Docket #: S11-222

Analysis and optimization of gene expression using synthetic promoters

Stanford researchers have developed a method to quantify a cell phenotypic response over a continuous range of ectopic gene expression levels. The researchers generated a library of synthetic promoters capable of a 40-fold expression range in mammalian cells and developed a retroviral vector to faithfully deploy the library, gene of interest, and fluorescent reporter.

This invention is fast, efficient, and highly compatible with existing expression systems since the promoters have been generated from constitutive promoters already commonly used in practice. This invention will allow experiments that generate and evaluate a range of gene expression levels. These types of experiments have been limited in the past since currently available tools and methods are unavailable, tedious, or inadequate.

Applications

- **Tune gene expression** in synthetic biology devices, genetic circuits, and engineered cells.
- **Identify optimal individual gene and multi-gene expression levels** for generating specific cell behaviors and phenotypes, including proliferation, apoptosis, senescence, tumorigenesis, metatastasis, cell differentiation, and generation of stem cells from terminally differentiated somatic cells.
- **Generate cell populations that can be used to screen for therapeutics** that abrogate synergy between genes or expressed factors. The invention can be used to generate dose-responses for genes of interest.

Advantages

- **High compatibility with existing expression systems** - The promoters have been generated from constitutive promoters already commonly used in practice.
- **Efficient** - Use of viral expression vectors allows for efficient gene delivery and makes high-throughput gene transduction possible.
- **Fast with high resolution** - The method is able to generate gene expression dose-response curves with higher resolution in a faster manner than other methods.

Publications

- Ferreira, J.P., Peacock, R.W., Lawhorn, I.E., and Wang, C.L. (2011). "Modulating ectopic gene expression levels by using retroviral vectors equipped with synthetic promoters." Syst Synth Biol (in press).
- Ferreira, J.P., W., Lawhorn, I.E., Peacock, R. and Wang, C.L. (2012) "Quantitative assessment of Ras over-expression via shotgun deployment of vectors utilizing synthetic promoters." Integr. Biol. (Camb).
- Peacock, R.W., Lawhorn, I.E., Ferreira, J.P. and Wang, C.L. (2012). "Flow cytometry of v-Abl transformed pre-B cells heterogeneous in ectopic expression levels reveals Ras dose-response." J Immunol Methods 384, 177-183.

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