NATIONAL CANCER INSTITUTE
Technology Transfer Center

CytoSig: A Software Platform for Predicting Cytokine Signaling Activities, Target Discovery, and Clinical Decision Support System (CDSS) from Transcriptomic Profiles

Summary

Scientists at the National Cancer Institute (NCI) have developed the Cytokine Signaling Analyzer (CytoSig), a software-based platform that provides both a database of target genes modulated by cytokines and a predictive model of cytokine signaling cascades from transcriptomic profiles. NCI seeks collaborators or licensees to advance the development of CytoSig for research, target discovery, or as a Clinical Decision Support System (CDSS).

NIH Reference Number

E-086-2021

Product Type

- Diagnostics
- Research Tools

Keywords

- Cytokine Signaling, Target Discovery, Clinical Decision Support System, CDSS, Transcriptomic Profiles, Big-data Integration, Infectious Disease, Inflammation, Cancer Immunotherapy, Jiang

Collaboration Opportunity

This invention is available for licensing and co-development.

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Description of Technology

Cytokines are a broad category of intercellular signaling proteins that are critical for intercellular communication in human health and disease. However, systematic profiling of cytokine signaling activities has remained challenging due to the short half-lives of cytokines, and the pleiotropic functions and redundancy of cytokine activities within specific cellular contexts. The redundancy and pleiotropy in cytokine activities are not fully captured by most immunological assays such as the enzyme-linked immunosorbent

assay (ELISA) and Luminex xMAP, which only measures the cytokine release level that could be transient and do not reflect target signaling activities. On the other hand, existing databases of cytokine signaling targets cover only a small fraction of cytokines, leaving most cytokine-induced target changes unexplored.

Researchers at National Cancer Institute (NCI) have developed the Cytokine Signaling Analyzer (CytoSig) that uses transcriptome data to model the cytokine signaling activity and regulatory cascade in human inflammatory processes. To build the CytoSig platform, the Framework for Data Curation (FDC) was created to couple large-scale automatic data processing with natural language processing functions to assist expert annotations of metadata to analyze RNA-sequencing (RNA-seq) and MicroArray big-data resources. CytoSig includes an initial set of 20,591 curated human cytokine, chemokine, and growth factor response experiments, and can reliably predict the activity of 43 cytokines in both tissues and single cells based on the transcriptional effect of cytokine target genes. CytoSig, an excellent tool for leveraging the big-data resource in public domains to predict clinical outcome of anticancer therapies that inhibit cytokine signaling, is available for co-development and/or licensing.

Potential Commercial Applications

- Predicting cytokine target activities from bulk transcriptomic data available from large-scale cohorts and single-cell RNA-seq data
- Identifying new immunological functions of cytokines and candidate therapeutic targets in inflammatory diseases
- Predicting the clinical outcome of therapies that inhibit cytokine signaling in human inflammatory diseases and cancer.
- Framework for Data Curation (FDC) can be used by data scientists to accelerate data curation projects
- Applicable to cancers, infectious diseases, and inflammation

Competitive Advantages

- Integrative framework that leverages the big-data resource in public domains to identify candidate therapeutic targets
- Higher cytokine coverage compared to existing databases
- CytoSig predictions had better associations with the clinical outcome than other metrics, such as ligand or receptor expression and gene-set signatures
- Offers particular advantages in analyzing single-cell data because it is not affected by the absence of cytokine-producing cells or zero read counts for ligand or receptor genes

Inventor(s)

Peng Jiang Ph.D (NCI)

Development Stage

- Pre-clinical (in vivo)

Publications

Jiang P, et al. Systematic investigation of cytokine signaling activity at the tissue and single-cell levels. [34594031]

Patent Status

- **Research Material:** NIH will not pursue patent prosecution for this technology

Therapeutic Area

- Cancer/Neoplasm
- Immune System and Inflammation

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