which is a group of signal molecules involved in regulating various developmental processes, including cell fate determination, cell migration, and organogenesis. Here are some key points about WNT5A:

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Biological Role Non-Canonical Wnt Signaling Pathway: WNT5A is primarily involved in the noncanonical Wnt signaling pathway, which does not involve β -catenin. This pathway is crucial for controlling cell movement and polarity, as well as inhibiting the canonical Wnt/ β -catenin pathway under certain conditions.

Developmental Processes: WNT5A is essential in embryonic development, influencing the formation and patterning of the vertebrate axis, limb formation, and organ development. It plays a role in the development of structures such as the heart, lungs, and limbs.

Cell Migration and Polarity: WNT5A is involved in processes such as cell migration and establishing cell polarity, which are vital for proper tissue organization and function. This is particularly important in processes like wound healing and tissue regeneration.

Clinical Significance Cancer: Aberrant WNT5A signaling has been implicated in various cancers. Depending on the context, it can act as either a tumor suppressor or an oncogene. For instance, it can suppress tumor growth in certain contexts by inhibiting the canonical Wnt pathway, but in others, it may promote metastasis and invasion.

Developmental Disorders: Mutations or dysregulation of WNT5A can lead to developmental disorders. One example is Robinow syndrome, a condition characterized by limb shortening, facial dysmorphism, and genital anomalies, which is associated with mutations in WNT5A.

Inflammation and Immune Response: WNT5A is also involved in the regulation of inflammation and the immune response. It has been shown to play a role in the pathogenesis of inflammatory diseases such as rheumatoid arthritis.

Research and Therapeutic Potential Target for Therapy: Due to its involvement in various signaling pathways and diseases, WNT5A is a potential target for therapeutic interventions. Modulating WNT5A activity could be beneficial in treating cancers, developmental disorders, and inflammatory conditions.

Biomarker: WNT5A expression levels can serve as a biomarker for certain diseases, aiding in diagnosis and prognosis. For example, high WNT5A expression levels have been linked to poor prognosis in some cancers.

Molecular Mechanisms Receptors and Co-Receptors: WNT5A interacts with several receptors and coreceptors, including Frizzled receptors and ROR1/2, to initiate downstream signaling cascades. These interactions can activate various intracellular pathways such as the planar cell polarity (PCP) pathway and the Wnt/Ca2+ pathway.

Cross-Talk with Other Pathways: WNT5A signaling often intersects with other signaling pathways, such as the TGF- β pathway, influencing cellular outcomes. This cross-talk adds another layer of complexity to its regulatory functions in development and disease.

In summary, WNT5A is a critical component of the Wnt signaling network, influencing a wide range of biological processes and playing significant roles in development, disease, and potential therapeutic applications.

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