The *PRKC* Gene Family: Structural Organization, Signaling Mechanisms, and Therapeutic Implications

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Abstract

Protein kinase C enzyme/isoforms (PKC) represents a family of serine/threonine kinases encoded by the *PRKC* gene family that plays a central role in intracellular signal transduction. PKC isoforms act as molecular switches that translate extracellular signals into coordinated cellular responses regulating proliferation, differentiation, apoptosis, metabolism, immune activation, and neuronal signaling. Molecular studies have established that PKC comprises multiple isoenzymes with distinct regulatory domains, cofactor requirements, tissue distribution, and functional specificity. Dysregulation of PKC signaling is implicated in a wide range of pathological conditions, including cancer, metabolic disorders, cardiovascular disease, immune-mediated disorders, and neurodegenerative diseases. From a green pharmacy perspective, increasing attention has focused on plant-derived and naturally occurring compounds capable of modulating PKC activity with improved safety and sustainability profiles. This review provides a comprehensive and plagiarism-safe overview of the *PRKC* gene family, detailing the structural organization, activation mechanisms, signaling pathways, and physiological roles of PKC isoforms. Furthermore, it highlights the involvement of PKC dysregulation in human diseases and discusses emerging therapeutic strategies, with particular emphasis on natural and phytochemical PKC modulators relevant to green pharmacy research. Understanding PRKC biology at the molecular and systems levels is essential for the rational development of sustainable, isoform-selective therapeutic interventions.

Key words: Green pharmacy, phytochemicals, *PRKC* genes, protein kinase C, signal transduction, therapeutic targeting