Translational Modulation of Lung Inflammation via Natural Molecules and Engineered Microbial Therapeutics

Introduction:

In Human's respiratory Bronchioli intricate the life of the cellular level, few stages are as volatile and consequential as the lung. Our lungs vital filters of air and guardians against environmental hostility — are constantly exposed to chemical insults, pathogens, allergens, and carcinogens. As urbanization intensifies and air pollution spirals globally, contains of air , Carbon monoxide, Nitrous oxides, Cigarette (NICOTINE & TOBACCO) contents are prone to chronic lung Malfunctions like Tumours, Carcinomas , inflammation has become a pervasive health burden, directly linked to diseases such as asthma, chronic obstructive pulmonary disease (COPD), pulmonary fibrosis, and even non-small cell lung carcinoma (NSCLC). The bridge between inflammation and tumorigenesis is no longer a mere speculative path — it's a paved highway. Chronic inflammatory microenvironments produce oxidative stress, DNA damage, immune suppression, and continuous cytokine storms — the perfect breeding ground for mutation accumulation and malignant transformation. Lung tumors often originate in such chronically agitated tissues, where immune regulation is hijacked, and apoptotic pathways are silenced. In this landscape, natural molecules derived from plants, microbes, or marine sources are emerging as potent allies. These compounds—rich in flavonoids, alkaloids, terpenoids, and peptides—possess dual capabilities: modulating inflammation and directly interacting with tumor pathways. The natural world has spent engineering these compounds as defense mechanisms, and our role is to harness their evolved wisdom. But the horizon doesn't end there. Imagine a multi-phased therapeutic strategy, where inflammation is first chemically calmed using natural biomolecules, and then the battlefield is rewired using engineered bacterial strains — living medicines designed to infiltrate, detect, and suppress tumors through direct signaling, immune modulation, and genome-level interference using next-generation gene editing systems.

Objectives of Research :

To identify and characterize the Natural Bioactive molecules

(structures identification contains : Nicotine, EDTA, Tobacco, Ethidium bromide)

To investigate the effect of the natural molecules on Lung inflammation

(observation of Interaction of given Carcinogenic molecules basis on the cell intricated pathways for induced inflammation & ruptures)

To study molecular interactions at the DNA, RNA and Protein level

(Physiology of animal models different cellular metabolic levels basis on the mechanisms at the Intracellular levels)

To control the induced Mutations and Inflammations using gene editing tools

(In-Vivo(animal model) progressions of Inflammations ,to pivoted into remediation by CRISPr-Cas9 tools:CRIPr i,CRISPr a, for for gene regulation, Another methods EPIGENOME editing tools cas9 fused with epigentic modifiers like DNMT3A , TET1 for methylation ,acetylation for directly on gene's code)

Other hand Applied metabolites from *flora* ,to Tumor Suppression Models

(Other(parallel) *in-vitro* methodological approached plant's secondary metabolites based studies to carried out the inflammation abnormal into normal)