Synthetic Binders of Breast Cancer Stem Cells

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Technology description

In recent decades, abundant research data has indicated the existence of cancer stem cells (CSCs), which represent a small, but significant, population among all cells within tumor tissues. These CSCs are mostly responsible for resistance to chemotherapy and radiation therapy, thereby becoming a root of tumor recurrence and metastasis. Several known cell-surface and intracellular markers have been widely used for CSC identification. Novel CSC targeting therapeutics hold great promise for curing cancers.

This technology highlights several synthetic ligands with high affinity and selectivity for breast CSCs. They bind to a subpopulation of breast cancer cell lines or cells within primary tumor tissues. The targeted cells demonstrate commonly accepted CSC characteristics, i.e. $CD24^{low}/CD44^{high}$, $ALDH^{high}$, and an elevated expression of stemness-associated transcription factors (C-Myc, Klf4, Sox 2, and Nanog). These ligands are the only known reagents capable of one-step identification of breast CSCs and can be developed further into diagnostic & imaging kits.

Technical Summary:

The novel ligands presented have high binding specificity and affinity to the aggressive tumorigenic CSC population in several breast cancer cell lines and the CSC in primary breast tumor tissues. The targeted cells are $CD24^{low}/CD44^{high}$, $ALDH^{high}$, and have elevated expression levels of stemness-associated transcription factors, i.e. c-Myc, Klf4, Sox2, and Nanog. The ligand’ s unbound population have low expression of c-Myc, Klf4, Sox2, and Nanog. Importantly, the targeted population was shown to be significantly more tumorigenic compared to the whole-population. Additionally, the tumor derived from the targeted population was found to display increased levels of CSC-markers and several mesenchymal markers.

The presented ligands are stable and are not susceptible to enzymatic degradation. The biotinylated ligands can be detected by standard protocols.

Value Proposition:

These are novel ligands which bind highly specifically to CSC populations over non-CSC populations of breast cancer cells, including some TNBC cell lines, in a simple procedure.

Publication:

Chen, Luxi, et al. “A Synthetic Binder of Breast Cancer Stem Cells.” Chemistry - A European Journal, 11 Jan. 2018, doi:10.1002/chem.201705663.

Application area

Life Science Research Reagents– For imaging and isolation of CSCs, including those in TNBC cell lines (which currently lack molecular markers)
Clinical Ex-vivo Diagnostic Tests– May be developed towards CSC-targeted therapeutics applications and tests

Advantages

Single Step Detection and Isolation– Uses high-affinity ligands to identify and isolate a subpopulation of cancer cells with CSC characteristics.
Novel Reagent– The ligands are structurally novel and the target receptors are unknown. Selectivity for breast CSC populations over non-CSC populations can be applied for ex-vivo separation of CSCs.

Institution

University of Texas, Dallas

Inventors

Luxi Chen
Postdoctoral Associate
Chemistry and Biochemistry
Jiyong Lee
Assistant Professor
Chemistry and Biochemistry
Chao Long
Teaching Assistant
Chemistry and Biochemistry

联系我们

叶先生

电 话：021-65679356

手 机：13414935137

邮 箱：yeyingsheng@zf-ym.com