(12) INTERNATIONAL APPLICATION PUBLISHED UNDER THE PATENT COOPERATION TREATY (PCT)

(19) World Intellectual Property Organization
International Bureau

(43) International Publication Date
28 April 2016 (28.04.2016)

WIPO | PCT

(10) International Publication Number
WO 2016/064676 A1

(51) **International Patent Classification**:
A61K 31/12 (2006.01) *A61K 31/437* (2006.01)
A61K 31/11 (2006.01) *A61P 35/00* (2006.01)

(21) **International Application Number**:
PCT/US2015/055968

(22) **International Filing Date**:
16 October 2015 (16.10.2015)

(25) **Filing Language**: English

(26) **Publication Language**: English

(30) **Priority Data**:

62/066,686	21 October 2014 (21.10.2014)	US
62/161,090	13 May 2015 (13.05.2015)	US
14/721,011	26 May 2015 (26.05.2015)	US
62/184,051	24 June 2015 (24.06.2015)	US

(71) **Applicant**: **GENZADA PHARMACEUTICALS LLC** [US/US]; 119 W. Main St., Sterling, Kansas 67579 (US).

(72) **Inventors**: **ZAID, Gene H.**; 205 S. Broadway, Sterling, Kansas 67579 (US). **BURGOYNE, Thomas W.**; 116 E. Jefferson, Sterling, Kansas 67579 (US).

(74) **Agent**: **COLLINS, John M.**; 10801 Mastin Blvd, Suite 1000, 84 Corporate Woods, Overland Park, Kansas 66210 (US).

(81) **Designated States** *(unless otherwise indicated, for every kind of national protection available)*: AE, AG, AL, AM, AO, AT, AU, AZ, BA, BB, BG, BH, BN, BR, BW, BY, BZ, CA, CH, CL, CN, CO, CR, CU, CZ, DE, DK, DM, DO, DZ, EC, EE, EG, ES, FI, GB, GD, GE, GH, GM, GT, HN, HR, HU, ID, IL, IN, IR, IS, JP, KE, KG, KN, KP, KR, KZ, LA, LC, LK, LR, LS, LU, LY, MA, MD, ME, MG, MK, MN, MW, MX, MY, MZ, NA, NG, NI, NO, NZ, OM, PA, PE, PG, PH, PL, PT, QA, RO, RS, RU, RW, SA, SC, SD, SE, SG, SK, SL, SM, ST, SV, SY, TH, TJ, TM, TN, TR, TT, TZ, UA, UG, US, UZ, VC, VN, ZA, ZM, ZW.

(84) **Designated States** *(unless otherwise indicated, for every kind of regional protection available)*: ARIPO (BW, GH, GM, KE, LR, LS, MW, MZ, NA, RW, SD, SL, ST, SZ, TZ, UG, ZM, ZW), Eurasian (AM, AZ, BY, KG, KZ, RU, TJ, TM), European (AL, AT, BE, BG, CH, CY, CZ, DE, DK, EE, ES, FI, FR, GB, GR, HR, HU, IE, IS, IT, LT, LU, LV, MC, MK, MT, NL, NO, PL, PT, RO, RS, SE, SI, SK, SM, TR), OAPI (BF, BJ, CF, CG, CI, CM, GA, GN, GQ, GW, KM, ML, MR, NE, SN, TD, TG).

Declarations under Rule 4.17:

— *as to applicant's entitlement to apply for and be granted a patent (Rule 4.17(ii))*

— *as to the applicant's entitlement to claim the priority of the earlier application (Rule 4.17(iii))*

Published:

— *with international search report (Art. 21(3))*

WO 2016/064676 A1

(54) **Title**: HUMAN THERAPEUTIC AGENTS

(57) **Abstract**: Human therapeutic treatment compositions comprise at least two of a curcumin component, a harmine component, and an isovanillin component, and preferably all three in combination. The agents are effective for the treatment of human conditions, especially human cancers.

HUMAN THERAPEUTIC AGENTS

CROSS-REFERENCE TO RELATED APPLICATION

This application claims the benefit of three Provisional Applications, SN 62/066,686 filed October 21, 2014, SN 62/161,090 filed May 13, 2015, and SN 62/184,051 filed June 24, 2015, and non-provisional application SN 14/721011, filed May 26, 2015. Each of the above provisional and non-provisional applications is incorporated by reference herein in its entirety.

BACKGROUND OF THE INVENTION

Field of the Invention

The present invention relates to combination chemotherapeutics for treatment of humans, and especially for the treatment of human cancers, and corresponding methods for the treatment of humans suffering from cancers or other maladies. The invention further provides dosage forms and regimens for administration to human patients, and methods of formulating and administering such dosage forms to yield improvements in treatment outcomes. More particularly, the invention is concerned with the administration of specific chemotherapeutic dosage forms (e.g., liquid mixtures, capsules, pills, or tablets) containing one or more curcumin component(s), harmine component(s), and isovanillin component(s), and sub-combinations thereof.

Description of Related Art

Cancer is a generic term for a large group of diseases that can affect any part of the body. Other terms used are malignant tumors and neoplasms. One defining feature of cancer is the rapid creation of abnormal cells that grow beyond their usual boundaries, and which can then invade adjoining parts of the body and spread to other organs. This process is referred to as metastasis. Metastases are the major cause of death from cancer.

The transformation from a normal cell into a tumor cell is a multistage process, typically a progression from a pre-cancerous lesion to malignant tumors. These changes are the result of the interaction between a person's genetic factors and three categories of external agents, including:

- physical carcinogens, such as ultraviolet and ionizing radiation

- chemical carcinogens, such as asbestos, components of tobacco smoke, aflatoxin (a food contaminant) and arsenic (a drinking water contaminant)
- biological carcinogens, such as infections from certain viruses, bacteria or parasites.

Some examples of infections associated with certain cancers:

- Viruses: hepatitis B and liver cancer, Human Papilloma Virus (HPV) and cervical cancer, and human immunodeficiency virus (HIV) and Kaposi sarcoma.
- Bacteria: Helicobacter pylori and stomach cancer.
- Parasites: schistosomiasis and bladder cancer.

Aging is another fundamental factor for the development of cancer. The incidence of cancer rises dramatically with age, most likely due to a buildup of risks for specific cancers that increase with age. The overall risk accumulation is combined with the tendency for cellular repair mechanisms to be less effective as a person grows older.

Tobacco use, alcohol use, low fruit and vegetable intake, and chronic infections from hepatitis B (HBV), hepatitis C virus (HCV) and some types of Human Papilloma Virus (HPV) are leading risk factors for cancer in low- and middle-income countries. Cervical cancer, which is caused by HPV, is a leading cause of cancer death among women in low-income countries. In high-income countries, tobacco use, alcohol use, and being overweight or obese are major risk factors for cancer.

The most common cancer treatment modalities are surgery, chemotherapy, and radiation treatments. All of these techniques have significant drawbacks in terms of side effects and patient discomfort. For example, chemotherapy may result in significant decreases in white blood cell count (neutropenia), red blood cell count (anemia), and platelet count (thrombocytopenia). This can result in pain, diarrhea, constipation, mouth sores, hair loss, nausea, and vomiting.

Biological therapy (sometimes called immunotherapy, biotherapy, or biological response modifier therapy) is a relatively new addition to the family of cancer treatments. Biological therapies use the body's immune system, either directly or indirectly, to fight cancer or to lessen the side effects that may be caused by some cancer treatments.

During chemotherapies involving multiple-drug treatments, adverse drug events are common, and indeed toxicities related to drug-drug interactions are one of the leading causes of

hospitalizations in the US. Obach, R.S. "Drug-Drug Interactions: An Important Negative Attribute in Drugs." *Drugs Today* 39.5 (2003): 308-338. In fact, in any single-month period, one-fifth of all surveyed adults in the USA reported an adverse drug response. Hakkarainen, K.M. et al. "Prevalence and Perceived Preventability of Self-Reported Adverse Drug Events – A Population-Based Survey of 7,099 Adults." *PLoS One* 8.9 (2013): e73166. A large-scale study of adults aged 57-85 found that 29% were taking more than five prescription medications and nearly 5% were at risk of major adverse drug-drug interactions. In the field of oncology, a review of over 400 cancer patients determined that 77% were taking drugs that were considered to have a moderately severe potential for adverse drug interactions, and 9% had major adverse drug interactions. Ghalib, M.S. et al. "Alterations of Chemotherapeutic Pharmocokinetic Profiles by Drug-Drug Interactions." *Expert Opin. Drug Metabl. Toxicol* 5.2 (2009): 109-130.

Such interactions are a global health problem, and the WHO has determined that negative drug interactions are leading causes of morbidity and mortality around the world, with up to 7% of all hospitalizations in the US due to negative drug interactions. A recent survey of a single hospital shows that 83% of hospitalized patients were prescribed drug combinations with the potential to cause adverse reactions. Patel, P.S. et al. "A Study of Potential Adverse Drug-Drug Interactions Among Prescribed Drugs in a Medicine Outpatient Department of a Tertiary Care Teaching Hospital." *J. Basic Clin. Pharm.* 5.2 (2014): 44-48.

Examples of famous negative drug interactions include the development of rhabdomyolysis, a severe muscle disease, when taking Simvastatin with Amiodarone. As a result, the FDA introduced a warning on the drug label about the interaction. The calcium channel blocker Mibefradif, taken for high blood pressure, was removed from the market because of the harmful interaction with drugs that work on the electrical activity of the heart.

US Patent No. 8,039.025 describes cancer treatments in the form of extracts of *Arum palaestinum* Boiss, supplemented with individual amounts of β-sitosterol, isovanillin, and linoleic acid, and this patent is incorporated by reference herein in its entirety.

Despite the immense amount of worldwide research and efforts to stem the tide of cancer and its side effects, the disease in its many manifestations continues to be a huge problem. Therefore, any new cancer treatment having a curative affect and/or the ability to ameliorate cancer symptoms and improve the lifestyle of patients is highly significant and important.

SUMMARY OF THE INVENTION

The present invention provides improved chemotherapeutics for treatment of humans, and especially in the treatment of human cancers, with novel combinations of compounds, which are useful against a wide variety of different cancers with minimal or nonexistent adverse side effects. Generally speaking, the chemotherapeutics of the invention comprise respective quantities of at least two of, curcumin component(s), harmine component(s), and isovanillin component(s). The preferred chemotherapeutics include all three of these components, but sub-combinations thereof are also useful, i.e., therapeutics comprising curcumin component(s) and harmine component(s), curcumin component(s) and isovanillin component(s), and harmine component(s) and isovanillin component(s). In particularly preferred embodiments, the active components of the compositions (i.e., those having a significant therapeutic effect) consist essentially of curcumin, harmine, and isovanillin components in the case of three-component compositions, and consist essentially of two of the three components in the case of the two-component compositions. Preferably, the at least one curcumin component comprises curcumin, the at least one harmine component comprises harmine, and the at least one isovanillin component comprises isovanillin or vanillin.

The invention also provides new methods for treatment of cancers by administration of appropriate quantities of the anti-cancer compositions hereof. Hence, the compositions are particularly designed for use in the treatment of cancers, and the compositions can be used for the manufacture of medicaments of anti-cancer therapeutic applications. In addition, the invention provides pharmaceutical compositions for the treatment of cancers comprising administering therapeutically effective amounts of the new compositions, prepared by processes known *per se*, with a pharmaceutically acceptable carrier.

Curcumin (CAS #458-37-7) is a diaryl heptanoid, and has the molecular formula C21H20O6. Curcumin occurs as a part of a curcuminoid plant extract containing curcumin, demethoxycurcumin, and bis-demethoxycurcumin. One commercially available effective curcuminoid is sold as "Curcumin from Curcuma Longa (Turmeric)," which contains greater than 65% by weight curcumin, as determined by HPLC analysis.

Harmine (CAS #442-51-3) is a methoxy methyl pyrido indole belonging to the β-carboline family of compounds, and has the molecular formula C13H12N2O. Harmine occurs in a number of different plants native to the Middle East and South America.

Isovanillin (CAS #621-59-0) is a phenolic aldehyde vanillin isomer, and has the molecular formula C8H8O3.

A "chemotherapeutic" or "chemotherapeutic agent" as used herein refers to the combinations of chemical compounds described herein as useful in the treatment of human conditions, especially human cancers. Chemotherapeutics may be cytostatic, selectively toxic or destructive of cancerous tissue and/or cells, but also include indiscriminately cytotoxic compounds used in cancer treatments.

The combination therapeutic agents of the invention have been found to be effective in the treatment of a broad spectrum of human cancers, and also to other conditions, such as elevated PSA counts in men. The broad scope of utility with the agents of the invention is in itself highly unusual. However, this feature, together with the nonexistent or minimal side effects induced by the agents, represents a startling development in the art.

BRIEF DESCRIPTION OF THE DRAWINGS

Figure 1 is a graph of cell number versus dosage amounts of GZ17-6.02, illustrating the effect thereof in inducing the death of two different types of human head and neck cancer cells, as described in Example 1;

Fig. 2A is a graph of cell number versus dosage amounts of GZ17-6.02, illustrating the effect thereof GZ17-6.02 in inducing the death of pediatric leukemia cells, as described in Example 2;

Fig. 2B is a graph of cell number versus dosage amounts of GZ17-6.02, illustrating the effect thereof GZ17-6.02 in inducing the death of pediatric osteosarcoma cells, as described in Example 2;

Fig. 3A is a graph of cell number versus dosage amounts of GZ17-6.02, illustrating the effect thereof GZ17-6.02 in inducing the death of lymphoma cells, as described in Example 3;

Fig. 3B is a graph of cell number versus dosage amounts of GZ17-6.02, illustrating the effect thereof GZ17-6.02 in inducing the death of lung cancer cells, as described in Example 3;

Fig. 4A is a graph of cell number versus dosage amounts of GZ17-6.02, illustrating the effect thereof GZ17-6.02 in inducing the death of ovarian cancer cells, as described in Example 4;

Fig. 4B is a graph of cell number versus dosage amounts of GZ17-6.02, illustrating the effect thereof in inducing the death of prostate cancer cells, as described in Example 4;

Fig. 5A is a graph of cell number versus dosage amounts of GZ17-6.02, illustrating the effect thereof in inducing the death of human breast cancer cells, as described in Example 5;

Fig. 5B is a graph of cell number versus dosage amounts of GZ17-6.02, illustrating the effect thereof in inducing the death of pancreatic cancer cells, as described in Example 5;

Fig. 6 is a graph of cell number versus doses of GZ17-6.02 illustrating the relative effects thereof in inducing cell death in prostate cancer and ovarian cancer cells, as compared with non-cancerous fibroblasts, as described in Example 6;

Fig. 7A is a graph illustrating the effect of GZ17-6.02 in preventing migration of head and neck cancer cells, as described in Example 7;

Fig. 7B is a graph illustrating the effect of GZ17-6.02 in preventing invasion of head and neck cancer cells, as described in Example 7;

Fig. 8 is a graph of normalized cell number versus increasing doxorubicin doses alone and with the addition of two different concentrations of GZ17-6.02, as described in Example 8;

Fig. 9A is a graph illustrating extent of apoptosis in a control test, as described in Example 9, and illustrating about 19.8% cell death via apoptosis;

Fig. 9B is a graph illustrating extent of apoptosis in a test identical to the control test of Fig. 9A, but including GZ17-6.02, as described in Example 9, and illustrating about 48.2% cell death via apoptosis;

Fig. 10A is a graph illustrating that caspase 3 and 7 concentrations increased in response to GZ17-6.02, but caspase 9 levels did not change in response to GZ17-6.02 in lung cancer cells, as described in Example 10;

Fig. 10B is a graph illustrating that caspase 6 concentrations increased in response to GZ17-6.02 in lung cancer cells, as described in Example 10;

Fig. 10C is a graph illustrating that ATP levels, as a marker of mitochondrial toxicity, were not increased by GZ17-6.02 in lung cancer cells, as described in Example 10;

Fig. 11A is a graph illustrating the mechanisms of ovarian cancer cells death by application of GZ17-6.02, as explained in Example 11;

Fig. 11B is a graph illustrating the mechanisms of ovarian cancer cells death by application of GZ17-6.02, as explained in Example 11;

Fig. 11C is a graph illustrating the mechanisms of ovarian cancer cells death by application of GZ17-6.02, as explained in Example 11;

Fig. 11D is a graph illustrating the mechanisms of ovarian cancer cells death by application of GZ17-6.02, as explained in Example 11;

Fig. 11E is a graph illustrating the mechanisms of ovarian cancer cells death by application of GZ17-6.02, as explained in Example 11;

Fig. 12A is a graph illustrating the mechanisms of osteosarcoma cells death by application of GZ17-6.02, as explained in Example 12;

Fig. 12B is a graph illustrating the mechanisms of osteosarcoma cells death by application of GZ17-6.02, as explained in Example 12;

Fig. 12C is a graph illustrating the mechanisms of osteosarcoma cells death by application of GZ17-6.02, as explained in Example 12;

Fig. 12D is a graph illustrating the mechanisms of osteosarcoma cells death by application of GZ17-6.02, as explained in Example 12;

Fig. 13 is a graph illustrating the mechanisms of human head and neck cancer cells death by application of GZ17-6.02, as explained in Example 13;

Fig. 14A is a control quantitative dot-blot, which measures the relative amount of proteins, known to be involved in cell proliferation described in Example 14, where the proteins were epidermal growth factor receptor (EGFR), extracellular-signal-regulated kinase (ERK1/2), the catalytic subunit of AMP-activated kinase (AMPKα2), β-catenin, and Chk-2.

Fig. 14B is a quantitative dot-block similar to that described in Fig. 14A, but illustrating the amounts of the test proteins upon application of GZ17-6.02, as described in Example 14;

Fig. 15A is a graph depicting the results of two independent scientists, each carrying out an identical induced cell death test with GZ17-6.02 on ovarian cancer cells, as described in Example 15;

Fig. 15B is a graph depicting the results of two independent scientists, each carrying out an identical induced cell death test with GZ17-6.02 on lung cancer cells, as described in Example 4; and

Fig. 16A is a comparative graph of tumor volume versus days after cancer cell inoculation in mice, between control inoculations (ethanol vehicle) and test inoculations containing the vehicle and GZ17-6.02, illustrating the dramatic reduction in tumor volumes in the test mice, as explained in Example 16;

Fig. 16B is a comparative graph of contralateral tumor volume versus days after cancer cell inoculation in mice, indicating a systemic effect of use of GZ17-6.02, as explained in Example 16;

Fig. 16C is a graph of fractional tumor volume versus days after treatment wherein one group of mice was implanted with human head and neck tumor cells using an implantation vehicle, and a control group of mice was implanted with only the vehicle, in order to determine tumor volume over time, as set forth in Example 16;

Fig. 17A is a graph of cell number versus dosage amounts of GZ17-6.02 (open circles) versus a combined product including 1/3 by weight of each GZ17-6.02 component (filled circles), tested on ovarian cancer cells, as described in Example 4;

Fig. 17B is a graph of cell number versus dosage amounts of GZ17-6.02 (open circles) versus a combined product including 1/3 by weight of each GZ17-6.02 component (filled circles), tested on lung cancer cells, as described in Example 3;

Fig. 17C is a graph of cell number versus dosage amounts of GZ17-6.02 (open circles) versus a combined product including 1/3 by weight of each GZ17-6.02 component (filled circles), tested on prostate cancer cells, as described in Example 4;

Fig. 18A is a graph of percent ovarian cancer cell death versus different component combinations of GZ17-6.02, illustrating results using isovanillin alone, and two-component products respectively including isovanillin plus curcumin, and isovanillin plus harmine, where the isovanillin concentration was held constant throughout;

Fig. 18B is a graph of percent lung cancer cell death versus different component combinations of GZ17-6.02, illustrating results using isovanillin alone, and two-component products respectively including isovanillin plus curcumin, and isovanillin plus harmine, where the isovanillin concentration was held constant throughout;

Fig. 18C is a graph of percent prostate cancer cell death versus different component combinations of GZ17-6.02, illustrating results using isovanillin alone, and two-component

products respectively including isovanillin plus curcumin, and isovanillin plus harmine, where the isovanillin concentration was held constant throughout;

Fig. 18D is a graph of percent lymphoma cancer cell death versus different component combinations of GZ17-6.02, illustrating results using isovanillin alone, and two-component products respectively including isovanillin plus curcumin, and isovanillin plus harmine, where the isovanillin concentration was held constant throughout;

Fig. 19A is a graph of percent ovarian cancer cell death versus different component combinations of GZ17-6.02, illustrating results using curcumin alone, and two-component products respectively including curcumin plus isovanillin, and curcumin plus harmine, where the curcumin concentration was held constant throughout;

Fig. 19B is a graph of percent lung cancer cell death versus different component combinations of GZ17-6.02, illustrating results using curcumin alone, and two-component products respectively including curcumin plus isovanillin, and curcumin plus harmine, where the curcumin concentration was held constant throughout;

Fig. 19C is a graph of percent prostate cancer cell death versus different component combinations of GZ17-6.02, illustrating results using curcumin alone, and two-component products respectively including curcumin plus isovanillin, and curcumin plus harmine, where the curcumin concentration was held constant throughout;

Fig. 19D is a graph of percent lymphoma cancer cell death versus different component combinations of GZ17-6.02, illustrating results using curcumin alone, and two-component products respectively including curcumin plus isovanillin, and curcumin plus harmine, where the curcumin concentration was held constant throughout;

Fig. 20A is a graph of percent ovarian cancer cell death versus different component combinations of GZ17-6.02, illustrating results using harmine alone, and two-component products respectively including harmine plus isovanillin, and harmine plus curcumin, where the harmine concentration was held constant throughout;

Fig. 20B is a graph of percent lung cancer cell death versus different component combinations of GZ17-6.02, illustrating results using harmine alone, and two-component products respectively including harmine plus isovanillin, and harmine plus curcumin, where the harmine concentration was held constant throughout;

Fig. 20C is a graph of percent prostate cancer cell death versus different component combinations of GZ17-6.02, illustrating results using harmine alone, and two-component products respectively including harmine plus isovanillin, and harmine plus curcumin, where the harmine concentration was held constant throughout;

Fig. 20D is a graph of percent lymphoma cancer cell death versus different component combinations of GZ17-6.02, illustrating results using harmine alone, and two-component products respectively including harmine plus isovanillin, and harmine plus curcumin, where the harmine concentration was held constant throughout;

Fig. 21A is a graph of lymphoma cancer cell lethality using GZ17-6.02 at a dosage rate of 12 μg/mL, and using the three components of GZ17-6.02 individually at the concentration present in GZ17-6.02, and further illustrating the theoretical additive effect of the three components versus GZ17-6.02;

Fig. 21B is a graph of lymphoma cancer cell lethality using GZ17-6.02 at a dosage rate of 24 μg/mL, and using the three components of GZ17-6.02 individually at the concentration present in GZ17-6.02, and further illustrating the theoretical additive effect of the three components versus GZ17-6.02;

Fig. 21C is a graph of lymphoma cancer cell lethality using GZ17-6.02 at a dosage rate of 48 μg/mL, and using the three components of GZ17-6.02 individually at the concentration present in GZ17-6.02, and further illustrating the theoretical additive effect of the three components versus GZ17-6.02;

Fig. 21D is a graph of lymphoma cancer cell lethality using GZ17-6.02 at a dosage rate of 96 μg/mL, and using the three components of GZ17-6.02 individually at the concentration present in GZ17-6.02, and further illustrating the theoretical additive effect of the three components versus GZ17-6.02;

Fig. 22A is a graph of ovarian cancer cell lethality using GZ17-6.02 at a dosage rate of 12 μg/mL, and using the three components of GZ17-6.02 individually at the concentration present in GZ17-6.02, and further illustrating the theoretical additive effect of the three components versus GZ17-6.02;

Fig. 22B is a graph of ovarian cancer cell lethality using GZ17-6.02 at a dosage rate of 24 μg/mL, and using the three components of GZ17-6.02 individually at the concentration present in

GZ17-6.02, and further illustrating the theoretical additive effect of the three components versus GZ17-6.02;

Fig. 22C is a graph of breast cancer cell lethality using GZ17-6.02 at a dosage rate of 24 μg/mL, and using the three components of GZ17-6.02 individually at the concentration present in GZ17-6.02, and further illustrating the theoretical additive effect of the three components versus GZ17-6.02;

Fig. 23A is a graph of lung cancer cell number versus increasing dosage amounts of vanillin alone, as described in Example 1;

Fig. 23B is a graph of lung cancer cell number versus increasing dosage amounts of isovanillic acid alone, as described in Example 1;

Fig. 23C is a graph of lung cancer cell number versus increasing dosage amounts of O-vanillin alone, as described in Example 1;

Fig. 23D is a graph of lung cancer cell number versus increasing dosage amounts of isovanillyl alcohol alone, as described in Example 1;

Fig. 23E is a graph of ovarian cancer cell number versus increasing dosage amounts of vanillin alone, as described in Example 1;

Fig. 23F is a graph of ovarian cancer cell number versus increasing dosage amounts of isovanillic acid alone, as described in Example 1;

Fig. 23G is a graph of ovarian cancer cell number versus increasing dosage amounts of O-vanillin alone, as described in Example 1;

Fig. 23H is a graph of ovarian cancer cell number versus increasing dosage amounts of isovanillyl alcohol alone, as described in Example 1;

Fig. 23I is a graph of prostate cancer cell number versus increasing dosage amounts of vanillin alone, as described in Example 1;

Fig. 23J is a graph of prostate cancer cell number versus increasing dosage amounts of isovanillic acid alone, as described in Example 1;

Fig. 23K is a graph of prostate cancer cell number versus increasing dosage amounts of O-vanillin alone, as described in Example 1;

Fig. 23L is a graph of prostate cancer cell number versus increasing dosage amounts of isovanillyl alcohol alone, as described in Example 1;

Fig. 24A is a graph of lung cancer cell number versus increasing dosage amounts of harmaline alone, as described in Example 1;

Fig. 24B is a graph of lung cancer cell number versus increasing dosage amounts of tetrahydro-harmine alone, as described in Example 1;

Fig. 24C is a graph of lung cancer cell number versus increasing dosage amounts of harmol hydrochloride alone, as described in Example 1;

Fig. 24D is a graph of lung cancer cell number versus increasing dosage amounts of harmalol hydrochloride dihydrate alone, as described in Example 1;

Fig. 24E is a graph of lung cancer cell number versus increasing dosage amounts of harmane alone, as described in Example 1;

Fig. 24F is a graph of ovarian cancer cell number versus increasing dosage amounts of harmaline alone, as described in Example 1;

Fig. 24G is a graph of ovarian cancer cell number versus increasing dosage amounts of tetrahydro-harmine alone, as described in Example 1;

Fig. 24H is a graph of ovarian cancer cell number versus increasing dosage amounts of harmol hydrochloride alone, as described in Example 1;

Fig. 24I is a graph of ovarian cancer cell number versus increasing dosage amounts of harmalol hydrochloride dihydrate alone, as described in Example 1;

Fig. 24J is a graph of ovarian cancer cell number versus increasing dosage amounts of harmane alone, as described in Example 1;

Fig. 24K is a graph of prostate cancer cell number versus increasing dosage amounts of harmaline alone, as described in Example 1;

Fig. 24L is a graph of prostate cancer cell number versus increasing dosage amounts of tetrahydro-harmine alone, as described in Example 1;

Fig. 24M is a graph of prostate cancer cell number versus increasing dosage amounts of harmol hydrochloride alone, as described in Example 1;

Fig. 24N is a graph of prostate cancer cell number versus increasing dosage amounts of harmalol hydrochloride dihydrate alone, as described in Example 1;

Fig. 24O is a graph of prostate cancer cell number versus increasing dosage amounts of harmane alone, as described in Example 1;

Fig. 25A is a graph of lung cancer cell number versus increasing dosage amounts of bisdemethoxy curcumin alone, as described in Example 1;

Fig. 25B is a graph of ovarian cancer cell number versus increasing dosage amounts of bisdemethoxy curcumin alone, as described in Example 1;

Fig. 25C is a graph of prostate cancer cell number versus increasing dosage amounts of bisdemethoxy curcumin alone, as described in Example 1;

Fig. 26 is a graph of ovarian cancer cell number versus dosage amounts of GZ17-6.02 where the product was stored at varying temperatures over two months, confirming that the product has long-term stability;

Fig. 27 is a graph of ovarian cancer cell number versus dosage amounts of GZ17-6.02, where the GZ17-6.02 was subjected to a series of successive freeze/thaw cycles, confirming that the product has excellent freeze/thaw stability;

Fig 28A is a graph of cell number versus dosage amounts of GZ17-8.03, illustrating the effect thereof in inducing the death of two different types ovarian cancer, lung cancer, prostate cancer, pancreatic cancer and fibroblast cells, as described in Example 28;

Fig 28B is a graph of cell number versus dosage amounts of GZ17-8.04, illustrating the effect thereof in inducing the death of ovarian cancer, lung cancer, prostate cancer, pancreatic cancer and fibroblast cells, as described in Example 28;

Fig 28C is a graph of cell number versus dosage amounts of GZ17-8.05, illustrating the effect thereof in inducing the death of ovarian cancer, lung cancer, prostate cancer, pancreatic cancer and fibroblast cells, as described in Example 28;

Fig 28D is a graph of cell number versus dosage amounts of GZ17-8.06, illustrating the effect thereof in inducing the death of ovarian cancer, lung cancer, prostate cancer, pancreatic cancer and fibroblast cells, as described in Example 28;

Fig 28E is a graph of cell number versus dosage amounts of GZ17-8.07, illustrating the effect thereof in inducing the death of ovarian cancer, lung cancer, prostate cancer, pancreatic cancer and fibroblast cells, as described in Example 28;

Fig 28F is a graph of cell number versus dosage amounts of GZ17-8.08, illustrating the effect thereof in inducing the death of ovarian cancer, lung cancer, prostate cancer, pancreatic cancer and fibroblast cells, as described in Example 28;

Fig 28G is a graph of cell number versus dosage amounts of GZ17-8.09, illustrating the effect thereof in inducing the death of ovarian cancer, lung cancer, prostate cancer, pancreatic cancer and fibroblast cells, as described in Example 28;

Fig 28H is a graph of cell number versus dosage amounts of GZ17-8.10, illustrating the effect thereof in inducing the death of ovarian cancer, lung cancer, prostate cancer, pancreatic cancer and fibroblast cells, as described in Example 28;

Fig. 29A is a graph of cell number versus dosage amounts of GZ17-8.11, illustrating the effect thereof in inducing the death of ovarian cancer;

Fig. 29B is a graph of cell number versus dosage amounts of GZ17-8.11, illustrating the effect thereof in inducing the death of lung cancer;

Fig. 29C is a graph of cell number versus dosage amounts of GZ17-8.11, illustrating the effect thereof in inducing the death of prostate cancer;

Fig. 29D is a graph of cell number versus dosage amounts of GZ17-8.11, illustrating the effect thereof in inducing the death of head and neck cancer;

Fig. 29E is a graph of cell number versus dosage amounts of GZ17-8.11, illustrating the effect thereof in inducing the death of breast cancer;

Fig. 29F is a graph of cell number versus dosage amounts of GZ17-8.11, illustrating the effect thereof in inducing the death of leukemia;

Fig. 29G is a graph of cell number versus dosage amounts of GZ17-8.11, illustrating the effect thereof in inducing the death of lymphoma;

Fig. 30A is a graph of cell number versus dosage amounts of GZ17-8.12, illustrating the effect thereof in inducing the death of ovarian cancer;

Fig. 30B is a graph of cell number versus dosage amounts of GZ17-8.12, illustrating the effect thereof in inducing the death of lung cancer;

Fig. 30C is a graph of cell number versus dosage amounts of GZ17-8.12, illustrating the effect thereof in inducing the death of prostate cancer;

Fig. 30D is a graph of cell number versus dosage amounts of GZ17-8.12, illustrating the effect thereof in inducing the death of head and neck cancer;

Fig. 30E is a graph of cell number versus dosage amounts of GZ17-8.12, illustrating the effect thereof in inducing the death of breast cancer;

Fig. 30F is a graph of cell number versus dosage amounts of GZ17-8.12, illustrating the effect thereof in inducing the death of leukemia;

Fig. 30G is a graph of cell number versus dosage amounts of GZ17-8.12, illustrating the effect thereof in inducing the death of lymphoma;

Fig. 31A is a graph of cell number versus dosage amounts of GZ17-8.13, illustrating the effect thereof in inducing the death of ovarian cancer;

Fig. 31B is a graph of cell number versus dosage amounts of GZ17-8.13, illustrating the effect thereof in inducing the death of lung cancer;

Fig. 31C is a graph of cell number versus dosage amounts of GZ17-8.13, illustrating the effect thereof in inducing the death of prostate cancer;

Fig. 31D is a graph of cell number versus dosage amounts of GZ17-8.13, illustrating the effect thereof in inducing the death of head and neck cancer;

Fig. 31E is a graph of cell number versus dosage amounts of GZ17-8.13, illustrating the effect thereof in inducing the death of breast cancer;

Fig. 31F is a graph of cell number versus dosage amounts of GZ17-8.13, illustrating the effect thereof in inducing the death of leukemia;

Fig. 31G is a graph of cell number versus dosage amounts of GZ17-8.13, illustrating the effect thereof in inducing the death of lymphoma;

Fig. 32A is a graph of cell number versus dosage amounts of GZ17-8.14, illustrating the effect thereof in inducing the death of ovarian cancer;

Fig. 32B is a graph of cell number versus dosage amounts of GZ17-8.14, illustrating the effect thereof in inducing the death of lung cancer;

Fig. 32C is a graph of cell number versus dosage amounts of GZ17-8.14, illustrating the effect thereof in inducing the death of prostate cancer;

Fig. 32D is a graph of cell number versus dosage amounts of GZ17-8.14, illustrating the effect thereof in inducing the death of head and neck cancer;

Fig. 32E is a graph of cell number versus dosage amounts of GZ17-8.14, illustrating the effect thereof in inducing the death of breast cancer;

Fig. 32F is a graph of cell number versus dosage amounts of GZ17-8.14, illustrating the effect thereof in inducing the death of leukemia;

Fig. 32G is a graph of cell number versus dosage amounts of GZ17-8.14, illustrating the effect thereof in inducing the death of lymphoma;

Fig. 33A is a graph of cell number versus dosage amounts of GZ17-8.15, illustrating the effect thereof in inducing the death of ovarian cancer;

Fig. 33B is a graph of cell number versus dosage amounts of GZ17-8.15, illustrating the effect thereof in inducing the death of lung cancer;

Fig. 33C is a graph of cell number versus dosage amounts of GZ17-8.15, illustrating the effect thereof in inducing the death of prostate cancer;

Fig. 33D is a graph of cell number versus dosage amounts of GZ17-8.15, illustrating the effect thereof in inducing the death of head and neck cancer;

Fig. 33E is a graph of cell number versus dosage amounts of GZ17-8.15, illustrating the effect thereof in inducing the death of breast cancer;

Fig. 33F is a graph of cell number versus dosage amounts of GZ17-8.15, illustrating the effect thereof in inducing the death of leukemia;

Fig. 33G is a graph of cell number versus dosage amounts of GZ17-8.15, illustrating the effect thereof in inducing the death of lymphoma;

Fig. 34A is a graph of cell number versus dosage amounts of GZ17-8.16, illustrating the effect thereof in inducing the death of ovarian cancer;

Fig. 34B is a graph of cell number versus dosage amounts of GZ17-8.16, illustrating the effect thereof in inducing the death of lung cancer;

Fig. 34C is a graph of cell number versus dosage amounts of GZ17-8.16, illustrating the effect thereof in inducing the death of prostate cancer;

Fig. 34D is a graph of cell number versus dosage amounts of GZ17-8.16, illustrating the effect thereof in inducing the death of head and neck cancer;

Fig. 34E is a graph of cell number versus dosage amounts of GZ17-8.16, illustrating the effect thereof in inducing the death of breast cancer;

Fig. 34F is a graph of cell number versus dosage amounts of GZ17-8.16, illustrating the effect thereof in inducing the death of leukemia;

Fig. 34G is a graph of cell number versus dosage amounts of GZ17-8.16, illustrating the effect thereof in inducing the death of lymphoma;

Fig. 35A is a graph of cell number versus dosage amounts of GZ17-8.17, illustrating the effect thereof in inducing the death of ovarian cancer;

Fig. 35B is a graph of cell number versus dosage amounts of GZ17-8.17, illustrating the effect thereof in inducing the death of lung cancer;

Fig. 35C is a graph of cell number versus dosage amounts of GZ17-8.17, illustrating the effect thereof in inducing the death of prostate cancer;

Fig. 35D is a graph of cell number versus dosage amounts of GZ17-8.17, illustrating the effect thereof in inducing the death of head and neck cancer;

Fig. 35E is a graph of cell number versus dosage amounts of GZ17-8.17, illustrating the effect thereof in inducing the death of breast cancer;

Fig. 35F is a graph of cell number versus dosage amounts of GZ17-8.17, illustrating the effect thereof in inducing the death of leukemia;

Fig. 35G is a graph of cell number versus dosage amounts of GZ17-8.17, illustrating the effect thereof in inducing the death of lymphoma;

Fig. 36A is a graph of cell number versus dosage amounts of GZ17-8.18, illustrating the effect thereof in inducing the death of ovarian cancer;

Fig. 36B is a graph of cell number versus dosage amounts of GZ17-8.18, illustrating the effect thereof in inducing the death of lung cancer;

Fig. 36C is a graph of cell number versus dosage amounts of GZ17-8.18, illustrating the effect thereof in inducing the death of prostate cancer;

Fig. 36D is a graph of cell number versus dosage amounts of GZ17-8.18, illustrating the effect thereof in inducing the death of head and neck cancer;

Fig. 36E is a graph of cell number versus dosage amounts of GZ17-8.18, illustrating the effect thereof in inducing the death of breast cancer;

Fig. 36F is a graph of cell number versus dosage amounts of GZ17-8.18, illustrating the effect thereof in inducing the death of leukemia;

Fig. 36G is a graph of cell number versus dosage amounts of GZ17-8.18, illustrating the effect thereof in inducing the death of lymphoma;

Fig. 37A is a graph of cell number versus dosage amounts of GZ17-8.19, illustrating the effect thereof in inducing the death of ovarian cancer;

Fig. 37B is a graph of cell number versus dosage amounts of GZ17-8.19, illustrating the effect thereof in inducing the death of lung cancer;

Fig. 37C is a graph of cell number versus dosage amounts of GZ17-8.19, illustrating the effect thereof in inducing the death of prostate cancer;

Fig. 37D is a graph of cell number versus dosage amounts of GZ17-8.19, illustrating the effect thereof in inducing the death of head and neck cancer;

Fig. 37E is a graph of cell number versus dosage amounts of GZ17-8.19, illustrating the effect thereof in inducing the death of breast cancer;

Fig. 37F is a graph of cell number versus dosage amounts of GZ17-8.19, illustrating the effect thereof in inducing the death of leukemia;

Fig. 37G is a graph of cell number versus dosage amounts of GZ17-8.19, illustrating the effect thereof in inducing the death of lymphoma;

Fig. 38A is a graph of cell number versus dosage amounts of GZ17-8.20, illustrating the effect thereof in inducing the death of ovarian cancer;

Fig. 38B is a graph of cell number versus dosage amounts of GZ17-8.20, illustrating the effect thereof in inducing the death of lung cancer;

Fig. 38C is a graph of cell number versus dosage amounts of GZ17-8.20, illustrating the effect thereof in inducing the death of prostate cancer;

Fig. 38D is a graph of cell number versus dosage amounts of GZ17-8.20, illustrating the effect thereof in inducing the death of head and neck cancer;

Fig. 38E is a graph of cell number versus dosage amounts of GZ17-8.20, illustrating the effect thereof in inducing the death of breast cancer;

Fig. 38F is a graph of cell number versus dosage amounts of GZ17-8.20, illustrating the effect thereof in inducing the death of leukemia;

Fig. 38G is a graph of cell number versus dosage amounts of GZ17-8.20, illustrating the effect thereof in inducing the death of lymphoma;

Fig. 39A is a graph of cell number versus dosage amounts of GZ17-8.21, illustrating the effect thereof in inducing the death of ovarian cancer;

Fig. 39B is a graph of cell number versus dosage amounts of GZ17-8.21, illustrating the effect thereof in inducing the death of lung cancer;

Fig. 39C is a graph of cell number versus dosage amounts of GZ17-8.21, illustrating the effect thereof in inducing the death of prostate cancer;

Fig. 39D is a graph of cell number versus dosage amounts of GZ17-8.21, illustrating the effect thereof in inducing the death of head and neck cancer;

Fig. 39E is a graph of cell number versus dosage amounts of GZ17-8.21, illustrating the effect thereof in inducing the death of breast cancer;

Fig. 39F is a graph of cell number versus dosage amounts of GZ17-8.21, illustrating the effect thereof in inducing the death of leukemia;

Fig. 39G is a graph of cell number versus dosage amounts of GZ17-8.21, illustrating the effect thereof in inducing the death of lymphoma;

Fig. 40A is a graph of cell number versus dosage amounts of GZ17-8.22, illustrating the effect thereof in inducing the death of ovarian cancer;

Fig. 40B is a graph of cell number versus dosage amounts of GZ17-8.22, illustrating the effect thereof in inducing the death of lung cancer;

Fig. 40C is a graph of cell number versus dosage amounts of GZ17-8.22, illustrating the effect thereof in inducing the death of prostate cancer;

Fig. 40D is a graph of cell number versus dosage amounts of GZ17-8.22, illustrating the effect thereof in inducing the death of head and neck cancer;

Fig. 40E is a graph of cell number versus dosage amounts of GZ17-8.22, illustrating the effect thereof in inducing the death of breast cancer;

Fig. 40F is a graph of cell number versus dosage amounts of GZ17-8.22, illustrating the effect thereof in inducing the death of leukemia;

Fig. 40G is a graph of cell number versus dosage amounts of GZ17-8.22, illustrating the effect thereof in inducing the death of lymphoma;

Fig. 41A is a graph of cell number versus dosage amounts of GZ17-8.23, illustrating the effect thereof in inducing the death of ovarian cancer;

Fig. 41B is a graph of cell number versus dosage amounts of GZ17-8.23, illustrating the effect thereof in inducing the death of lung cancer;

Fig. 41C is a graph of cell number versus dosage amounts of GZ17-8.23, illustrating the effect thereof in inducing the death of prostate cancer;

Fig. 41D is a graph of cell number versus dosage amounts of GZ17-8.23, illustrating the effect thereof in inducing the death of head and neck cancer;

Fig. 41E is a graph of cell number versus dosage amounts of GZ17-8.23, illustrating the effect thereof in inducing the death of breast cancer;

Fig. 41F is a graph of cell number versus dosage amounts of GZ17-8.23, illustrating the effect thereof in inducing the death of leukemia;

Fig. 41G is a graph of cell number versus dosage amounts of GZ17-8.23, illustrating the effect thereof in inducing the death of lymphoma;

Fig. 42A is a graph of cell number versus dosage amounts of GZ17-8.24, illustrating the effect thereof in inducing the death of ovarian cancer;

Fig. 42B is a graph of cell number versus dosage amounts of GZ17-8.24, illustrating the effect thereof in inducing the death of lung cancer;

Fig. 42C is a graph of cell number versus dosage amounts of GZ17-8.24, illustrating the effect thereof in inducing the death of prostate cancer;

Fig. 42D is a graph of cell number versus dosage amounts of GZ17-8.24, illustrating the effect thereof in inducing the death of head and neck cancer;

Fig. 42E is a graph of cell number versus dosage amounts of GZ17-8.24, illustrating the effect thereof in inducing the death of breast cancer;

Fig. 42F is a graph of cell number versus dosage amounts of GZ17-8.24, illustrating the effect thereof in inducing the death of leukemia;

Fig. 42G is a graph of cell number versus dosage amounts of GZ17-8.24, illustrating the effect thereof in inducing the death of lymphoma;

Fig. 43A is a graph of cell number versus dosage amounts of GZ17-8.25, illustrating the effect thereof in inducing the death of ovarian cancer;

Fig. 43B is a graph of cell number versus dosage amounts of GZ17-8.25, illustrating the effect thereof in inducing the death of lung cancer;

Fig. 43C is a graph of cell number versus dosage amounts of GZ17-8.25, illustrating the effect thereof in inducing the death of prostate cancer;

Fig. 43D is a graph of cell number versus dosage amounts of GZ17-8.25, illustrating the effect thereof in inducing the death of head and neck cancer;

Fig. 43E is a graph of cell number versus dosage amounts of GZ17-8.25, illustrating the effect thereof in inducing the death of breast cancer;

Fig. 43F is a graph of cell number versus dosage amounts of GZ17-8.25, illustrating the effect thereof in inducing the death of leukemia;

Fig. 43G is a graph of cell number versus dosage amounts of GZ17-8.25, illustrating the effect thereof in inducing the death of lymphoma;

Fig. 44A is a graph of cell number versus dosage amounts of GZ17-8.26, illustrating the effect thereof in inducing the death of ovarian cancer;

Fig. 44B is a graph of cell number versus dosage amounts of GZ17-8.26, illustrating the effect thereof in inducing the death of lung cancer;

Fig. 44C is a graph of cell number versus dosage amounts of GZ17-8.26, illustrating the effect thereof in inducing the death of prostate cancer;

Fig. 44D is a graph of cell number versus dosage amounts of GZ17-8.26, illustrating the effect thereof in inducing the death of head and neck cancer;

Fig. 44E is a graph of cell number versus dosage amounts of GZ17-8.26, illustrating the effect thereof in inducing the death of breast cancer;

Fig. 44F is a graph of cell number versus dosage amounts of GZ17-8.26, illustrating the effect thereof in inducing the death of leukemia;

Fig. 44G is a graph of cell number versus dosage amounts of GZ17-8.26, illustrating the effect thereof in inducing the death of lymphoma;

Fig. 45A is a graph of cell number versus dosage amounts of GZ17-8.27, illustrating the effect thereof in inducing the death of ovarian cancer;

Fig. 45B is a graph of cell number versus dosage amounts of GZ17-8.27, illustrating the effect thereof in inducing the death of lung cancer;

Fig. 45C is a graph of cell number versus dosage amounts of GZ17-8.27, illustrating the effect thereof in inducing the death of prostate cancer;

Fig. 45D is a graph of cell number versus dosage amounts of GZ17-8.27, illustrating the effect thereof in inducing the death of head and neck cancer;

Fig. 45E is a graph of cell number versus dosage amounts of GZ17-8.27, illustrating the effect thereof in inducing the death of breast cancer;

Fig. 45F is a graph of cell number versus dosage amounts of GZ17-8.27, illustrating the effect thereof in inducing the death of leukemia;

Fig. 45G is a graph of cell number versus dosage amounts of GZ17-8.27, illustrating the effect thereof in inducing the death of lymphoma;

Fig. 46A is a graph of cell number versus dosage amounts of GZ17-8.28, illustrating the effect thereof in inducing the death of ovarian cancer;

Fig. 46B is a graph of cell number versus dosage amounts of GZ17-8.28, illustrating the effect thereof in inducing the death of lung cancer;

Fig. 46C is a graph of cell number versus dosage amounts of GZ17-8.28, illustrating the effect thereof in inducing the death of prostate cancer;

Fig. 46D is a graph of cell number versus dosage amounts of GZ17-8.28, illustrating the effect thereof in inducing the death of head and neck cancer;

Fig. 46E is a graph of cell number versus dosage amounts of GZ17-8.28, illustrating the effect thereof in inducing the death of breast cancer;

Fig. 46F is a graph of cell number versus dosage amounts of GZ17-8.28, illustrating the effect thereof in inducing the death of leukemia;

Fig. 46G is a graph of cell number versus dosage amounts of GZ17-8.28, illustrating the effect thereof in inducing the death of lymphoma;

Fig. 47A is a graph of cell number versus dosage amounts of GZ17-8.29, illustrating the effect thereof in inducing the death of ovarian cancer;

Fig. 47B is a graph of cell number versus dosage amounts of GZ17-8.29, illustrating the effect thereof in inducing the death of lung cancer;

Fig. 47C is a graph of cell number versus dosage amounts of GZ17-8.29, illustrating the effect thereof in inducing the death of prostate cancer;

Fig. 47D is a graph of cell number versus dosage amounts of GZ17-8.29, illustrating the effect thereof in inducing the death of head and neck cancer;

Fig. 47E is a graph of cell number versus dosage amounts of GZ17-8.29, illustrating the effect thereof in inducing the death of breast cancer;

Fig. 47F is a graph of cell number versus dosage amounts of GZ17-8.29, illustrating the effect thereof in inducing the death of leukemia;

Fig. 47G is a graph of cell number versus dosage amounts of GZ17-8.29, illustrating the effect thereof in inducing the death of lymphoma;

Fig. 48A is a graph of cell number versus dosage amounts of GZ17-8.30, illustrating the effect thereof in inducing the death of ovarian cancer;

Fig. 48B is a graph of cell number versus dosage amounts of GZ17-8.30, illustrating the effect thereof in inducing the death of lung cancer;

Fig. 48C is a graph of cell number versus dosage amounts of GZ17-8.30, illustrating the effect thereof in inducing the death of prostate cancer;

Fig. 48D is a graph of cell number versus dosage amounts of GZ17-8.30, illustrating the effect thereof in inducing the death of head and neck cancer;

Fig. 48E is a graph of cell number versus dosage amounts of GZ17-8.30, illustrating the effect thereof in inducing the death of breast cancer;

Fig. 48F is a graph of cell number versus dosage amounts of GZ17-8.30, illustrating the effect thereof in inducing the death of leukemia;

Fig. 48G is a graph of cell number versus dosage amounts of GZ17-8.30, illustrating the effect thereof in inducing the death of lymphoma;

Fig. 49A is a graph of cell number versus dosage amounts of GZ17-8.31, illustrating the effect thereof in inducing the death of ovarian cancer;

Fig. 49B is a graph of cell number versus dosage amounts of GZ17-8.31, illustrating the effect thereof in inducing the death of lung cancer;

Fig. 49C is a graph of cell number versus dosage amounts of GZ17-8.31, illustrating the effect thereof in inducing the death of lymphoma;

Fig. 49D is a graph of cell number versus dosage amounts of GZ17-8.31, illustrating the effect thereof in inducing the death of leukemia;

Fig. 50A is a graph of cell number versus dosage amounts of GZ17-8.32, illustrating the effect thereof in inducing the death of ovarian cancer;

Fig. 50B is a graph of cell number versus dosage amounts of GZ17-8.32, illustrating the effect thereof in inducing the death of lung cancer;

Fig. 50C is a graph of cell number versus dosage amounts of GZ17-8.32, illustrating the effect thereof in inducing the death of lymphoma;

Fig. 50D is a graph of cell number versus dosage amounts of GZ17-8.32, illustrating the effect thereof in inducing the death of leukemia;

Fig. 51A is a graph of cell number versus dosage amounts of GZ17-8.33, illustrating the effect thereof in inducing the death of ovarian cancer;

Fig. 51B is a graph of cell number versus dosage amounts of GZ17-8.33, illustrating the effect thereof in inducing the death of lung cancer;

Fig. 51C is a graph of cell number versus dosage amounts of GZ17-8.33, illustrating the effect thereof in inducing the death of lymphoma;

Fig. 51D is a graph of cell number versus dosage amounts of GZ17-8.33, illustrating the effect thereof in inducing the death of leukemia;

Fig. 52A is a graph of cell number versus dosage amounts of GZ17-8.34, illustrating the effect thereof in inducing the death of ovarian cancer;

Fig. 52B is a graph of cell number versus dosage amounts of GZ17-8.34, illustrating the effect thereof in inducing the death of lung cancer;

Fig. 52C is a graph of cell number versus dosage amounts of GZ17-8.34, illustrating the effect thereof in inducing the death of lymphoma;

Fig. 52D is a graph of cell number versus dosage amounts of GZ17-8.34, illustrating the effect thereof in inducing the death of leukemia;

Fig. 53A is a graph of cell number versus dosage amounts of GZ17-8.35, illustrating the effect thereof in inducing the death of ovarian cancer;

Fig. 53B is a graph of cell number versus dosage amounts of GZ17-8.35, illustrating the effect thereof in inducing the death of lung cancer;

Fig. 53C is a graph of cell number versus dosage amounts of GZ17-8.35, illustrating the effect thereof in inducing the death of lymphoma;

Fig. 53D is a graph of cell number versus dosage amounts of GZ17-8.35, illustrating the effect thereof in inducing the death of leukemia;

Fig. 54A is a graph of cell number versus dosage amounts of GZ17-8.36, illustrating the effect thereof in inducing the death of ovarian cancer;

Fig. 54B is a graph of cell number versus dosage amounts of GZ17-8.36, illustrating the effect thereof in inducing the death of lung cancer;

Fig. 54C is a graph of cell number versus dosage amounts of GZ17-8.36, illustrating the effect thereof in inducing the death of lymphoma;

Fig. 54D is a graph of cell number versus dosage amounts of GZ17-8.36, illustrating the effect thereof in inducing the death of leukemia;

Fig. 55A is a graph of cell number versus dosage amounts of GZ17-8.37, illustrating the effect thereof in inducing the death of ovarian cancer;

Fig. 55B is a graph of cell number versus dosage amounts of GZ17-8.37, illustrating the effect thereof in inducing the death of lung cancer;

Fig. 55C is a graph of cell number versus dosage amounts of GZ17-8.37, illustrating the effect thereof in inducing the death of lymphoma;

Fig. 55D is a graph of cell number versus dosage amounts of GZ17-8.37, illustrating the effect thereof in inducing the death of leukemia;

Fig. 56A is a graph of cell number versus dosage amounts of GZ17-8.38, illustrating the effect thereof in inducing the death of ovarian cancer;

Fig. 56B is a graph of cell number versus dosage amounts of GZ17-8.38, illustrating the effect thereof in inducing the death of lung cancer;

Fig. 56C is a graph of cell number versus dosage amounts of GZ17-8.38, illustrating the effect thereof in inducing the death of lymphoma;

Fig. 56D is a graph of cell number versus dosage amounts of GZ17-8.38, illustrating the effect thereof in inducing the death of leukemia;

Fig. 57A is a graph of cell number versus dosage amounts of GZ17-8.39, illustrating the effect thereof in inducing the death of ovarian cancer;

Fig. 57B is a graph of cell number versus dosage amounts of GZ17-8.39, illustrating the effect thereof in inducing the death of lung cancer;

Fig. 57C is a graph of cell number versus dosage amounts of GZ17-8.39, illustrating the effect thereof in inducing the death of lymphoma;

Fig. 57D is a graph of cell number versus dosage amounts of GZ17-8.39, illustrating the effect thereof in inducing the death of leukemia;

Fig. 58A is a graph of cell number versus dosage amounts of GZ17-8.40, illustrating the effect thereof in inducing the death of ovarian cancer;

Fig. 58B is a graph of cell number versus dosage amounts of GZ17-8.40, illustrating the effect thereof in inducing the death of lung cancer;

Fig. 58C is a graph of cell number versus dosage amounts of GZ17-8.40, illustrating the effect thereof in inducing the death of lymphoma;

Fig. 58D is a graph of cell number versus dosage amounts of GZ17-8.40, illustrating the effect thereof in inducing the death of leukemia;

Fig. 59A is a graph of cell number versus dosage amounts of GZ17-8.41, illustrating the effect thereof in inducing the death of ovarian cancer;

Fig. 59B is a graph of cell number versus dosage amounts of GZ17-8.41, illustrating the effect thereof in inducing the death of lung cancer;

Fig. 59C is a graph of cell number versus dosage amounts of GZ17-8.41, illustrating the effect thereof in inducing the death of lymphoma;

Fig. 59D is a graph of cell number versus dosage amounts of GZ17-8.41, illustrating the effect thereof in inducing the death of leukemia;

Fig. 60A is a graph of cell number versus dosage amounts of GZ17-8.42, illustrating the effect thereof in inducing the death of ovarian cancer;

Fig. 60B is a graph of cell number versus dosage amounts of GZ17-8.42, illustrating the effect thereof in inducing the death of lung cancer;

Fig. 60C is a graph of cell number versus dosage amounts of GZ17-8.42, illustrating the effect thereof in inducing the death of lymphoma;

Fig. 60D is a graph of cell number versus dosage amounts of GZ17-8.42, illustrating the effect thereof in inducing the death of leukemia;

Fig. 61A is a graph of cell number versus dosage amounts of GZ17-8.43, illustrating the effect thereof in inducing the death of ovarian cancer;

Fig. 61B is a graph of cell number versus dosage amounts of GZ17-8.43, illustrating the effect thereof in inducing the death of lung cancer;

Fig. 61C is a graph of cell number versus dosage amounts of GZ17-8.43, illustrating the effect thereof in inducing the death of lymphoma;

Fig. 61D is a graph of cell number versus dosage amounts of GZ17-8.43, illustrating the effect thereof in inducing the death of leukemia;

Fig. 62A is a graph of cell number versus dosage amounts of GZ17-8.44, illustrating the effect thereof in inducing the death of ovarian cancer;

Fig. 62B is a graph of cell number versus dosage amounts of GZ17-8.44, illustrating the effect thereof in inducing the death of lung cancer;

Fig. 62C is a graph of cell number versus dosage amounts of GZ17-8.44, illustrating the effect thereof in inducing the death of lymphoma;

Fig. 62D is a graph of cell number versus dosage amounts of GZ17-8.44, illustrating the effect thereof in inducing the death of leukemia;

Fig. 63A is a graph of cell number versus dosage amounts of GZ17-8.45, illustrating the effect thereof in inducing the death of ovarian cancer;

Fig. 63B is a graph of cell number versus dosage amounts of GZ17-8.45, illustrating the effect thereof in inducing the death of lung cancer;

Fig. 63C is a graph of cell number versus dosage amounts of GZ17-8.45, illustrating the effect thereof in inducing the death of lymphoma;

Fig. 63D is a graph of cell number versus dosage amounts of GZ17-8.45, illustrating the effect thereof in inducing the death of leukemia;

Fig. 64A is a graph of cell number versus dosage amounts of GZ17-8.46, illustrating the effect thereof in inducing the death of ovarian cancer;

Fig. 64B is a graph of cell number versus dosage amounts of GZ17-8.46, illustrating the effect thereof in inducing the death of lung cancer;

Fig. 64C is a graph of cell number versus dosage amounts of GZ17-8.46, illustrating the effect thereof in inducing the death of lymphoma;

Fig. 64D is a graph of cell number versus dosage amounts of GZ17-8.46, illustrating the effect thereof in inducing the death of leukemia;

Fig. 65A is a graph of cell number versus dosage amounts of GZ17-8.47, illustrating the effect thereof in inducing the death of ovarian cancer;

Fig. 65B is a graph of cell number versus dosage amounts of GZ17-8.47, illustrating the effect thereof in inducing the death of lung cancer;

Fig. 65C is a graph of cell number versus dosage amounts of GZ17-8.47, illustrating the effect thereof in inducing the death of lymphoma;

Fig. 65D is a graph of cell number versus dosage amounts of GZ17-8.47, illustrating the effect thereof in inducing the death of leukemia;

Fig. 66A is a graph of cell number versus dosage amounts of GZ17-8.48, illustrating the effect thereof in inducing the death of ovarian cancer;

Fig. 66B is a graph of cell number versus dosage amounts of GZ17-8.48, illustrating the effect thereof in inducing the death of lung cancer;

Fig. 66C is a graph of cell number versus dosage amounts of GZ17-8.48, illustrating the effect thereof in inducing the death of lymphoma;

Fig. 66D is a graph of cell number versus dosage amounts of GZ17-8.48, illustrating the effect thereof in inducing the death of leukemia;

Fig. 67A is a graph of cell number versus dosage amounts of GZ17-8.49, illustrating the effect thereof in inducing the death of ovarian cancer;

Fig. 67B is a graph of cell number versus dosage amounts of GZ17-8.49, illustrating the effect thereof in inducing the death of lung cancer;

Fig. 67C is a graph of cell number versus dosage amounts of GZ17-8.49, illustrating the effect thereof in inducing the death of lymphoma;

Fig. 67D is a graph of cell number versus dosage amounts of GZ17-8.49, illustrating the effect thereof in inducing the death of leukemia;

Fig. 68A is a graph of cell number versus dosage amounts of GZ17-8.50, illustrating the effect thereof in inducing the death of ovarian cancer;

Fig. 68B is a graph of cell number versus dosage amounts of GZ17-8.50, illustrating the effect thereof in inducing the death of lung cancer;

Fig. 68C is a graph of cell number versus dosage amounts of GZ17-8.50, illustrating the effect thereof in inducing the death of lymphoma;

Fig. 68D is a graph of cell number versus dosage amounts of GZ17-8.50, illustrating the effect thereof in inducing the death of leukemia;

Fig. 69A is a graph of cell number versus dosage amounts of GZ17-8.51, illustrating the effect thereof in inducing the death of ovarian cancer;

Fig. 69B is a graph of cell number versus dosage amounts of GZ17-8.51, illustrating the effect thereof in inducing the death of lung cancer;

Fig. 69C is a graph of cell number versus dosage amounts of GZ17-8.51, illustrating the effect thereof in inducing the death of lymphoma;

Fig. 69D is a graph of cell number versus dosage amounts of GZ17-8.51, illustrating the effect thereof in inducing the death of leukemia;

Fig. 70A is a graph of cell number versus dosage amounts of GZ17-8.52, illustrating the effect thereof in inducing the death of ovarian cancer;

Fig. 70B is a graph of cell number versus dosage amounts of GZ17-8.52, illustrating the effect thereof in inducing the death of lung cancer;

Fig. 70C is a graph of cell number versus dosage amounts of GZ17-8.52, illustrating the effect thereof in inducing the death of lymphoma;

Fig. 70D is a graph of cell number versus dosage amounts of GZ17-8.52, illustrating the effect thereof in inducing the death of leukemia;

Fig. 71A is a graph of cell number versus dosage amounts of GZ17-8.53, illustrating the effect thereof in inducing the death of ovarian cancer;

Fig. 71B is a graph of cell number versus dosage amounts of GZ17-8.53, illustrating the effect thereof in inducing the death of lung cancer;

Fig. 71C is a graph of cell number versus dosage amounts of GZ17-8.53, illustrating the effect thereof in inducing the death of lymphoma;

Fig. 71D is a graph of cell number versus dosage amounts of GZ17-8.53, illustrating the effect thereof in inducing the death of leukemia;

Fig. 72A is a graph of cell number versus dosage amounts of GZ17-8.54, illustrating the effect thereof in inducing the death of ovarian cancer;

Fig. 72B is a graph of cell number versus dosage amounts of GZ17-8.54, illustrating the effect thereof in inducing the death of lung cancer;

Fig. 72C is a graph of cell number versus dosage amounts of GZ17-8.54, illustrating the effect thereof in inducing the death of lymphoma;

Fig. 72D is a graph of cell number versus dosage amounts of GZ17-8.54, illustrating the effect thereof in inducing the death of leukemia;

Fig. 73A is a graph of cell number versus dosage amounts of GZ17-8.55, illustrating the effect thereof in inducing the death of ovarian cancer;

Fig. 73B is a graph of cell number versus dosage amounts of GZ17-8.55, illustrating the effect thereof in inducing the death of lung cancer;

Fig. 73C is a graph of cell number versus dosage amounts of GZ17-8.55, illustrating the effect thereof in inducing the death of lymphoma;

Fig. 73D is a graph of cell number versus dosage amounts of GZ17-8.55, illustrating the effect thereof in inducing the death of leukemia;

Fig. 74A is a graph of cell number versus dosage amounts of GZ17-8.56, illustrating the effect thereof in inducing the death of ovarian cancer;

Fig. 74B is a graph of cell number versus dosage amounts of GZ17-8.56, illustrating the effect thereof in inducing the death of lung cancer;

Fig. 74C is a graph of cell number versus dosage amounts of GZ17-8.56, illustrating the effect thereof in inducing the death of lymphoma;

Fig. 74D is a graph of cell number versus dosage amounts of GZ17-8.56, illustrating the effect thereof in inducing the death of leukemia;

Fig. 75A is a graph of cell number versus dosage amounts of GZ17-8.57, illustrating the effect thereof in inducing the death of ovarian cancer;

Fig. 75B is a graph of cell number versus dosage amounts of GZ17-8.57, illustrating the effect thereof in inducing the death of lung cancer;

Fig. 75C is a graph of cell number versus dosage amounts of GZ17-8.57, illustrating the effect thereof in inducing the death of lymphoma;

Fig. 75D is a graph of cell number versus dosage amounts of GZ17-8.57, illustrating the effect thereof in inducing the death of leukemia;

Fig. 76A is a graph of cell number versus dosage amounts of GZ17-8.58, illustrating the effect thereof in inducing the death of ovarian cancer;

Fig. 76B is a graph of cell number versus dosage amounts of GZ17-8.58, illustrating the effect thereof in inducing the death of lung cancer;

Fig. 76C is a graph of cell number versus dosage amounts of GZ17-8.58, illustrating the effect thereof in inducing the death of lymphoma;

Fig. 76D is a graph of cell number versus dosage amounts of GZ17-8.58, illustrating the effect thereof in inducing the death of leukemia;

Fig. 77A is a graph of cell number versus dosage amounts of GZ17-8.59, illustrating the effect thereof in inducing the death of ovarian cancer;

Fig. 77B is a graph of cell number versus dosage amounts of GZ17-8.59, illustrating the effect thereof in inducing the death of lung cancer;

Fig. 77C is a graph of cell number versus dosage amounts of GZ17-8.59, illustrating the effect thereof in inducing the death of lymphoma;

Fig. 77D is a graph of cell number versus dosage amounts of GZ17-8.59, illustrating the effect thereof in inducing the death of leukemia;

Fig. 78A is a graph of cell number versus dosage amounts of GZ17-8.60, illustrating the effect thereof in inducing the death of ovarian cancer;

Fig. 78B is a graph of cell number versus dosage amounts of GZ17-8.60, illustrating the effect thereof in inducing the death of lung cancer;

Fig. 78C is a graph of cell number versus dosage amounts of GZ17-8.60, illustrating the effect thereof in inducing the death of lymphoma;

Fig. 78D is a graph of cell number versus dosage amounts of GZ17-8.60, illustrating the effect thereof in inducing the death of leukemia;

Fig. 79A is a graph of cell number versus dosage amounts of GZ17-8.61, illustrating the effect thereof in inducing the death of ovarian cancer;

Fig. 79B is a graph of cell number versus dosage amounts of GZ17-8.61, illustrating the effect thereof in inducing the death of lung cancer;

Fig. 79C is a graph of cell number versus dosage amounts of GZ17-8.61, illustrating the effect thereof in inducing the death of lymphoma;

Fig. 79D is a graph of cell number versus dosage amounts of GZ17-8.61, illustrating the effect thereof in inducing the death of leukemia;

Fig. 80A is a graph of cell number versus dosage amounts of GZ17-10.04, illustrating the effect thereof in inducing the death of ovarian cancer;

Fig. 80B is a graph of cell number versus dosage amounts of GZ17-10.05, illustrating the effect thereof in inducing the death of ovarian cancer;

Fig. 80C is a graph of cell number versus dosage amounts of GZ17-10.06, illustrating the effect thereof in inducing the death of ovarian cancer;

Fig. 80D is a graph of cell number versus dosage amounts of GZ17-10.04, illustrating the effect thereof in inducing the death of lymphoma;

Fig. 80E is a graph of cell number versus dosage amounts of GZ17-10.05, illustrating the effect thereof in inducing the death of lymphoma;

Fig. 80F is a graph of cell number versus dosage amounts of GZ17-10.06, illustrating the effect thereof in inducing the death of lymphoma;

Fig. 80G is a comparative bar graph illustrating the comparative lymphoma cell-killing effect of the individual components, GZ17-10.04-10.06, versus the theoretical additive effect of these components, and the actual effect thereof, demonstrating the synergism of the three-component composition;

Fig. 80H is a comparative bar graph illustrating the comparative lymphoma cell-killing effect of the individual components, GZ17-10.04 and10.06, versus the theoretical additive effect of these components, and the actual effect thereof, demonstrating the synergism of the three-component composition;

Fig. 80I is a graph of cell number versus dosage amounts of GZ17-10.04, illustrating the effect thereof in inducing the death of leukemia;

Fig. 80J is a graph of cell number versus dosage amounts of GZ17-10.05, illustrating the effect thereof in inducing the death of leukemia;

Fig. 80K is a graph of cell number versus dosage amounts of GZ17-10.06, illustrating the effect thereof in inducing the death of leukemia;

Fig. 80L is a comparative bar graph illustrating the comparative leukemia cell-killing effect of the individual components, GZ17-10.04-10.06, versus the theoretical additive effect of these components, and the actual effect thereof, demonstrating the synergism of the three-component composition;

Fig. 80M is a comparative bar graph illustrating the comparative leukemia cell-killing effect of the individual components, GZ17-10.04 and 10.06, versus the theoretical additive effect of these components, and the actual effect thereof, demonstrating the synergism of the three-component composition;

Fig. 80N is a graph of cell number versus dosage amounts of GZ17-10.04, illustrating the effect thereof in inducing the death of breast cancer;

Fig. 80O is a graph of cell number versus dosage amounts of GZ17-10.05, illustrating the effect thereof in inducing the death of breast cancer;

Fig. 80P is a graph of cell number versus dosage amounts of GZ17-10.06, illustrating the effect thereof in inducing the death of breast cancer;

Fig. 80Q is a comparative bar graph illustrating the comparative breast cancer cell-killing effect of the individual components, GZ17-10.04-10.06, versus the theoretical additive effect of these components, and the actual effect thereof, demonstrating the synergism of the three-component composition;

Fig. 80R is a comparative bar graph illustrating the comparative breast cancer cell-killing effect of the individual components, GZ17-10.04 and 10.06, versus the theoretical additive effect of these components, and the actual effect thereof, demonstrating the synergism of the three-component composition;

Fig. 81A is a graph of cell number versus dosage amounts of GZ17-08.512, illustrating the effect thereof in inducing the death of ovarian cancer;

Fig. 81B is a graph of cell number versus dosage amounts of GZ17-08.512, illustrating the effect thereof in inducing the death of lymphoma;

Fig. 81C is a graph of cell number versus dosage amounts of GZ17-08.512, illustrating the effect thereof in inducing the death of head and neck cancer;

Fig. 81D is a graph of cell number versus dosage amounts of GZ17-08.513, illustrating the effect thereof in inducing the death of ovarian cancer;

Fig. 81E is a graph of cell number versus dosage amounts of GZ17-08.513, illustrating the effect thereof in inducing the death of lymphoma;

Fig. 81F is a graph of cell number versus dosage amounts of GZ17-08.513, illustrating the effect thereof in inducing the death of head and neck cancer;

Fig. 81G is a graph of cell number versus dosage amounts of GZ17-08.514, illustrating the effect thereof in inducing the death of ovarian cancer;

Fig. 81H is a graph of cell number versus dosage amounts of GZ17-08.514, illustrating the effect thereof in inducing the death of lymphoma;

Fig. 81I is a graph of cell number versus dosage amounts of GZ17-08.514, illustrating the effect thereof in inducing the death of head and neck cancer;

Fig. 81J is a graph of cell number versus dosage amounts of GZ17-08.515, illustrating the effect thereof in inducing the death of ovarian cancer;

Fig. 81K is a graph of cell number versus dosage amounts of GZ17-08.515, illustrating the effect thereof in inducing the death of lymphoma;

Fig. 81L is a graph of cell number versus dosage amounts of GZ17-08.515, illustrating the effect thereof in inducing the death of head and neck cancer;

Fig. 81M is a graph of cell number versus dosage amounts of GZ17-08.516, illustrating the effect thereof in inducing the death of ovarian cancer;

Fig. 81N is a graph of cell number versus dosage amounts of GZ17-08.516, illustrating the effect thereof in inducing the death of lymphoma;

Fig. 81O is a graph of cell number versus dosage amounts of GZ17-08.516, illustrating the effect thereof in inducing the death of head and neck cancer;

Fig. 81P is a graph of cell number versus dosage amounts of GZ17-08.517, illustrating the effect thereof in inducing the death of ovarian cancer;

Fig. 81Q is a graph of cell number versus dosage amounts of GZ17-08.517, illustrating the effect thereof in inducing the death of lymphoma;

Fig. 81R is a graph of cell number versus dosage amounts of GZ17-08.517, illustrating the effect thereof in inducing the death of head and neck cancer;

Fig. 81S is a graph of cell number versus dosage amounts of GZ17-08.518, illustrating the effect thereof in inducing the death of ovarian cancer;

Fig. 81T is a graph of cell number versus dosage amounts of GZ17-08.518, illustrating the effect thereof in inducing the death of lymphoma;

Fig. 81U is a graph of cell number versus dosage amounts of GZ17-08.518, illustrating the effect thereof in inducing the death of head and neck cancer;

Fig. 81V is a graph of cell number versus dosage amounts of GZ17-08.519, illustrating the effect thereof in inducing the death of ovarian cancer;

Fig. 81W is a graph of cell number versus dosage amounts of GZ17-08.519, illustrating the effect thereof in inducing the death of lymphoma;

Fig. 81X is a graph of cell number versus dosage amounts of GZ17-08.519, illustrating the effect thereof in inducing the death of head and neck cancer;

Fig. 81Y is a graph of cell number versus dosage amounts of GZ17-08.520, illustrating the effect thereof in inducing the death of ovarian cancer;

Fig. 81Z is a graph of cell number versus dosage amounts of GZ17-08.520, illustrating the effect thereof in inducing the death of lymphoma;

Fig. 81AA is a graph of cell number versus dosage amounts of GZ17-08.520, illustrating the effect thereof in inducing the death of head and neck cancer;

Fig. 81BB is a graph of cell number versus dosage amounts of GZ17-08.521, illustrating the effect thereof in inducing the death of ovarian cancer;

Fig. 81CC is a graph of cell number versus dosage amounts of GZ17-08.521, illustrating the effect thereof in inducing the death of lymphoma; and

Fig. 81DD is a graph of cell number versus dosage amounts of GZ17-08.521, illustrating the effect thereof in inducing the death of head and neck cancer.

DETAILED DESCRIPTION

The therapeutic agents of the invention are used in therapeutically effective amounts, i.e., amounts that will elicit the biological or medical response of a tissue, system, or subject that is being sought, and in particular to elicit some desired therapeutic effect against a variety of human diseases, and especially cancers; in the case of cancers, the agents operate by preventing and/or inhibiting proliferation and/or survival of cancerous cells, and/or by slowing the progression of cancers. Those skilled in the art recognize that an amount may be considered therapeutically effective even if the condition is not totally eradicated or prevented, but it or its symptoms and/or effects are improved or alleviated partially in the subject. Of course, the appropriate makeup of the agents hereof and dosing regimens using such agents will depend on the particular cancer being treated, the extent of the disease, and other factors related to the patient as determined by those skilled in the art. Hence, the terms "therapeutic" or "treat," as used herein, refer to products or processes in accordance with the invention that are intended to produce a beneficial change in an existing condition (e.g., cancerous tissue, tumor size, metastases, etc.) of a subject, such as by reducing the severity of the clinical symptoms and/or effects of the condition, and/or reducing the duration of the symptoms/effects of a subject.

Additional ingredients may be included with the chemotherapeutic agents of the invention for administration to the subject. Such additional ingredients include, other active agents, preservatives, buffering agents, salts, carriers, excipients, diluents, or other pharmaceutically-acceptable ingredients. The active agents that could be included in the compositions include antiviral, antibiotic, or other anticancer compounds.

The combined therapeutic agents of the invention preferably give synergistic results, which are entirely unexpected. Moreover, the lack of side effects when the agents are administered to patients is quite surprising and essentially unique. As used herein, the terms "combination" or "in combination" are intended to embrace compositions wherein the components are physically intermixed as dosage forms, and to situations where the individual components are separately administered to a subject over relatively short periods of time, which would have the same therapeutic effects as a single dosage form.

In use, a therapeutically effective amount of an agent in accordance with the invention is administered to a subject in need thereof. Such may comprise a single unit dosage or, more usually, periodic (e.g., daily) administration of lower dosages over time. Advantageously, administration of such therapeutically effective amounts achieves an unexpected therapeutic synergy. This means that the therapeutic two- or three-component compositions of the invention exhibit a joint action where one or more of the components supplements or enhances the action of at least one of the other components to produce an effect greater than that which may be obtained by use of individual components in equivalent quantities, or produce effects that could not be obtained with safe quantities of the other components, individually or in combination. Generally, one or more of the components working together produce an effect greater than the sum of their individual effects.

The dosages may be administered in any convenient manner, such as by oral, rectal, nasal, ophthalmic, parenteral (including intraperitoneal, gastrointestinal, intrathecal, intravenous, cutaneous (e.g., dermal patch), subcutaneous (e.g. injection or implant), or intramuscular) administrations. The dosage forms of the invention may be in the form of liquids, gels, suspensions, solutions, or solids (e.g., tablets, pills, or capsules). Moreover, therapeutically effective amounts of the agents of the invention may be co-administered with other chemotherapeutic agent(s), where the two products are administered substantially simultaneously or in any sequential manner.

Additional advantages of the various embodiments of the invention will be apparent to those skilled in the art upon review of the disclosure herein and the working examples below. It will be appreciated that the various embodiments described herein are not necessarily mutually exclusive unless otherwise indicated herein. For example, a feature described or depicted in one embodiment may also be included in other embodiments, but is not necessarily included. Thus, the present invention encompasses a variety of combinations and/or integrations of the specific embodiments described herein.

As used herein, the phrase "and/or," when used in a list of two or more items, means that any one of the listed items can be employed by itself or any combination of two or more of the listed items can be employed. For example, if a composition is described as containing or excluding components A, B, and/or C, the composition can contain or exclude A alone; B alone; C alone; A and B in combination; A and C in combination; B and C in combination; or A, B, and C in combination.

The present description also uses numerical ranges to quantify certain parameters relating to various embodiments of the invention. It should be understood that when numerical ranges are provided, such ranges are to be construed as providing literal support for claim limitations that only recite the lower value of the range as well as claim limitations that only recite the upper value of the range. For example, a disclosed numerical range of about 10 to about 100 provides literal support for a claim reciting "greater than about 10" (with no upper bounds) and a claim reciting "less than about 100" (with no lower bounds).

In the ensuing discussion, the curcumin, harmine, and isovanillin component(s) will be individually described. In such discussions, where terms are used which specify or imply the presence of carbon-carbon chains (e.g., alkyl, alkenyl, alkoxy, alkyl amine, alkenyl amine, aldehyde, carboxylate, or the like), these disclosures should be understood to refer to primary (straight), branched chain, or cyclic carbon chain groups. Moreover, unless indicated otherwise, reference to aryl groups means phenyl, substituted phenyl, napthyl, substituted napthyl; and heteroatom aryl groups refers to aryl groups containing a nitrogen, oxygen, boron, or sulfur atom, such as pyridine; heterocyclic groups refers to cyclic groups containing from 3-7 atoms, one or more of which is a nitrogen, oxygen, boron, or sulfur heteroatom; and amine refers to primary, secondary, tertiary, or quaternary amines.

As used herein, pharmaceutically acceptable salts with reference to the components means salts of the component compounds of the present invention which are pharmaceutically acceptable, i.e., salts which are useful in preparing pharmaceutical compositions that are generally safe, non-toxic, and neither biologically nor otherwise undesirable and are acceptable for human pharmaceutical use, and which possess the desired degree of pharmacological activity. Such pharmaceutically acceptable salts include acid addition salts formed with inorganic acids such as hydrochloric acid, hydrobromic acid, sulfuric acid, nitric acid, phosphoric acid, and the like; or with organic acids such as 1,2-ethanedisulfonic acid, 2-hydroxyethanesulfonic acid, 2-naphthalenesulfonic acid, 3-phenylpropionic acid, 4,4'-methylenebis(3-hydroxy-2-ene-1-carboxylic acid), 4-methylbicyclo[2.2.2]oct-2-ene-1-carboxylic acid, acetic acid, aliphatic mono- and dicarboxylic acids, aliphatic sulfuric acids, aromatic sulfuric acids, benzenesulfonic acid, benzoic acid, camphorsulfonic acid, carbonic acid, cinnamic acid, citric acid, cyclopentanepropionic acid, ethanesulfonic acid, fumaric acid, glucoheptonic acid, gluconic acid, glutamic acid, glycolic acid, heptanoic acid, hexanoic acid, hydroxynaphthoic acid, lactic acid, laurylsulfuric acid, maleic acid, malic acid, malonic acid, mandelic acid, methanesulfonic acid, muconic acid, o-(4-hydroxybenzoyl)benzoic acid, oxalic acid, p-chlorobenzenesulfonic acid, phenyl-substituted alkanoic acids, propionic acid, p-toluenesulfonic acid, pyruvic acid, salicylic acid, stearic acid, succinic acid, tartaric acid, tertiarybutylacetic acid, trimethylacetic acid, and the like. Pharmaceutically acceptable salts also include base addition salts which may be formed when acidic protons present are capable of reacting with inorganic or organic bases. Acceptable inorganic bases include sodium hydroxide, sodium carbonate, potassium hydroxide, aluminum hydroxide and calcium hydroxide. Acceptable organic bases include ethanolamine, diethanolamine, triethanolamine, tromethamine, N-methylglucamine and the like. It should be recognized that the particular anion or cation forming a part of any salt of this invention is not critical, so long as the salt, as a whole, is pharmacologically acceptable. Additional examples of pharmaceutically acceptable salts and their methods of preparation and use are presented in *Handbook of Pharmaceutical Salts Properties, and Use*, P. H. Stahl & C. G. Wermuth eds., ISBN 978-3-90639-058-1 (2008).

As noted below, the curcumin, harmine, and isovanillin component(s) may be obtained as synthetic compounds of high purity, or from modified naturally occurring sources. In either case,

however, it is preferred that the component(s) be purified to a level of at least about 50% by weight, more preferably at least about 70% by weight, still more preferably at least about 90% by weight, and most preferably at least about 98% by weight.

The individual discussions of the component(s) contain structural formulas. In order to be entirely clear, curcumin-based formulas are indicated "C-number," (not to be confused with carbon chain numbers, which are indicated as "Cnumber," without an intervening hyphen), harmine-based formulas are indicated as "H-number," and isovanillin-based formulas are indicated as "I-number."

Before discussing the individual components of the invention, it should be understood that use of unmodified, naturally occurring sources of the components is generally not appropriate or desirable, because these naturally occurring products contain relatively small amounts of the desired components and/or have potentially interfering compounds therein. For example, naturally occurring turmeric has only approximately 2-3% by weight curcumin therein and accordingly the straightforward use of unmodified turmeric would not be suitable for the invention. In like manner, naturally occurring harmala seed contains only a very minor amount of harmine and such a product would also be inappropriate.

Thus, the preferred components of the invention are either synthetically derived or derived from one or more naturally occurring product(s) which have been significantly modified so as to contain at least about 25% by weight (more preferably at least about 50% by weight, and still more preferably about 70% by weight) of the desired component. As used herein, "synthetically derived" means that the component in question was synthesized using specific starting ingredients and one or more chemical and/or biological reactions to obtain substantially pure compounds. Modification of naturally occurring products may involve extractions, or any other physical or chemical steps to achieve the desired end product, e.g., harmine components may be obtained from treatment of harmala seed, or curcumin components may be obtained from treatment of turmeric.

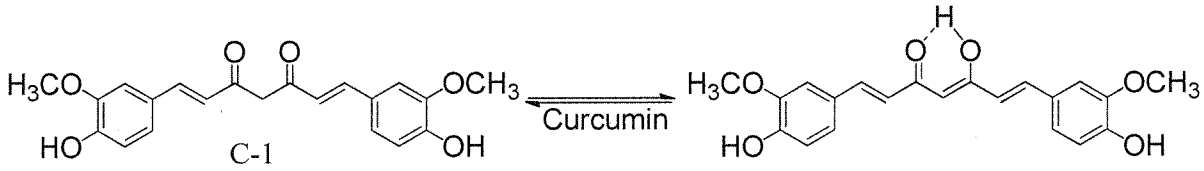
For example, curcumin can be synthetically derived to a high degree of purity. Alternately, curcumin can be obtained by extraction or other treatment of naturally occurring turmeric so that the curcumin content of the modified turmeric has the above-noted levels of curcumin therein.

The Curcumin Component(s)

As used herein, "curcumin component(s)" shall mean curcumin, its metabolites and derivatives, isomers and tautomers thereof, esters, metal complexes (e.g., Cu, Fe, Zn, Pt, V), and pharmaceutically acceptable salts of any of the foregoing. Curcumin derivatives include both naturally occurring and synthetic derivatives, e.g., the spontaneous degradation products of curcumin, curcumin metabolites, and synthetic curcumin derivative compounds.

1. Curcumin.

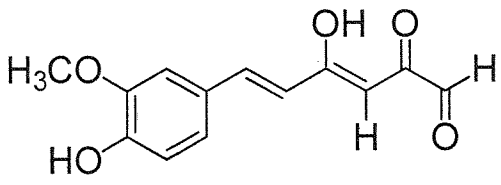
Curcumin (diferuloylmethane, 1,7-bis(4-hydroxy3-mcthoxyphenyl)-1,6-heptadiene-3,5-dione) is a symmetrical diphenolic dienone, see structure C-1 below. It exists in solution as an equilibrium mixture of the symmetrical dienone (diketo) and the keto-enol tautomer; the keto-enol form is strongly favored by intramolecular hydrogen bonding.



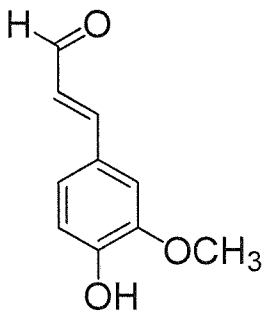
Curcumin contains two aryl rings separated by an unsaturated 7-carbon linker having a symmetrical β-diketone group (as used herein, "β-diketone" embraces both tautomeric forms, namely the diketo and enol forms). The aryl rings of curcumin contain a hydroxyl group in the para position and a methoxy group in the *meta* position.

2. Degradation Products of Curcumin.

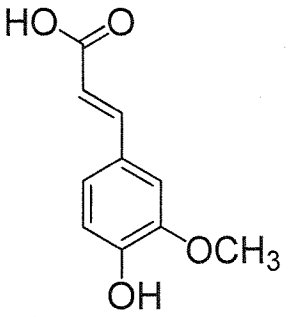
It is known that, under certain pH and other conditions, curcumin will spontaneously form degradation products, and especially one or more of the following:



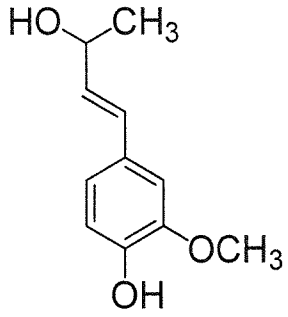
Trans-6-(4'-hydroxy-3'-methoxyphenyl)-2,4-dioxo-5-hexenal
C-2



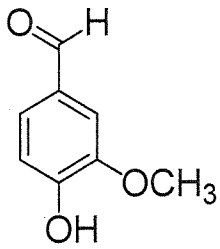
Ferulic aldehyde
C-3



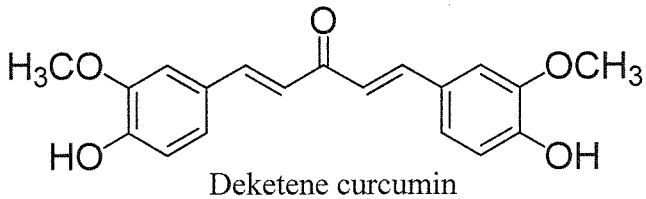
Ferulic acid C-4



Feruloyl methane C-5



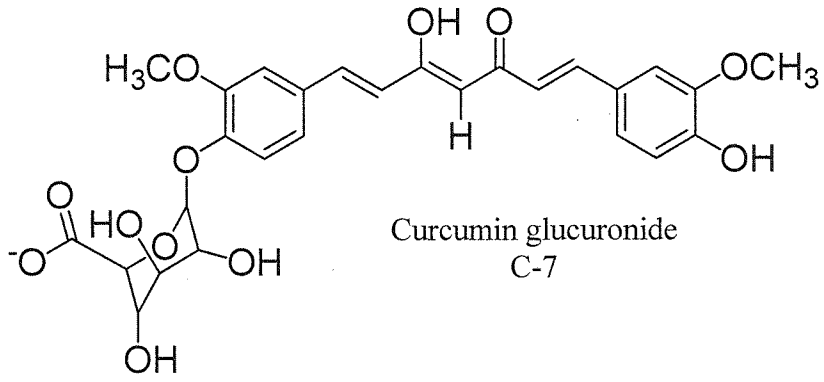
Vanillin C-6



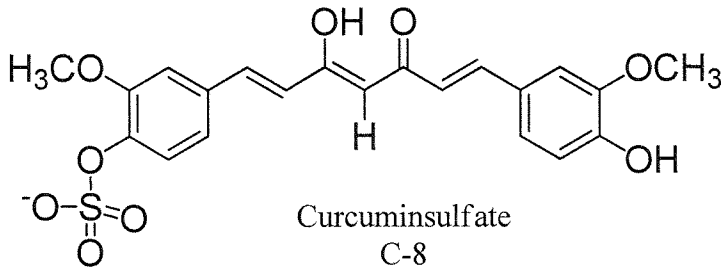
Deketene curcumin C-47

3. Curcumin Metabolites

It has been determined that curcumin is differently metabolized *in vivo* depending upon the route of administration, *see*, Shen et al. *The Pharmacology of Curcumin: Is it the Degradation Products?* Trends in Molecular Medicine, March 2012 **Vol.** 18, **No.** 2, incorporated by reference herein it its entirety. Thus, when curcumin is orally administered, the metabolites normally include one or more of the following:

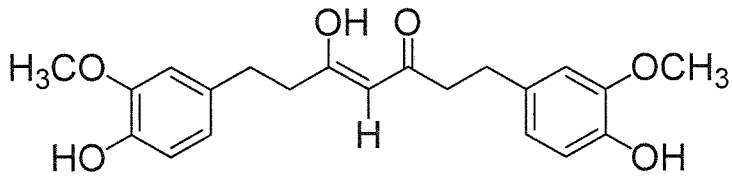


Curcumin glucuronide C-7

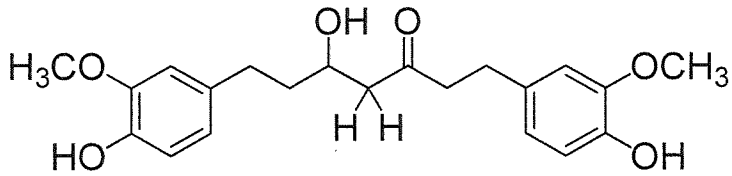


Curcuminsulfate
C-8

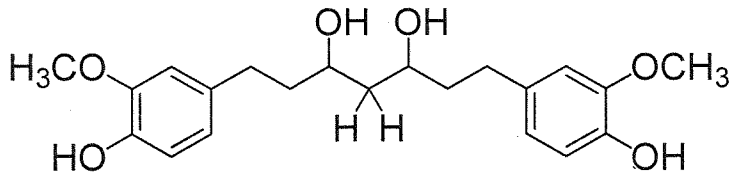
On the other hand, where the route of administration is intravenous/intraperitoneal, the metabolites generally include the following:



Tetrahydrocurcumin
C-9



Hexahydrocurcumin
C-10



Octahydrocurcumin
C-11

Other naturally occurring curcumin derivatives include cyclocurcumin, bisdemethoxycurcumin, demethoxycurcumin, dihydrocurcumin, caffeic acid, cinnamic acid, isoeugenol, dibenzoylmethane, dehydrozingerone, capsaicin, [6]-gingerol, [6]-paradol, chlorogenic acid, yakuchinone A, oregonin, cassumuin A, and cassumuin B.

4. Synthetic Curcumin Derivatives.

Curcumin derivatives are expected to be beneficial for use in the treatment methods of the invention. The term "curcumin derivative" is used interchangeably with the term "curcumin analog" and "curcumin analogue" (alternative spelling) and includes, for example, curcumin

derivatives, analogs, curcuminoids and chalcones. In one embodiment the curcumin derivative includes first and second aryl groups covalently attached by way of a linker or a linking group. In another embodiment, the second aryl group is absent, such that the curcumin derivative contains a first aryl group and the linker but no second aryl group at the distal end of the linker. Optionally, the first and/or second aryl group is a heteroaryl group. The first and second aryl groups may be independently substituted or unsubstituted.

Curcumin derivatives that exhibit improved pharmacokinetic properties and/or reduced toxicity are preferred. For example, curcumin derivatives that include heteroaryl groups and/or unsaturated linkers are expected to impart improved pharmacokinetic properties and/or reduced toxicity to the compounds, because they are expected to be less chemically reactive *in vivo*. One example of preferred curcumin derivatives includes those including one or two carbonyl groups in the linker region, including those derivatives that preserve the enone functionality of curcumin. Derivatives that include heteroaryl groups and/or unsaturated linkers are expected to be less likely to be degraded and/or form toxic adducts or intermediates under physiological conditions.

Thus, in one aspect, curcumin derivatives of the invention are generally encompassed by the formula:

Ar1—L—Ar2 C12

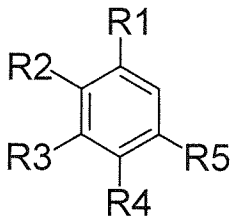
where Ar1 and Ar2 are independently aryl groups, and L is a divalent linking group that includes between 3 and 7 backbone carbon atoms, wherein one or more of the backbone carbon atoms include a carbonyl or hydroxyl moiety.

a. Aryl Groups

Preferred aryl groups include phenyl, naphthyl, thienyl, pyridinium, and pyridyl groups.

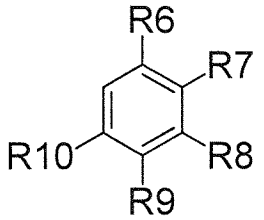
Aryl groups Ar1 and Ar2 may be substituted or unsubstituted, and one or more of the ring carbons may be substituted with a heteroatom, and especially N, S, B, or O.

For example, in one embodiment of the invention, Ar1 can be an aryl group according to the formula:



C-13

and Ar2 can be an aryl group according to the formula:



C-14

where one or more of the aryl ring carbons of Ar1 and Ar2 may be independently substituted with a heteroatom selected from N, S, B, or O, and R1-R10 are independently selected from the group consisting of H, hydroxyl, halogen, amine, nitro, sulfonate, sulfoxide, thio, ester, carboxylate, amide, borate, C1-C4 boronate, C1-C8 alkyl, C2-C8 alkenyl, C1-C6 haloalkyl, C1-C6 alkoxy, C1-C6 amine, C2-C8 carboxyl, C2-C8 ester, C1-C4 aldehyde, and glucuronide groups; L is a divalent linker including from 3-7 backbone carbon atoms that form a chain connecting the Ar1, Ar2, and R11 groups as the case may be, where L includes at least one of a carbonyl or hydroxyl group. In further embodiments, Ar1 and Ar2 are phenyl groups; R1-R10 are independently selected from the group consisting of H, hydroxyl, halogen, amine, nitro, sulfonate, thio, borate, C1-C2 boronate, sulfoxide, C1-C4 alkyl, C1-C4 alkoxy, C1-C4 alkylamine, C2-C6 alkenylamine, C1-C6 acetoxy, C1-C4 carboxyl, with at least one of R1-R5 and R6-R10 being hydroxyl.

b. Divalent Linking Groups

The linker L is a spacer that preferably includes 3, 4, 5, 6 or 7 carbon atoms that form a linear carbon chain connecting the first and second aryl groups. The carbons atoms in the carbon chain that trace out shortest path between the first and optional second aryl groups are referred to herein as the "backbone" carbon atoms. The number of backbone carbon atoms is readily determined in straight chain alkyl groups. In linkers that include a cyclic alkyl group as a constituent of the linear chain, the backbone carbon atoms include the least number of ring carbons possible. The number of backbone carbon atoms is used herein as a shorthand way to designate the length of the linker being used. For example, a 7-carbon linker is a divalent linker that includes 7 backbone carbon atoms.

Preferably at least one of the backbone carbon atoms is included in a carbonyl (C=O) or thio carbonyl (C=S) moiety. The linker may be substituted or unsubstituted. The linker may further be saturated or unsaturated. In a preferred embodiment, the linker contains an odd number of carbon atoms (i.e., 3, 5, or 7 carbon atoms), and at least one unsaturated carbon-carbon bond.

In additional embodiments, the linker may include a hydroxyl moiety in place of, or in addition to, the at least one carbonyl moiety.

Curcumin derivatives of the invention include a linking group L that is preferably covalently attached at one end to aryl group Ar1. Optionally, the linking group L may also be covalently attached at the other end to a second aryl group, Ar2, which is selected independently from Ar1. The linking group L is a divalent linking group that preferably includes an alkylene or an alkenylene group having between 3 and 7 backbone carbon atoms, and more advantageously an odd number of backbone carbon atoms (i.e., 3, 5, or 7 carbon atoms). The linker also preferably has at least one carbonyl moiety, and may further include a hydroxyl moiety in place of, or in addition to, the at least one carbonyl moiety. The linking group may be substituted or unsubstituted, and may be saturated or unsaturated. Preferably, the linking group has a carbon-carbon double bond between the α and β carbons relative to Ar1 and/or Ar2 (e.g., see formulas C-1 and C-19 through C-33, which illustrate such a double bond. Still more preferably, the linking group includes conjugated double bonds. Table 1 shows compounds with 7-carbon linkers; Table 2 shows compounds with 5-carbon linkers; and Table 3 shows compounds with 3-carbon linkers.

A divalent linking group includes two carbons with unfilled valencies that provide valence points where a covalent bond can be formed to an adjacent alkyl or aryl group that also includes a carbon with an unfilled valency. Generally, a valence point is represented in a chemical formula by a bond that is shown as not being attached to another group (e.g., CH3—, wherein — represents the valence point).

In embodiments wherein the curcumin derivative lacks the second aryl group Ar2, the distal valence point on the linking group can be filled with any substituent of interest, preferably a short chain alkyl group (e.g., C1-C6, more preferably C1-C4) or a hydrogen (H). Compounds lacking a second aryl group may be represented by formula:

Ar1—L—R11 C-15

R11 can be, for example, a heterocyclic group or an alkyl group, preferably an alkyl group having four or fewer carbon atoms, e.g., a methyl group. R11 can alternately be an amine, a hydroxyl, a hydrogen, nitro, sulfonate, sulfoxide, thio, ester, carboxylate, amide, borate, or a C1-C4 boronate.

i. Curcumin Derivatives Including 7-carbon Linking Groups.

In one embodiment of the invention, the curcumin derivatives include one or two aryl groups (Ar1 and optionally Ar2) and a linking group L that is a 7-carbon linking group (i.e., a linking group that includes 7 backbone carbon atoms). Preferably, the 7-carbon linking group includes at least one unsaturated carbon-carbon bond. Examples of 7-carbon linking groups include

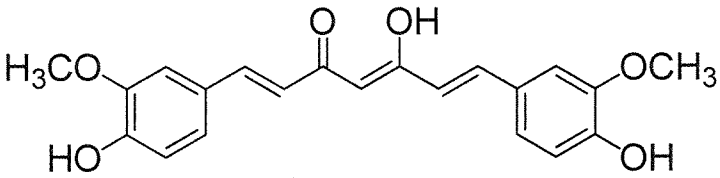
—CH=CH—(CO)—CR12=C(OH)—CH=CH—,	C-16
—CH=CH—(CO)—C(R12)2—(CO)—CH=CH—, and	C-17
—CH=CH—(CO)—CH=C(OH)—CH=CH—	C-18

where R12 includes substituent alkyl, arylalkyl, or aryl groups comprising 10 carbon atoms or less. In some embodiments, R12 may be a methyl, ethyl, or benzyl group. These linking groups are the divalent forms of 4-alkyl-1,6 heptadiene-3,5-dione; 4,4-dialkyl-1,6 heptadiene-3,5-dione; and heptane-3,5-dione.

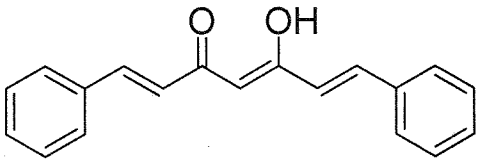
Table 1 shows a number of examples of curcumin derivatives that include a 7-carbon linker. The compounds shown contain two aryl rings separated by a 7-carbon linker having two carbonyls (or the equivalent keto-enol tautomer). In many, but not all, of the compounds, the linker is unsaturated. "Bn" refers to a benzyl group.

TABLE 1

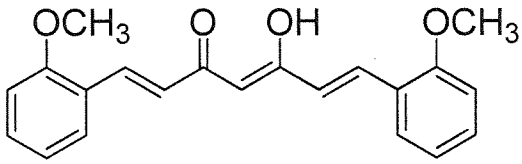
7-Carbon Linker Analogs.



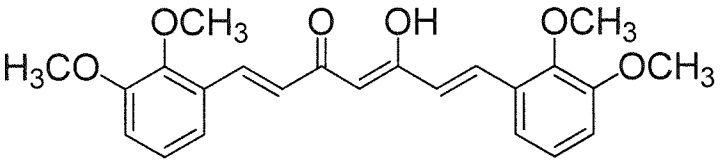
C-19



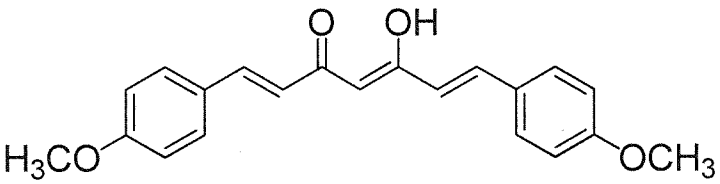
C-20



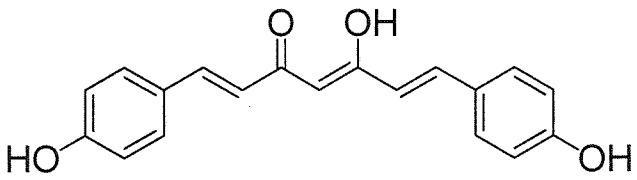
C-21



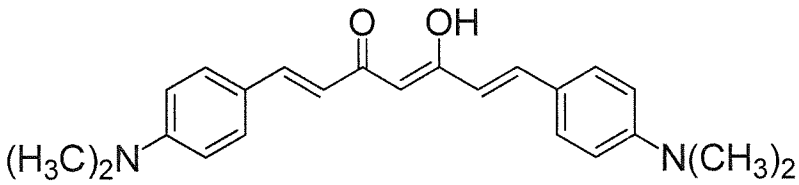
C-22



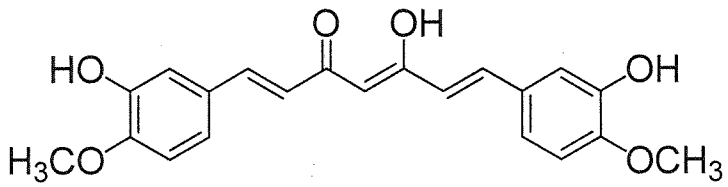
C-23



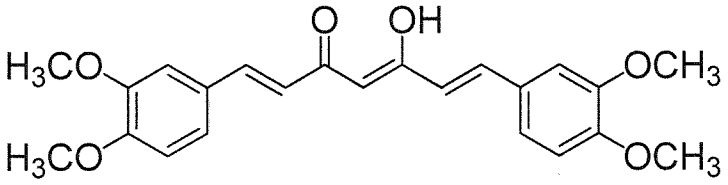
C-24



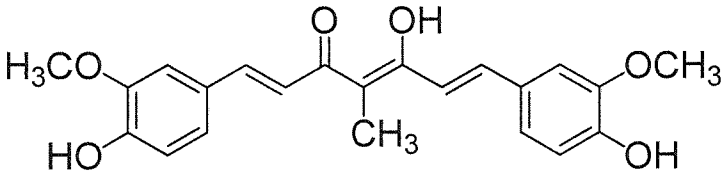
C-25



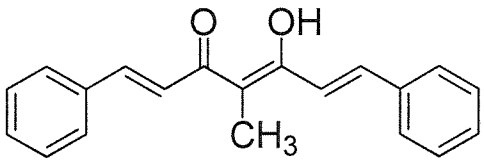
C-26



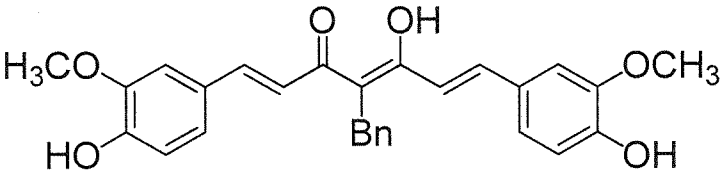
C-27



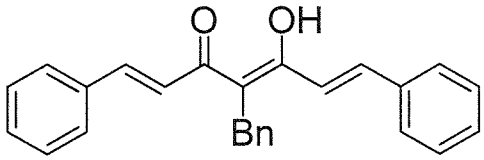
C-28



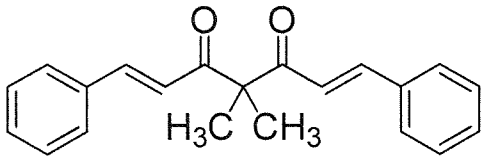
C-29



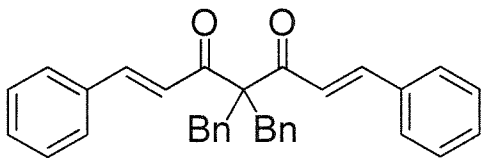
C-30



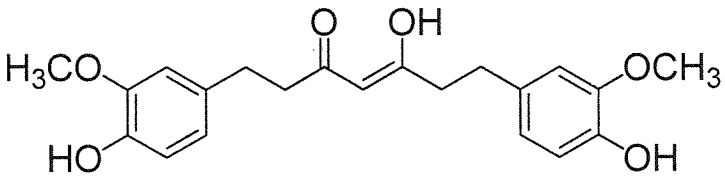
C-31



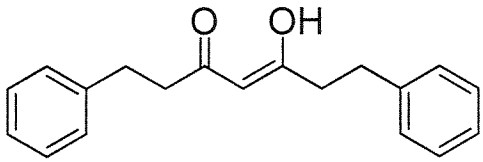
C-32



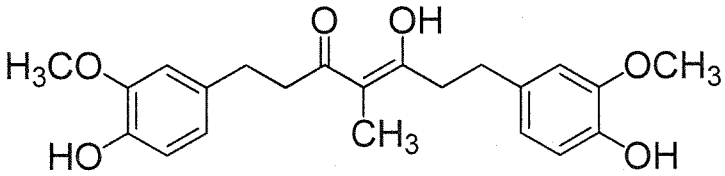
C-33



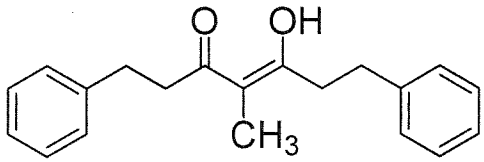
C-34



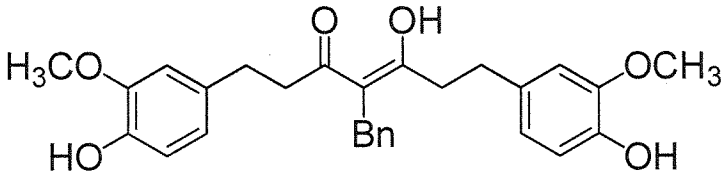
C-35



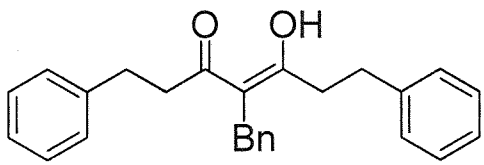
C-36



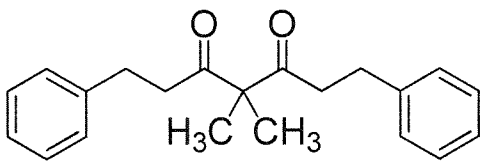
C-37



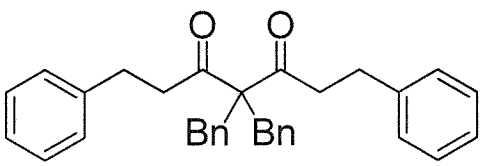
C-38



C-39



C-40



C-41

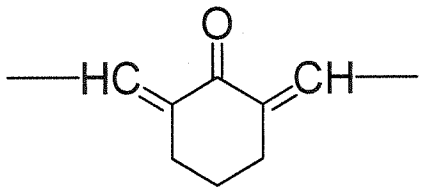
ii. Curcumin Derivatives Including 5-carbon Linking Groups

In a further embodiment of the invention, the curcumin derivatives include one or two aryl groups (Ar1 and optionally Ar2) that are linked by a linking group L that is a 5-carbon linking group (i.e., a linking group that includes 5 backbone carbon atoms). Preferably, the 5-carbon linking group includes at least one unsaturated carbon-carbon bond. Examples of 5-carbon linking groups include:

—CH=CH—(CO)—CH=CH—, C-42

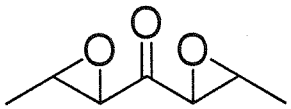
—CH2—CH2—(CO)—CH2—CH2—, C-43

—CH2—CH2—CH(OH)—CH2—CH2—, C-44



C-45

, and



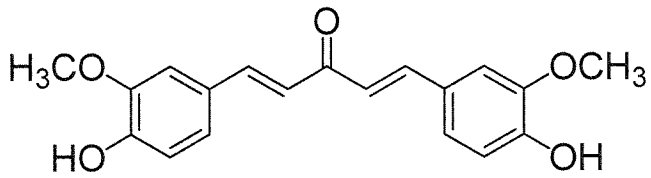
C-46

These linking groups are the divalent forms of 1,4-pentadiene-3-one; pentan-3-one; pentan-3-ol, 2,6; bis(methylene)cyclohexanone; and 1,2,4,5-diepoxy pentan-3-one. As noted herein, curcumin derivatives may include a cyclic linking group. For example, 1-methyl-2,6-diphenyl-4-piperidone provides a compound with a 5-carbon linking group that is bridged by a tertiary amine to form a cyclic alkylene linking group including the heteroatom nitrogen.

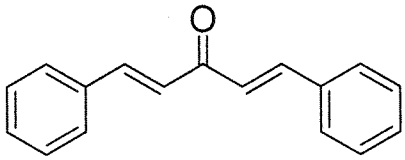
Table 2 shows a number of examples of curcumin derivatives that include a 5-carbon linker. The compounds shown contain two aryl rings separated by a 5-carbon linker having a single carbonyl or hydroxyl. In many, but not all, of the compounds, the linker is unsaturated.

TABLE 2

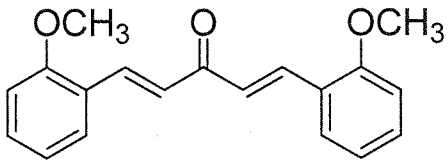
5-Carbon Linker Analogs.



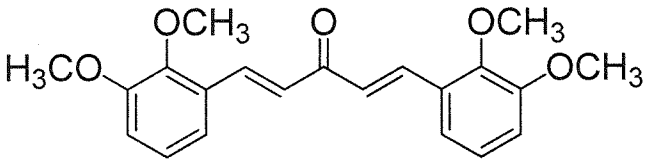
C-47



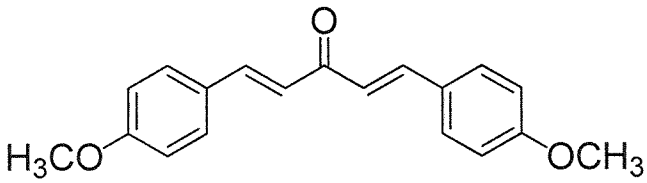
C-48



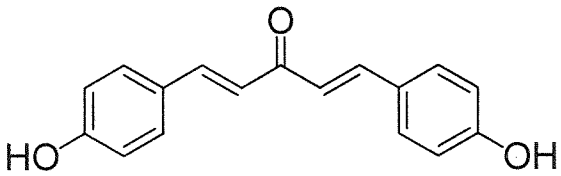
C-49



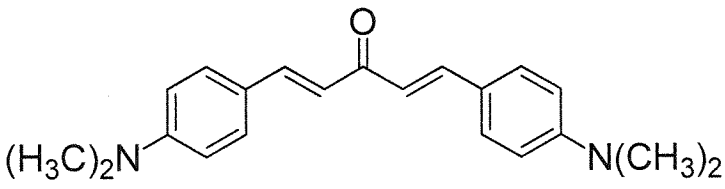
C-50



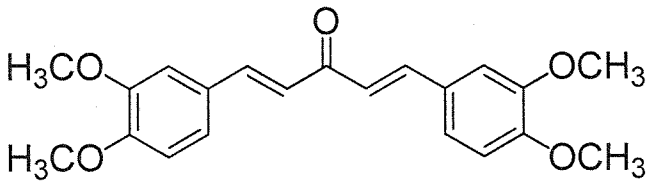
C-51



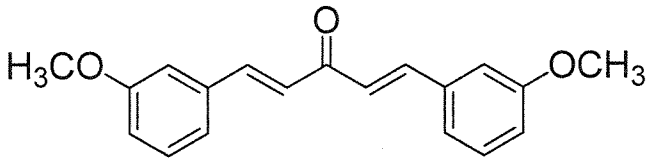
C-52



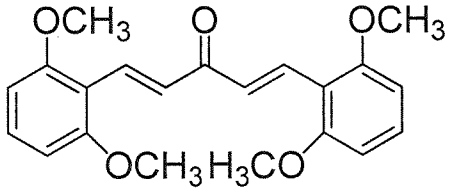
C-53



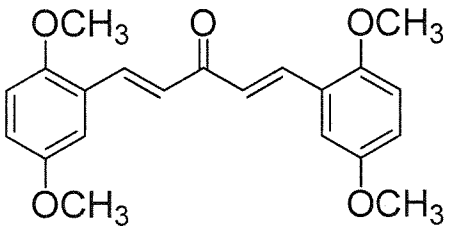
C-54



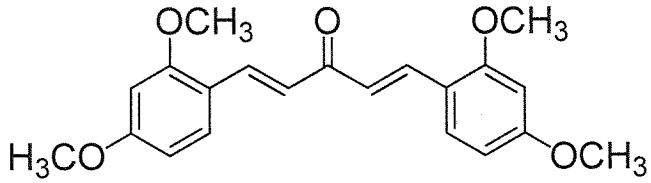
C-55



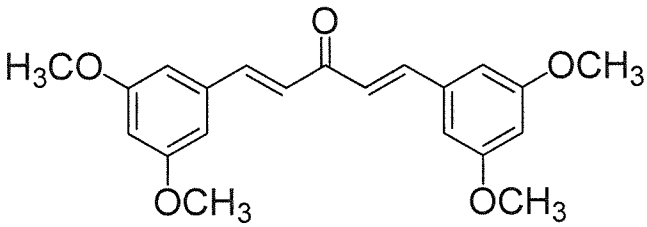
C-56



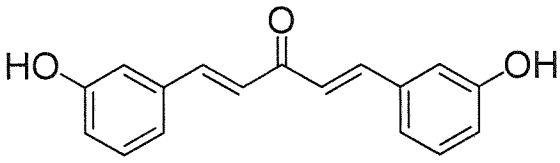
C-57



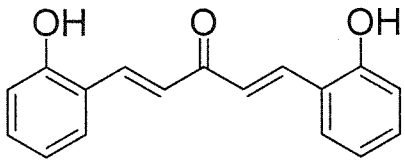
C-58



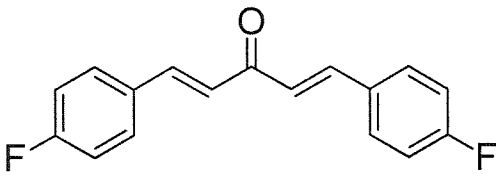
C-59



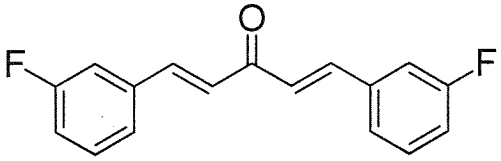
C-60



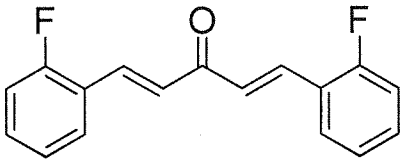
C-61



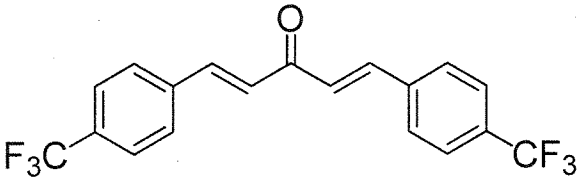
C-62



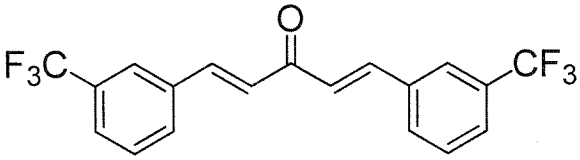
C-63



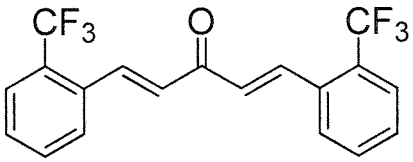
C-64



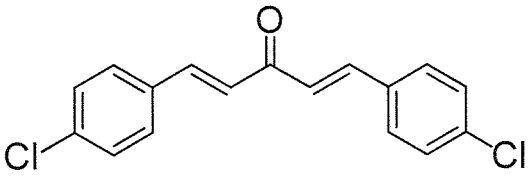
C-65



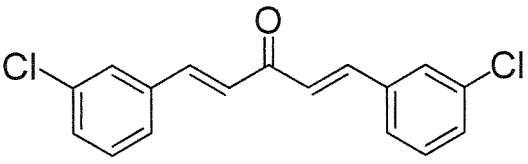
C-66



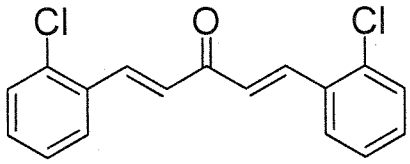
C-67



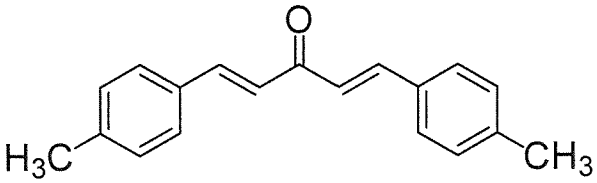
C-68



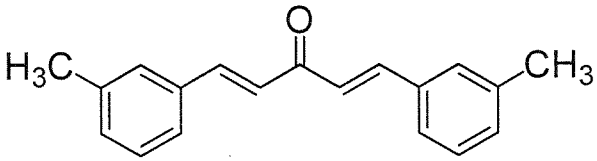
C-69



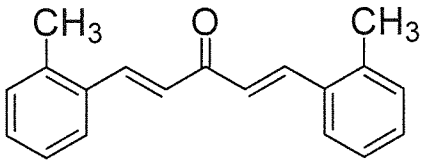
C-70



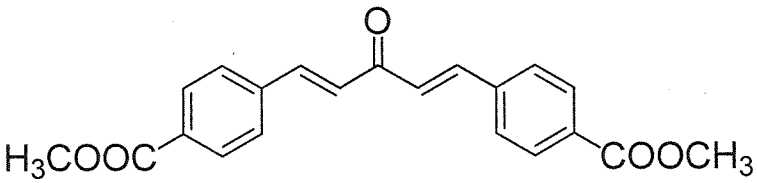
C-71



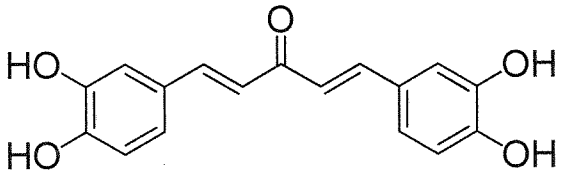
C-72



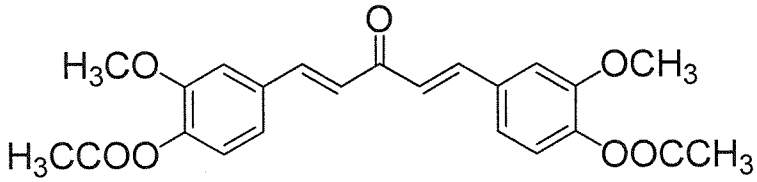
C-73



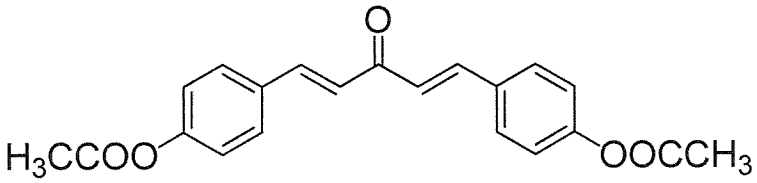
C-74



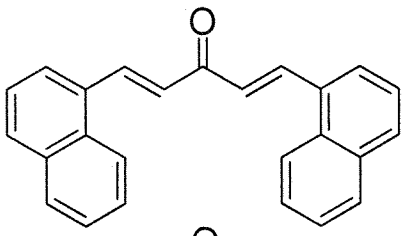
C-75



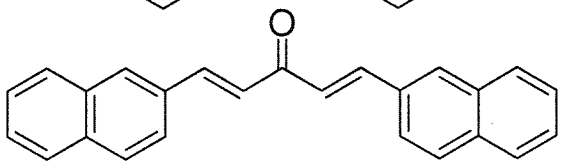
C-76



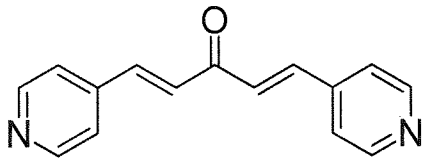
C-77



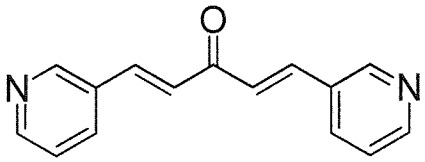
C-78



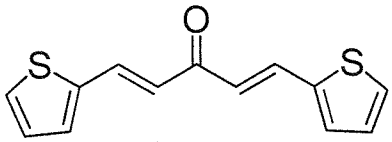
C-79



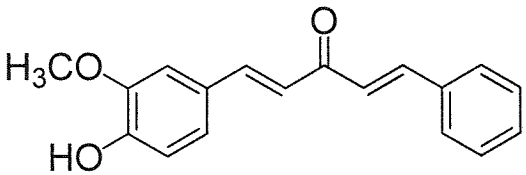
C-80



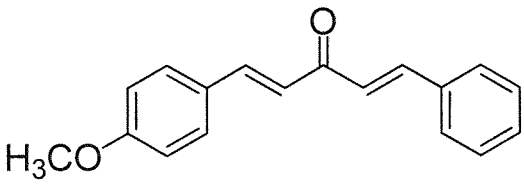
C-81



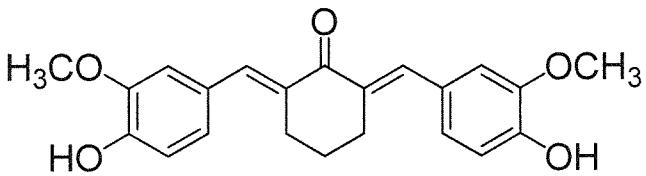
C-82



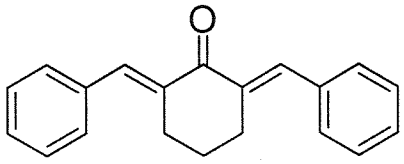
C-83



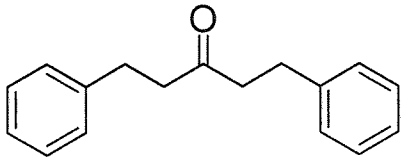
C-84



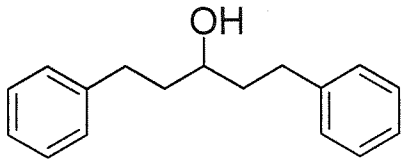
C-85



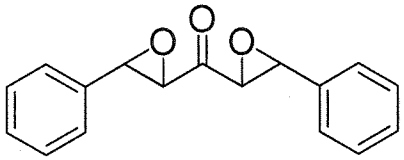
C-86



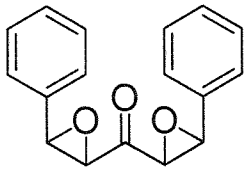
C-87



C-88



C-89



C-90

iii. Curcumin Derivatives Including 3-carbon Linking Groups

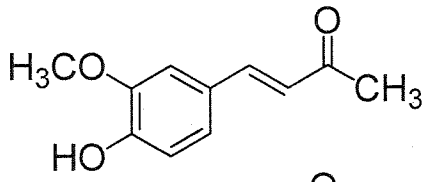
In a further embodiment of the invention, the curcumin derivatives include one or two aryl groups (Ar1 and optionally Ar2) that are linked by a linking group L that is a 3-carbon linking group (i.e., a linking group that includes 3 backbone carbon atoms). Preferably, the 3-carbon linking group includes at least one unsaturated carbon-carbon bond. An example of a 3-carbon linking group is —CH=CH—(CO)--; i.e., a divalent form of propenone.

Table 3 shows a number of examples of curcumin derivatives that include a 3-carbon linker. The compounds shown generally have an unsaturated 3-carbon linker having a single carbonyl. While most of the examples shown have two aryl groups separated by the linker, several of the embodiments include only a single aryl group. In the examples that include only a single aryl group, a methyl group is provided at the other end of the linking group. One compound includes the heteroatom N in place of one of the backbone carbon atoms; however, this is still

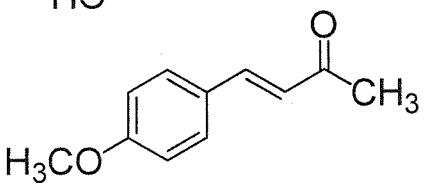
considered a 3-C linker in that 3 atoms (C, N, and C) are present along the shortest bridge between the two aryl groups.

TABLE 3

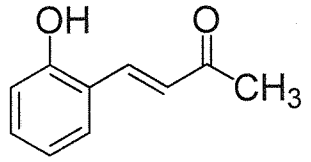
3-Carbon Linker Analogs.



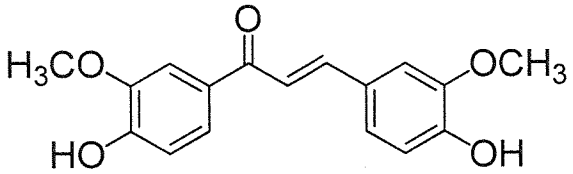
C-91



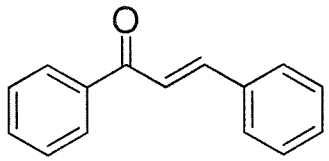
C-92



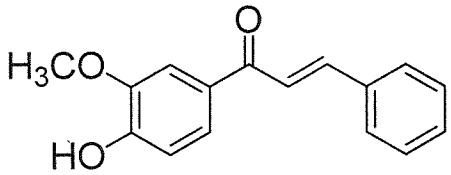
C-93



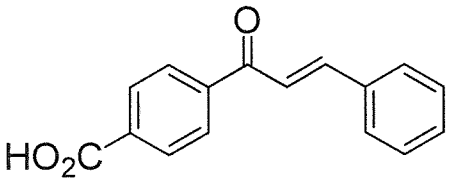
C-94



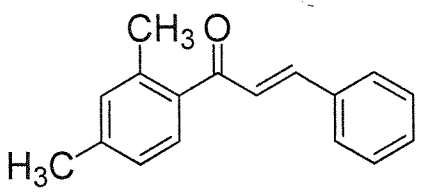
C-95



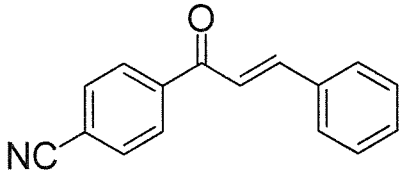
C-96



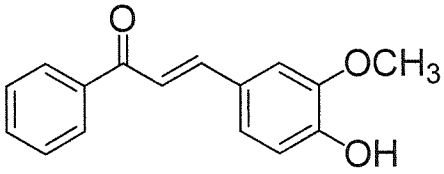
C-97



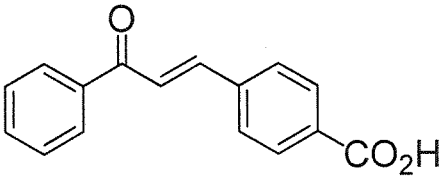
C-98



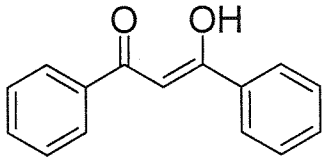
C-99



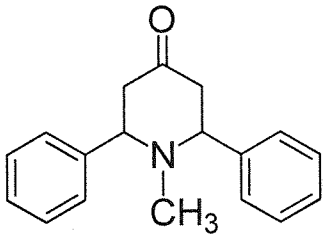
C-100



C-101



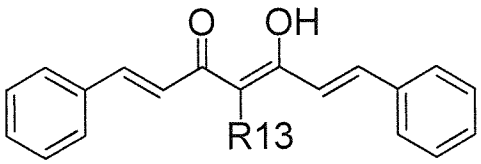
C-102



C-103

iv. Additional Curcumin Derivatives

Curcumin derivatives of the invention may include a variety of linking groups and Ar groups while retaining the necessary activity. Accordingly, additional curcumin analogs are contemplated. These include curcumin analogs containing central methylene substituents such as ethyl, propyl, butyl, isopropyl and substituted benzyl groups according to the formula:

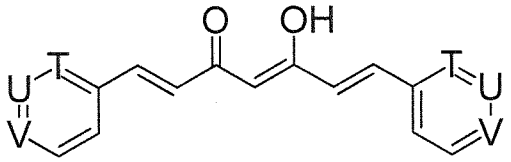


C-104

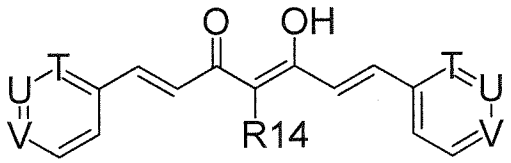
R13 = CH_2CH_3, $CH(CH_3)_2$, $CH_2CH_2CH_3$, $CH_2CH_2CH_2CH_3$
$CH_2C_6H_4X$; X = OH, OCH_3, $N(CH_3)_2$, CH_3

Central methylene substituent analogs

Additional analogs that are contemplated are those having a pyridine ring with and without a central methylene substituent on the 7-carbon linker such as those shown in the formulas:



C-105

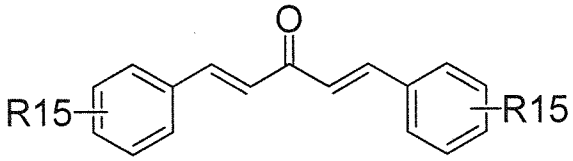


C-106

each T, U, V is independently selected from N, CH, such that each Ar ring is a pyridine; R14 = CH_2CH_3, $CH(CH_3)_2$, $CH_2CH_2CH_3$, $CH_2CH_2CH_2CH_3$, $CH_2C_6H_4X$; X = OH, OCH_3, $N(CH_3)_2$, CH_3

Pyridine aryl ring analogs

Many curcumin analogs which have a 5-carbon linker possess significant activity. Additional active analogs in this series may contain substituents such as hydroxy and methoxy groups on the aryl rings. Examples of these analogs are shown in the formula:

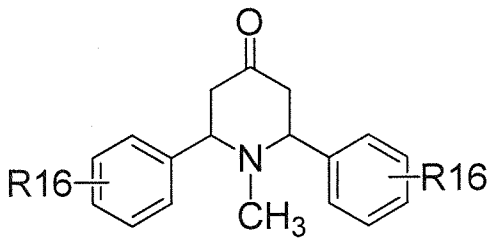


C-107

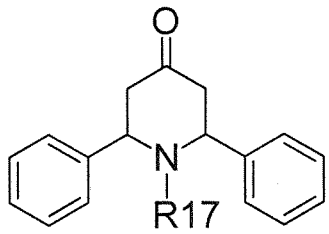
each R15 is independently selected from CH_2CH_3, $CH(CH_3)_2$, $CH_2CH_2CH_3$, $CH_2CH_2CH_2CH_3$

Aryl substituent analogs

Other analogs include heterocyclic moieties, which may be substituted or unsubstituted, as shown in the formulas:



C-108
each R16 is independently selected from Cl, F, CF_3, OH

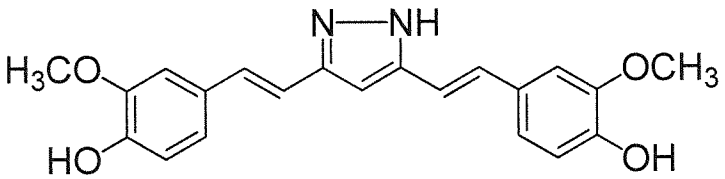


C-109
R17 = Ph, CH_2CH_3

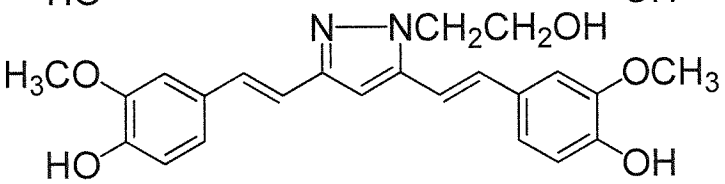
Heterocyclic analogs

v. Synthetic Curcumin Derivatives Via Different Reaction Schemes

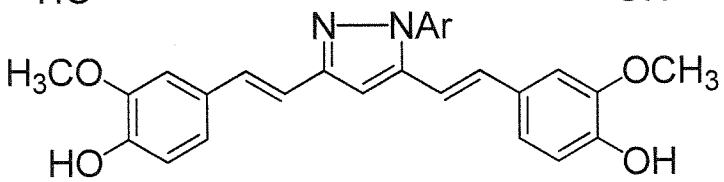
A large number of naturally occurring and synthetic curcumin derivatives, the latter explicated by reference to the methods of synthesis thereof, are disclosed in Anand et al. "Biological Activities of Curcumin and Its Analogues (Congeners) Made By Man and Mother Nature." *Biochemical Pharmacology* 76 (2008):1590-1611, which is incorporated by reference herein its entirety. Representative synthetic curcumin derivatives are set forth below.



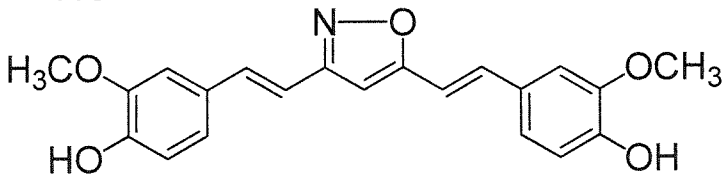
C-110



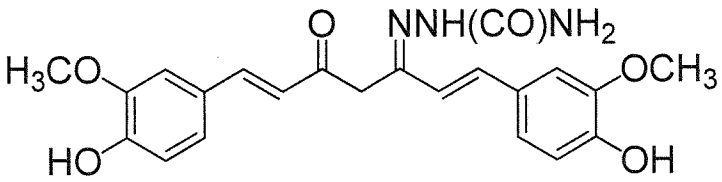
C-111



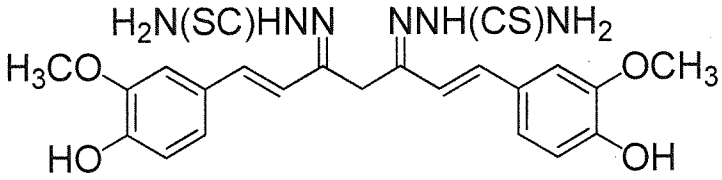
C-112



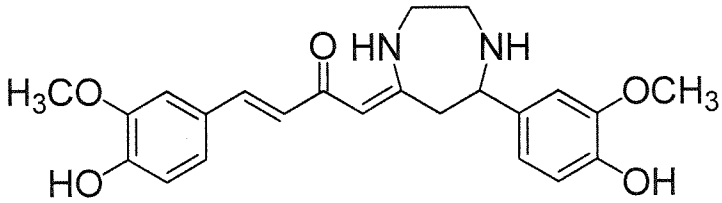
C-113



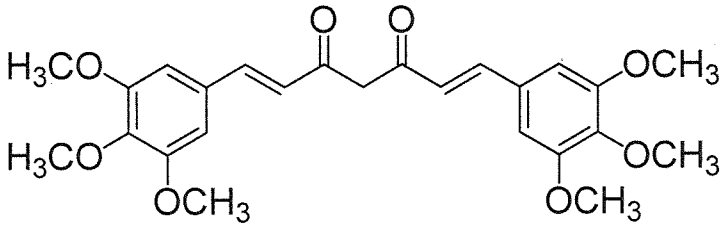
C-114



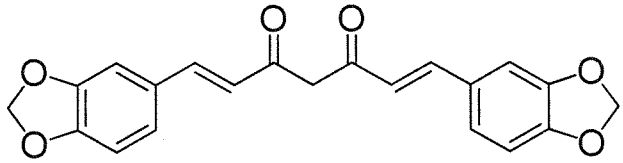
C-115



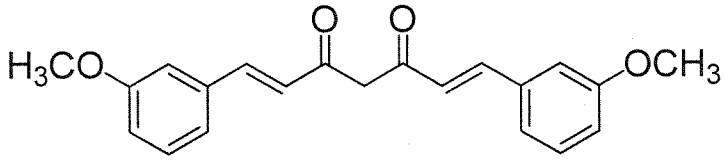
C-116



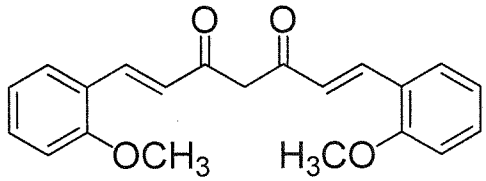
C-117



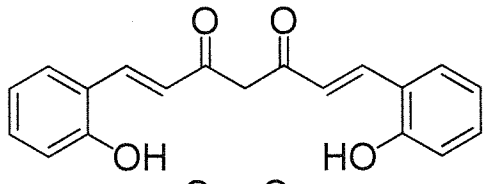
C-118



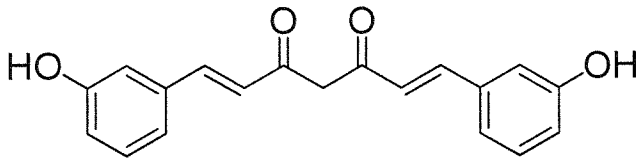
C-119



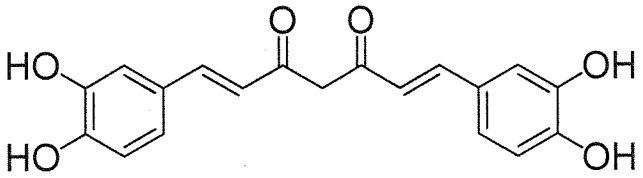
C-120



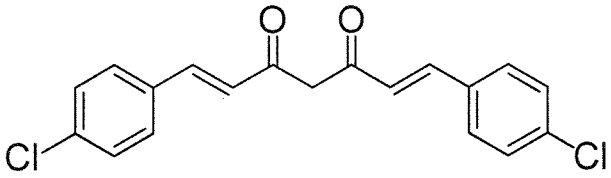
C-121



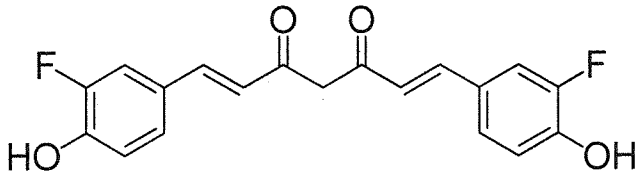
C-122



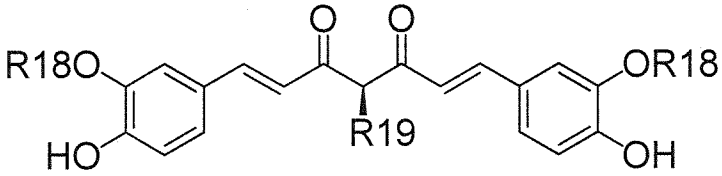
C-123



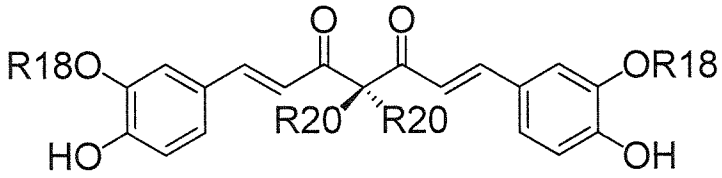
C-124



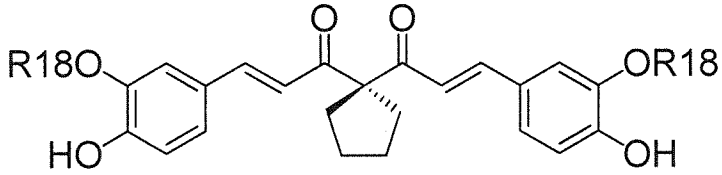
C-125



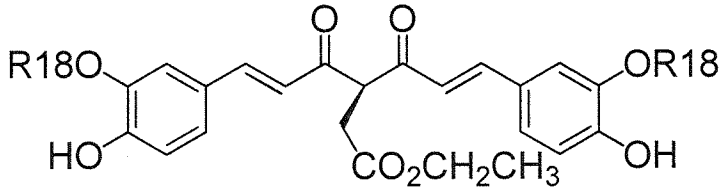
C-126



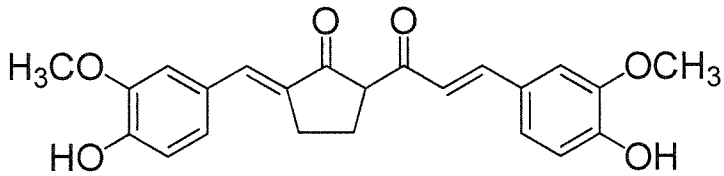
C-127



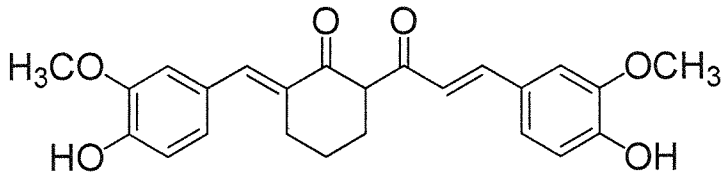
C-128



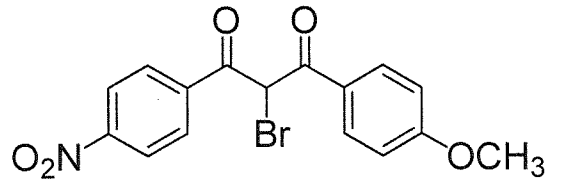
C-129



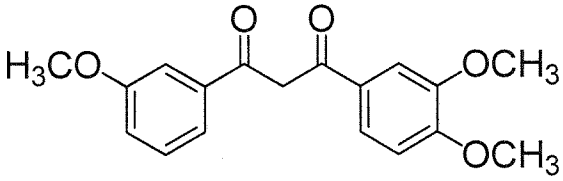
C-130



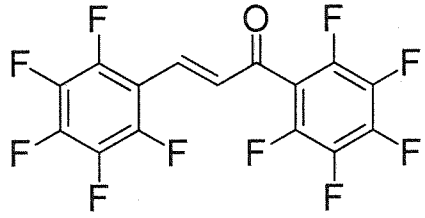
C-131



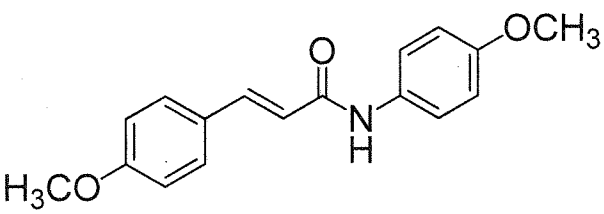
C-132



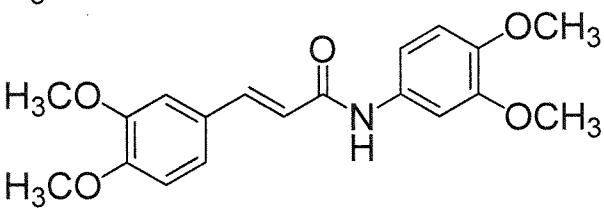
C-133



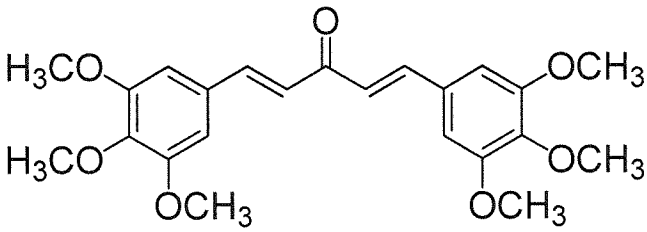
C-134



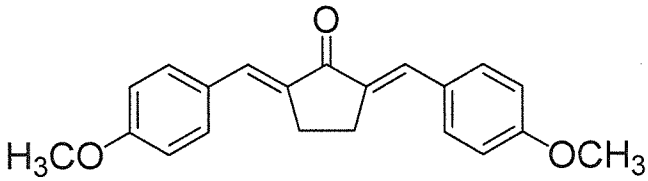
C-135



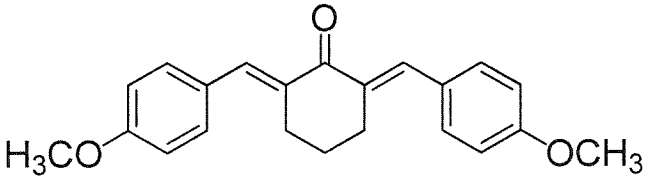
C-136



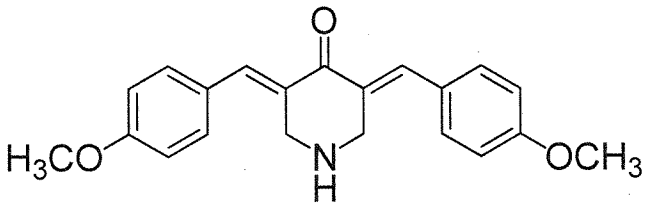
C-137



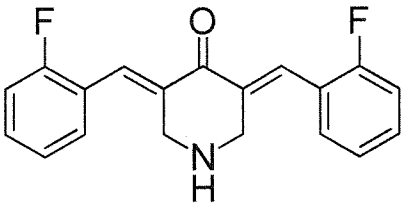
C-138



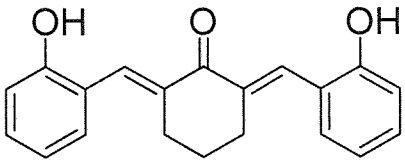
C-139



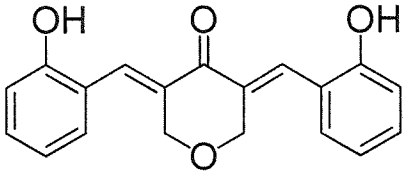
C-140



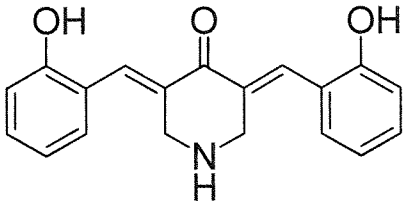
C-141



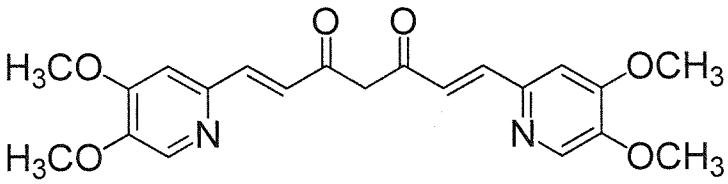
C-142



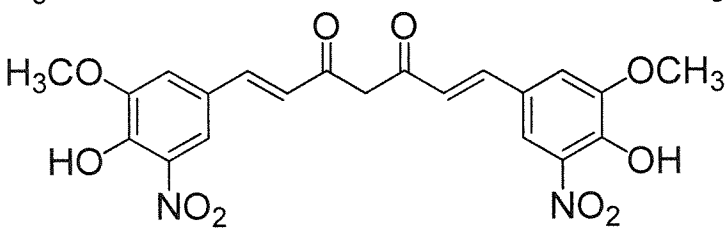
C-143



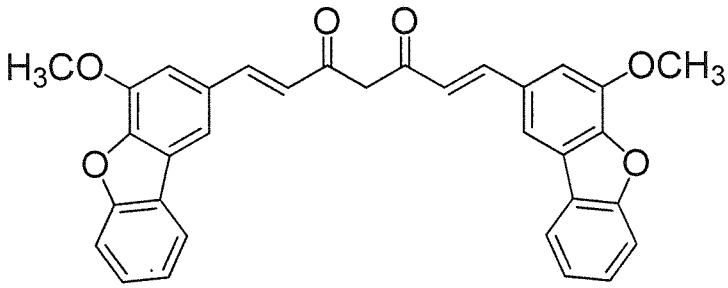
C-144



C-145



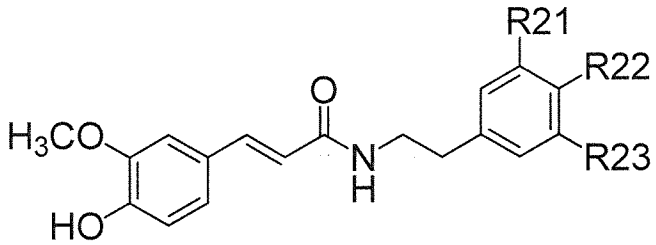
C-146



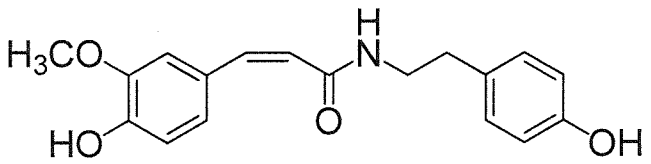
C-147

where R18, R19, and R20 are each independently selected from the group consisting of H, C1-C4 alkyl, and C1-C4 amine groups.

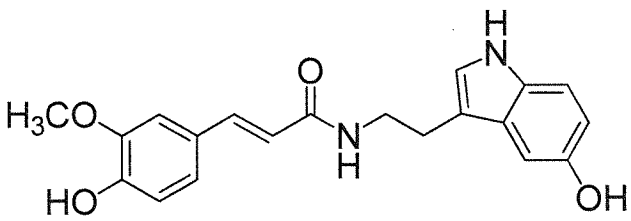
vi. Miscellaneous Curcumin Components



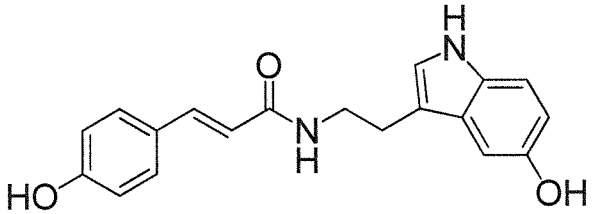
	R21	R22	R23
C-148	OCH_3	OH	OCH_3
C-149	OCH_3	OH	H
C-150	H	OH	H



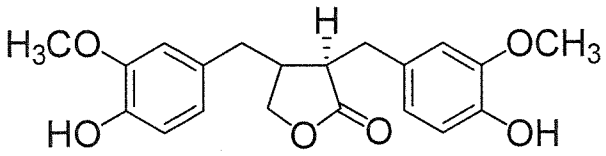
C-151



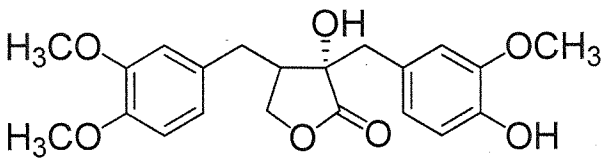
C-152



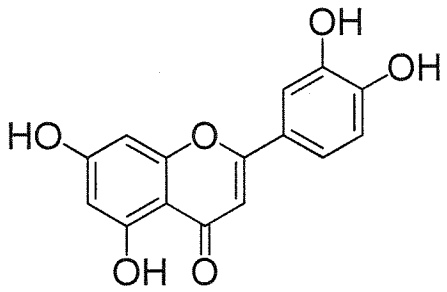
C-153



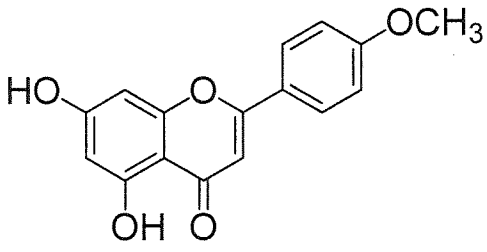
C-154



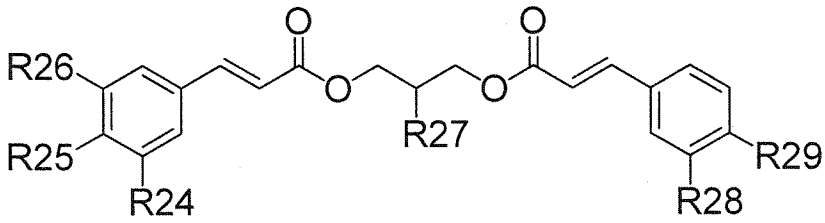
C-155



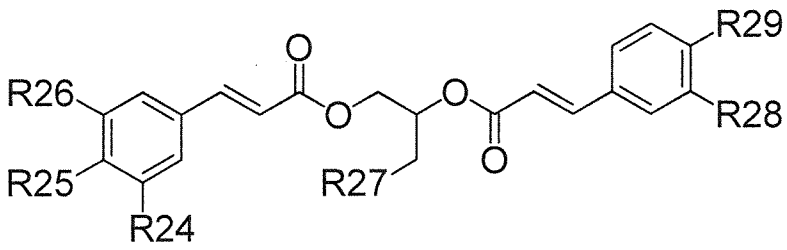
C-156



C-157

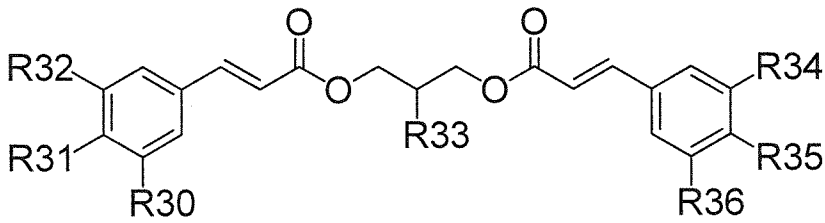


C-158

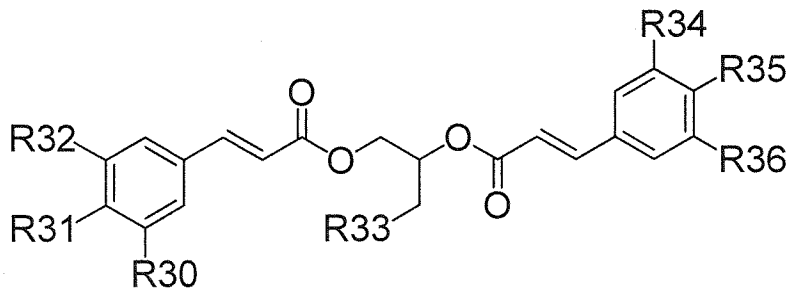


C-159

where R24 and R25 are independently selected from the group consisting of OH, C1-C4 alkoxy, and C1-C4 alkylcarbonyloxy; R26 and R27 are independently selected from the group consisting of H, OH, C1-C4 alkoxy, and C1-C4 alkylcarbonyloxy; R28 is selected from the group consisting of H, OH, and C1-C4 alkylcarbonyloxy; and R29 is selected from the group consisting of H and C1-C4 alkoxy.

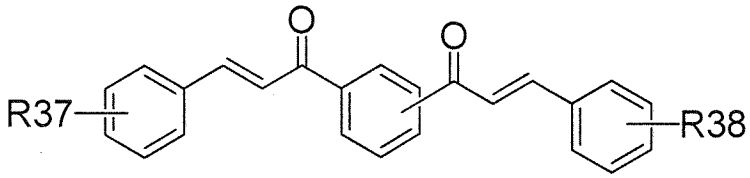


C-160



C-161

where R30, R31, R32, R33, R34, R35, and R36 are independently selected from the group consisting of H, OH, C1-C4 alkoxy, and C1-C4 alkylcarbonyloxy.



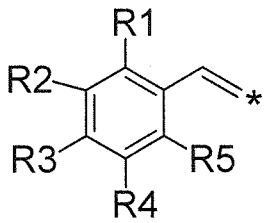
C-162

where R37 and R38 are independently selected from the group consisting of methoxy and OH, and the center benzene ring may be substituted in the 1,3- or the 1,4-position with the acryloyl groups.

Additionally, some or all of the carbonyl (C=O) moieties of formulae C-148 through C-162 may be substituted with thio carbonyl (C=S) moieties.

vii. Presently Preferred Curcumin Components

Based upon the structure activity relationships of curcumin and curcumin derivatives, curcumin components of formula C-13A are preferred:



C-13A

where R1-R5 are as previously defined, and the * denotes the valence point where the additional portion of the compounds are attached. That is, the preferred components have the moiety depicted in C-13A and additional portion exemplified by the foregoing disclosure, e.g., the remaining structure of the linker L and Ar2 or R11.

The most preferred curcumin components are exemplified by formula C-12 where:

- Ar1 and Ar2 are each aryl groups, and especially phenyl, naphthyl, thienyl, pyridinium, and pyridyl groups, and most preferably phenyl groups, wherein all of the foregoing may be substituted or unsubstituted;
- L contains either 5 or 7 backbone carbon atoms and at least one of a carbonyl or hydroxyl group;
- at least one of R1-R5 and R6-R10 is hydroxyl.

Still more preferably, the curcumin components should have:

- the R2 and R7, or R3 and R7, substituents of formulas C-13 and C-14 as hydroxyl;

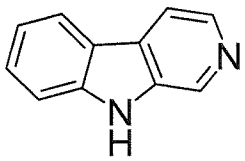
- the R3 and R8 substituents of formulas C-13 and C-14 as methoxy or ethoxy (most preferably methoxy);
- a β-diketone group in the linker L of formula C-12; and/or
- at least one, and preferably two, carbon-carbon double bonds in the linker L of formula C-12, where at least one of the double bonds is located between the α and β carbons relative to Ar1 and/or Ar2;
- where the curcumin component is not apocynin.

Use has also been made of a commercially available, proprietary curcumin product sold under the designation "ResCu" by Davospharma, and which is asserted to be a more bioavailable form of standard curcumin. This commercial product has been tested in connection with the invention and found to be a suitable curcumin component.

The Harmine Component(s)

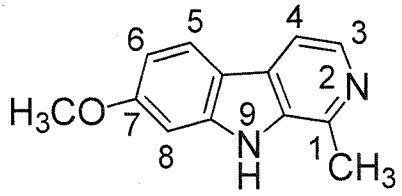
As used herein, "harmine component(s)" shall mean harmine, its metabolites and derivatives, isomers and tautomers thereof, and esters and pharmaceutically acceptable salts of any of the foregoing.

Harmine belongs to the family of β-carboline alkaloids, its chemical name is 7-methoxy-1-methyl 9H-pyrrole[3,4-b]indole, and its molecular formula is C13H12N2O. The base structure of β-carboline is shown in H-0.



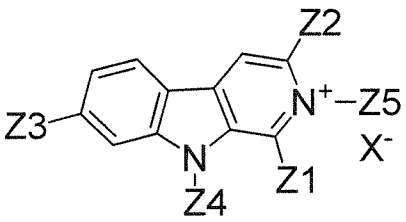
β-Carboline
H-0

Harmine has a molecular weight of 212.25 and a melting point of 261°C. Harmine was originally isolated from *Peganum harmala*, which is widely used as a traditional herbal drug in the Middle East and North Africa. The chemical structure of harmine, 1-methyl-7-methoxy- β-carboline, is shown as follows:

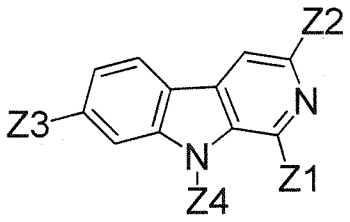


H-1

Harmine derivatives, which are variously substituted β-carbolines, are illustrated in the following formulas, which differ in that H-2 has a quaternary ammonium group at the 2-position, whereas H-3 has a tertiary nitrogen at the 2-position.



H-2



H-3

With reference to formulas H-2 and H-3:

Z1 is hydrogen; a C1-C6 alkyl or haloalkyl, a C2-C6 alkenyl or haloalkenyl; an aryl group or an arylalkyl group, wherein the aryl group is optionally substituted at any position with halogen, nitro, hydroxyl, C1-C3 alkoxy, amino, sulfonate, sulfoxide, thio, ester, carboxylate, amide, borate, or C1-C4 boronate and wherein the alkyl group is selected from C1-C4 alkyl; or a heterocyclic group;

Z2 is hydrogen; a C1-C6 carboxyl, ester, carboxylate, acylamino, acyl halide, sulfonate, sulfoxide, thio, amide or alkoxycarbonyl group; an aryloxycarbonyl group; alkyl group optionally substituted with hydroxyl or alkoxycarbonyl; carbamate; acylhydrazine; or a heterocyclic oxycarbonyl group, where the heterocyclic portion contains from 3-7 atoms and a nitrogen, oxygen, boron, or sulfur heteroatom;

Z3 is hydrogen; a C1-C6 alkyl or haloalkyl; sulfonate, sulfoxide, thio, carboxylate, amide, C2-C6 alkenyl group; hydroxyl; a C1-C6 alkoxy group; a C1-C6 carboxylic ester group; an arylalkoxy group where the alkoxy portion contains from 1-6 carbon atoms; or a heterocyclic group containing from 3-7 atoms and a nitrogen, oxygen, boron, or sulfur heteroatom;

Z4 is hydrogen; a C1-C6 alkyl, haloalkyl; C2-C6 alkenyl group; a hydroxyalkyl group where the alkyl portion contains from 1-6 carbon atoms; an arylalkyl group wherein the aryl group

is optionally substituted at any position with halogen, nitro, hydroxyl, C1-C3 alkoxy, borate, C1-C4 boronate, sulfonate, sulfoxide, thio, ester, carboxylate, amide or amino, and wherein the alkyl group is selected from C1-C4 alkyl group; an arylalkanone; or a heterocyclic group containing from 3-7 atoms and a nitrogen, oxygen, boron or sulfur heteroatom;

Z5 is hydrogen; a C1-C6 alkyl group; an aryl group substituted at any position with one or more of (1)-(2), where (1) is a C1-C4 alkyl group, and (2) is a C1-C6 carbonyl, hydroxycarbonyl, ester, sulfonate, sulfoxide, thio, ester, carboxylate, amide or amino group; arylalkyl where the alkyl group is a C1-C6 alkyl; 1-5 substituted arylalkyl; arylhydrocarbyl; arylcarboxyl; aryl ester group; arylamino group; or a heterocyclic group containing from 3-7 atoms and a nitrogen, oxygen, boron or sulfur heteroatom;

X is a halogen; a sulfonic group, a sulfuric group, a nitric acid group or a carboxylate, in the compounds of the above formulas H-2 and H-3:

Z1 is preferably hydrogen, a Cl-C4 alkyl group, or an arylalkyl group; more preferably hydrogen, or a Cl-C2 alkyl group; and most preferably methyl;

Z2 is preferably hydrogen or a Cl-C4 alkoxycarbonyl group; more preferably a Cl-C2 alkoxycarbonyl group; and most preferably hydrogen;

Z3 is preferably hydrogen, hydroxyl, or a C1-C4 alkyloxy group; more preferably methoxy;

Z4 is preferably hydrogen, a C1-C4 alkyl group, a C1-C4 hydroxyalkyl group, or an optionally substituted arylalkyl group; more preferably hydrogen, a C1-C2 alkyl group, or a C1-C2 hydroxyalkyl group; still more preferably ethyl or benzyl; and most preferably hydrogen.

In certain embodiments where Z1 is hydrogen, a C1-C4 alkyl group, or an arylalkyl group, Z2 is hydrogen, hydroxyl, a C1-C4 carboxyl group, a C1-C4 ester group, a carboxylate group, a halogen, or a C1-C4 alkoxycarbonyl group; Z3 is hydrogen, hydroxyl, or a C1-4 alkoxy group; Z4 is hydrogen, a C1-C2 alkyl group, a C1-C2 hydroxyalkyl group, or an optionally substituted arylalkyl group; and Z5 is hydrogen, a C1-C6 alkyl group, or an optionally substituted aryl-alkyl group.

In certain embodiments where Z1 is hydrogen, Z2 is a C1-C2 alkoxycarbonyl group, Z3 is hydrogen, and Z4 is C l-C2 alkyl group, or an optionally substituted arylalkyl group.

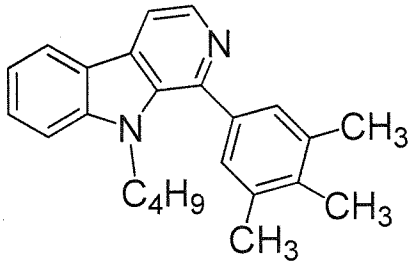
In certain embodiments where Z1 is hydrogen, Z2 is ethoxycarbonyl, Z3 is hydrogen, and Z4 is ethyl or benzyl.

In certain embodiments where Z1 is methyl, Z2 is ethoxycarbonyl, Z3 is hydrogen, Z4 is pentafluorobenzyl, and Z5 is hydrogen.

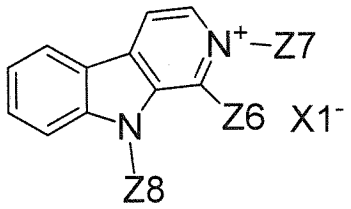
In certain embodiments where Z1 is hydrogen, Z2 is hydrogen, Z3 is hydrogen, Z4 is benzyl, Z5 is benzyl, and X is bromine.

Certain preferred harmine components include β-carboline, tryptoline, pinoline, harmine, harmalol, harmalol hydrochloride dehydrate, tetrahydroharmine, harmane, harmol, vasicine, and vasicinone.

Other harmine derivatives include:



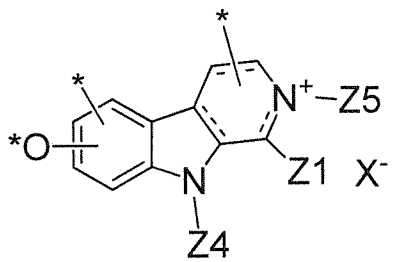
H-4



H-5

where Z1, Z2, and Z9 are set forth below, and X1 is a halogen preferably Cl, Br, and F or carboxylate anion.

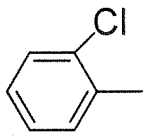
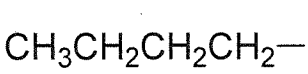
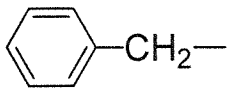
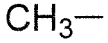
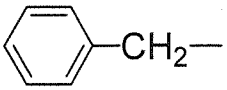
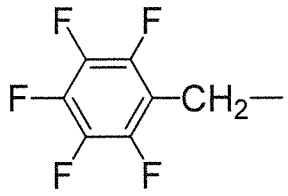
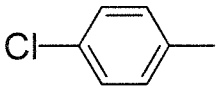
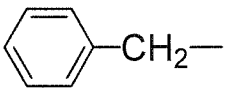
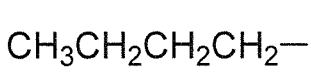
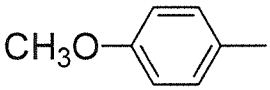
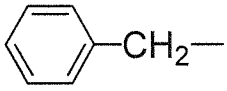
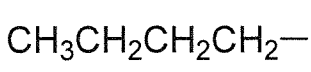
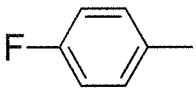
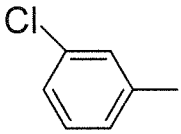
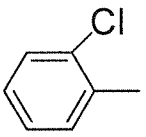
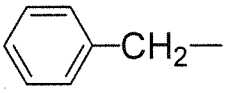
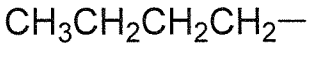
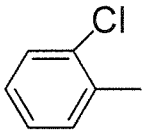
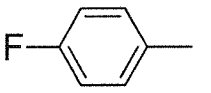
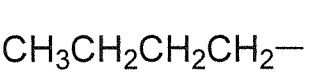
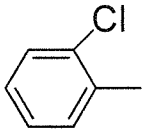
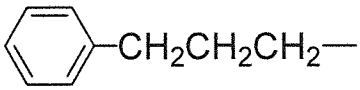
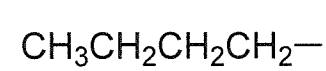
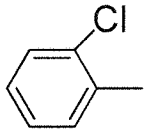
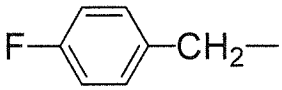
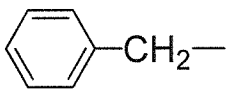
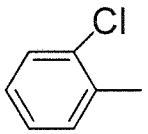
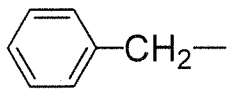
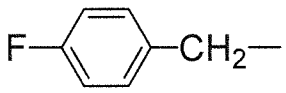
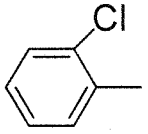
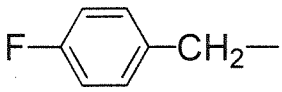
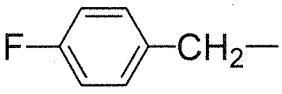
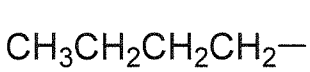
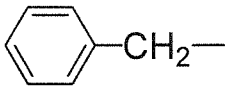
Based upon the structure-activity relationships of harmine and harmine derivatives, preferred components are illustrated by formula H-6:



H-6

where the three * denote valence points where respective additional portions of the components are attached; the dotted lines in the right-hand six-membered ring of H-6 indicate that the ring may

optionally be aromatic; Z1 and Z4 are independently H or a C1-C6 alkyl group, more preferably a C1-C4 alkyl group, and most preferably methyl for Z1 and hydrogen for Z4; and the remaining positions on the six-membered rings (i.e., the left-hand phenyl group and the right-hand six-membered ring) are each independently selected from the group consisting of Z1, as previously defined. That is, the preferred harmine components have the moiety depicted in H-1 and additional portions exemplified by the foregoing disclosure. N+ is optionally substituted with Z5, as previously defined. In some cases, X^- as previously defined is present. One of ordinary skill in the art would understand that ----- indicates a double or single bond is present. For example, where * CH3 is bonded with the O, the other * groups and the remaining positions on the phenyl rings are all H, and Z4 is H with Z1 being methyl, and Z5 and X not existing, the resulting compound is harmine.

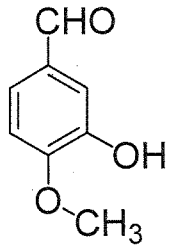
Z6	Z7	Z8
		
		
		
		
		
		
		
		
		
		
		
		

One class of preferred harmine components are shown in formula H-3, where Z3 is a methoxy or ethoxy group and Z4 is a benzyl group. A second preferred class of harmine components is shown in formula H-2, where Z1 is a methyl group, Z2 is hydrogen, Z3 is a benzyloxy group, Z4 and Z5 are benzyl groups.

The Isovanillin Component(s)

As used herein, "isovanillin component(s)" refers to isovanillin, its metabolites and derivatives, isomers and tautomers thereof, and esters and pharmaceutically acceptable salts of any of the foregoing.

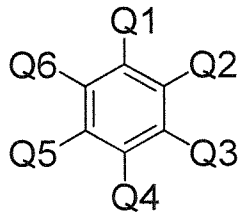
Isovanillin is a phenolic aldehyde having a hydroxyl group at the *meta* position and a methoxy group at the *para* position. Isovanillin is illustrated in the following structure:



I-1

Isovanillin is metabolized *in vivo* to vanillin, which is the same as structure I-1, except that the hydroxyl and methoxy substituents are exchanged, i.e., in vanillin, the hydroxyl group is in the *para* position, and the methoxy group is in the *meta* position.

Useful derivatives of isovanillin have the following general formula:



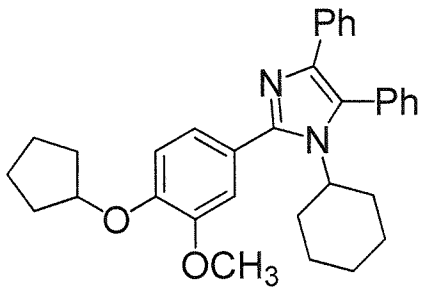
I-2

where at least one of Q1-Q6 is an alkoxy group and/or an aldehyde group, especially where the alkoxy and/or aldehyde groups contain from 1-6 carbon atoms; more preferably, where Q1 is an aldehyde, alcohol, amine, carbonyl, carboxylate, C1-C6 alkylhydroxy, ester, imidazole, nitro, sulfonate, sulfoxide, thio, amide, borate, or boronate, or semicarbazone group; the Q2-Q6 groups are independently selected from hydrogen, hydroxyl, halo, nitro, C1-C6 alkoxy, C1-C6 alkyl or alkenyl groups, with the proviso that at least one of the Q2-Q6 groups is an alkoxy group. In more

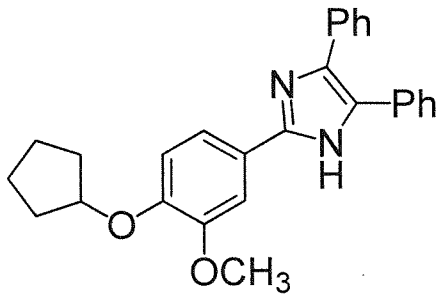
preferred forms, the aldehyde, alcohol, amine, carbonyl, carboxylate, and ester groups should have a C1-C6 carbon chain length, the boronate is a C1-C4 boronate, and at least one of the Q2-Q6 groups is an alkoxy group (most preferably methoxy), and another is a hydroxyl group; advantageously, the alkoxy and hydroxyl groups are adjacent each other. In particularly preferred forms, the remainder of the Q2-Q6 groups, apart from the alkoxy and hydroxyl groups, are all H. Advantageously, the isovanillin components of the invention should include only one phenyl group and are free of any fused ring structures (as used herein, "fused ring structures" refer to structures such as found in naphthalene or anthracene where two rings share common atoms).

Some preferred isovanillin components are selected from isovanillin, vanillin, ethyl vanillin, *ortho*-vanillin, vanillic acid, isovanillic acid, vanillic alcohol, isovanillic alcohol, 6-bromine-5-hydroxy-4-methoxybenzaldehyde, 4-hydroxy-3,5-dimethoxybenzaldehyde, 4,5-dihydroxy-3-methoxybenzaldehyde, 5-hydroxy-4-methoxybenazldehyde, 2-Benzyloxy-3-methoxybenzaldehyde, 2-(2-benzyloxy-3-methoxyphenyl)-1H-benzimidazole, N-l-(2-benzyloxy-3-methoxybenzyl)-2-(2-benzyloxy-3-methoxyphenyl)-lH-benzimidazole, and (S)-1-(2-benzyloxy-3-methoxyphenyl)-2, 2, 2-trichloroethyl benzenesulfonate (regarding the last four compounds, see Al-Mudaris et al., *Anticancer Properties of Novel Synthetic Vanillin Derivatives* (2012)).

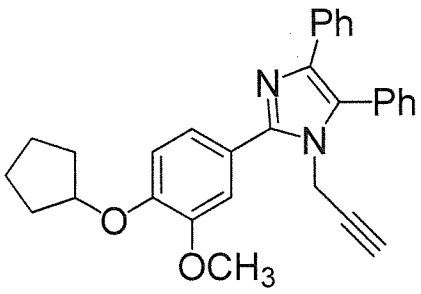
Certain imidazole derivatives (such as nitro-imidazoles) have been shown to have significant anticancer activity, see, e.g., Sharma et al., "Imidazole Derivatives Show Anticancer Potential by Inducing Apoptosis and Cellular Senescence," *Med.Chem.Commun.* 2014, 5, 1751, incorporated by reference herein. Representative imidazole derivatives include:



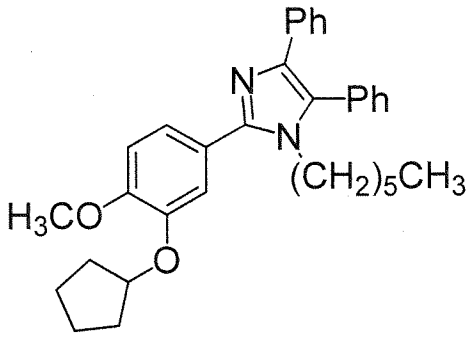
I-3



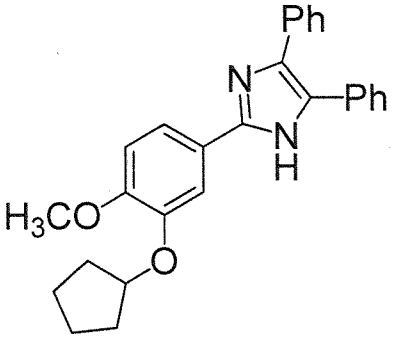
I-4



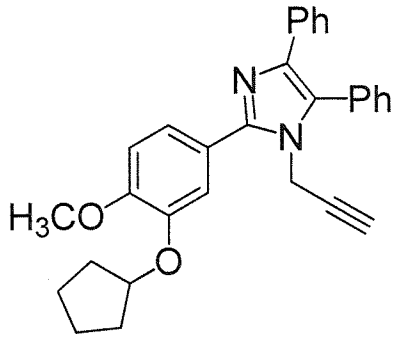
I-5



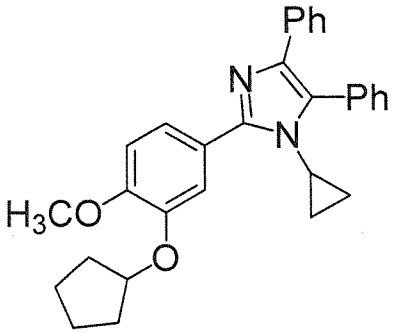
I-6



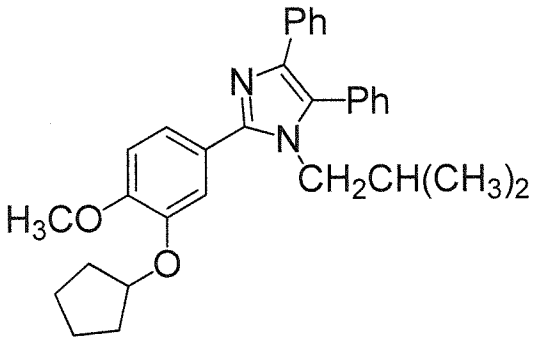
I-7



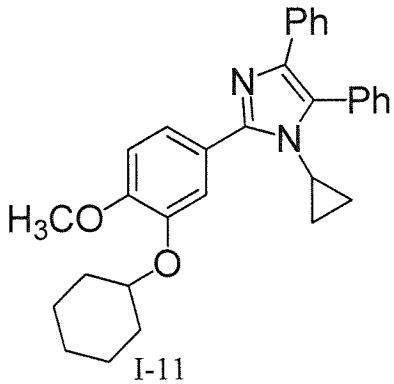
I-8



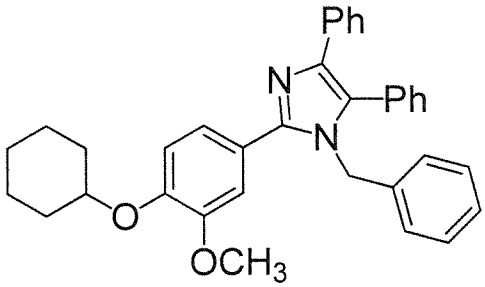
I-9



I-10

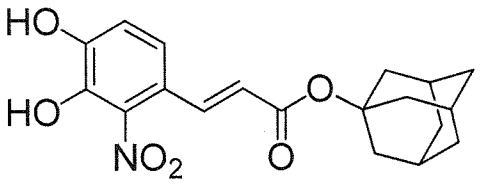


I-11

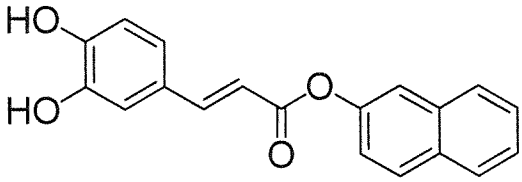


I-12

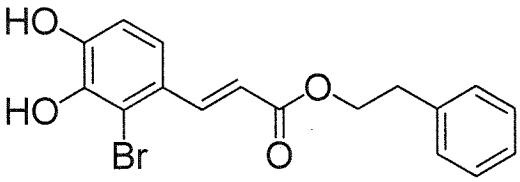
Additional isovanillin derivatives of interest are:



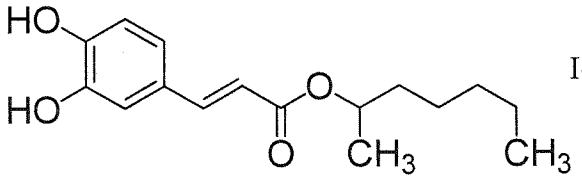
I-14



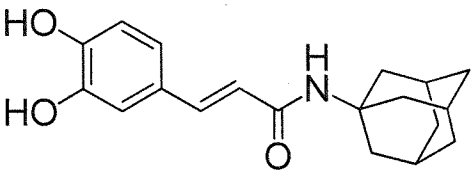
I-15



I-16



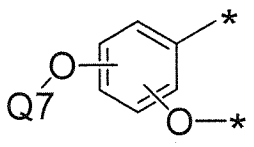
I-17



I-18

It will be appreciated that the aryl group substituents in formulas I-14-I18 can be at any desired position on the on the aryl rings, e.g., the –OH need not be adjacent and the heteroatom substituents may be at any desired location.

Based upon the structure-activity relationships of isovanillin and isovanillin derivatives, preferred components are illustrated by formula I-13:



I-13

where the two * denote valence points where respective additional portions of the components are attached, the remaining phenyl ring positions are independently R1 as previously defined with reference to formula C-13, and Q7 is H or a C1-C6 alkyl group, more preferably a C1-C4 alkyl group, and most preferably methyl. That is, the preferred isovanillin components have the moiety depicted in I-13 and additional portions exemplified by the foregoing disclosure. For example, where * is CHO, the substituent –O–Q7 is located at the *para* position, Q7 is a methyl group, and the –O–* group is located at the *meta* position, the * thereof is H, and the remaining positions on the phenyl ring are all H, the resulting compound is isovanillin. In preferred forms, the isovanillin component is not apocynin.

The Complete Compositions of the Invention

In the case of the preferred three-component compositions of the invention, made by combining individual quantities of normally highly purified curcumin component(s), harmine component(s), and isovanillin component(s), the as-added amounts should give weight ratios of about 10:1.7:0.85 (isovanillin component(s):harmine component(s):curcumin component(s)), but more broadly, the ratios are approximately 0.1-25:0.1-5:0.1-5 (isovanillin component(s):harmine component(s):curcumin component(s)). In this respect, it will be seen that the isovanillin component(s) of the preferred GZ17-6.02 product is/are the preponderant component(s) in the compositions on a weight basis, with the harmine and curcumin component(s) being present in lesser amounts on a weight basis. Generally, the isovanillin component(s) in the most preferred product should be present at a level at least three times (more preferably at least five times) greater than that of each of the harmine and curcumin component(s), again on a weight basis. However, the invention is not limited to such weight ratios. As noted in Example 17, an isovanillin component:harmine component:curcumin component weight ratio of 1:1:1 is also effective. In terms of amounts of the three components, the isovanillin component(s) should be present at a level of from about 25-85% by weight, the harmine component(s) should be present at a level of from about 7-50% by weight, and the curcumin component(s) should be present at a level of from about 5-40% by weight, based upon the total weight of the three components taken as 100% by weight.

In the case of two-component compositions in accordance with the invention made up of curcumin component(s) plus harmine component(s), the weight ratio of the curcumin component(s):harmine component(s) should range from about 0.01:1 to 10:1; and the weight amounts of the curcumin component(s) should range from about 20% to 75% by weight (more preferably from about 30-55% by weight, and most preferably about 45% by weight), and the weight amounts of the harmine component(s) should range from about 25% to 80% by weight (more preferably from about 45% to 70% by weight, and most preferably about 55% by weight), based upon the total weight of the two components in the compositions taken as 100% by weight. Generally, the amount of the harmine component should be greater than the amount of the curcumin component in these two-component compositions.

Two-component compositions made up of isovanillin component(s) plus curcumin component(s) should have a weight ratio of the isovanillin component(s): curcumin component(s) ranging from about 0.5:1 to 25:1; and the weight amounts of the isovanillin component(s) should range from about 25% to 95% by weight (more preferably from about 75% to 95% by weight, and most preferably about 88% by weight), and the weight amounts of the curcumin component(s) should range from about 5% to 75% by weight (more preferably from about 5% to 25% by weight, and most preferably about 12% by weight), based upon the total weight of the two components in the compositions taken as 100% by weight.

Finally, two-component compositions made up of isovanillin component(s) plus harmine component(s) should have a weight ratio of the isovanillin component(s): harmine component(s) should range from about 0.5:1 to 15:1; and the weight amounts of the isovanillin component(s) should range from about 25% to 95% by weight (more preferably from about 75% to 95% by weight, and most preferably about 85% by weight), and the weight amounts of the harmine component(s) should range from about 5% to 75% by weight (more preferably from about 5% to 25% by weight, and most preferably about 15% by weight) by weight, based upon the total weight of the two components in the compositions taken as 100% by weight.

In this connection, it should be understood that the isovanillin component(s) of any of the foregoing two- or three-component compositions containing isovanillin component(s) may be made up of initially added isovanillin component(s) plus any degradation products of the other component(s) yielding products within the ambit of the isovanillin component(s); for example, it

is known that under certain circumstances curcumin will spontaneously degrade to give quantities of vanillin, and, in such circumstances, the total amount of the isovanillin component(s) would be the initially added amounts together with these degradation products. More broadly, the ultimate amounts of the curcumin, harmine, and isovanillin component(s) in the compositions of the invention should be determined based upon the actual contents of the component(s) in question, regardless of whether these component(s) are derived from the originally added component(s) or as degradation products of some or all of these originally added component(s).

As indicated previously, levels of dosing using the compositions of the invention is quite variable owing to factors such as the patient's age, patient's physical condition, the type of condition(s) being treated (e.g., specific cancer(s)), and the severity of the conditions. In general, however, regardless of the dosage form or route of administration employed, such as liquid solutions or suspensions, capsules, pills, or tablets, via oral, parenteral, or injection, the compositions should be dosed of from about 5 to 2000 mg per day, and more usually from about 100-800 mg per day. Such dosages may be based on a single administration per day, but more usually multiple administrations per day.

Finally, the invention also embraces compositions and methods where the individual components are provided and administered separately to subjects, so long as the therapeutic effects of the invention are substantially preserved.

Examples 1-28

The following Examples set forth preferred therapeutic agents and methods in accordance with the invention, but it is to be understood that these examples are given by way of illustration only, and nothing therein should be taken as a limitation upon the overall scope of the invention. A number of the Examples set forth various tests using the preferred drug of the invention, GZ17-6.02, which is sometimes referred to as GZ17Syn-6.02.

The GZ17-6.02 product of the Examples was made by dispersing quantities of solid synthetic isovanillin (771 mg, 98% by weight purity), synthetic harmine (130.3 mg, 99% by weight purity), and a commercially available curcumin product derived by the treatment of turmeric (98.7 mg, containing 99.76% by weight curcuminoids, namely 71.38% curcumin, 15.68% demethoxycurcumin, and 12.70% bisdemethoxycurcumin), in a 1 mL ethanol at a weight ratio of

771:130.3:98.7 (isovanillin:harmine:curcumin product) in ethanol followed by sonication of the dispersion. Aliquots of this stock solution were then used to create the different GZ17-6.02 dilutions using stock media of the cells in question.

The two-component products described in Example 23 were made in the same fashion as the GZ17-6.02 agent, and the weight ratios of the two components were as set forth immediately above, e.g., the isovanillin/harmine sub-combinations contained a weight ratio of 771:130.3, and so forth.

Example 1

In this example, the preferred GZ17-6.02 product was tested with two different human head and neck cancers (HN5 and OSC19), in order to determine the extent of cell death induced by the product.

Methods

The respective cells were individually cultured in a growth medium prepared using RPMI-1640 medium containing 11.1 mM D-glucose with 10% fetal bovine serum, 10 mM HEPES, 2 mM L-glutamine, 1 mM sodium pyruvate, 0.05 mM 2-mercaptoethanol, and Antibiotic-Antimycotic. These cells were maintained in T75 tissue culture flasks in a humidified incubator at 37°C and 5% CO_2. The media were changed on a third day after cell plating, and the cells were passaged on day 5 by trypsinization.

Formation of Cancer Spheroids

Custom-made micromolds with 100 μm diameter wells were loaded with the cells (US Patent No. 8,735,154, incorporated by reference herein). The media were changed every day by partial replacement. Cell aggregates were allowed to form in the micromolds for 72 hours and then were transferred to a 100 mm non-treated tissue culture dishes for 3 additional days. The spheroids were passed through 70 μm and 100 μm cell strainers (#3431751 and # 43152, Corning, Tewksbury, MA) and maintained in HEPES Balanced Salt Solution comprised of: 20 mM HEPES, 114 mM NaCl, 4.7 mM KCl,1.2 mM KH_2PO_4,1.16 mM $MgSO_4$, 2.5 mM $CaCl_2$, 25.5 mM $NaHCO_3$ and 0.2% bovine serum albumin (fatty acid free), pH 7.2.

Testing of GZ17-6.02 on Head and Neck Cancer Spheroids

Individual wells of a 96 well plate were manually loaded with 15-20 cancer spheroids each, and exposed to selected doses of GZ17-6.02. Each trial was run with at least 4 replicates at each

dose. After a 24 hour exposure to the selected dosages of GZ17-6.02, PrestoBlue (Life Technologies, Inc) was added to each well and fluorescence readings were taken 4-6 hours later with an excitation wavelength of 485 nm and an emission wavelength of 560nm, using a microplate reader (Enspire Multimode, PerkinElmer). Results were averaged following background subtraction and normalized to untreated cell controls.

Fig. 1 demonstrated that GZ17-6.02 dramatically kills HN5 and OSC19 cancer cells in a dose-dependent manner. The X axis is the increasing dose of GZ17-6.02 and the Y axis is the average number of live cells in each well at the end of a 24 hour exposure to the stated dose of GZ17-6.02.

Example 2

In this example, GZ17-6.02 was found to induce significant cancer cell death in human pediatric leukemia cells and pediatric osteosarcoma in a dose-dependent manner.

Jurkat leukemia cells were grown in suspension in media (RPMI supplemented with 10% FBS), maintained at approximately 500,000 cells/mL. The cells were plated in 96-well plates, and each well was exposed to a selected dose of GZ17-6.02 for 24 hours (a minimum of 4 replicates for each dosage). These cells were not treated to generate spheroids, but were directly plated onto the well plates. After a 24 hour exposure to the selected dosages of GZ17-6.02, PrestoBlue (Life Technologies, Inc) was added to each well and fluorescence readings were taken 4-6 hours later with an excitation wavelength of 485 nm and an emission wavelength of 560nm, using a microplate reader (Enspire Multimode, PerkinElmer). Results were averaged following background subtraction and normalized to untreated cell controls.

Human osteosarcoma cells (HOS) also had a significant dose-dependent increase in cell death when exposed to GZ17-6.02 for 24 hours. The methods to create and test osteosarcoma spheroids were the same as the methods described in Example 1.

As illustrated in Figs. 2A and 2B, increasing doses of GZ17-6.02 induced significant cell death in both leukemia and osteosarcoma cell types tested.

Example 3

In this example, the effect of increasing doses of GZ17-6.02 in killing human lymphoma cells (mo205) and human lung cancer cells (H358) was tested.

The lymphomas treatment methods used were identical to those described in Example 2 relative to the pediatric leukemia cells, whereas the lung cancer treatment method was the same as described in Example 1.

Figs. 3A and 3B set forth the results of these tests, and demonstrate the effectiveness of GZ17-6.02 in inducing lymphoma and lung cancer cell death.

Example 4

In this example, the effect of increasing doses of GZ17-6.02 in killing human ovarian cancer cells (A1847) and human prostate cancer cells (22rv1) was tested.

The cells were treated and tested as set forth in Example 1.

This test confirmed that both types of cells experienced dose-dependent death when exposed to GZ17-6.02, see Figs. 4A and 4B.

Example 5

In this example, the effect of increasing doses of GZ17-6.02 in killing human breast cancer cells (du4475) and human pancreatic cancer cells (panc-1) was tested.

The cells were treated and tested as set forth in Example 1, except that a different growth medium was used, namely Dulbecco's Modified Eagle Medium (DMEM) with 10% fetal bovine serum, and 1% penicillin/streptomycin mix (Sigma-Aldrich).

This test confirmed that both types of cells experienced dose-dependent death when exposed to GZ17-6.02, see Figs. 5A and 5B.

As is evident from Examples 1-5, ten different cancer types were tested with GZ17-6.02 and they all were sensitive to the therapeutic agent. In most of the cancers (head and neck cancer (OSC19), leukemia, osteosarcoma (bone cancer), lymphoma, lung cancer, ovarian, prostate, breast, and pancreatic cancer), the compound killed nearly all of the cells in the dish at a dose of 3.13-6.25 mg/mL. This array of cancer types represents a substantial portion of human cancers. Moreover, the results confirm that the therapeutic agent is effective in both solid tumor cancers and blood cancers.

Example 6

In this test, non-cancerous integumental (dermal) fibroblasts (hgf-1) were tested with GZ17-6.02 and compared with prostate cancer (22rv1) and ovarian cancer cells (A1847), to

determine the effect of GZ17-6.02 on the non-cancerous cells versus the prostate cancer and ovarian cancer cells.

The fibroblasts were treated as follows: The cells were grown to confluence in the DMEM medium of Example 5, and then placed in 96-well plates where they adhered to the bottom of the plates. Each well was then exposed to a selected dose of GZ17-6.02 for 24 hours (a minimum of 4 replicates each), and tested according to Example 1. The prostate cancer and ovarian cancer results were taken from the previous Example 4.

As illustrated in Fig. 6, the cancer cells begin to die at lower GZ17-6.02 doses than the non-cancerous fibroblast cells, demonstrating that GZ17-6.02 is more toxic to cancer cells versus the non-cancerous fibroblasts.

Example 7

Migration of cells away from a primary tumor, followed by invasion of those tumor cells first into the blood vessels and later out of the blood vessels and into other tissues, are the two steps essential for metastases to form from a primary tumor. The cells were grown in the DMEM media of Example 5.

Head and neck cancer cells (OSC19) were tested using a commercially available migration assay kit, Cultrex 96 Well Migration Assay (R&D Systems). The cell movement from the upper compartment to the lower compartment was measured as representative of cell migration. A negative control migration was also measured, using the GZ17-6.02 vehicle, namely a dilution of ethanol in the growth media to the same concentration as GZ17-6.02 in the growth media.

The head and neck cancer cells were also assayed for migration using a Cultrex Cell Invasion Assay (R&D Systems). The ability of the head and neck cancer cells to invade a collagen matrix was measured by counting cells that exited the upper chamber and passed through a collagen-surrounded lower chamber. Similarly, a negative control for invasion was also measured, using the same ethanol vehicle employed in the migration assay.

As illustrated in Fig. 7A, the GZ17-6.02 significantly inhibited migration so that almost no head and neck cancer cells could migrate from the site of origin. Likewise, GZ17-6.02 significantly inhibited invasion (Fig. 7B) by more than 60%.

Example 8

In this test, the synergism of GZ17-6.02 with doxorubicin (a common chemotherapy drug) was tested on ovarian cancer cells. In this test, increasing doses of doxorubicin were administered to ovarian cancer spheroids and cell deaths were measured, as described in Example 1. The protocol involved testing doxorubicin alone at various dosages (Fig. 8, doxorubicin alone – closed circles), with comparative tests using the various dosages of doxorubicin in combination with either 0.2 mg/mL (Fig. 8 open circles) or 0.4 mg/mL (Fig. 8 closed triangles) GZ17-6.02. Additionally, the induced cell death results from use of 0.2 mg/mL GZ17-6.02 alone (Fig. 8, line A) and 0.4 mg/mL GZ17-6.02 alone (Fig. 8, line B) were determined.

As is evident from Fig. 8, even at the lowest dose of doxorubicin (0.002 μM), the addition of GZ17-6.02 at 0.2 and 0.4 mg/mL increased cell death significantly below the level of either compound alone. At low doses of doxorubicin alone (up to 0.158 μM), doxorubicin was ineffective. GZ17-6.02 administered alone at a dose of 0.2 mg/mL resulted in cell death at a level represented by the upper horizontal dotted line in Fig. 8. Moreover, GZ17-6.02 administered alone at a dose of 0.4 mg/mL resulted in cell death at a level represented by the lower horizontal dotted line in Fig. 8. Thus, even at these low dosages, addition of GZ17-6.02 significantly increased cell death (see data points under both of the horizontal dotted lines in Fig. 8). This demonstrates the synergy of the combination of GZ17-6.02 and doxorubicin, even at low dosages of both GZ17-6.02 and doxorubicin. This trend is confirmed at higher dosages of doxorubicin, where the combined products were always more effective than doxorubicin alone.

Example 9

There are multiple general ways in which cancer (blood or solid tumors) can be blocked by chemotherapy. One is to actually induce death in the cancer cells (apoptosis), and a second is to block the ability of cells to receive nutrients, basically starving them to death (necrosis). This test demonstrates that at the ED_{50} of GZ17-6.02 on head and neck cancer cells (OSC19) caused cell death via apoptosis. In the test, head and neck cancer cells were stained with an apoptotic fluorophore and sorted by flow cytometry, which allows a single cell to be counted and measured for fluorescence simultaneously. This histograms in Fig. 9A and 9B illustrate the shift in fluorescence intensity to a lower level, indicating apoptotic cell death. While the control (Fig. 9A, head and neck cancer cells without GZ17-6.02) had little apoptotic cell death (19.8%), 48.2% of

the cells exposed to GZ17-6.02 died of apoptosis (Fig. 9B). This indicates one type of mechanism of action of GZ17-6.02.

Example 10

Caspase proteins are intracellular proteins involved in the apoptotic programmed cell death pathway. In instances where live lung cancer cell number decrease while a caspase protein increases, it can be inferred by association that the caspase was activated, and was thus associated with the molecular pathway of the cell death.

In these tests, the lung cancer cells (H358) were assayed using caspase testing kits (Promega Caspase-Glo 3/7, -Glo 2, -Glo 6, -Glo 8, and -Glo 9). Sample lung cancer cells were homogenized on ice in the provided preparation buffer and agitated on a plate shaker at low speeds (around 300 rpm). The supernatants were exposed to the provided assay solutions and read on a microplate reader for luminescent output (Enspire Multimode, PerkinElmer).

The test results indicated that caspases 3 and 7 (Fig. 10A, filled triangles) increased dramatically in association with cell death (filled circles). In addition, results indicated that caspase 6 (Fig. 10B, open circles) increased in association with cell death (filled circles). In contrast, caspase 9 was not activated (Fig. 10A, open circles). This implies a receptor-mediated cell death pathway and not a mitochondrial cell death pathway. In order to confirm this, an ATP assay (CellTiter-Glo, Promega) was conducted in which toxicity of the mitochondria were measured at the same time as cell death, based upon ATP concentrations. If a mitochondrial toxicity were responsible for cell death, it would happen at lower doses or prior in time to the cell death. Fig. 10C confirms that there was no significant mitochondrial toxicity (filled circles) while there was cell death (open circles).

Example 11

The procedures of Example 10 were followed, with testing of GZ17-6.02 on ovarian cancer cells (A1847). Caspases 3 and 7 were activated at low doses of GZ17-6.02, indicating a receptor-mediated cell death (Fig. 11A, filled circles). Caspase 6 was active at low doses of GZ17-6.02 (Fig. 11B, filled circles). However, caspase 8 was activated, which typically signals cell death via the mitochondria (Figs. 11C, filled circles) and caspase 9 was also activated (Fig. 11D, filled circles). In order to confirm the mitochondrial cell death pathway, mitochondrial toxicity was

monitored in comparison to cell death (Fig. 11E, filled circles), indicating that the mitochondrial toxicity was at least partially involved in the subsequent cell death.

Example 12

The procedures of Example 10 were followed, with testing of GZ17-6.02 on osteosarcoma cells (HOS). These tests indicated that levels of caspases 3 and 7 were significantly higher when exposed to doses of GZ17-6.02 over 0.4 mg/mL before or during cell death (Fig. 12A, filled circles). Caspase 6 was activated at high doses of GZ17-6.02 (Fig. 12B, filled circles). In contrast, caspase 2 (Fig. 12C, filled circles) and caspase 9 (Fig. 12D, filled circles) showed no activation that would indicate that they were involved in the cell death pathways induced by GZ17-6.02.

Example 13

The procedures of Example 10 were followed, with testing of GZ17-6.02 on human head and neck cancer cells (OSC19). Fig. 13 (filled circles) indicates that there is no mitochondrial toxicity involved in GZ17-6.02 induced cell death in the head and neck cancer cells.

Example 14

In addition to directly killing cancer cells, chemotherapeutic agents can work by blocking the rapid proliferation of cancer cells, thus eventually halting the progression of the cancer.

In this test, a multiplex dot-based Western assay for proliferative proteins was used to measure the relative amounts of proteins known to be involved in cell proliferation signaling, in both a control test (no GZ17-6.02) and an inactivation test (with GZ17-6.02, at the ED_{50} for head and neck cancer cells).

Following a 24 hour exposure to GZ17-6.02 or vehicle head and neck cancer cells (OSC19) were homogenized and the lysate loaded onto the Human Phospho-Kinase Array Kit (R&D Systems) using the following procedure. The antibody-attached membranes were incubated overnight at 4°C with the respective cell lysates, followed by repeated washing and incubation in the detection antibodies for 24 hours. After subsequent repeated washes, streptavidin-HRP was applied for 30 minutes. Membranes were washed and exposed to film after applying chemiluminescence reagent mix.

Cellular proteins specific to a pathway of cell proliferation were tested in duplicate (resulting in 2 side-by-side dots for each protein in Fig. 14A). The darker the dot, the more relative protein was present in the homogenate. As shown in Fig. 14B, cell proliferation proteins showed

a dramatic reduction in amount when exposed to the head and neck cancer cell ED_{50} dose of GZ17-6.02. The proteins showing the greatest reduction included epidermal growth factor receptor (block a compared to block a'), extracellular-signal-regulated kinase (block b compared to block b'), the catalytic subunit of AMP-activated kinase (block c compared to block c'), β-catenin (block d compared to block d'), STAT2 (block e compared to block e') and Chk-2 (block f compared to block f').

Example 15

In this example, two independent scientists conducted identical tests with ovarian cancer and lung cancer cells (A1847 and H358) using the techniques described in Example 1, in order to determine induced cell death upon application of GZ17-6.02. The nearly identical results (filled circles versus open circles) confirm the reliability of the testing as a determination of GZ17-6.02 effectiveness. Fig. 15A sets forth the ovarian cancer results, whereas Fig. 15B gives the lung cancer cell results.

Example 16

Six-week old FOXN1 mice were inoculated with human head and neck cancer cells (OSC19) bilaterally into the flank region, in order to induce the formation of palpable tumors. The bilateral tumors were measured at one week after cell injection, and had each grown to an average volume of approximately 9 mm^3. Half of the mice were injected daily with 15 mg/kg body weight GZ17-6.02 stock solution into the right side tumors, starting on day 7 after inoculation of the tumor cells. The other half of the mice were injected with the same volume of the ethanol carrier of the stock solution into the right side tumors. Thus, each mouse had 2 palpable tumors, one on either flank, but only one side was injected with GZ17-6.02. Every 2-4 days, the tumors on both sides of each mouse were measured with vernier calipers in 2 perpendicular dimensions and the volumes calculated.

Fig. 16A shows that GZ17-6.02 dramatically halted tumor growth in the treated mice, so that by 3 weeks there was a distinct and statistically significant difference between the vehicle-treated controls and the GZ17-6.02 treated mice. Further, the trend in the GZ17-6.02 treated mice was that the tumors began to decrease in volume from day 21 (although the decrease was not statistically significant) from tumor size at day 28. Fig. 16A shows the decline in tumor volume in the tumors that were directly injected with GZ17-6.02. Fig. 16B shows the halt in tumor growth

that occurred in the non-injected tumors on the contralateral side of the neck of the treated mice. Fig. 16B demonstrates that GZ17-6.02 has a systemic anticancer effect, i.e., the contralateral tumor size decrease without direct injection of GZ17-6.02 indicates that the agent traveled through the bloodstream of the mice.

Throughout the study, the animals showed no signs of complications, distress, or toxicity. Thus, none of the over 30 mice in the study exhibited any observable adverse reactions. Daily observation of the mice documented that none suffered any weight loss, new tumor formation, loss of appetite, change in fur appearance or grooming behavior, or change in activity owing to lethargy. Moreover, there were no gross abnormalities of any of the internal organs of the mice upon necropsy. It was thus concluded that there were no drug-drug interactions, which are common with multiple-drug anti-cancer compositions.

In another mice study, a head and neck tumor was surgically removed from a human patient, and approximate 35 mg-portions of the tumor were implanted in a first randomized group of ten nude-FOXN1 mice using a 5% ethanol in saline vehicle via oral gavage. A second randomized group of ten mice was treated only with the vehicle as a control, in the same manner as the first group. The first mice group was treated with 30 mg/kg/day doses of GZ17-6.02 five days/week, and the doses were increased to 50 mg/kg/day during the second week of treatment. The two groups of mice were treated for a total of three weeks, and tumor volumes were measured twice a week using a Vernier caliper. The results of this study are set forth in Fig. 16C, which illustrates that the fractional tumor volumes relative to the pretreatment tumor size were reduced in the first group of mice, while the control mice exhibited gradually increasing tumor burdens.

Example 17

In this Example, a different ratio of isovanillin, harmine, and curcumin was used, as compared with GZ17-6.02, namely 1/3 by weight of each component. This formulation was prepared by mixing the three GZ17-6.02 components in 1 mL of ethanol to obtain a secondary stock solution. Fig. 17A shows that the original stock solution (filled circles) and the secondary stock solution (open circles) are bioequivalent in terms of ovarian cancer cell (A1847) kill rate. Figs. 17B and 17C show the same general effect for lung cancer cells (H358) and prostate cancer cells (22rv1).

Example 18

In this Example, a known ovarian cancer cell kill rate for GZ17-6.02 was selected, and the amount of isovanillin in this dosage (0.78 mg/mL) was tested against GZ17-6.02. Additionally, sub-combinations of isovanillin:curcumin and isovanillin:harmine were tested, where the concentrations of the two ingredients were identical to those in the GZ17-6.02. Thus, the concentration of the isovanillin:curcumin product was 0.78 mg/mL isovanillin and 0.13 mg/mL curcumin, and the concentration of the isovanillin:harmine product was 0.78 mg/mL isovanillin and 0.099 mg/mL harmine. Figs. 18A-18D illustrate these results with ovarian cancer cells (A1847), lung cancer cells (H358), prostate cancer cells (22rv1), and lymphoma cells (MO205). As is evident, the two-component products each exhibited greater kill rates as compared with isovanillin alone.

Example 19

The procedures of Example 18 were followed, except that curcumin was tested alone versus GZ17-6.02, together with curcumin:isovanillin and curcumin:harmine two-component products. In this test, the curcumin was present at a level of 0.78 mg/mL and the concentrations in the curcumin:isovanillin product were 0.78 mg/mL curcumin and 3.59 mg/mL isovanillin, and in the curcumin:harmine product the concentrations were 0.78 mg/mL curcumin and 0.59 mg/mL harmine. Figs. 19A-19D illustrate the results of this test, and confirm that the two-component products give better results than curcumin alone.

Example 20

The procedures of Example 18 were followed, except that harmine was tested alone versus GZ17-6.02, together with harmine:isovanillin and harmine:curcumin two-component products. In this test, the harmine was present at a level of 0.78 mg/mL and the concentrations in the harmine:isovanillin product were 0.78 mg/mL harmine and 6.09 mg/mL isovanillin, and in the harmine:curcumin product the concentrations were 0.78 mg/mL curcumin and 1.03 mg/mL curcumin. Figs. 20A-20D illustrate the results of this test, and confirm that the two-component products give better results than harmine alone.

Example 21

In this example, the individual components of GZ17-6.02 were tested against lymphoma cancer cells (MO205) at the component concentrations found in GZ17-6.02, at dosage rates of 12,

24, 48, and 96 μg/mL. The theoretical additive effect (black bar) of the 3 components was also calculated in each case and shown versus the actual test results found using GZ17-6.02. Figs. 21A-21D illustrate the results of these tests, and confirm that, at the tested dosages, the GZ17-6.02 product had a greater effect than the individual components and the theoretical additive effect thereof, thus establishing synergistic effects. In this regard, those skilled in the art understand that dosages of anticancer products actually administered to patients depend on a number of factors, including age, weight, sex, physical conditions, types of cancers, and stages of cancers. By the same token, it should also be understood that at some dosage levels and/or specific concentrations of components, the results of Figs. 21A-21D may not be duplicated. These same considerations apply to the tests set forth in Examples 22 and 23 below. In most cases, however, compositions giving therapeutic synergies at the selected dosages are preferred.

Example 22

In this example, the individual components of GZ17-6.02 were tested against ovarian cancer cells (A1847) and breast cancer cells (du4475) at the component concentrations found in GZ17-6.02, at dosage rates of 12 and 24 μg/mL. The theoretical additive effect (black bar) of the 3 components was also calculated in each case and shown versus the actual test results found using GZ17-6.02. Figs. 22A and 22B illustrate the results of these ovarian cancer tests, and confirm that, at the tested dosages, the GZ17-6.02 product had a greater effect than the individual components and the theoretical additive effect thereof. In an additional test at 48 μg/mL dosage rate, this effect was not observed. Fig. 22C sets forth the results using breast cancer cells.

Example 23

In this example, increasing concentrations of different isovanillin derivatives or metabolites were tested using lung cancer cells (H358), ovarian cancer cells (A1847), and prostate cancer cells (22rv1), to determine the anticancer effects of the derivatives/metabolites, using the techniques of Example 1. Each of the derivatives/metabolites (vanillin, isovanillic acid, O-vanillin, and isovanillyl alcohol) demonstrated anticancer effects (see Figs. 23A-23L).

Example 24

In this example, increasing concentrations of different harmine derivatives or metabolites were tested using lung cancer cells (H358), ovarian cancer cells (A1847), and prostate cancer cells (22rv1), to determine the anticancer effects of the derivatives/metabolites, using the techniques of

Example 1. Each of the derivatives/metabolites (harmaline, tetrahydro-harmine, harmole hydrochloride, harmalol hydrochloride, and harmane) demonstrated anticancer effects (see Figs. 24A-24O).

Example 25

In this example, increasing concentrations of a curcumin derivative, bisdemethoxy curcumin, were tested using lung cancer cells (H358), ovarian cancer cells (A1847), and prostate cancer cells (22rv1), to determine the anticancer effects of the derivative, using the techniques of Example 1. The results confirmed the anticancer effects of this derivative (see Figs. 25A-25C).

Example 26

In this test, the preferred GZ17-6.02 product was stored at various temperatures over a two-month period, and then tested against ovarian cancer cells (A1847). The results are set forth in Fig. 26, which illustrates that at storage temperatures of -20°C and 4°C, the product maintained its potency.

Example 27

In this test, the GZ17-6.02 product was subjected to successive freeze/thaw cycles. In each cycle, the product was frozen at -20°C, followed by allowing the product temperature to equilibrate at room temperature. At the end of each cycle, the product was tested against ovarian cancer cells (A1847) using the methods of Example 1. A total of 10 successive freeze/thaw cycles were performed on the same sample. Fig. 27 illustrates that there was no significant change in the efficacy of the GZ17-6.02 against ovarian cancer cells.

Example 28

In this series of tests, GZ17-8.02 (which is identical with the preferred GZ17-6.02 composition), and several different combinations of curcumin, harmine, and isovanillin derivatives were tested against ovarian cancer (A1847), lung cancer (H358), prostate cancer (22rv1), pancreatic cancer, and fibroblast cells (hgf-1), in order to confirm that such derivative combinations were effective. In each case, the weight ratio of the isovanillin component:curcumin component:harmine component was 7.7:1:1.3, and the compositions were prepared as described above and the tests were carried out as described in Examples 1, 2, and 6. The compositions are identified below, including the respective graphs giving the results of the tests:

- GZ17-8.02 (Fig. 28A)

- GZI7-8.03 contained vanillin, turmeric-derived curcumin, and harmine (Fig. 28B)
- GZI7-8.04 contained orthovanillin, turmeric-derived curcumin, and harmine, and (Fig. 28C)
- GZI7-8.05 contained isovanillyl alcohol, turmeric-derived curcumin, and harmine (Fig. 28D)
- GZI7-8.06 contained isovanillic acid, turmeric-derived curcumin, and harmine (Fig. 28E)
- GZI7-8.07 contained isovanillin, turmeric-derived curcumin, and harmaline (Fig. 28F)
- GZI7-8.08 contained isovanillin, turmeric-derived curcumin, and harmane (Fig. 28G)
- GZI7-8.09 contained isovanillin, 100% synthetic curcumin, and harmine (Fig. 28H)
- GZI7-8.10 contained isovanillin, bisdemethoxy curcumin, and harmine (Fig. 28I)

Examples 29-79

In each of the following examples, respective compositions having different combinations of isovanillin, curcumin, and harmine components were tested as set forth in Examples 1-6, against cancer cells to determine the anti-cancer effectiveness thereof. The specific cancer cell lines used in each case were those previously described. In all cases, the weight ratio of the isovanillin component:curcumin component:harmine component was 7.7:1:1.3, and the compositions were prepared as described above in connection with the preparation of GZ17-6.02. A separate graph is provided for each test, which identifies the cancer cells tested.

The following Table sets forth the Example numbers, composition designation, components, and corresponding Figure numbers for this series of tests. Where "curcumin" is specified, this refers to turmeric-derived curcumin, and where "curcumin (syn)" is specified, this refers to essentially pure synthetically-derived curcumin.

Example No.	Composition	Isovanillin Component	Curcumin Component	Harmine Component	Figure Nos.
29	GZ17-08.11	isovanillin	bisdemethoxy curcumin	harmaline	29 A-G
30	GZ17-08.12	isovanillin	bisdemethoxy curcumin	harmane	30 A-G
31	GZ17-08.13	isovanillin	bisdemethoxy curcumin	harmalol	31 A-G
32	GZ17-08.14	isovanillin	bisdemethoxy curcumin	harmol	32 A-G
33	GZ17-08.15	vanillin	bisdemethoxy curcumin	harmine	33 A-G

34	GZ17-08.16	vanillin	bisdemethoxy curcumin	harmaline	34 A-G
35	GZ17-08.17	vanillin	bisdemethoxy curcumin	harmane	35 A-G
36	GZ17-08.18	vanillin	bisdemethoxy curcumin	harmalol	36 A-G
37	GZ17-08.19	vanillin	bisdemethoxy curcumin	harmol	37 A-G
38	GZ17-08.20	isovanillin	curcumin (syn)	harmalol	38 A-G
39	GZ17-08.21	isovanillin	curcumin (syn)	harmol	39 A-G
40	GZ17-08.22	vanillin	curcumin (syn)	harmaline	40 A-G
41	GZ17-08.23	vanillin	curcumin (syn)	harmane	41 A-G
42	GZ17-08.24	vanillin	curcumin (syn)	harmalol	42 A-G
43	GZ17-08.25	vanillin	curcumin (syn)	harmol	43 A-G
44	GZ17-08.26	orthovanillin	bisdemethoxy curcumin	harmine	44 A-G
45	GZ17-08.27	orthovanillin	bisdemethoxy curcumin	harmaline	45 A-G
46	GZ17-08.28	orthovanillin	bisdemethoxy curcumin	harmane	46 A-G
47	GZ17-08.29	orthovanillin	bisdemethoxy curcumin	harmalol	47 A-G
48	GZ17-08.30	orthovanillin	bisdemethoxy curcumin	harmol	48 A-G
49	GZ17-08.31	isovanillyl alcohol	bisdemethoxy curcumin	harmine	49 A-D
50	GZ17-08.32	isovanillyl alcohol	bisdemethoxy curcumin	harmaline	50 A-D
51	GZ17-08.33	isovanillyl alcohol	bisdemethoxy curcumin	harmane	51 A-D
52	GZ17-08.34	isovanillyl alcohol	bisdemethoxy curcumin	harmalol	52 A-D
53	GZ17-08.35	isovanillyl alcohol	bisdemethoxy curcumin	harmol	53 A-D
54	GZ17-08.36	orthovanillin	curcumin (syn)	harmaline	54 A-D
55	GZ17-08.37	orthovanillin	curcumin (syn)	harmane	55 A-D
56	GZ17-08.38	orthovanillin	curcumin (syn)	harmalol	56 A-D
57	GZ17-08.39	orthovanillin	curcumin (syn)	harmol	57 A-D
58	GZ17-08.40	isovanillyl alcohol	curcumin (syn)	harmaline	58 A-D
59	GZ17-08.41	isovanillyl alcohol	curcumin (syn)	harmane	59 A-D
60	GZ17-08.42	isovanillyl alcohol	curcumin (syn)	harmalol	60 A-D
61	GZ17-08.43	isovanillyl alcohol	curcumin (syn)	harmol	61 A-D
62	GZ17-08.44	isovanillic acid	bisdemethoxy curcumin	harmine	62 A-D

63	GZ17-08.45	isovanillic acid	bisdemethoxy curcumin	harmaline	63 A-D
64	GZ17-08.46	isovanillic acid	bisdemethoxy curcumin	harmane	64 A-D
65	GZ17-08.47	isovanillic acid	bisdemethoxy curcumin	harmalol	65 A-D
66	GZ17-08.48	isovanillic acid	bisdemethoxy curcumin	harmol	66 A-D
67	GZ17-08.49	isovanillic acid	curcumin (syn)	harmaline	67 A-D
68	GZ17-08.50	isovanillic acid	curcumin (syn)	harmane	68 A-D
69	GZ17-08.51	isovanillic acid	curcumin (syn)	harmalol	69 A-D
70	GZ17-08.52	isovanillic acid	curcumin (syn)	harmol	70 A-D
71	GZ17-08.53	5-bromovanillin	curcumin	harmine	71 A-D
72	GZ17-08.54	2-bromo-3-hydroxy-4-methoxy benzaldehyde	curcumin	harmine	72 A-D
73	GZ17-08.55	2-iodo-3-hydroxy-4-methoxy benzaldehyde	curcumin	harmine	73 A-D
74	GZ17-08.56	isovanillin	(1E,4E)-1,5-bis(3,5-dimethoxyphenyl)-1,4-pentadien-3-one	harmine	74 A-D
75	GZ17-08.57	isovanillin	cardamonin	harmine	75 A-D
76	GZ17-08.58	isovanillin	2'-hydroxy-3,4,4',5'-tetramethoxychalcone	harmine	76 A-D
77	GZ17-08.59	isovanillin	2,2'-dihydroxy-4',6'-dimethoxychalcone	harmine	77 A-D
78	GZ17-08.60	isovanillin	(1E,4E)-1,5-Bis(2-Hydroxyphenyl)-1,4-pentadien-3-one	harmine	78 A-D
79	GZ17-08.61	isovanillin	curcumin	1,2,3,4-tetrahy-droharmane-3-carboxylic acid	79 A-D

These test results confirm that all of the compositions were effective anti-cancer agents.

Example 80

In this series of tests, the following compositions were prepared:

Composition	Isovanillin Component	Curcumin Component	Harmine Component
GZ17-10.00	orthovanillin	curcumin	harmaline
GZ17-10.01	orthovanillin	-	harmaline
GZ17-10.02	orthovanillin	curcumin	-
GZ17-10.03	-	curcumin	harmaline

GZ17-10.04	orthovanillin	-	-
GZ17-10.05	-	curcumin	-
GZ17-10.06	-	-	harmaline

GZ17-10.00 is identical with the above-described GZ17-6.02, having the identical amounts of the components and method of preparation. The two-component compositions have the same relative ratios, namely 7.7:1.3 for GZ17-10.01, 7.7:1 for GZ17-10.02, and 1:1.3 for GZ17-10.03. The single-component compositions contain the same amount of component as used in the three- and two-component compositions.

The respective compositions of this Example were tested against different cancer cell lines, as previously identified, using the methods of Examples 1-6, as set forth in the accompanying relevant graphs, 80A-80R. Six of these (Figs. 80G, H, L, M, Q, and R) are comparative bar graphs setting forth the theoretical additive effect of the components, and the results obtained using the complete formulations, thereby demonstrating the synergistic effects of the compositions of the invention.

These test results confirm that all of the compositions were effective anti-cancer agents.

Example 81

In this series of tests, the following compositions were prepared:

Composition	Isovanillin Component (ratio component = 7.7)	Harmine Component (ratio component = 1.3)
GZ17-08.512	isovanillin	harmine
GZ17-08.513	isovanillin	harmaline
GZ17-08.514	isovanillin	harmane
GZ17-08.515	isovanillin	harmalol
GZ17-08.516	isovanillin	harmol
GZ17-08.517	vanillin	harmine
GZ17-08.518	vanillin	harmaline
GZ17-08.519	vanillin	harmane
GZ17-08.520	vanillin	harmalol
GZ17-08.521	vanillin	harmol

The respective compositions of this Example were tested against different cancer cell lines, as previously identified, using the methods of Examples 1-6, as set forth in the accompanying relevant graphs, 81A-81DD.

These test results confirm that all of the compositions were effective anti-cancer agents.

Example 82

The purpose of this study was to determine the effect of GZ17-6.02 on the regression of growth and the inhibition of metastases in a pancreatic cancer mouse model. Twelve immunocompromised (nude) mice were treated injected with MiaPaCa-2 cells (a pancreatic cancer cell line) that had been genetically transformed to express TdTomato and luciferin for *in vivo* tumor imaging. After tumors reached a measurable size (approximately 2 weeks), half of the mice were randomly assigned to the experimental group and the other half to the control group.

The experimental group was treated with GZ17-6.02 at a daily dose of 100 mg/kg body weight. The drug administration was oral, dissolved in peptamen. Control mice were fed the vehicle (peptamen) alone. Once a week mice were lightly anesthetized in order to use IVIS imaging to detect the tumor sizes. On day 5, there was no statistical difference in the amount of fluorescence measured from the control (placebo-fed) and GZ17-6.02-fed mice. However, by day 20, there was a statistically significant decrease in the amount of fluorescence, indicating a decreased total tumor burden, in the mice fed GZ17-6.02, as compared with the control. In addition, the placebo-treated mice had dramatic levels of peritoneal ascites that were not present in the GZ17-6.02 group.

At the end of 21 days of treatment with GZ17-6.02 or the placebo, the mice were sacrificed and tumor samples removed from the pancreas, liver, and lungs. The primary pancreatic tumors were weighed. The placebo-fed animals had pancreatic tumors that averaged 2.4 times statistically larger than the GZ17-6.02 fed mice.

Example 83

A 63-year-old male patient having a Prostate-Specific Antigen (PSA) count of 8.2 began a treatment regimen using a dosage form of GZ17-6.02. Specifically, solid GZ17-6.02 prepared by evaporating the ethanol from the previously described GZ17-6.02 agent was dispersed in water in equal weight amounts, e.g., 5 grams solid GZ17-6.02 in 5 grams water. This dosage form was taken three times daily for six weeks, with each dose being four fluid ounces of the 50%:50% dispersion. At the end of six weeks, the patient's PSA count had dropped to 2.1, and all prostate and urological tests were normal. The treating physician had no explanation for the decline in PSA. The patient experienced no observable adverse reactions to the treatment with GZ17-6.02.

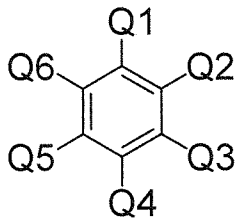
Although not wishing to be bound by any theory of operation, the inventors believe that the therapeutic agents of the invention ameliorate a number of conditions or illnesses, and especially reduce and/or eliminate cancer and/or the symptoms thereof by augmenting or stimulating the patients' immune systems. In this sense, the invention is believed to be a form of biological therapy. As such, it is considered that the invention is applicable to virtually all cancers, such as the following: Acute Lymphoblastic Leukemia, Adult; Acute Lymphoblastic Leukemia, Childhood; Acute Myeloid Leukemia, Adult; Acute Myeloid Leukemia, Childhood; Adrenocortical Carcinoma; Adrenocortical Carcinoma, Childhood; Adolescents, Cancer in; AIDS-Related Cancers; AIDS-Related Lymphoma; Anal Cancer; Appendix Cancer; Astrocytomas, Childhood; Atypical Teratoid/Rhabdoid Tumor, Childhood, Central Nervous System; Basal Cell Carcinoma; Bile Duct Cancer, Extrahepatic; Bladder Cancer; Bladder Cancer, Childhood; Bone Cancer, Osteosarcoma and Malignant Fibrous Histiocytoma; Brain Stem Glioma, Childhood; Brain Tumor, Adult; Brain Tumor, Brain Stem Glioma, Childhood; Brain Tumor, Central Nervous System Atypical Teratoid/Rhabdoid Tumor, Childhood; Brain Tumor, Central Nervous System Embryonal Tumors, Childhood; Brain Tumor, Astrocytomas, Childhood; Brain Tumor, Craniopharyngioma, Childhood; Brain Tumor, Ependymoblastoma, Childhood; Brain Tumor, Ependymoma, Childhood; Brain Tumor, Medulloblastoma, Childhood; Brain Tumor, Medulloepithelioma, Childhood; Brain Tumor, Pineal Parenchymal Tumors of Intermediate Differentiation, Childhood; Brain Tumor, Supratentorial Primitive Neuroectodermal Tumors and Pineoblastoma, Childhood; Brain and Spinal Cord Tumors, Childhood (Other); Breast Cancer; Breast Cancer and Pregnancy; Breast Cancer, Childhood; Breast Cancer, Male; Bronchial Tumors, Childhood; Burkitt Lymphoma; Carcinoid Tumor, Childhood; Carcinoid Tumor,Gastrointestinal; Carcinoma of Unknown Primary; Central Nervous System Atypical Teratoid/Rhabdoid Tumor, Childhood; Central Nervous System Embryonal Tumors, Childhood; Central Nervous System (CNS) Lymphoma, Primary; Cervical Cancer; Cervical Cancer, Childhood; Childhood Cancers; Chordoma, Childhood; Chronic Lymphocytic Leukemia; Chronic Myelogenous Leukemia; Chronic Myeloproliferative Disorders; Colon Cancer; Colorectal Cancer, Childhood; Craniopharyngioma, Childhood; Cutaneous T-Cell Lymphoma; Embryonal Tumors, Central Nervous System, Childhood; Endometrial Cancer; Ependymoblastoma, Childhood; Ependymoma, Childhood; Esophageal Cancer; Esophageal Cancer, Childhood; Esthesioneuroblastoma,

Childhood; Ewing Sarcoma Family of Tumors; Extracranial Germ Cell Tumor, Childhood; Extragonadal Germ Cell Tumor; Extrahepatic Bile Duct Cancer; Eye Cancer, Intraocular Melanoma; Eye Cancer, Retinoblastoma; Gallbladder Cancer; Gastric (Stomach) Cancer; Gastric (Stomach) Cancer, Childhood; Gastrointestinal Carcinoid Tumor; Gastrointestinal Stromal Tumor (GIST); Gastrointestinal Stromal Cell Tumor, Childhood; Germ Cell Tumor, Extracranial, Childhood; Germ Cell Tumor, Extragonadal; Germ Cell Tumor, Ovarian; Gestational Trophoblastic Tumor; Glioma, Adult; Glioma, Childhood Brain Stem; Hairy Cell Leukemia; Head and Neck Cancer; Heart Cancer, Childhood; Hepatocellular (Liver) Cancer, Adult (Primary); Hepatocellular (Liver) Cancer, Childhood (Primary); Histiocytosis, Langerhans Cell; Hodgkin Lymphoma, Adult; Hodgkin Lymphoma, Childhood; Hypopharyngeal Cancer; Intraocular Melanoma; Islet Cell Tumors (Endocrine Pancreas); Kaposi Sarcoma; Kidney (Renal Cell) Cancer; Kidney Cancer, Childhood; Langerhans Cell Histiocytosis; Laryngeal Cancer; Laryngeal Cancer, Childhood; Leukemia, Acute Lymphoblastic, Adult; Leukemia, Acute Lymphoblastic, Childhood; Leukemia, Acute Myeloid, Adult; Leukemia, Acute Myeloid, Childhood; Leukemia, Chronic Lymphocytic; Leukemia, Chronic Myelogenous; Leukemia, Hairy Cell; Lip and Oral Cavity Cancer; Liver Cancer, Adult (Primary); Liver Cancer, Childhood (Primary); Lung Cancer, Non-Small Cell; Lung Cancer, Small Cell; Lymphoma, AIDS-Related; Lymphoma, Burkitt; Lymphoma, Cutaneous T-Cell; Lymphoma, Hodgkin, Adult; Lymphoma, Hodgkin, Childhood; Lymphoma, Non-Hodgkin, Adult; Lymphoma, Non-Hodgkin, Childhood; Lymphoma, Primary Central Nervous System (CNS); Macroglobulinemia, Waldenström; Malignant Fibrous Histiocytoma of Bone and Osteosarcoma; Medulloblastoma, Childhood; Medulloepithelioma, Childhood; Melanoma; Melanoma, Intraocular (Eye); Merkel Cell Carcinoma; Mesothelioma, Adult Malignant; Mesothelioma, Childhood; Metastatic Squamous Neck Cancer with Occult Primary; Mouth Cancer; Multiple Endocrine Neoplasia Syndromes, Childhood; Multiple Myeloma/Plasma Cell Neoplasm; Mycosis Fungoides; Myelodysplastic Syndromes; Myelodysplastic/Myeloproliferative Neoplasms; Myelogenous Leukemia, Chronic; Myeloid Leukemia, Adult Acute; Myeloid Leukemia, Childhood Acute; Myeloma, Multiple; Myeloproliferative Disorders, Chronic; Nasal Cavity and Paranasal Sinus Cancer; Nasopharyngeal Cancer; Nasopharyngeal Cancer, Childhood; Neuroblastoma; Non-Hodgkin Lymphoma, Adult; Non-Hodgkin Lymphoma, Childhood; Non-Small Cell Lung Cancer; Oral Cancer, Childhood;

Oral Cavity Cancer, Lip and; Oropharyngeal Cancer; Osteosarcoma and Malignant Fibrous Histiocytoma of Bone; Ovarian Cancer, Childhood; Ovarian Epithelial Cancer; Ovarian Germ Cell Tumor; Ovarian Low Malignant Potential Tumor; Pancreatic Cancer; Pancreatic Cancer, Childhood; Pancreatic Cancer, Islet Cell Tumors; Papillomatosis, Childhood; Paranasal Sinus and Nasal Cavity Cancer; Parathyroid Cancer; Penile Cancer; Pharyngeal Cancer; Pineal Parenchymal Tumors of Intermediate Differentiation, Childhood; Pineoblastoma and Supratentorial Primitive Neuroectodermal Tumors, Childhood; Pituitary Tumor; Plasma Cell Neoplasm/Multiple Myeloma; Pleuropulmonary Blastoma, Childhood; Pregnancy and Breast Cancer; Primary Central Nervous System (CNS) Lymphoma; Prostate Cancer; Rectal Cancer; Renal Cell (Kidney) Cancer; Renal Pelvis and Ureter, Transitional Cell Cancer; Respiratory Tract Cancer with Chromosome 15 Changes; Retinoblastoma; Rhabdomyosarcoma, Childhood; Salivary Gland Cancer; Salivary Gland Cancer, Childhood; Sarcoma, Ewing Sarcoma Family of Tumors; Sarcoma, Kaposi; Sarcoma, Soft Tissue, Adult; Sarcoma, Soft Tissue, Childhood; Sarcoma, Uterine; Sézary Syndrome; Skin Cancer (Nonmelanoma); Skin Cancer, Childhood; Skin Cancer (Melanoma); Skin Carcinoma, Merkel Cell; Small Cell Lung Cancer; Small Intestine Cancer; Soft Tissue Sarcoma, Adult; Soft Tissue Sarcoma, Childhood; Squamous Cell Carcinoma; Squamous Neck Cancer with Occult Primary, Metastatic; Stomach (Gastric) Cancer; Stomach (Gastric) Cancer, Childhood; Supratentorial Primitive Neuroectodermal Tumors, Childhood; T-Cell Lymphoma, Cutaneous; Testicular Cancer; Testicular Cancer, Childhood; Throat Cancer; Thymoma and Thymic Carcinoma; Thymoma and Thymic Carcinoma, Childhood; Thyroid Cancer; Thyroid Cancer, Childhood; Transitional Cell Cancer of the Renal Pelvis and Ureter; Trophoblastic Tumor, Gestational; Unknown Primary Site, Carcinoma of, Adult; Unknown Primary Site, Cancer of, Childhood; Unusual Cancers of Childhood; Ureter and Renal Pelvis, *Transitional* Cell Cancer; Urethral Cancer; Uterine Cancer, Endometrial; Uterine Sarcoma; Vaginal Cancer; Vaginal Cancer, Childhood; Vulvar Cancer; Waldenström Macroglobulinemia; Wilms Tumor; Women's Cancers.

We Claim:

1. A therapeutic composition comprising the combination of at least one curcumin component, at least one harmine component, and at least one isovanillin component, wherein the components of the composition are different, said at least one isovanillin component selected from the group consisting of compounds of the formula



where at least one of Q1-Q6 is an alkoxy group.

2. The composition of claim 1, where Q1 is an aldehyde, alcohol, amine, carbonyl, carboxylate, C1-C6 alkylhydroxy, ester, imidazole, or semicarbazone group; the Q2-Q6 groups are independently selected from hydrogen, hydroxyl, halo, sulfonate, sulfoxide, thio, ester, carboxylate, amide or borate, nitro, C1-C6 alkoxy, and C1-C6 alkyl or alkenyl groups.

3. The composition of claim 2, at least one of the Q2-Q6 groups is an alkoxy group, and another is a hydroxyl group.

4. A therapeutic composition comprising the combination of at least one curcumin component, at least one harmine component, and at least one isovanillin component, wherein the components of the composition are different, wherein said composition exhibits therapeutic synergy.

5. A therapeutic composition comprising the combination of at least one curcumin component, at least one harmine component, and at least one isovanillin component, wherein the components of the composition are different, said at least one isovanillin component being present in an amount greater than the amounts of the at least one harmine component and the at least one curcumin component.

6. A therapeutic composition comprising the combination of at least one curcumin component, at least one harmine component, and at least one isovanillin component, wherein the components of the composition are different, the ratio of said at least one curcumin component, said at least one harmine component, and said at least one isovanillin component being from about 0.1-5:0.1-5:0.1-25.

7. A therapeutic composition comprising the combination of at least one curcumin component, at least one harmine component, and at least one isovanillin component, wherein the components of the composition are different, said curcumin component having two substituted or unsubstituted aryl groups connected by a linker.

8. The composition of claim 7, said linker having 3-7 backbone carbon atoms.

9. The composition of any of claims 1-8, said composition consisting essentially of said curcumin, harmine, and isovanillin components.

10. The composition of any of claims 1-8, said at least one curcumin component being synthetically derived or derived from naturally occurring product(s) containing said at least one curcumin component which have been treated so that the at least one curcumin component is present at a level of at least about 25% by weight in the treated naturally occurring product(s), said at least one harmine component being synthetically derived or derived from naturally occurring product(s) containing said at least one harmine component which have been treated so that the at least one harmine component is present at a level of at least about 25% by weight in the treated naturally occurring product(s), and said at least one isovanillin component being synthetically derived or derived from naturally occurring product(s) containing said at least one isovanillin component which have been treated so that the at least one isovanillin component is present at a level of at least about 25% by weight in the treated naturally occurring product(s).

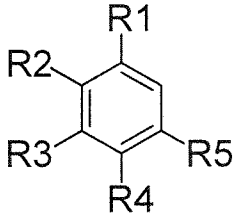
11. The composition of claim 10, wherein said at least one curcumin component, said at least one harmine component, and said at least one isovanillin component are each at least about 50% pure.

12. The composition of any of claims 1-6, said at least one curcumin component selected from the group consisting of compounds of the formulas

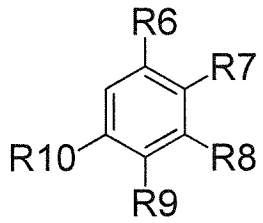
Ar1—L—Ar2, or

Ar1—L—R11,

where Ar1 is an aryl group of the formula



and Ar2 is an aryl group according to the formula



where one or more of the aryl ring carbons of Ar1 and Ar2 may be independently substituted with a heteroatom selected from N, S, B, or O, and R1-R10 are independently selected from the group consisting of H, hydroxyl, halogen, amine, nitro, sulfonate, sulfoxide, thio, ester, carboxylate, amide, borate, C1-C4 boronate, C1-C8 alkyl, C2-C8 alkenyl, C1-C6 haloalkyl, C1-C6 alkoxy, C1-C6 amine, C2-C8 carboxyl, C2-C8 ester, C1-C4 aldehyde, and glucuronide groups;

R11 is selected from the group consisting of H, and C1-C6 alkyl groups; sulfonate, sulfoxide, thio, ester, carboxylate, amide, amine or borate and

L is a linker including from 3-7 backbone carbon atoms that form a chain connecting the Ar1, Ar2, and R11 groups as the case may be, where L includes at least one of a carbonyl or hydroxyl group.

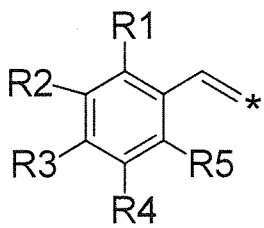
13. The composition of claim 12, wherein:

Ar1 and Ar2 are phenyl groups;

R1-R10 are independently selected from the group consisting of H, hydroxyl, halogen, C1-C4 alkyl, C1-C4 alkoxy, C1-C4 alkylamine, C2-C6 alkenylamine, C1-C6 acetoxy, C1-C4 carboxyl, sulfonate, sulfoxide, thio, ester, carboxylate, amide or borate, with at least one of R1-R5 and R6-R10 being hydroxyl; and

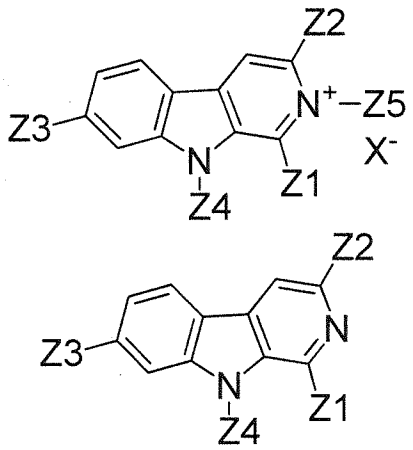
L contains at least one carbon-carbon double bond.

14. The composition of any of claims 1-8, said at least one curcumin component being of the formula



wherein R1-R5 are each independently selected from the group consisting of H, hydroxyl, halogen, C1-C8 alkyl, C2-C8 alkenyl, C1-C6 haloalkyl, C1-C6 alkoxy, C1-C6 amine, C2-C8 carboxyl, C2-C8 ester, C1-C4 aldehyde, sulfonate, sulfoxide, thio, ester, carboxylate, amide or borate and glucuronide groups, and * represents an additional portion of the component.

15. The composition of any of claims 1-8, said harmine component selected from the group consisting of compounds of the formulas



wherein:

Z1 is hydrogen; a C1-C6 alkyl or haloalkyl, a C2-C6 alkenyl or haloalkenyl; an aryl group or an arylalkyl group, wherein the aryl group is optionally substituted at any position with halogen, nitro, hydroxyl, C1-C3 alkoxy, amino, sulfonate, sulfoxide, thio, ester, carboxylate, amide, borate, or C1-C4 boronate and wherein the alkyl group is selected from C1-C4 alkyl; or a heterocyclic group;

Z2 is hydrogen; a C1-C6 carboxyl, ester, carboxylate, acylamino, acyl halide, sulfonate, sulfoxide, thio, amide or alkoxycarbonyl group; an aryloxycarbonyl group; alkyl group optionally substituted with hydroxyl or alkoxycarbonyl; carbamate; acylhydrazine; or a heterocyclic oxycarbonyl group, where the heterocyclic portion contains from 3-7 atoms and a nitrogen, oxygen, boron, or sulfur heteroatom;

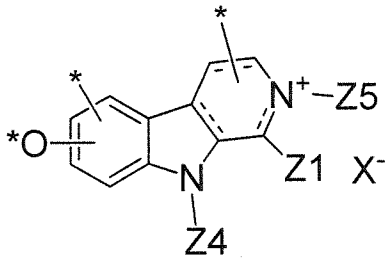
Z3 is hydrogen; a C1-C6 alkyl or haloalkyl; sulfonate, sulfoxide, thio, carboxylate, amide, C2-C6 alkenyl group; hydroxyl; a C1-C6 alkoxy group; a C1-C6 carboxylic ester group; an arylalkoxy group where the alkoxy portion contains from 1-6 carbon atoms; or a heterocyclic group containing from 3-7 atoms and a nitrogen, oxygen, boron, or sulfur heteroatom;

Z4 is hydrogen; a C1-C6 alkyl, haloalkyl; C2-C6 alkenyl group; a hydroxyalkyl group where the alkyl portion contains from 1-6 carbon atoms; an arylalkyl group wherein the aryl group is optionally substituted at any position with halogen, nitro, hydroxyl, C1-C3 alkoxy, borate, C1-C4 boronate, sulfonate, sulfoxide, thio, ester, carboxylate, amide or amino, and wherein the alkyl group is selected from C1-C4 alkyl group; an arylalkanone; or a heterocyclic group containing from 3-7 atoms and a nitrogen, oxygen, boron or sulfur heteroatom;

Z5 is hydrogen; a C1-C6 alkyl group; an aryl group substituted at any position with one or more of (1)-(2), where (1) is a C1-C4 alkyl group, and (2) is a C1-C6 carbonyl, hydroxycarbonyl, ester, sulfonate, sulfoxide, thio, ester, carboxylate, amide or amino group; arylalkyl where the alkyl group is a C1-C6 alkyl; 1-5 substituted arylalkyl; arylhydrocarbyl; arylcarboxyl; aryl ester group; arylamino group; or a heterocyclic group containing from 3-7 atoms and a nitrogen, oxygen, boron or sulfur heteroatom;

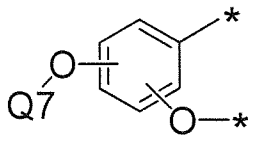
X is a halogen; a sulfonic group, a sulfuric group, a nitric acid group or a carboxylate, in the compounds of the formulas set forth in this claim.

16. The composition of claim 15, wherein said at least one harmine component is selected from the group consisting of compounds of the formula



where the three * denote valence points where respective additional portions of the components are attached; Z1 and Z4 are independently H or a C1-C6 alkyl group; and the remaining positions on the two six-membered rings are each independently selected from the group consisting of Z1.

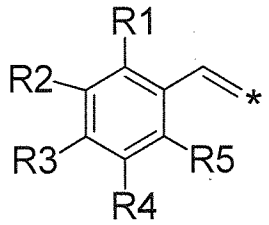
17. The composition of any of claims 4-8, said at least one isovanillin component having the formula



where the two * denote valence points where respective additional portions of the components are attached, the remaining phenyl ring positions are independently selected from the group consisting of H, hydroxyl, halogen, amine, nitro, sulfonate, sulfoxide, thio, ester, carboxylate, amide, borate, C1-C4 boronate, C1-C8 alkyl, C2-C8 alkenyl, C1-C6 haloalkyl, C1-C6 alkoxy, C1-C6 amine, C2-C8 carboxyl, C2-C8 ester, C1-C4 aldehyde, and glucuronide groups, and Q7 is H or a C1-C6 alkyl group.

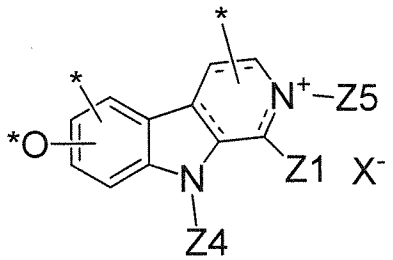
18. The composition of any of claims 4-8,

said at least one curcumin component being of the formula



wherein R1-R5 are each independently selected from the group consisting of H, hydroxyl, halogen, C1-C8 alkyl, C2-C8 alkenyl, C1-C6 haloalkyl, C1-C6 alkoxy, C1-C6 amine, C2-C8 carboxyl, C2-C8 ester, C1-C4 aldehyde, sulfonate, sulfoxide, thio, ester, carboxylate, amide or borate and glucuronide groups, and * represents an additional portion of the curcumin component;

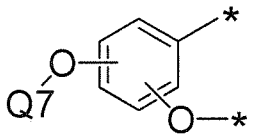
said at least one harmine component being of the formula



where the three * denote valence points where respective additional portions of the harmine component are attached; Z1 and Z4 are independently H or a C1-C6 alkyl group; and the remaining positions on the phenyl rings are each independently

selected from the group consisting of Z1, and X^- is a halogen, a sulfonic group, a nitric acid group, or a carboxylate group; and

said at least one isovanillin component has the formula



where the two * denote valence points where respective additional portions of the components are attached, the remaining phenyl ring positions are independently selected from the group consisting of H, hydroxyl, halogen, amine, nitro, sulfonate, sulfoxide, thio, ester, carboxylate, amide, borate, C1-C4 boronate, C1-C8 alkyl, C2-C8 alkenyl, C1-C6 haloalkyl, C1-C6 alkoxy, C1-C6 amine, C2-C8 carboxyl, C2-C8 ester, C1-C4 aldehyde, and glucuronide groups, and Q7 is H or a C1-C6 alkyl group.

19. The composition of any of claims 1-8, wherein the isovanillin component(s) is/are be present at a level of from about 25-85% by weight, the harmine component(s) is/are present at a level of from about 7-50% by weight, and the curcumin component(s) is/are present at a level of from about 5-40% by weight, based upon the total weight of the three components taken as 100% by weight.

20. A therapeutic composition comprising the combination of at least one curcumin component, at least one harmine component, and at least one isovanillin component, wherein the components of the composition are different, said curcumin component selected from the group consisting of curcumin, bisdemethoxy curcumin, (1E,4E)-1,5-bis(3,5-dimethoxyphenyl)-1,4-pentadien-3-one, cardamonin, 2'-hydroxy-3,4,4',5'-tetramethoxychalcone, 2,2'-dihydroxy-4',6'-dimethoxychalcone, and (1E,4E)-1,5-Bis(2-Hydroxyphenyl)-1,4-pentadien-3-one, said isovanillin component selected from the group consisting of isovanillin, vanillin, orthovanillin, isovanillyl alcohol, isovanillic acid, 5-bromovanillin, 2-bromo-3hydroxy-4-methoxy benzaldehyde, and 2-iodo-3hydroxy-4-methoxy benzaldehyde, and said harmine component selected from the group consisting of harmine, harmaline, harmane, harmalol, harmol, and 1,2,3,4-tetrahy-droharmane-3-carboxylic acid.

21. The composition of claim 20, said curcumin component being curcumin, said harmine component being harmine, and said isovanillin component being isovanillin.

22. The composition of any of claims 1-8 and 20-21, said composition being an anti-cancer composition for administration to a cancer patient.

23. The composition of claim 9, said composition being an anti-cancer composition for administration to a cancer patient.

24. The composition of claim 10, said composition being an anti-cancer composition for administration to a cancer patient.

25. The composition of claim 11, said composition being an anti-cancer composition for administration to a cancer patient.

26. The composition of claim 12, said composition being an anti-cancer composition for administration to a cancer patient.

27. The composition of claim 13, said composition being an anti-cancer composition for administration to a cancer patient.

28. The composition of claim 14, said composition being an anti-cancer composition for administration to a cancer patient.

29. The composition of claim 15, said composition being an anti-cancer composition for administration to a cancer patient.

30. The composition of claim 16, said composition being an anti-cancer composition for administration to a cancer patient.

31. The composition of claim 17, said composition being an anti-cancer composition for administration to a cancer patient.

32. The composition of claim 18, said composition being an anti-cancer composition for administration to a cancer patient.

33. The composition of claim 19, said composition being an anti-cancer composition for administration to a cancer patient.

34. A method of treating a patient suffering from cancer comprising the step of administering to the patient a composition in accordance with any of claims 1-8 and 20-21.

35. A method of treating a patient suffering from cancer comprising the step of administering to the patient a composition in accordance with claims 9.

36. A method of treating a patient suffering from cancer comprising the step of administering to the patient a composition in accordance with claims 10.

37. A method of treating a patient suffering from cancer comprising the step of administering to the patient a composition in accordance with claims 11.

38. A method of treating a patient suffering from cancer comprising the step of administering to the patient a composition in accordance with claims 12.

39. A method of treating a patient suffering from cancer comprising the step of administering to the patient a composition in accordance with claims 13.

40. A method of treating a patient suffering from cancer comprising the step of administering to the patient a composition in accordance with claims 14.

41. A method of treating a patient suffering from cancer comprising the step of administering to the patient a composition in accordance with claims 15.

42. A method of treating a patient suffering from cancer comprising the step of administering to the patient a composition in accordance with claims 16.

43. A method of treating a patient suffering from cancer comprising the step of administering to the patient a composition in accordance with claims 17.

44. A method of treating a patient suffering from cancer comprising the step of administering to the patient a composition in accordance with claims 18.

45. A method of treating a patient suffering from cancer comprising the step of administering to the patient a composition in accordance with claims 19.

46. A composition for use in the treatment of cancer, said composition being in accordance with any of claims 1-8 and 20-21.

47. A composition for use in the treatment of cancer, said composition being in accordance with claim 9.

48. A composition for use in the treatment of cancer, said composition being in accordance with claim 10.

49. A composition for use in the treatment of cancer, said composition being in accordance with claim 11.

50. A composition for use in the treatment of cancer, said composition being in accordance with claim 12.

51. A composition for use in the treatment of cancer, said composition being in accordance with claim 13.

52. A composition for use in the treatment of cancer, said composition being in accordance with claim 14.

53. A composition for use in the treatment of cancer, said composition being in accordance with claim 15.

54. A composition for use in the treatment of cancer, said composition being in accordance with claim 16.

55. A composition for use in the treatment of cancer, said composition being in accordance with claim 17.

56. A composition for use in the treatment of cancer, said composition being in accordance with claim 18.

57. A composition for use in the treatment of cancer, said composition being in accordance with claim 19.

58. The use of a composition for the manufacture of a medicament for anti-cancer therapeutic application, said composition being in accordance with any of claims 1-8 and 20-21.

59. The use of a composition for the manufacture of a medicament for anti-cancer therapeutic application, said composition being in accordance with claim 9.

60. The use of a composition for the manufacture of a medicament for anti-cancer therapeutic application, said composition being in accordance with claim 10.

61. The use of a composition for the manufacture of a medicament for anti-cancer therapeutic application, said composition being in accordance with claim 11.

62. The use of a composition for the manufacture of a medicament for anti-cancer therapeutic application, said composition being in accordance with claim 12.

63. The use of a composition for the manufacture of a medicament for anti-cancer therapeutic application, said composition being in accordance with claim 13.

64. The use of a composition for the manufacture of a medicament for anti-cancer therapeutic application, said composition being in accordance with claim 14.

65. The use of a composition for the manufacture of a medicament for anti-cancer therapeutic application, said composition being in accordance with claim 15.

66. The use of a composition for the manufacture of a medicament for anti-cancer therapeutic application, said composition being in accordance with claim 16.

67. The use of a composition for the manufacture of a medicament for anti-cancer therapeutic application, said composition being in accordance with claim 17.

68. The use of a composition for the manufacture of a medicament for anti-cancer therapeutic application, said composition being in accordance with claim 18.

69. The use of a composition for the manufacture of a medicament for anti-cancer therapeutic application, said composition being in accordance with claim 19.

70. A therapeutic composition comprising the combination of at least one curcumin component and at least one harmine component, wherein the components of the composition are different, wherein said at least one curcumin component and said at least one harmine component are at least about 70% pure.

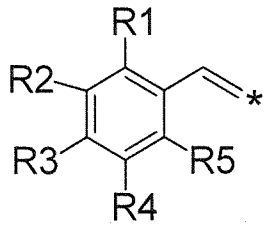
71. A therapeutic composition comprising the combination of at least one curcumin component and at least one harmine component, wherein the components of the composition are different, the weight ratio of said at least one curcumin component to said at least one harmine component ranging from about 0.01:1 to 10:1.

72. A therapeutic composition comprising the combination of at least one curcumin component and at least one harmine component, wherein the components of the composition are different, the weight amount of said at least one curcumin component being from about 20-75% by weight, and the weight amount of said at least one harmine component being from about 25-80% by weight, based upon the total weight of the two components taken as 100% by weight.

73. A therapeutic composition comprising the combination of at least one curcumin component and at least one harmine component, wherein the components of the composition are different, said composition exhibiting therapeutic synergy.

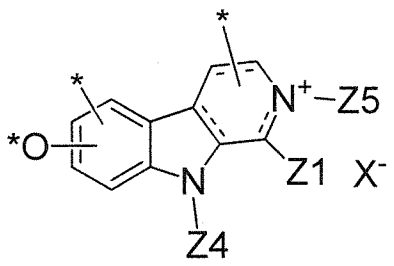
74. A therapeutic composition comprising the combination of at least one curcumin component and at least one harmine component, wherein the components of the composition are different, wherein:

said at least one curcumin component being of the formula



wherein R1-R5 are each independently selected from the group consisting of H, hydroxyl, halogen, C1-C8 alkyl, C2-C8 alkenyl, C1-C6 haloalkyl, C1-C6 alkoxy, C1-C6 amine, C2-C8 carboxyl, C2-C8 ester, C1-C4 aldehyde, sulfonate, sulfoxide, thio, ester, carboxylate, amide or borate and glucuronide groups, and * represents an additional portion of the curcumin component; and

said at least one harmine component being of the formula



where the three * denote valence points where the respective additional portions of the harmine component are attached; Z1 and Z4 are independently H or a C1-C6 alkyl group; and the remaining positions on the phenyl rings are each independently Z1, and X^- is a halogen, a sulfonic group, a nitric acid group, or a carboxylate group,

said at least one curcumin component being synthetically derived or derived from naturally occurring product(s) containing said at least one curcumin component which have been treated so that the at least one curcumin component is present at a level of at least about 25% by weight in the treated naturally occurring product(s), and said at

least one harmine component being synthetically derived or derived from naturally occurring product(s) containing said at least one harmine component which have been treated so that the at least one harmine component is present at a level of at least about 25% by weight in the treated naturally occurring product(s).

75. The composition of claim 74, wherein, in said at least one curcumin component, one f said R1-R5 groups is methoxy, and another of the R1-R5 groups is hydroxyl.

76. The composition of claim 74, the weight ratio of said at least one curcumin component to said at least one harmine component ranging from about 0.01:1 to 10:1.

77. The composition of claim 74, the weight amount of said at least one curcumin component being from about 20-75% by weight, and the weight amount of said at least one harmine component being from about 25%-80% by weight, based upon the total weight of the two components taken as 100% by weight.

78. A therapeutic composition comprising the combination of at least one curcumin component and at least one harmine component, wherein the components of the composition are different, said at least one harmine component being present in an amount greater than the amounts of the at least one curcumin component.

79. A therapeutic composition comprising the combination of at least one curcumin component and at least one harmine component, wherein the components of the composition are different, the ratio of said at least one curcumin component to said at least one harmine component being from about 0.01:1 to 10:1.

80. A therapeutic composition comprising the combination of at least one curcumin component and at least one harmine component, wherein the components of the composition are different, said curcumin component having two substituted or unsubstituted aryl groups connected by a linker.

81. The composition of claim 80, said linker having 3-7 backbone carbon atoms.

82. The composition of any of claims 70-81, said composition consisting essentially of curcumin and harmine components.

83. The composition of any of claims 71-81, said at least one curcumin component being synthetically derived or derived from naturally occurring product(s) containing said at least one curcumin component which have been treated so that the at least one curcumin component is present at a level of at least about 25% by weight in the treated naturally occurring product(s), and said at least one harmine component being synthetically derived or derived from naturally occurring product(s) containing said at least one harmine component which have been treated so that the at least one harmine component is present at a level of at least about 25% by weight in the treated naturally occurring product(s).

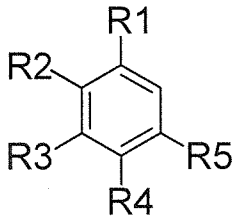
84. The composition of claim 83, wherein said at least one curcumin component and said at least one harmine component are each at least about 50% pure.

85. The composition of any of claims 70-81, said at least one curcumin component selected from the group consisting of compounds of the formulas

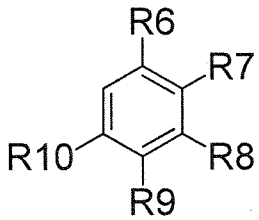
Ar1—L—Ar2, or

Ar1—L—R11,

where Ar1 is an aryl group of the formula



and Ar2 is an aryl group according to the formula



where one or more of the aryl ring carbons of Ar1 and Ar2 may be independently substituted with a heteroatom selected from N, S, B, or O, and R1-R10 are independently selected from the group consisting of H, hydroxyl, halogen, amine, nitro, sulfonate, sulfoxide, thio, ester, carboxylate, amide, borate, C1-C4 boronate, C1-C8 alkyl, C2-C8 alkenyl, C1-C6 haloalkyl, C1-C6 alkoxy, C1-C6 amine, C2-C8 carboxyl, C2-C8 ester, C1-C4 aldehyde, and glucuronide groups;

R11 is selected from the group consisting of H, and C1-C6 alkyl groups; sulfonate, sulfoxide, thio, ester, carboxylate, amide, amine or borate and

L is a linker including from 3-7 backbone carbon atoms that form a chain connecting the Ar1, Ar2, and R11 groups as the case may be, where L includes at least one of a carbonyl or hydroxyl group.

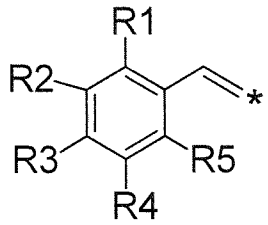
86. The composition of claim 85, wherein:

Ar1 and Ar2 are phenyl groups;

R1-R10 are independently selected from the group consisting of H, hydroxyl, halogen, C1-C4 alkyl, C1-C4 alkoxy, C1-C4 alkylamine, C2-C6 alkenylamine, C1-C6 acetoxy, C1-C4 carboxyl, sulfonate, sulfoxide, thio, ester, carboxylate, amide or borate, with at least one of R1-R5 and R6-R10 being hydroxyl; and

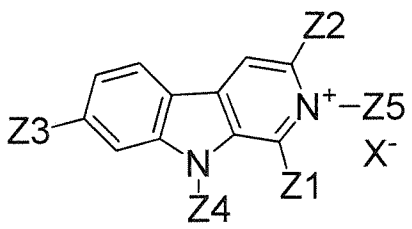
L contains at least one carbon-carbon double bond.

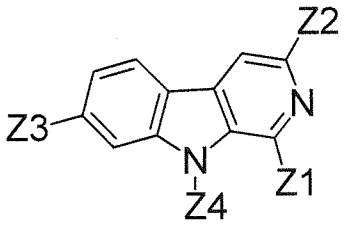
87. The composition of any of claims 70-81, said at least one curcumin component being of the formula



wherein R1-R5 are each independently selected from the group consisting of H, hydroxyl, halogen, C1-C8 alkyl, C2-C8 alkenyl, C1-C6 haloalkyl, C1-C6 alkoxy, C1-C6 amine, C2-C8 carboxyl, C2-C8 ester, C1-C4 aldehyde, sulfonate, sulfoxide, thio, ester, carboxylate, amide or borate and glucuronide groups, and * represents an additional portion of the component.

88. The composition of any of claims 70-81, said harmine component selected from the group consisting of compounds of the formulas





wherein:

Z1 is hydrogen; a C1-C6 alkyl or haloalkyl, a C2-C6 alkenyl or haloalkenyl; an aryl group or an arylalkyl group, wherein the aryl group is optionally substituted at any position with halogen, nitro, hydroxyl, C1-C3 alkoxy, amino, sulfonate, sulfoxide, thio, ester, carboxylate, amide, borate, or C1-C4 boronate and wherein the alkyl group is selected from C1-C4 alkyl; or a heterocyclic group;

Z2 is hydrogen; a C1-C6 carboxyl, ester, carboxylate, acylamino, acyl halide, sulfonate, sulfoxide, thio, amide or alkoxycarbonyl group; an aryloxycarbonyl group; alkyl group optionally substituted with hydroxyl or alkoxycarbonyl; carbamate; acylhydrazine; or a heterocyclic oxycarbonyl group, where the heterocyclic portion contains from 3-7 atoms and a nitrogen, oxygen, boron, or sulfur heteroatom;

Z3 is hydrogen; a C1-C6 alkyl or haloalkyl; sulfonate, sulfoxide, thio, carboxylate, amide, C2-C6 alkenyl group; hydroxyl; a C1-C6 alkoxy group; a C1-C6 carboxylic ester group; an arylalkoxy group where the alkoxy portion contains from 1-6 carbon atoms; or a heterocyclic group containing from 3-7 atoms and a nitrogen, oxygen, boron, or sulfur heteroatom;

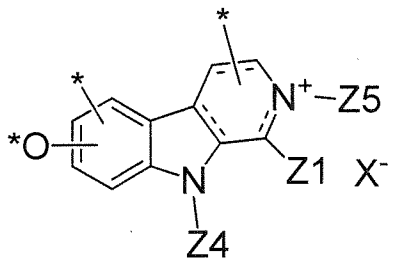
Z4 is hydrogen; a C1-C6 alkyl, haloalkyl; C2-C6 alkenyl group; a hydroxyalkyl group where the alkyl portion contains from 1-6 carbon atoms; an arylalkyl group wherein the aryl group is optionally substituted at any position with halogen, nitro, hydroxyl, C1-C3 alkoxy, borate, C1-C4 boronate, sulfonate, sulfoxide, thio, ester, carboxylate, amide or amino, and wherein the alkyl group is selected from C1-C4 alkyl group; an arylalkanone; or a heterocyclic group containing from 3-7 atoms and a nitrogen, oxygen, boron or sulfur heteroatom;

Z5 is hydrogen; a C1-C6 alkyl group; an aryl group substituted at any position with one or more of (1)-(2), where (1) is a C1-C4 alkyl group, and (2) is a C1-C6 carbonyl, hydroxycarbonyl, ester, sulfonate, sulfoxide, thio, ester, carboxylate, amide or

amino group; arylalkyl where the alkyl group is a C1-C6 alkyl; 1-5 substituted arylalkyl; arylhydrocarbyl; arylcarboxyl; aryl ester group; arylamino group; or a heterocyclic group containing from 3-7 atoms and a nitrogen, oxygen, boron or sulfur heteroatom;

X is a halogen; a sulfonic group, a sulfuric group, a nitric acid group or a carboxylate, in the compounds of the formulas set forth in this claim.

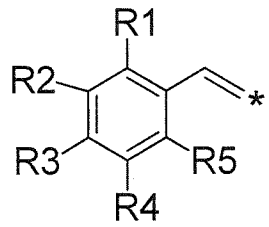
89. The composition of claim 88, wherein said at least one harmine component is selected from the group consisting of compounds of the formula



where the three * denote valence points where respective additional portions of the components are attached; Z1 and Z4 are independently H or a C1-C6 alkyl group; and the remaining positions on the two six-membered rings are each independently selected from the group consisting of Z1.

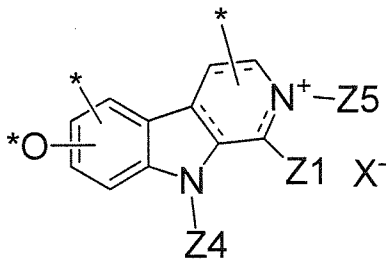
90. The composition of any of claims 70-81,

said at least one curcumin component being of the formula



wherein R1-R5 are each independently selected from the group consisting of H, hydroxyl, halogen, C1-C8 alkyl, C2-C8 alkenyl, C1-C6 haloalkyl, C1-C6 alkoxy, C1-C6 amine, C2-C8 carboxyl, C2-C8 ester, C1-C4 aldehyde, sulfonate, sulfoxide, thio, ester, carboxylate, amide or borate and glucuronide groups, and * represents an additional portion of the curcumin component; and

said at least one harmine component being of the formula



where the three * denote valence points where respective additional portions of the harmine component are attached; Z1 and Z4 are independently H or a C1-C6 alkyl group; and the remaining positions on the phenyl rings are each independently selected from the group consisting of Z1, and X^- is a halogen, a sulfonic group, a nitric acid group, or a carboxylate group.

91. The composition of any of claims 70-81, wherein the components of the composition are different, the weight amount of said at least one curcumin component being from about 20-75% by weight, and the weight amount of said at least one harmine component being from about 25-80% by weight, based upon the total weight of the two components taken as 100% by weight.

92. A therapeutic composition comprising the combination of at least one curcumin component and at least one harmine component, wherein the components of the composition are different, said curcumin component selected from the group consisting of curcumin, bisdemethoxy curcumin, (1E,4E)-1,5-bis(3,5-dimethoxyphenyl)-1,4-pentadien-3-one, cardamonin, 2'-hydroxy-3,4,4',5'-tetramethoxychalcone, 2,2'-dihydroxy-4',6'-dimethoxychalcone, and (1E,4E)-1,5-Bis(2-Hydroxyphenyl)-1,4-pentadien-3-one, and said harmine component selected from the group consisting of harmine, harmaline, harmane, harmalol, harmol, and 1,2,3,4-tetrahy-droharmane-3-carboxylic acid.

93. The composition of claim 92, said curcumin component being curcumin and said harmine component being harmine.

94. The composition of any of claims 70-81 and 92-93, said composition being an anti-cancer composition for administration to a cancer patient.

95. The composition of claim 82, said composition being an anti-cancer composition for administration to a cancer patient.

96. The composition of claim 83, said composition being an anti-cancer composition for administration to a cancer patient.

97. The composition of claim 84, said composition being an anti-cancer composition for administration to a cancer patient.

98. The composition of claim 85, said composition being an anti-cancer composition for administration to a cancer patient.

99. The composition of claim 86, said composition being an anti-cancer composition for administration to a cancer patient.

100. The composition of claim 87, said composition being an anti-cancer composition for administration to a cancer patient.

101. The composition of claim 88, said composition being an anti-cancer composition for administration to a cancer patient.

102. The composition of claim 89, said composition being an anti-cancer composition for administration to a cancer patient.

103. The composition of claim 90, said composition being an anti-cancer composition for administration to a cancer patient.

104. The composition of claim 91, said composition being an anti-cancer composition for administration to a cancer patient.

105. The method of treating a patient suffering from cancer comprising the step of administering to the patient a composition in accordance with any of claims 70-81 and 92-93.

106. The method of treating a patient suffering from cancer comprising the step of administering to the patient a composition in accordance with claim 82.

107. The method of treating a patient suffering from cancer comprising the step of administering to the patient a composition in accordance with claim 83.

108. The method of treating a patient suffering from cancer comprising the step of administering to the patient a composition in accordance with claim 84.

109. The method of treating a patient suffering from cancer comprising the step of administering to the patient a composition in accordance with claim 85.

110. The method of treating a patient suffering from cancer comprising the step of administering to the patient a composition in accordance with claim 86.

111. The method of treating a patient suffering from cancer comprising the step of administering to the patient a composition in accordance with claim 87.

112. The method of treating a patient suffering from cancer comprising the step of administering to the patient a composition in accordance with claim 88.

113. The method of treating a patient suffering from cancer comprising the step of administering to the patient a composition in accordance with claim 89.

114. The method of treating a patient suffering from cancer comprising the step of administering to the patient a composition in accordance with claim 90.

115. The method of treating a patient suffering from cancer comprising the step of administering to the patient a composition in accordance with claim 91.

116. A composition for use in the treatment of cancer, said composition being in accordance with any of claims 70-81 and 92-93.

117. A composition for use in the treatment of cancer, said composition being in accordance with claim 82.

118. A composition for use in the treatment of cancer, said composition being in accordance with claim 83.

119. A composition for use in the treatment of cancer, said composition being in accordance with claim 84.

120. A composition for use in the treatment of cancer, said composition being in accordance with claim 85.

121. A composition for use in the treatment of cancer, said composition being in accordance with claim 86.

122. A composition for use in the treatment of cancer, said composition being in accordance with claim 87.

123. A composition for use in the treatment of cancer, said composition being in accordance with claim 88.

124. A composition for use in the treatment of cancer, said composition being in accordance with claim 89.

125. A composition for use in the treatment of cancer, said composition being in accordance with claim 90.

126. A composition for use in the treatment of cancer, said composition being in accordance with claim 91.

127. The use of a composition for the manufacture of a medicament for anti-cancer therapeutic application, said composition being in accordance with any of claims 70-81 and 92-93.

128. The use of a composition for the manufacture of a medicament for anti-cancer therapeutic application, said composition being in accordance with claim 82.

129. The use of a composition for the manufacture of a medicament for anti-cancer therapeutic application, said composition being in accordance with claim 83.

130. The use of a composition for the manufacture of a medicament for anti-cancer therapeutic application, said composition being in accordance with claim 84.

131. The use of a composition for the manufacture of a medicament for anti-cancer therapeutic application, said composition being in accordance with claim 85.

132. The use of a composition for the manufacture of a medicament for anti-cancer therapeutic application, said composition being in accordance with claim 86.

133. The use of a composition for the manufacture of a medicament for anti-cancer therapeutic application, said composition being in accordance with claim 87.

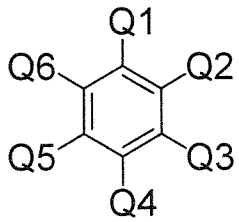
134. The use of a composition for the manufacture of a medicament for anti-cancer therapeutic application, said composition being in accordance with claim 88.

135. The use of a composition for the manufacture of a medicament for anti-cancer therapeutic application, said composition being in accordance with claim 89.

136. The use of a composition for the manufacture of a medicament for anti-cancer therapeutic application, said composition being in accordance with claim 90.

137. The use of a composition for the manufacture of a medicament for anti-cancer therapeutic application, said composition being in accordance with claim 91.

138. A therapeutic composition comprising the combination of at least one harmine component, and at least one isovanillin component, wherein the components of the composition are different, said at least one isovanillin component selected from the group consisting of compounds of the formula



where at least one of Q1-Q6 is an alkoxy group.

139. The composition of claim 138, where Q1 is an aldehyde, alcohol, amine, carbonyl, carboxylate, C1-C6 alkylhydroxy, ester, imidazole, or semicarbazone group; the Q2-Q6 groups are independently selected from hydrogen, hydroxyl, halo, sulfonate, sulfoxide, thio, ester, carboxylate, amide or borate, nitro, C1-C6 alkoxy, and C1-C6 alkyl or alkenyl groups.

140. The composition of claim 139, at least one of the Q2-Q6 groups is an alkoxy group, and another is a hydroxyl group.

141. A therapeutic composition comprising the combination of at least one isovanillin component and at least one harmine component, wherein the components of the composition are different, said at least one isovanillin component being synthetically derived or derived from naturally occurring product(s) containing said at least one isovanillin component which have been treated so that the at least one isovanillin component is present at a level of at least about 25% by weight in the treated naturally occurring product(s), and said at least one harmine component being synthetically derived or derived from naturally occurring product(s) containing said at least one harmine component which have been treated so that the at least one harmine component is present at a level of at least about 25% by weight in the treated naturally occurring product(s), where said composition exhibits therapeutic synergy.

142. A therapeutic composition comprising the combination of at least one isovanillin component and at least one harmine component, wherein the components of the composition are different, said at least one isovanillin component being synthetically derived or derived from naturally occurring product(s) containing said at least one isovanillin component

which have been treated so that the at least one isovanillin component is present at a level of at least about 25% by weight in the treated naturally occurring product(s), and said at least one harmine component being synthetically derived or derived from naturally occurring product(s) containing said at least one harmine component which have been treated so that the at least one harmine component is present at a level of at least about 25% by weight in the treated naturally occurring product(s), the weight ratio of said at least one isovanillin component to said at least one harmine component ranging from about 0.5:1 to 15:1.

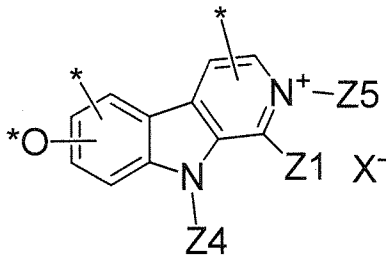
143. A therapeutic composition comprising the combination of at least one isovanillin component and at least one harmine component, wherein the components of the composition are different, said at least one isovanillin component being synthetically derived or derived from naturally occurring product(s) containing said at least one isovanillin component which have been treated so that the at least one isovanillin component is present at a level of at least about 25% by weight in the treated naturally occurring product(s), and said at least one harmine component being synthetically derived or derived from naturally occurring product(s) containing said at least one harmine component which have been treated so that the at least one harmine component is present at a level of at least about 25% by weight in the treated naturally occurring product(s), said at least one isovanillin component being isovanillin or vanillin and said at least one harmine component being harmine.

144. A therapeutic composition comprising the combination of at least one isovanillin component and at least one harmine component, wherein the components of the composition are different, said at least one isovanillin component being synthetically derived or derived from naturally occurring product(s) containing said at least one isovanillin component which have been treated so that the at least one isovanillin component is present at a level of at least about 25% by weight in the treated naturally occurring product(s), and said at least one harmine component being synthetically derived or derived from naturally occurring product(s) containing said at least one harmine component which have been treated so that the at least one harmine component is present at a level of at least about 25% by weight in the treated naturally occurring product(s), the weight amount of said at least one isovanillin component being from about 25% to 95% by weight, and the weight amount of said at least one harmine component being

from about 5% to 25% by weight, based upon the total weight of the two components in the composition taken as 100% by weight.

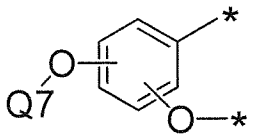
145. A therapeutic composition comprising the combination of at least one isovanillin component and at least one harmine component, wherein the components of the composition are different, wherein:

said at least one harmine component being of the formula



where the three * denote valence points where respective additional portions of the harmine component are attached; Z1 and Z4 are independently H or a C1-C6 alkyl group; and the remaining positions on the phenyl rings are each independently selected from the group consisting of Z1, and X^- is a halogen, a sulfonic group, a nitric acid group, or a carboxylate group; and

said at least one isovanillin component has the formula



where the two * denote valence points where respective additional portions of the components are attached, the remaining phenyl ring positions are independently selected from the group consisting of H, hydroxyl, halogen, amine, nitro, sulfonate, sulfoxide, thio, ester, carboxylate, amide, borate, C1-C4 boronate, C1-C8 alkyl, C2-C8 alkenyl, C1-C6 haloalkyl, C1-C6 alkoxy, C1-C6 amine, C2-C8 carboxyl, C2-C8 ester, C1-C4 aldehyde, and glucuronide groups, and Q7 is H or a C1-C6 alkyl group,

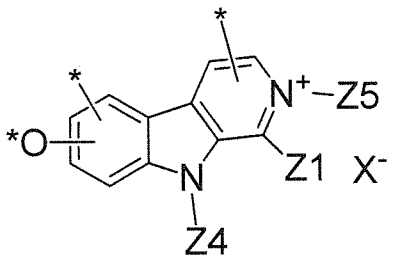
said at least one isovanillin component being synthetically derived or derived from naturally occurring product(s) containing said at least one isovanillin component which have been treated so that the at least one isovanillin component is present at

a level of at least about 25% by weight in the treated naturally occurring product(s), and said at least one harmine component being synthetically derived or derived from naturally occurring product(s) containing said at least one harmine component which have been treated so that the at least one harmine component is present at a level of at least about 25% by weight in the treated naturally occurring product(s),

the weight amount of said at least one isovanillin component being from about 75% to 95% by weight, and the weight amount of said at least one harmine component being from about 5% to 25% by weight, based upon the total weight of the two components in the composition taken as 100% by weight.

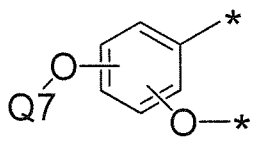
146. A therapeutic composition comprising the combination of at least one isovanillin component and at least one harmine component, wherein the components of the composition are different, wherein:

said at least one harmine component being of the formula



where the three * denote valence points where respective additional portions of the harmine component are attached; Z1 and Z4 are independently H or a C1-C6 alkyl group; and the remaining positions on the phenyl rings are each independently selected from the group consisting of Z1, and X^- is a halogen, a sulfonic group, a nitric acid group, or a carboxylate group; and

said at least one isovanillin component has the formula



where the two * denote valence points where respective additional portions of the components are attached, the remaining phenyl ring positions are independently selected from the group consisting of H, hydroxyl, halogen, amine, nitro, sulfonate,

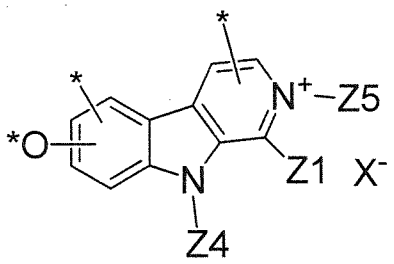
sulfoxide, thio, ester, carboxylate, amide, borate, C1-C4 boronate, C1-C8 alkyl, C2-C8 alkenyl, C1-C6 haloalkyl, C1-C6 alkoxy, C1-C6 amine, C2-C8 carboxyl, C2-C8 ester, C1-C4 aldehyde, and glucuronide groups, and Q7 is H or a C1-C6 alkyl group,

said at least one isovanillin component being synthetically derived or derived from naturally occurring product(s) containing said at least one isovanillin component which have been treated so that the at least one isovanillin component is present at a level of at least about 25% by weight in the treated naturally occurring product(s), and said at least one harmine component being synthetically derived or derived from naturally occurring product(s) containing said at least one harmine component which have been treated so that the at least one harmine component is present at a level of at least about 25% by weight in the treated naturally occurring product(s),

the weight ratio of said at least one isovanillin component to said at least one harmine component ranging from about 0.5:1 to 15:1.

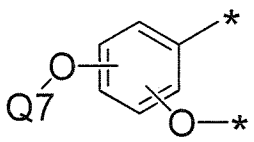
147. A therapeutic composition comprising the combination of at least one isovanillin component and at least one harmine component, wherein the components of the composition are different, wherein:

said at least one harmine component being of the formula



where the three * denote valence points where respective additional portions of the harmine component are attached; Z1 and Z4 are independently H or a C1-C6 alkyl group; and the remaining positions on the phenyl rings are each independently selected from the group consisting of Z1, and X^- is a halogen, a sulfonic group, a nitric acid group, or a carboxylate group; and

said at least one isovanillin component has the formula



where the two * denote valence points where respective additional portions of the components are attached, the remaining phenyl ring positions are independently selected from the group consisting of H, hydroxyl, halogen, amine, nitro, sulfonate, sulfoxide, thio, ester, carboxylate, amide, borate, C1-C4 boronate, C1-C8 alkyl, C2-C8 alkenyl, C1-C6 haloalkyl, C1-C6 alkoxy, C1-C6 amine, C2-C8 carboxyl, C2-C8 ester, C1-C4 aldehyde, and glucuronide groups, and Q7 is H or a C1-C6 alkyl group,

said at least one isovanillin component being synthetically derived or derived from naturally occurring product(s) containing said at least one isovanillin component which have been treated so that the at least one isovanillin component is present at a level of at least about 25% by weight in the treated naturally occurring product(s), and said at least one harmine component being synthetically derived or derived from naturally occurring product(s) containing said at least one harmine component which have been treated so that the at least one harmine component is present at a level of at least about 25% by weight in the treated naturally occurring product(s),

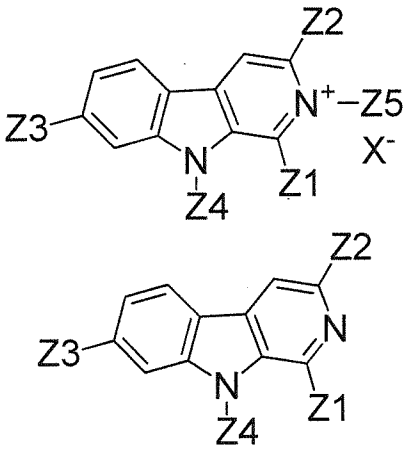
said at least one isovanillin component being isovanillin or vanillin and said at least one harmine component being harmine.

148. A composition in accordance with any of claims 138-147, said at least one isovanillin component being present in an amount greater than the amounts of the at least one harmine component and the at least one curcumin component.

149. A composition in accordance with any of claims 138-147, said composition consisting essentially of harmine and isovanillin components.

150. The composition of claim 149, said composition consisting essentially of harmine and isovanillin.

151. A composition in accordance with any of claims 138-147, said harmine component selected from the group consisting of compounds of the formulas



wherein:

Z1 is hydrogen; a C1-C6 alkyl or haloalkyl, a C2-C6 alkenyl or haloalkenyl; an aryl group or an arylalkyl group, wherein the aryl group is optionally substituted at any position with halogen, nitro, hydroxyl, C1-C3 alkoxy, amino, sulfonate, sulfoxide, thio, ester, carboxylate, amide, borate, or C1-C4 boronate and wherein the alkyl group is selected from C1-C4 alkyl; or a heterocyclic group;

Z2 is hydrogen; a C1-C6 carboxyl, ester, carboxylate, acylamino, acyl halide, sulfonate, sulfoxide, thio, amide or alkoxycarbonyl group; an aryloxycarbonyl group; alkyl group optionally substituted with hydroxyl or alkoxycarbonyl; carbamate; acylhydrazine; or a heterocyclic oxycarbonyl group, where the heterocyclic portion contains from 3-7 atoms and a nitrogen, oxygen, boron, or sulfur heteroatom;

Z3 is hydrogen; a C1-C6 alkyl or haloalkyl; sulfonate, sulfoxide, thio, carboxylate, amide, C2-C6 alkenyl group; hydroxyl; a C1-C6 alkoxy group; a C1-C6 carboxylic ester group; an arylalkoxy group where the alkoxy portion contains from 1-6 carbon atoms; or a heterocyclic group containing from 3-7 atoms and a nitrogen, oxygen, boron, or sulfur heteroatom;

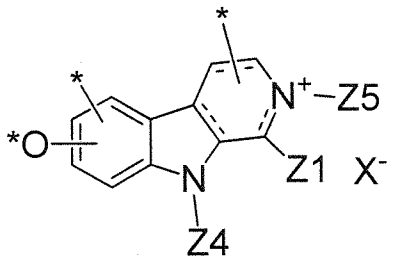
Z4 is hydrogen; a C1-C6 alkyl, haloalkyl; C2-C6 alkenyl group; a hydroxyalkyl group where the alkyl portion contains from 1-6 carbon atoms; an arylalkyl group wherein the aryl group is optionally substituted at any position with halogen, nitro, hydroxyl, C1-C3 alkoxy, borate, C1-C4 boronate, sulfonate, sulfoxide, thio, ester, carboxylate, amide or amino, and wherein the alkyl group is selected from C1-C4

alkyl group; an arylalkanone; or a heterocyclic group containing from 3-7 atoms and a nitrogen, oxygen, boron or sulfur heteroatom;

Z5 is hydrogen; a C1-C6 alkyl group; an aryl group substituted at any position with one or more of (1)-(2), where (1) is a C1-C4 alkyl group, and (2) is a C1-C6 carbonyl, hydroxycarbonyl, ester, sulfonate, sulfoxide, thio, ester, carboxylate, amide or amino group; arylalkyl where the alkyl group is a C1-C6 alkyl; 1-5 substituted arylalkyl; arylhydrocarbyl; arylcarboxyl; aryl ester group; arylamino group; or a heterocyclic group containing from 3-7 atoms and a nitrogen, oxygen, boron or sulfur heteroatom;

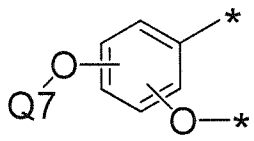
X is a halogen; a sulfonic group, a sulfuric group, a nitric acid group or a carboxylate, in the compounds of the formulas set forth in this claim.

152. The composition of claim 151, wherein said at least one harmine component is selected from the group consisting of compounds of the formula



where the three * denote valence points where respective additional portions of the components are attached; Z1 and Z4 are independently H or a C1-C6 alkyl group; and the remaining positions on the two six-membered rings are each independently selected from the group consisting of Z1.

153. The composition of any of claims 138-147, said at least one isovanillin component having the formula



where the two * denote valence points where respective additional portions of the components are attached, the remaining phenyl ring positions are independently selected from the group consisting of H, hydroxyl, halogen, amine, nitro, sulfonate, sulfoxide, thio, ester, carboxylate, amide, borate, C1-C4 boronate, C1-C8 alkyl, C2-C8 alkenyl, C1-C6 haloalkyl, C1-C6 alkoxy, C1-C6 amine, C2-

C8 carboxyl, C2-C8 ester, C1-C4 aldehyde, and glucuronide groups, and Q7 is H or a C1-C6 alkyl group.

154. A therapeutic composition comprising the combination of at least one harmine component, and at least one isovanillin component, wherein the components of the composition are different, said isovanillin component selected from the group consisting of isovanillin, vanillin, orthovanillin, isovanillyl alcohol, isovanillic acid, 5-bromovanillin, 2-bromo-3hydroxy-4-methoxy benzaldehyde, and 2-iodo-3hydroxy-4-methoxy benzaldehyde, and said harmine component selected from the group consisting of harmine, harmaline, harmane, harmalol, harmol, and 1,2,3,4-tetrahy-droharmane-3-carboxylic acid.

155. The composition of claim 154, said isovanillin component being isovanillin and said harmine component being harmine.

156. The composition of any of claims 138-147 and 154-155, said composition being an anti-cancer composition for administration to a cancer patient.

157. The composition of claim 148, said composition being an anti-cancer composition for administration to a cancer patient.

158. The composition of claim 149, said composition being an anti-cancer composition for administration to a cancer patient.

159. The composition of claim 150, said composition being an anti-cancer composition for administration to a cancer patient.

160. The composition of claim 151, said composition being an anti-cancer composition for administration to a cancer patient.

161. The composition of claim 152, said composition being an anti-cancer composition for administration to a cancer patient.

162. The composition of claim 153, said composition being an anti-cancer composition for administration to a cancer patient.

163. A method of treating a patient suffering from cancer comprising the step of administering to the patient a composition in accordance with any of claims 138-147 and 154-155.

164. A method of treating a patient suffering from cancer comprising the step of administering to the patient a composition in accordance with claim 148.

165. A method of treating a patient suffering from cancer comprising the step of administering to the patient a composition in accordance with claim 149.

166. A method of treating a patient suffering from cancer comprising the step of administering to the patient a composition in accordance with claim 150.

167. A method of treating a patient suffering from cancer comprising the step of administering to the patient a composition in accordance with claim 151.

168. A method of treating a patient suffering from cancer comprising the step of administering to the patient a composition in accordance with claim 152.

169. A method of treating a patient suffering from cancer comprising the step of administering to the patient a composition in accordance with claim 153.

170. A composition for use in the treatment of cancer, said composition being in accordance with any of claims 138-147 and 154-155.

171. A composition for use in the treatment of cancer, said composition being in accordance with claim 148.

172. A composition for use in the treatment of cancer, said composition being in accordance with claim 149.

173. A composition for use in the treatment of cancer, said composition being in accordance with claim 150.

174. A composition for use in the treatment of cancer, said composition being in accordance with claim 151.

175. A composition for use in the treatment of cancer, said composition being in accordance with claim 152.

176. A composition for use in the treatment of cancer, said composition being in accordance with claim 153.

177. The use of a composition for the manufacture of a medicament for anti-cancer therapeutic application, said composition being in accordance with any of claims 138-147 and 154-155.

178. The use of a composition for the manufacture of a medicament for anti-cancer therapeutic application, said composition being in accordance with claim 148.

179. The use of a composition for the manufacture of a medicament for anti-cancer therapeutic application, said composition being in accordance with claim 149.

180. The use of a composition for the manufacture of a medicament for anti-cancer therapeutic application, said composition being in accordance with claim 150.

181. The use of a composition for the manufacture of a medicament for anti-cancer therapeutic application, said composition being in accordance with claim 151.

182. The use of a composition for the manufacture of a medicament for anti-cancer therapeutic application, said composition being in accordance with claim 152.

183. The use of a composition for the manufacture of a medicament for anti-cancer therapeutic application, said composition being in accordance with claim 153.

184. A therapeutic composition comprising the combination of at least one isovanillin component and at least one curcumin component, wherein the components of the composition are different, the weight ratio of said isovanillin to said curcumin component being from about 0.5:1 to 25:1, said isovanillin component being present at a level of from about 25-95% by weight and said curcumin component being present at a level of from about 5-75% by weight, based upon the total weight of the isovanillin component and the curcumin component taken as 100% by weight, said at least one isovanillin component being the preponderant ingredient in said composition on a weight basis, said isovanillin component having only one phenyl group, said curcumin component having two substituted or unsubstituted aryl groups connected by a linker.

185. A therapeutic composition comprising the combination of at least one isovanillin component and at least one curcumin component, wherein the components of the composition are different, with the proviso that said isovanillin component is not apocynin.

186. A therapeutic composition comprising the combination of at least one isovanillin component and at least one curcumin component, wherein the components of the composition are different, the weight ratio of said isovanillin to said curcumin component being from about 0.5:1 to 25:1, said isovanillin component being present at a level of from about 25-

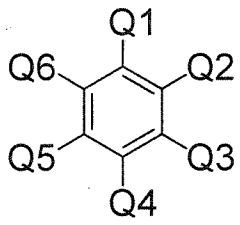
95% by weight and said curcumin component being present at a level of from about 5-75% by weight, based upon the total weight of the isovanillin component and the curcumin component taken as 100% by weight, said at least one isovanillin component being the preponderant ingredient in said composition on a weight basis, said isovanillin component being free of any fused ring structure.

187. The composition of claim 186, said curcumin component having two substituted or unsubstituted aryl groups connected by a linker, said linker having 3-7 backbone carbon atoms.

188. A therapeutic composition comprising the combination of at least one curcumin component, and at least one isovanillin component, wherein the components of the composition are different, said curcumin component selected from the group consisting of curcumin, bisdemethoxy curcumin, (1E,4E)-1,5-bis(3,5-dimethoxyphenyl)-1,4-pentadien-3-one, cardamonin, 2'-hydroxy-3,4,4',5'-tetramethoxychalcone, 2,2'-dihydroxy-4',6'-dimethoxychalcone, and (1E,4E)-1,5-Bis(2-Hydroxyphenyl)-1,4-pentadien-3-one, and said isovanillin component selected from the group consisting of isovanillin, vanillin, orthovanillin, isovanillyl alcohol, isovanillic acid, 5-bromovanillin, 2-bromo-3hydroxy-4-methoxy benzaldehyde, and 2-iodo-3hydroxy-4-methoxy benzaldehyde.

189. The composition of claim 188, said curcumin component being curcumin and said isovanillin component being isovanillin.

190. A therapeutic composition comprising the combination of at least one isovanillin component and at least one curcumin component, where the components of the composition are different, said isovanillin component being of the formula



where at least one of Q1-Q6 is an aldehyde group.

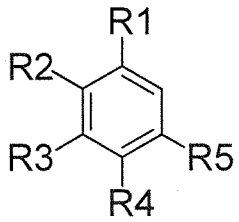
191. The composition of claim 190, at least one of said Q1-Q6 groups being an alkoxy group.

192. The composition of any of claims 184-191, said at least one curcumin component selected from the group consisting of compounds of the formulas

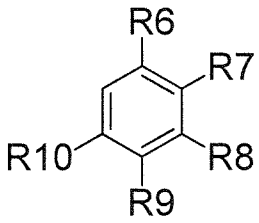
Ar1—L—Ar2, or

Ar1—L—R11,

where Ar1 is an aryl group of the formula



and Ar2 is an aryl group according to the formula



where one or more of the aryl ring carbons of Ar1 and Ar2 may be independently substituted with a heteroatom selected from N, S, B, or O, and R1-R10 are independently selected from the group consisting of H, hydroxyl, halogen, amine, nitro, sulfonate, sulfoxide, thio, ester, carboxylate, amide, borate, C1-C4 boronate, C1-C8 alkyl, C2-C8 alkenyl, C1-C6 haloalkyl, C1-C6 alkoxy, C1-C6 amine, C2-C8 carboxyl, C2-C8 ester, C1-C4 aldehyde, and glucuronide groups;

R11 is selected from the group consisting of H, and C1-C6 alkyl groups; sulfonate, sulfoxide, thio, ester, carboxylate, amide, amine or borate and

L is a linker including from 3-7 backbone carbon atoms that form a chain connecting the Ar1, Ar2, and R11 groups as the case may be, where L includes at least one of a carbonyl or hydroxyl group.

193. The composition of claim 190, wherein:

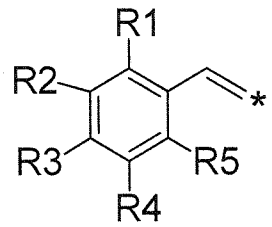
Ar1 and Ar2 are phenyl groups;

R1-R10 are independently selected from the group consisting of H, hydroxyl, halogen, C1-C4 alkyl, C1-C4 alkoxy, C1-C4 alkylamine, C2-C6 alkenylamine, C1-C6 acetoxy,

C1-C4 carboxyl, sulfonate, sulfoxide, thio, ester, carboxylate, amide or borate, with at least one of R1-R5 and R6-R10 being hydroxyl; and

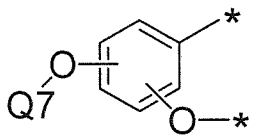
L contains at least one carbon-carbon double bond.

194. The composition of any of claims 184-191, said at least one curcumin component being of the formula



wherein R1-R5 are each independently selected from the group consisting of H, hydroxyl, halogen, C1-C8 alkyl, C2-C8 alkenyl, C1-C6 haloalkyl, C1-C6 alkoxy, C1-C6 amine, C2-C8 carboxyl, C2-C8 ester, C1-C4 aldehyde, sulfonate, sulfoxide, thio, ester, carboxylate, amide or borate and glucuronide groups, and * represents an additional portion of the component.

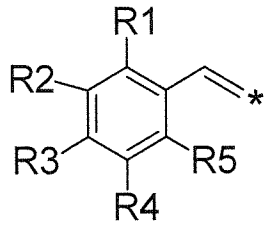
195. The composition of any of claims 184-191, said at least one isovanillin component having the formula



where the two * denote valence points where respective additional portions of the components are attached, the remaining phenyl ring positions are independently selected from the group consisting of H, hydroxyl, halogen, amine, nitro, sulfonate, sulfoxide, thio, ester, carboxylate, amide, borate, C1-C4 boronate, C1-C8 alkyl, C2-C8 alkenyl, C1-C6 haloalkyl, C1-C6 alkoxy, C1-C6 amine, C2-C8 carboxyl, C2-C8 ester, C1-C4 aldehyde, and glucuronide groups, and Q7 is H or a C1-C6 alkyl group.

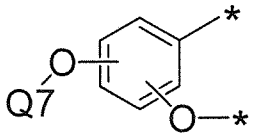
196. The composition of any of claims 184-191,

said at least one curcumin component being of the formula



wherein R1-R5 are each independently selected from the group consisting of H, hydroxyl, halogen, C1-C8 alkyl, C2-C8 alkenyl, C1-C6 haloalkyl, C1-C6 alkoxy, C1-C6 amine, C2-C8 carboxyl, C2-C8 ester, C1-C4 aldehyde, sulfonate, sulfoxide, thio, ester, carboxylate, amide or borate and glucuronide groups, and * represents an additional portion of the curcumin component; and

said at least one isovanillin component has the formula



where the two * denote valence points where respective additional portions of the components are attached, the remaining phenyl ring positions are independently selected from the group consisting of H, hydroxyl, halogen, amine, nitro, sulfonate, sulfoxide, thio, ester, carboxylate, amide, borate, C1-C4 boronate, C1-C8 alkyl, C2-C8 alkenyl, C1-C6 haloalkyl, C1-C6 alkoxy, C1-C6 amine, C2-C8 carboxyl, C2-C8 ester, C1-C4 aldehyde, and glucuronide groups, and Q7 is H or a C1-C6 alkyl group.

197. The composition of any of claims 184-191, said composition being an anti-cancer composition for administration to a cancer patient.

198. The composition of claim 192, said composition being an anti-cancer composition for administration to a cancer patient.

199. The composition of claim 193, said composition being an anti-cancer composition for administration to a cancer patient.

200. The composition of claim 194, said composition being an anti-cancer composition for administration to a cancer patient.

201. A method of treating a patient suffering from cancer, comprising the step of administering to the patient a composition in accordance with any of claims 184-191.

202. A method of treating a patient suffering from cancer, comprising the step of administering to the patient a composition in accordance with claim 192.

203. A method of treating a patient suffering from cancer, comprising the step of administering to the patient a composition in accordance with claim 193.

204. A method of treating a patient suffering from cancer, comprising the step of administering to the patient a composition in accordance with claim 194.

205. A composition for use in the treatment of cancer, said composition being in accordance with any of claims 184-191.

206. A composition for use in the treatment of cancer, said composition being in accordance with claim 192.

207. A composition for use in the treatment of cancer, said composition being in accordance with claim 193.

208. A composition for use in the treatment of cancer, said composition being in accordance with claim 194.

209. The use of a composition for the manufacture of a medicament for anti-cancer therapeutic application, said composition being in accordance with any of claims 184-191.

210. The use of a composition for the manufacture of a medicament for anti-cancer therapeutic application, said composition being in accordance with claim 192.

211. The use of a composition for the manufacture of a medicament for anti-cancer therapeutic application, said composition being in accordance with claim 193.

212. The use of a composition for the manufacture of a medicament for anti-cancer therapeutic application, said composition being in accordance with claim 194.

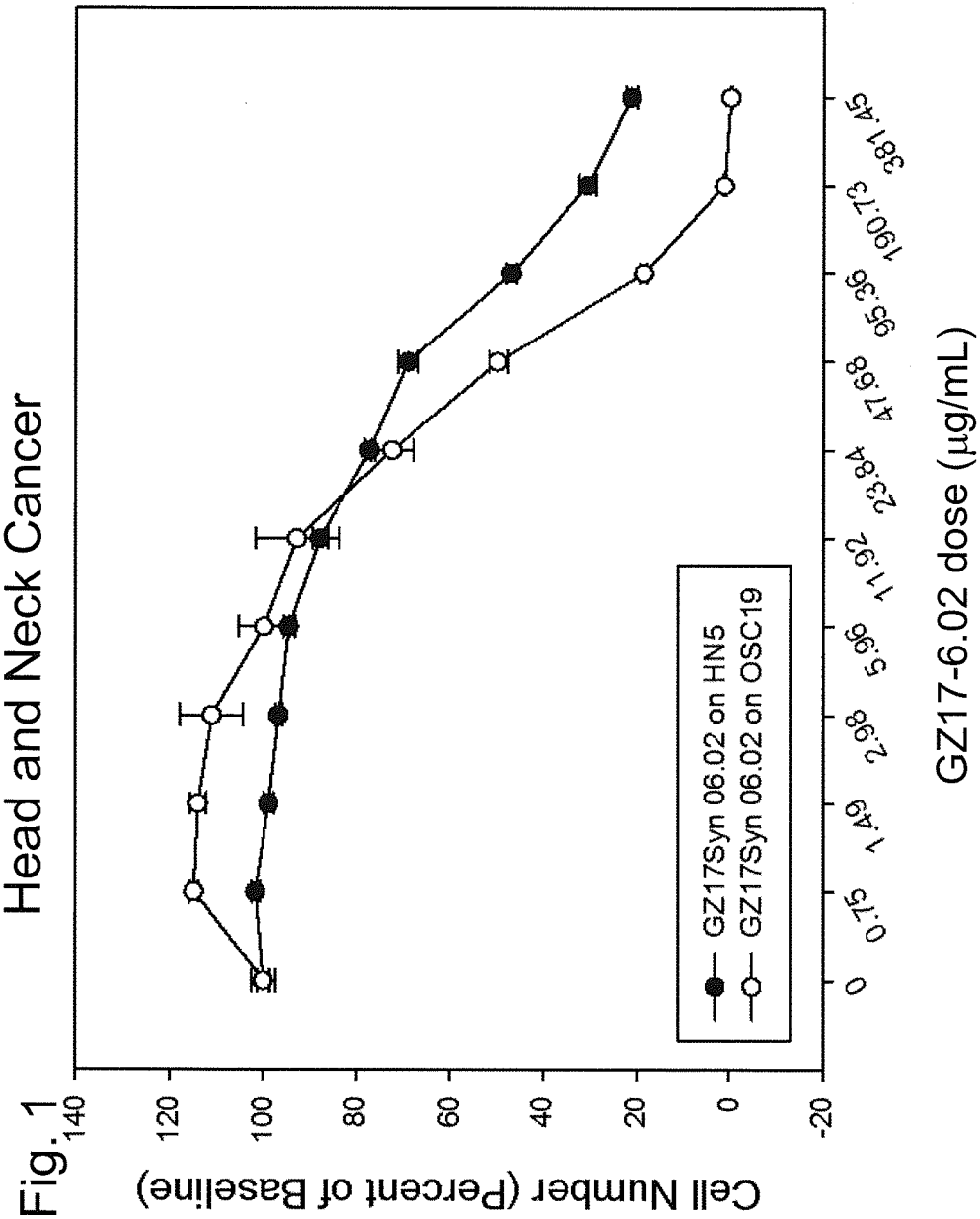
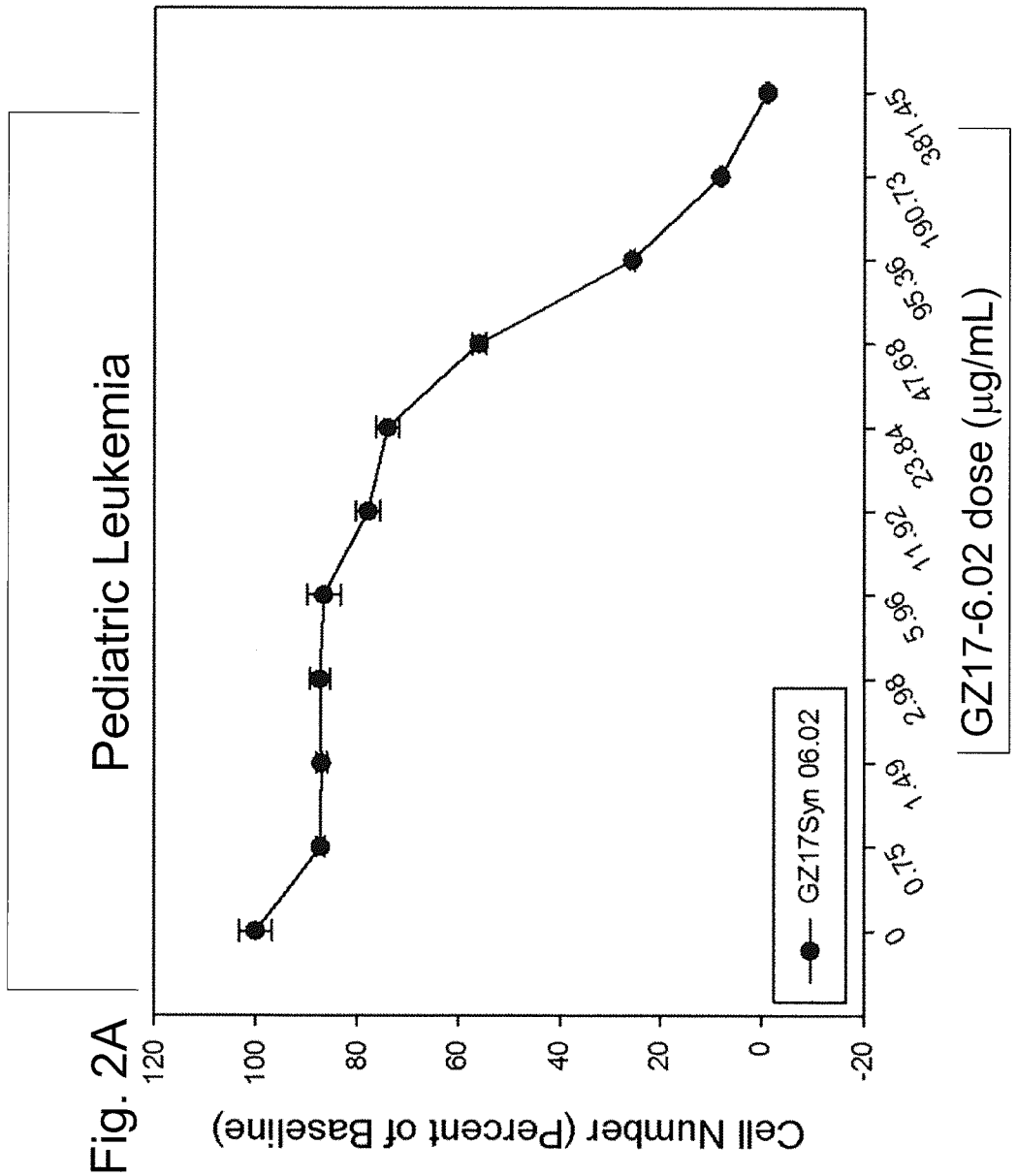

Head and Neck Cancer
Cell Number (Percent of Baseline)
140
120
100
80
60
40
20
0
-20
GZ17Sym 06.02 on HN5
GZ17Sym 06.02 on OSC19
0
0.75
1.49
2.98
5.96
11.92
23.84
47.68
95.36
190.73
381.45
GZ17-6.02 dose (µg/mL)

Fig. 1

Fig. 2A


Pediatric Leukemia
Cell Number (Percent of Baseline)
120
100
80
60
40
20
0
-20
GZ17Syn 06.02
0
0.75
1.9
4.9
12.2
29.6
71.9
95.5
190.7
381.45
GZ17-6.02 dose (µg/mL)

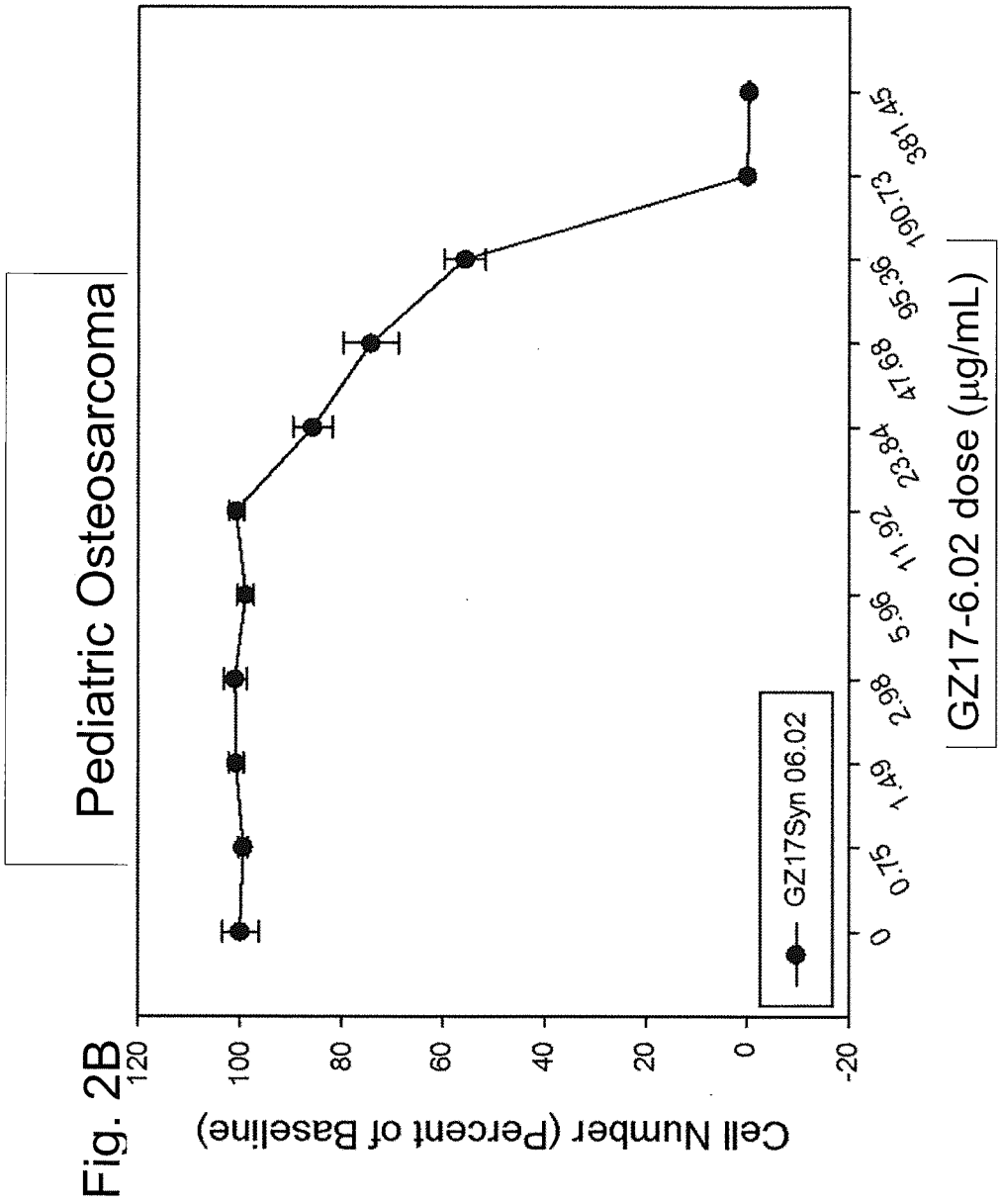

Pediatric Osteosarcoma
Cell Number (Percent of Baseline)
120
100
80
60
40
20
0
-20
GZ17Syn 06.02
0
0.75
1.49
2.98
5.96
11.92
23.84
47.68
95.36
190.73
381.45
GZ17-6.02 dose (µg/mL)

Fig. 2B

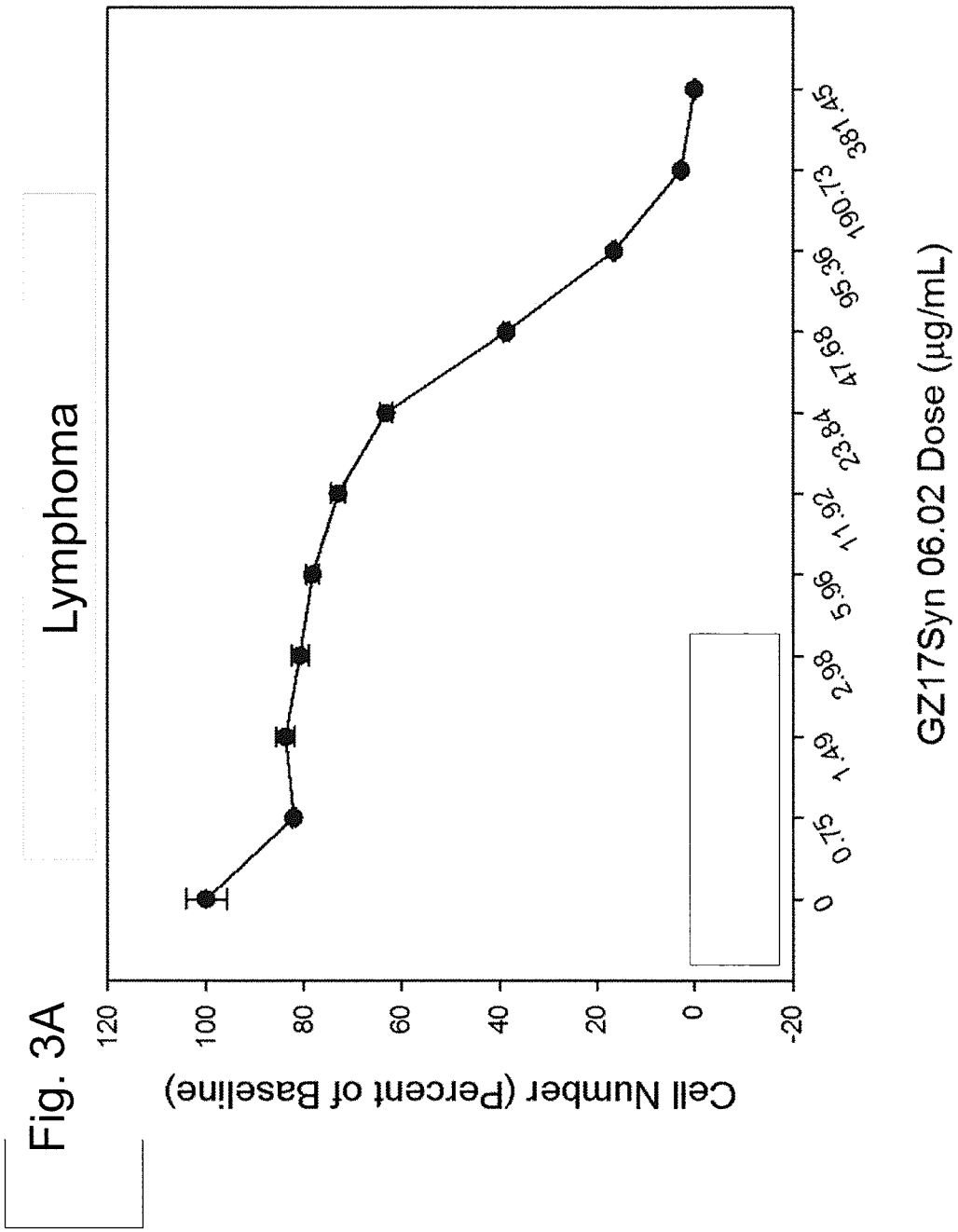

Lymphoma
Cell Number (Percent of Baseline)
120
100
80
60
40
20
0
-20
0
0.75
1.49
2.98
5.96
11.92
23.84
47.68
95.36
190.73
381.45
GZ17Syn 06.02 Dose (µg/mL)

Fig. 3A

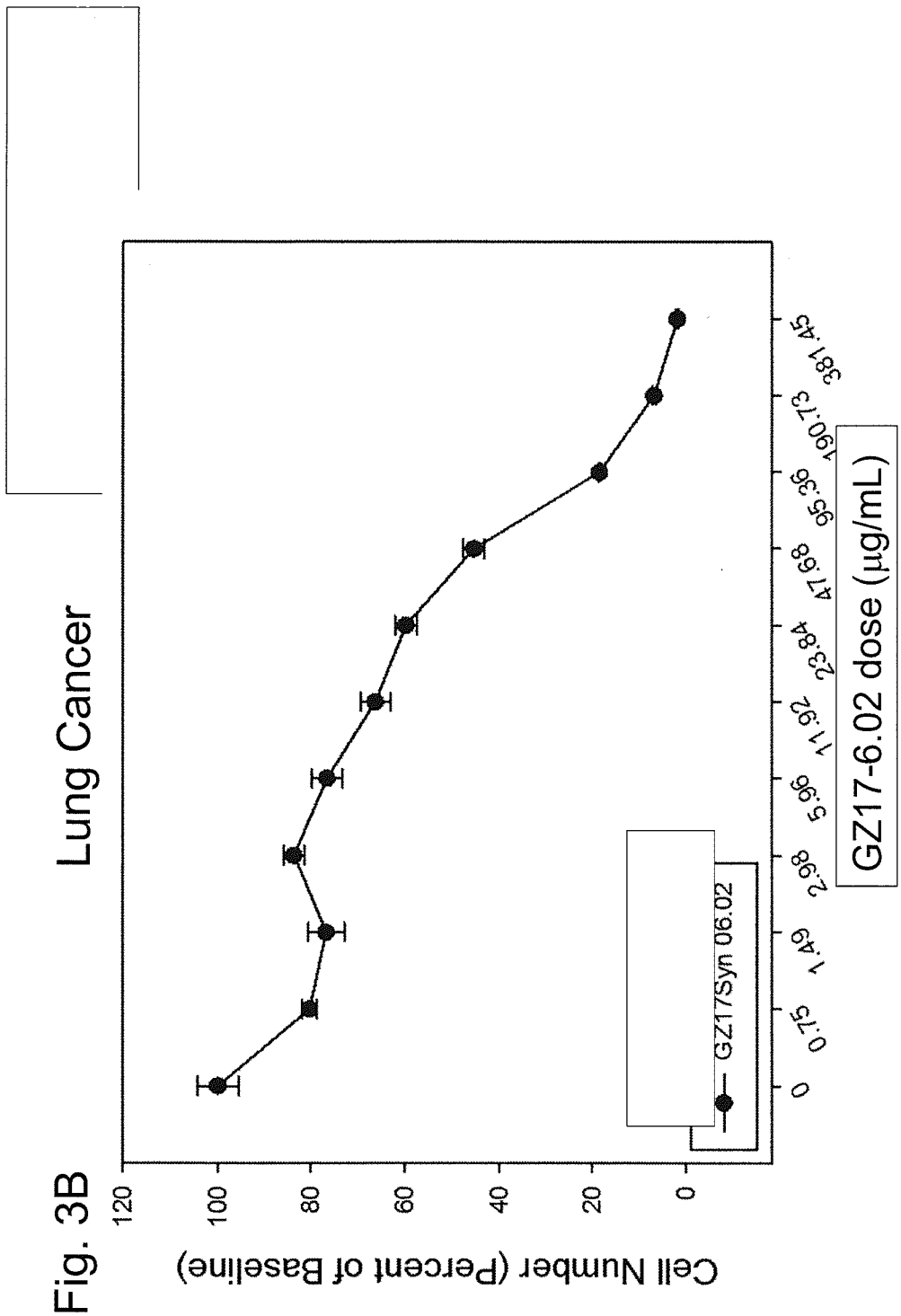

Lung Cancer
Cell Number (Percent of Baseline)
120
100
80
60
40
20
0
GZ17Syn 06.02
0
0.75
1.49
2.98
5.96
11.92
23.84
47.68
95.36
190.73
381.45
GZ17-6.02 dose (µg/mL)

Fig. 3B

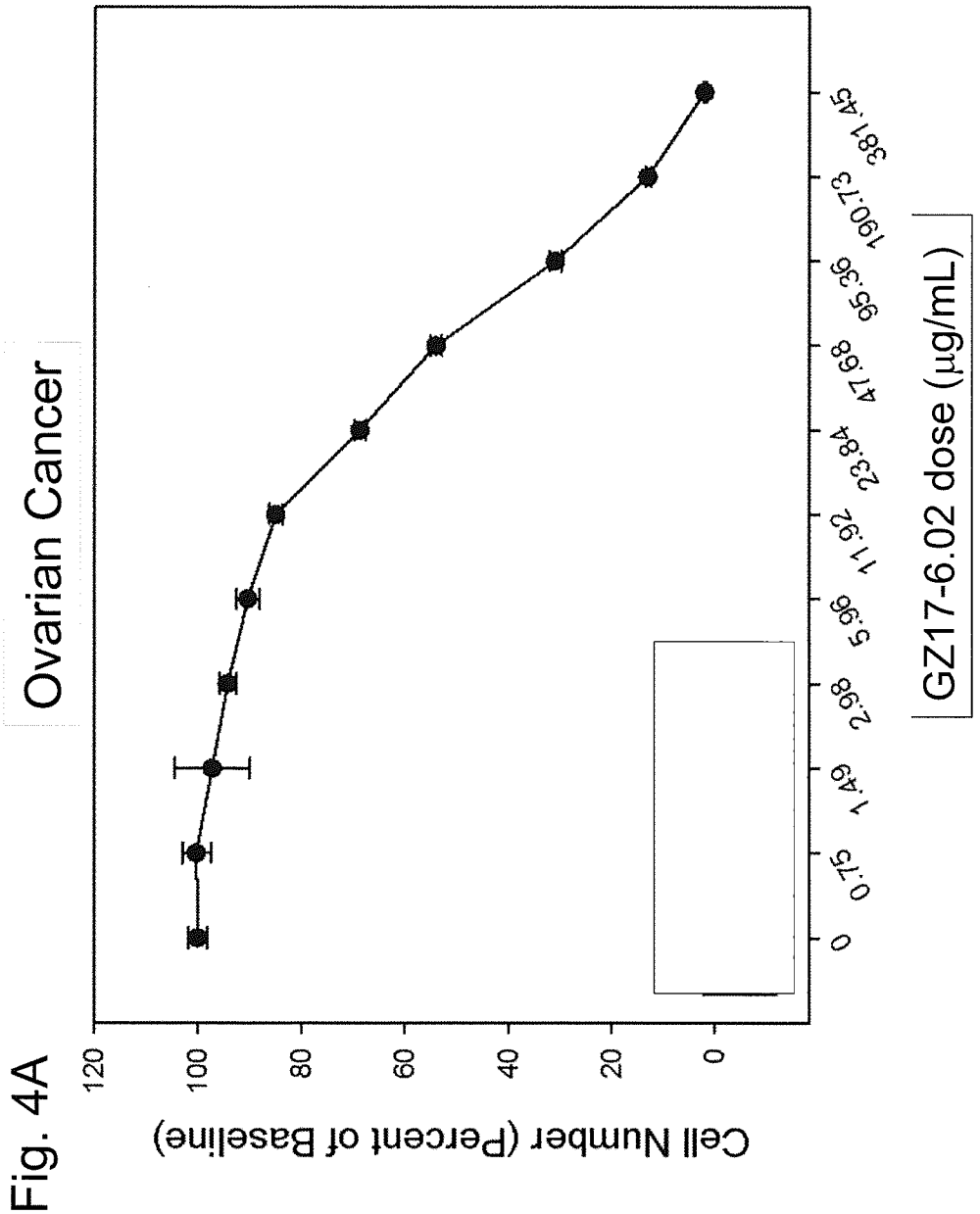

Ovarian Cancer
Cell Number (Percent of Baseline)
120
100
80
60
40
20
0
0
0.75
1.49
2.98
5.96
11.92
23.84
47.68
95.36
190.73
381.45
GZ17-6.02 dose (µg/mL)

Fig. 4A

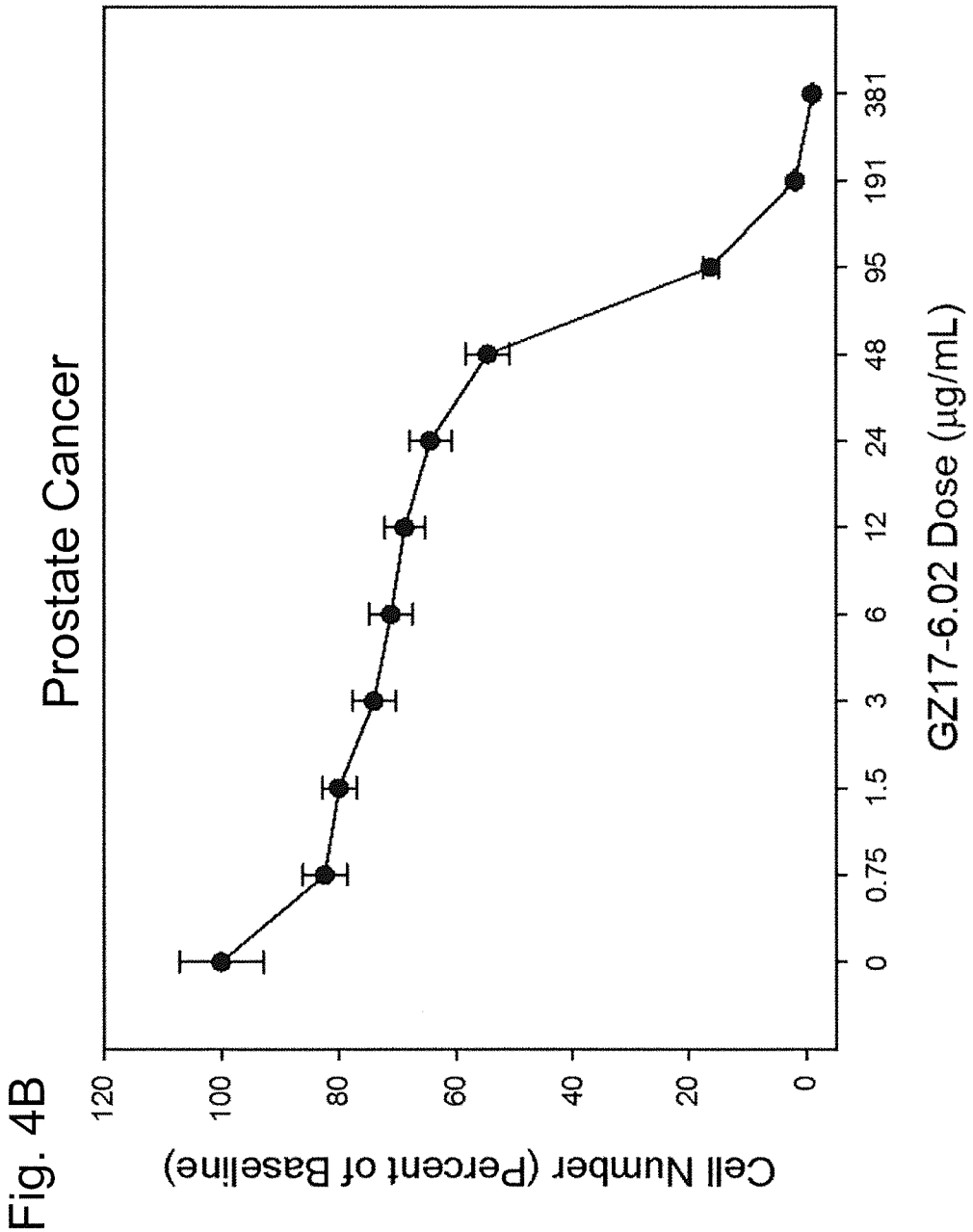

Prostate Cancer
Cell Number (Percent of Baseline)
120
100
80
60
40
20
0
0
0.75
1.5
3
6
12
24
48
95
191
381
GZ17-6.02 Dose (µg/mL)

Fig. 4B

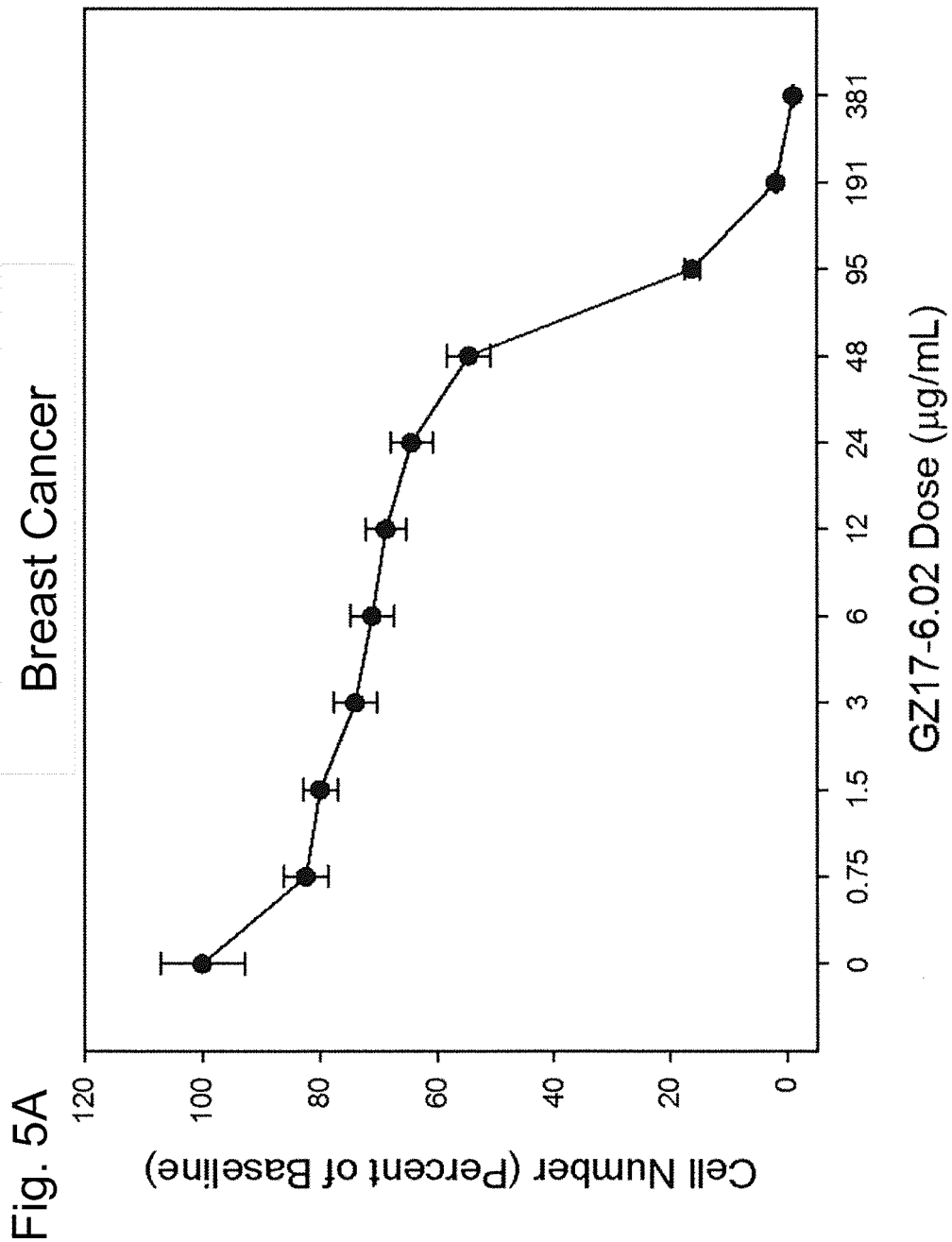

Breast Cancer
Cell Number (Percent of Baseline)
120
100
80
60
40
20
0
0
0.75
1.5
3
6
12
24
48
95
191
381
GZ17-6.02 Dose (µg/mL)

Fig. 5A

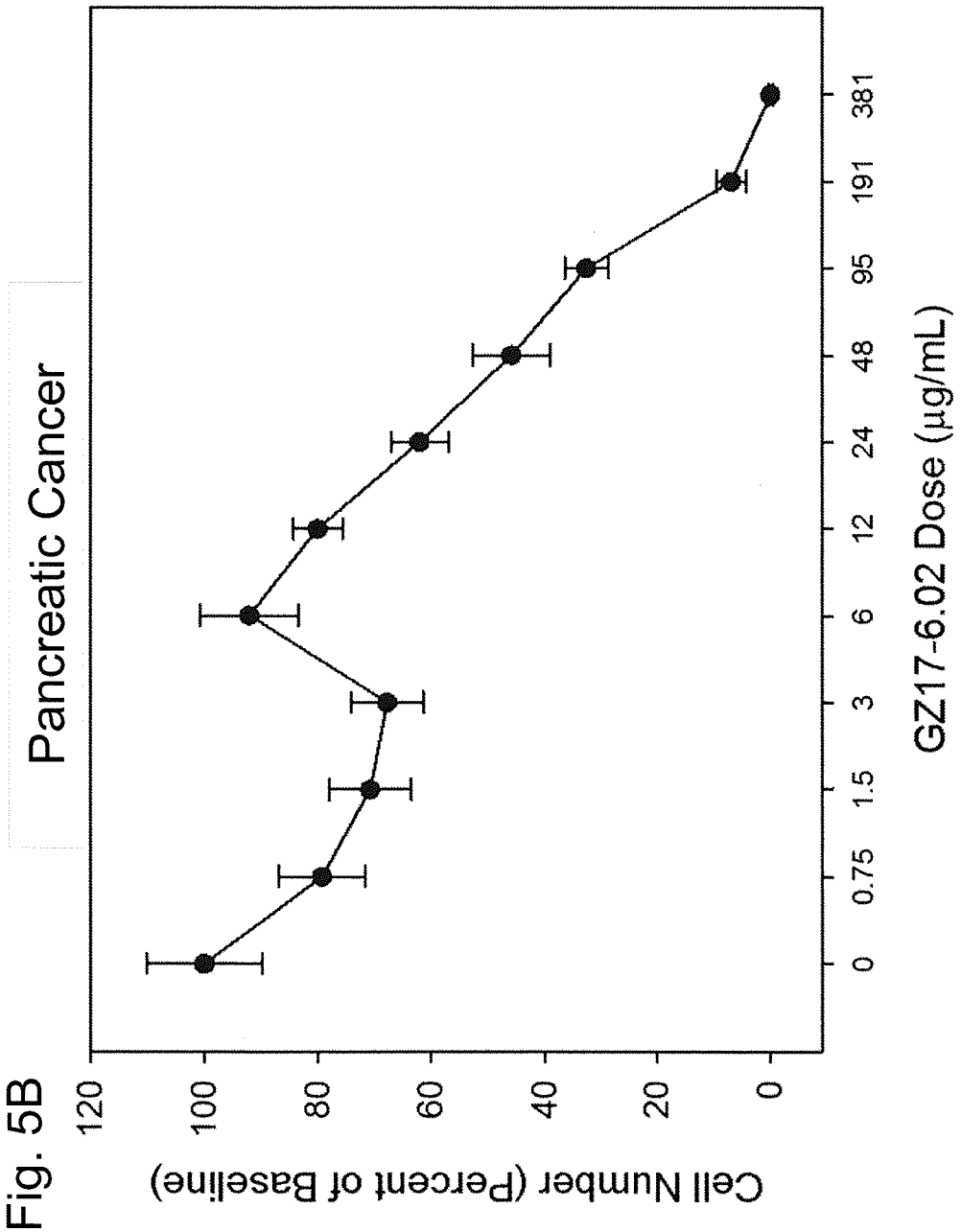

Pancreatic Cancer
Cell Number (Percent of Baseline)
120
100
80
60
40
20
0
0
0.75
1.5
3
6
12
24
48
95
191
381
GZ17-6.02 Dose (µg/mL)

Fig. 5B

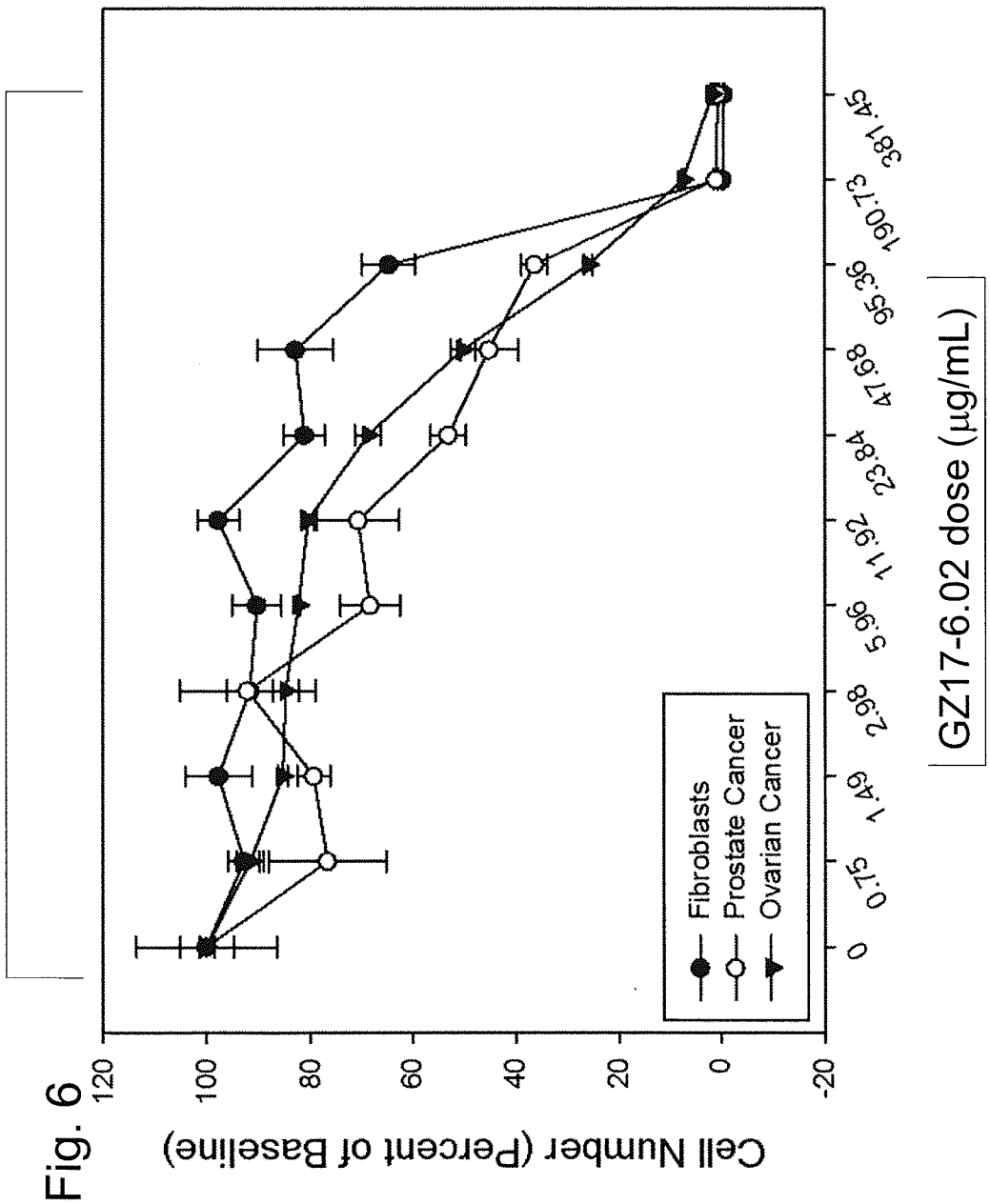

Cell Number (Percent of Baseline)
120
100
80
60
40
20
0
-20
Fibroblasts
Prostate Cancer
Ovarian Cancer
0
0.75
1.49
2.98
5.96
11.92
23.84
47.68
95.36
190.73
381.45
GZ17-6.02 dose (µg/mL)

Fig. 6

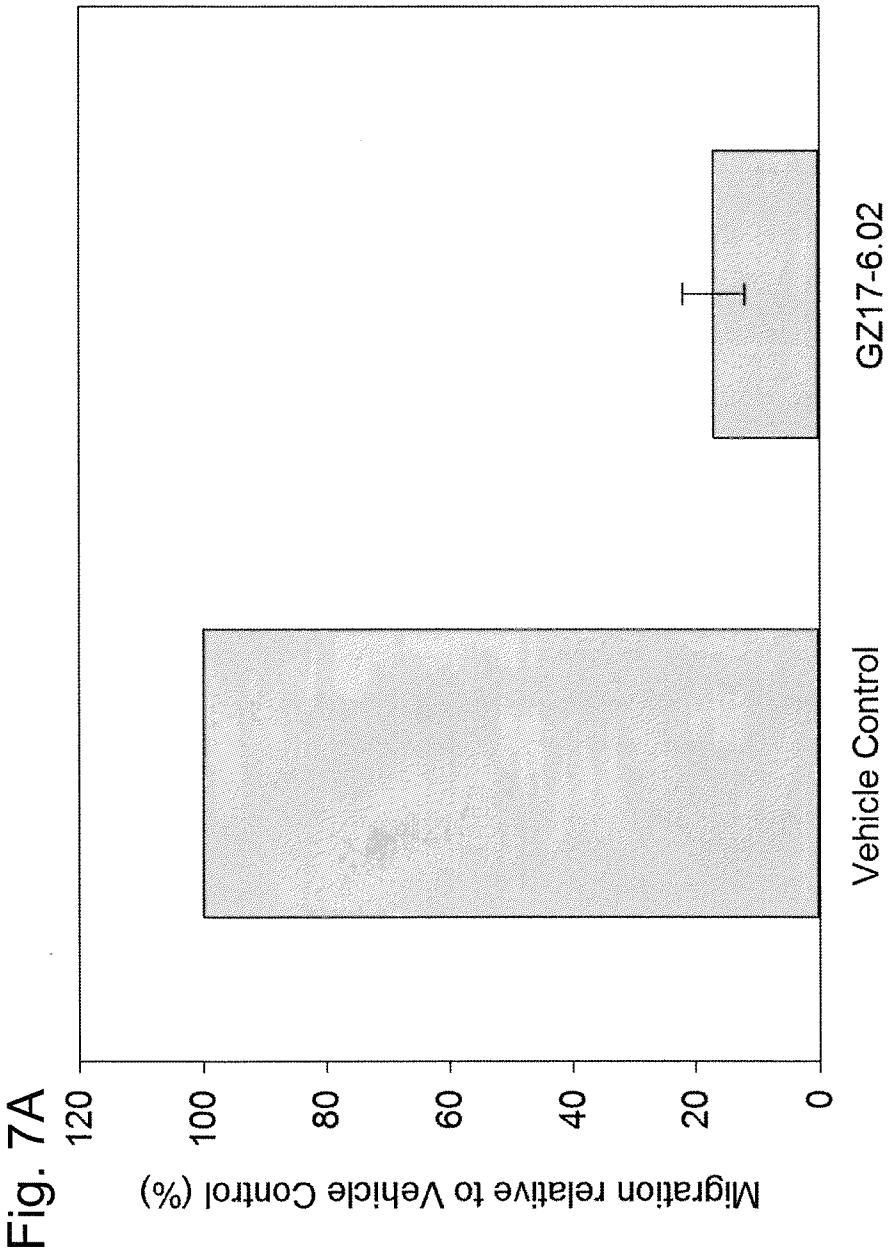

Migration relative to Vehicle Control (%)
0
20
40
60
80
100
120
Vehicle Control
GZ17-6.02

Fig. 7A

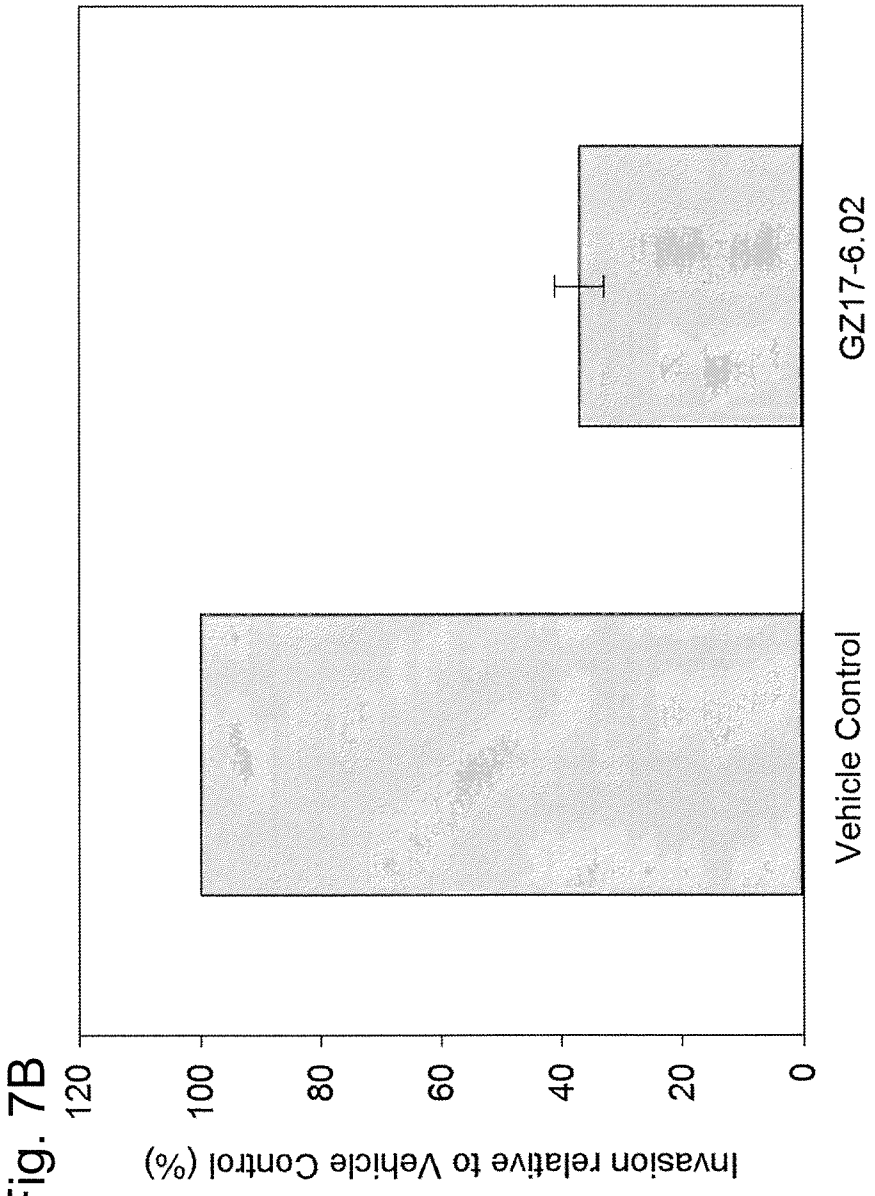

Invasion relative to Vehicle Control (%)
120
100
80
60
40
20
0
Vehicle Control
GZ17-6.02

Fig. 7B

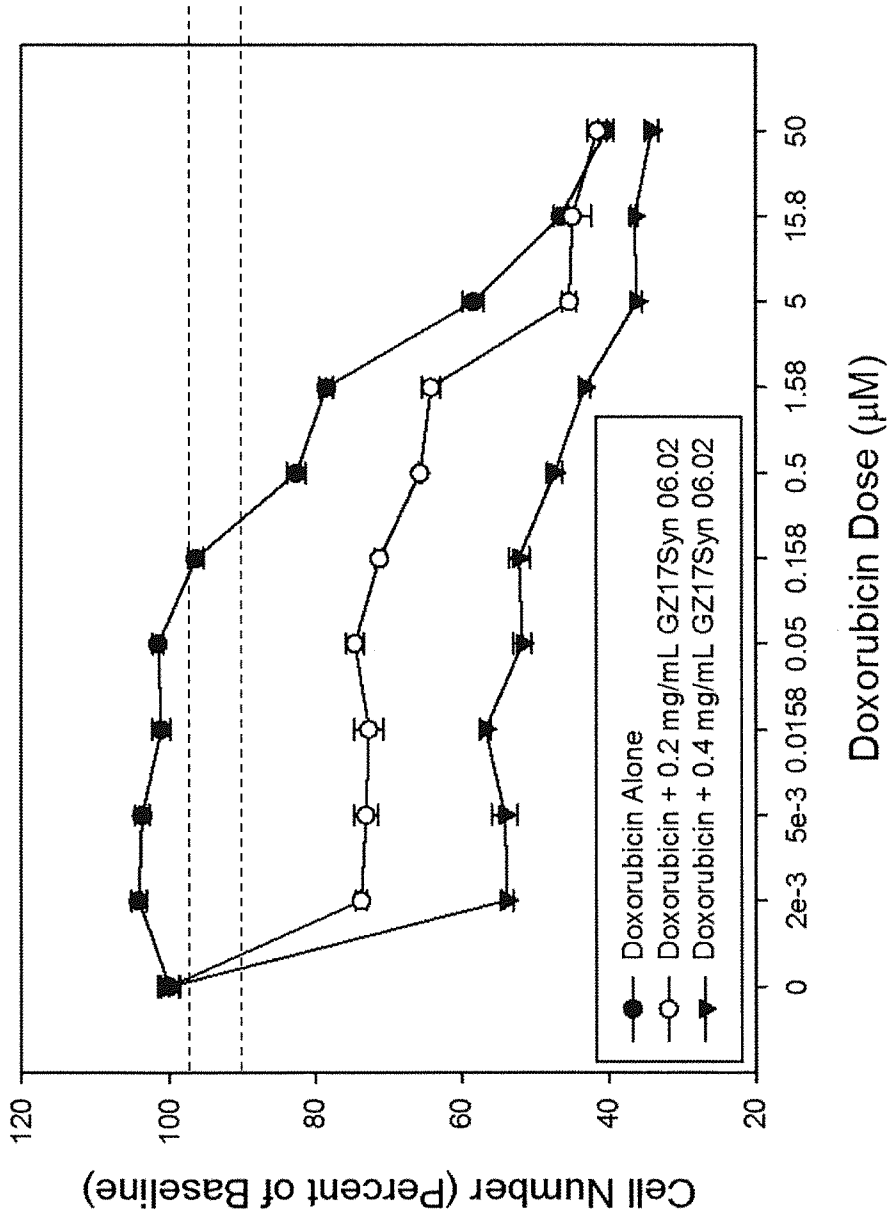

Cell Number (Percent of Baseline)
120
100
80
60
40
20
0
2e-3
5e-3
0.0158
0.05
0.158
0.5
1.58
5
15.8
50
Doxorubicin Dose (µM)
Doxorubicin Alone
Doxorubicin + 0.2 mg/mL GZ17Syn 06.02
Doxorubicin + 0.4 mg/mL GZ17Syn 06.02

Fig. 8

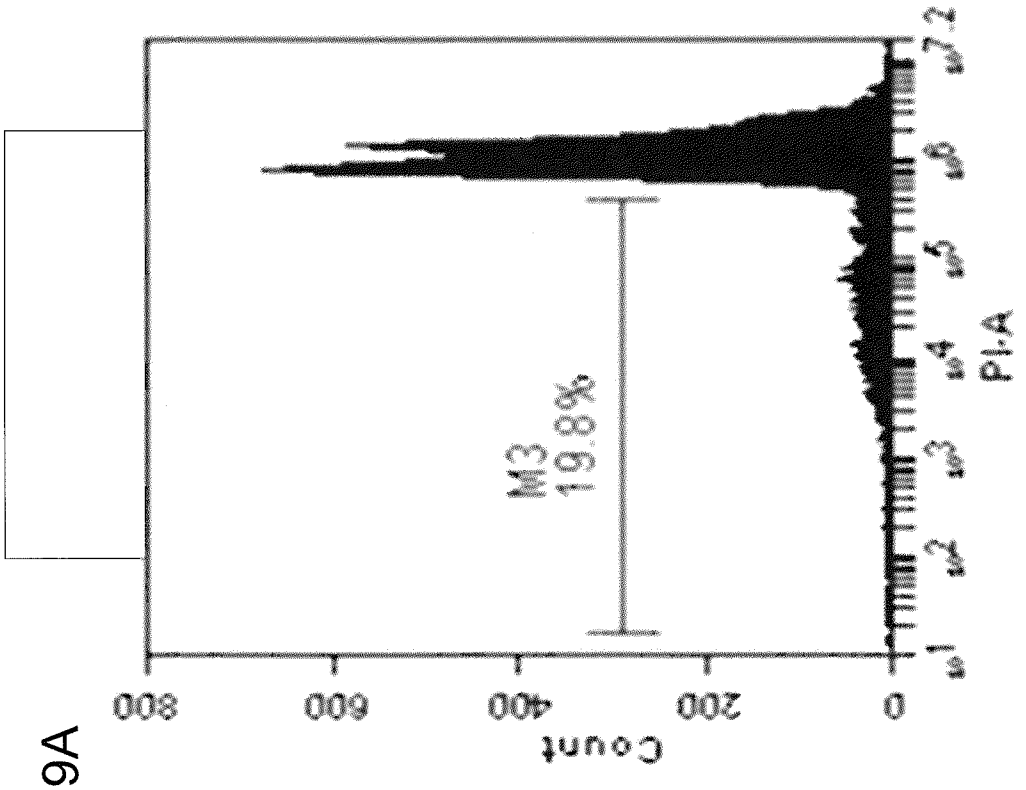


Fig. 9A

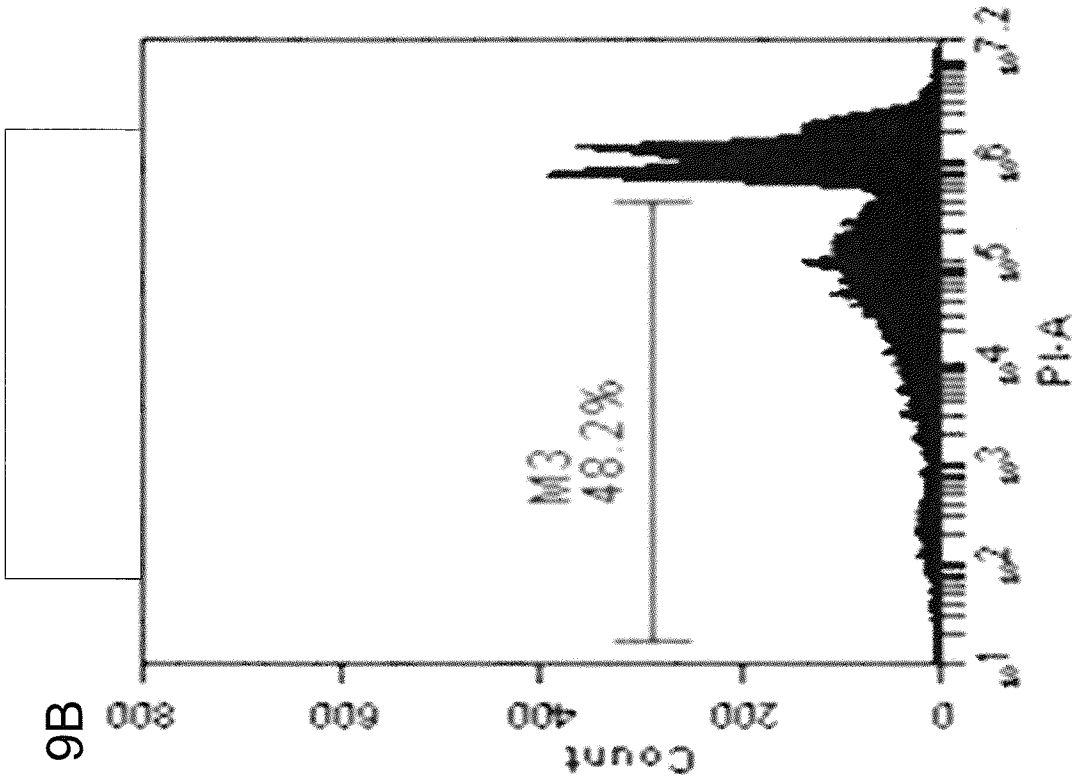
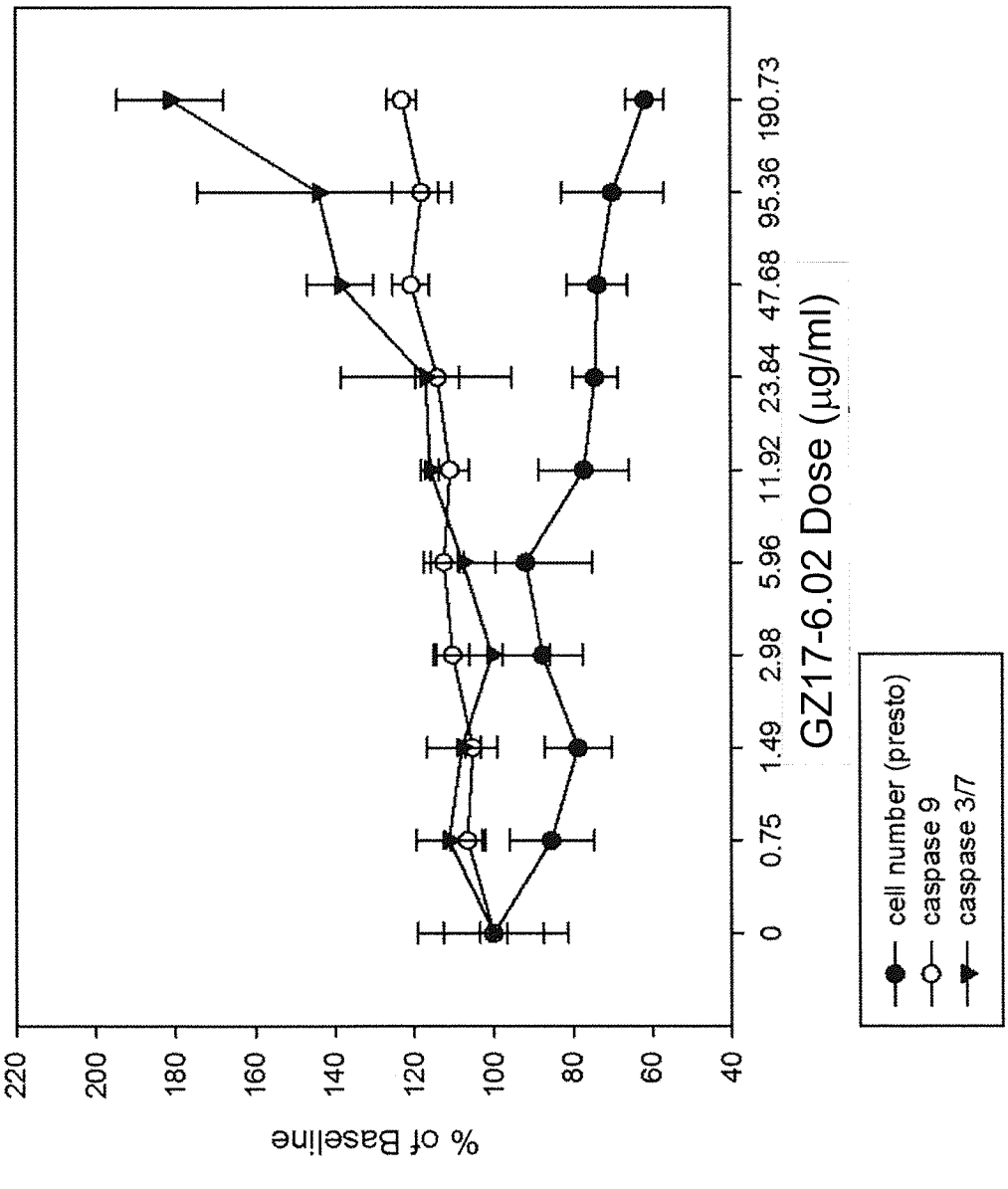


Fig. 9B

Fig. 10A


% of Baseline
220
200
180
160
140
120
100
80
60
40
0
0.75
1.49
2.98
5.96
11.92
23.84
47.68
95.36
190.73
GZ17-6.02 Dose (µg/ml)
cell number (presto)
caspase 9
caspase 3/7

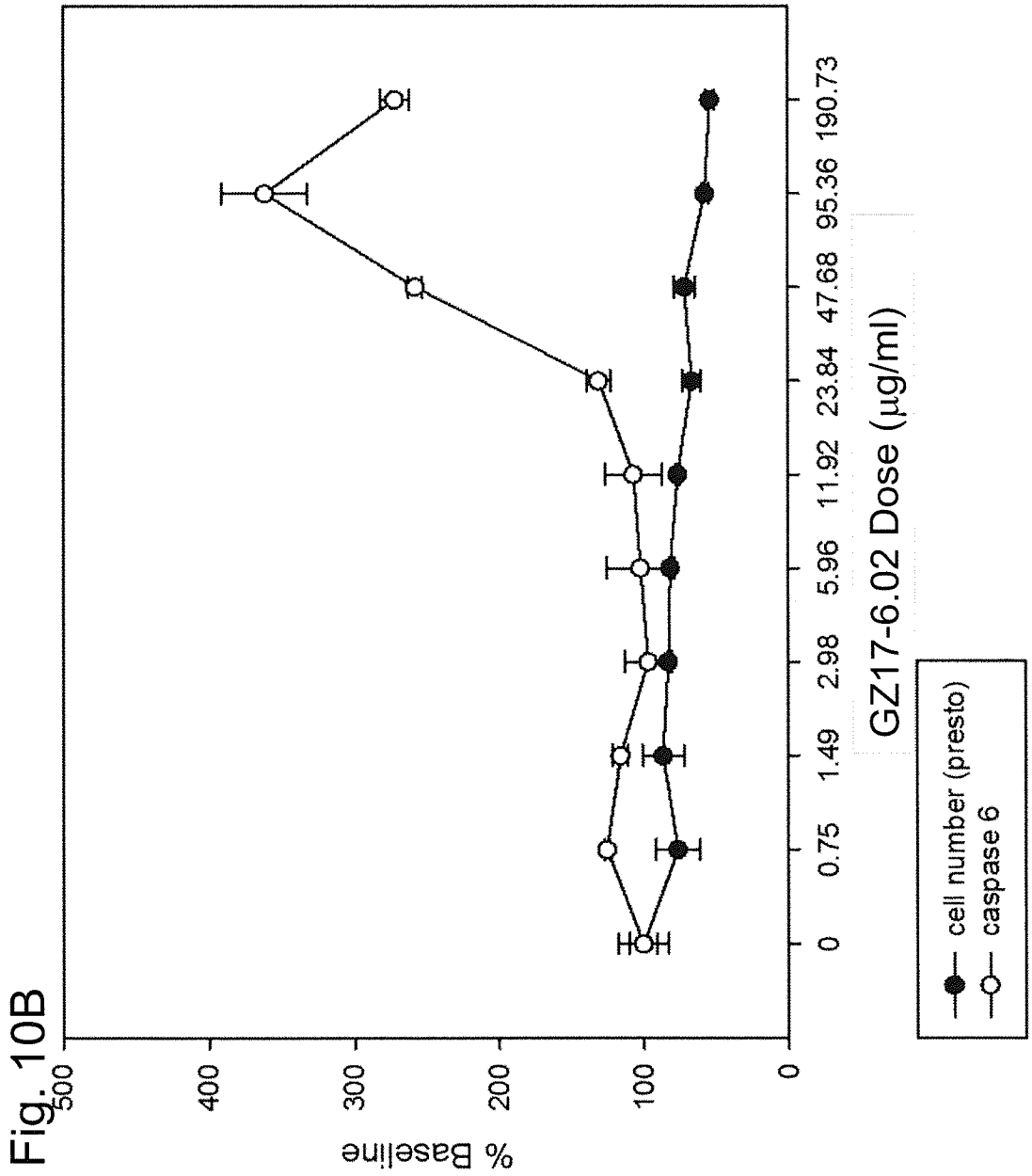

% Baseline
500
400
300
200
100
0
0
0.75
1.49
2.98
5.96
11.92
23.84
47.68
95.36
190.73
GZ17-6.02 Dose (µg/ml)
cell number (presto)
caspase 6

Fig. 10B

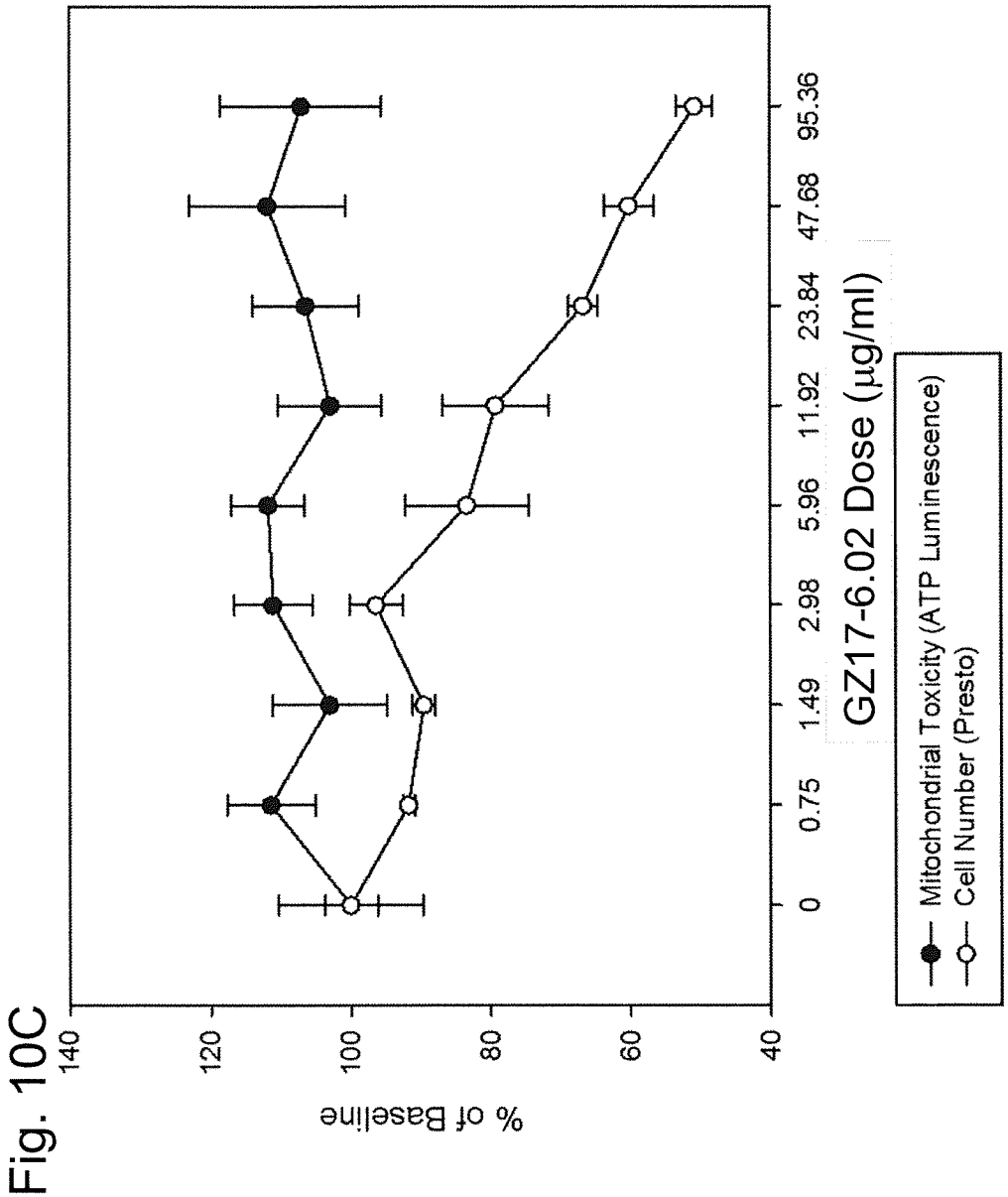

% of Baseline
140
120
100
80
60
40
0
0.75
1.49
2.98
5.96
11.92
23.84
47.68
95.36
GZ17-6.02 Dose (µg/ml)
Mitochondrial Toxicity (ATP Luminescence)
Cell Number (Presto)

Fig. 10C

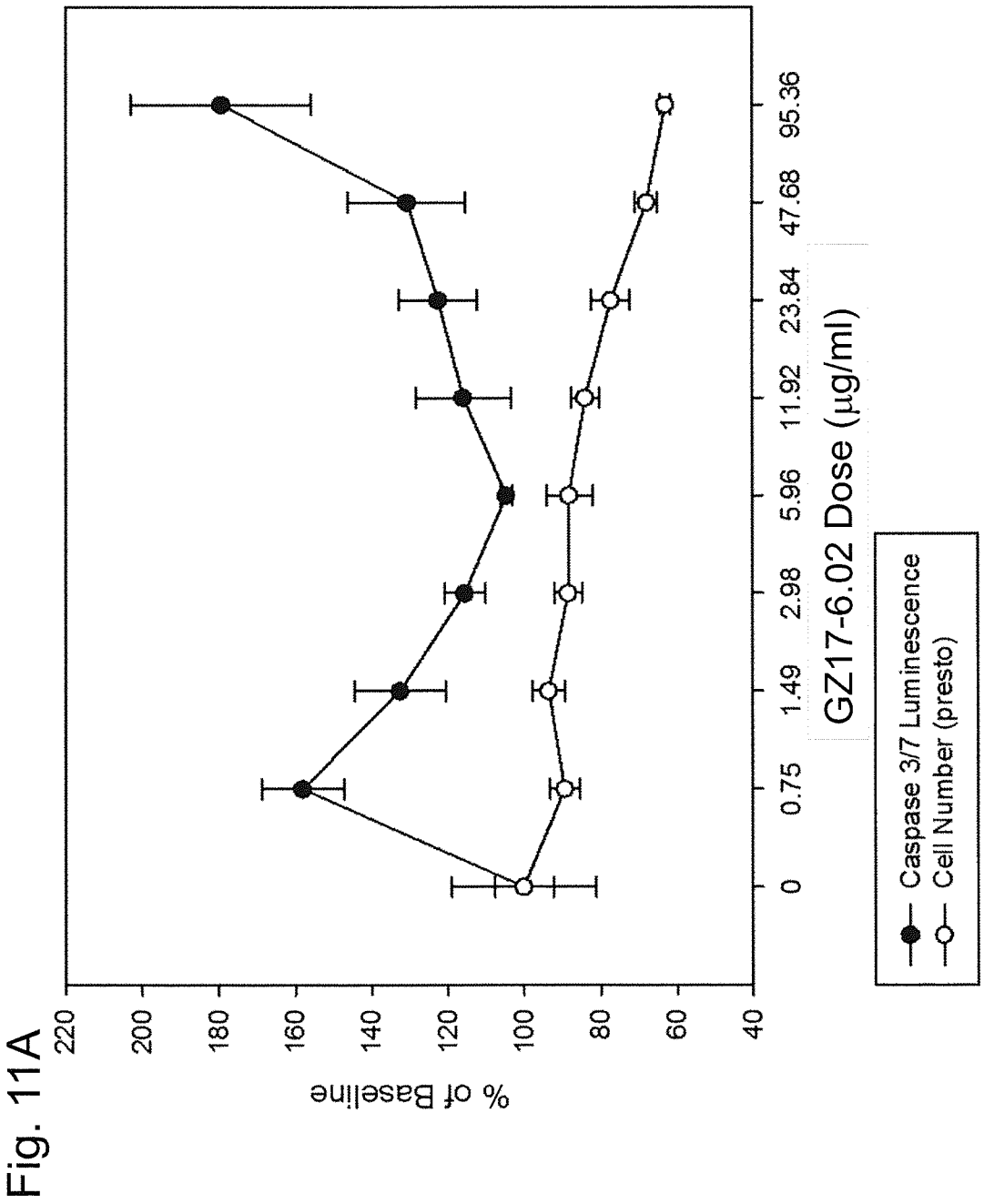
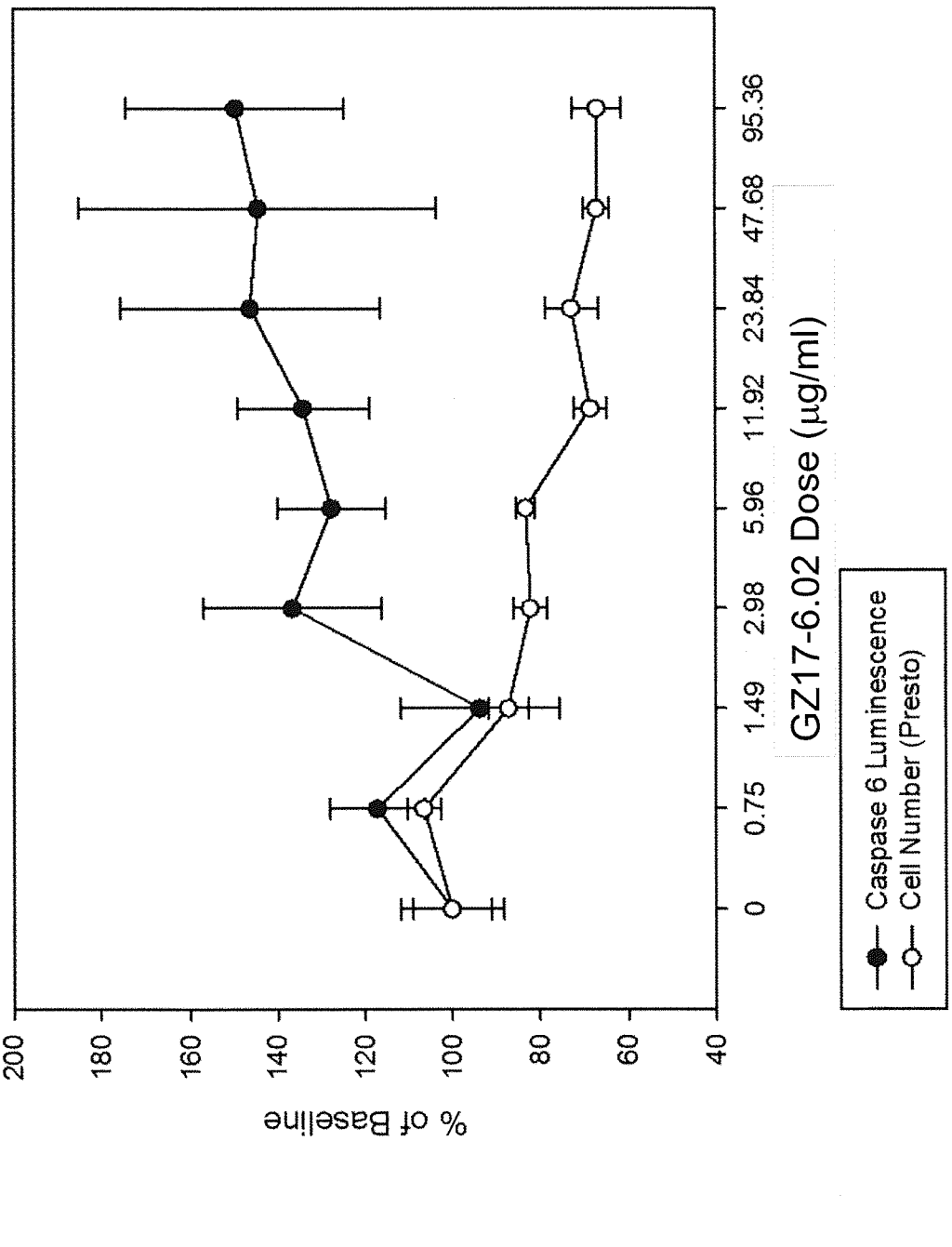

% of Baseline
220
200
180
160
140
120
100
80
60
40
0
0.75
1.49
2.98
5.96
11.92
23.84
47.68
95.36
GZ17-6.02 Dose (µg/ml)
Caspase 3/7 Luminescence
Cell Number (presto)

Fig. 11A

Fig. 11B


% of Baseline
200
180
160
140
120
100
80
60
40
0
0.75
1.49
2.98
5.96
11.92
23.84
47.68
95.36
GZ17-6.02 Dose (µg/ml)
Caspase 6 Luminescence
Cell Number (Presto)

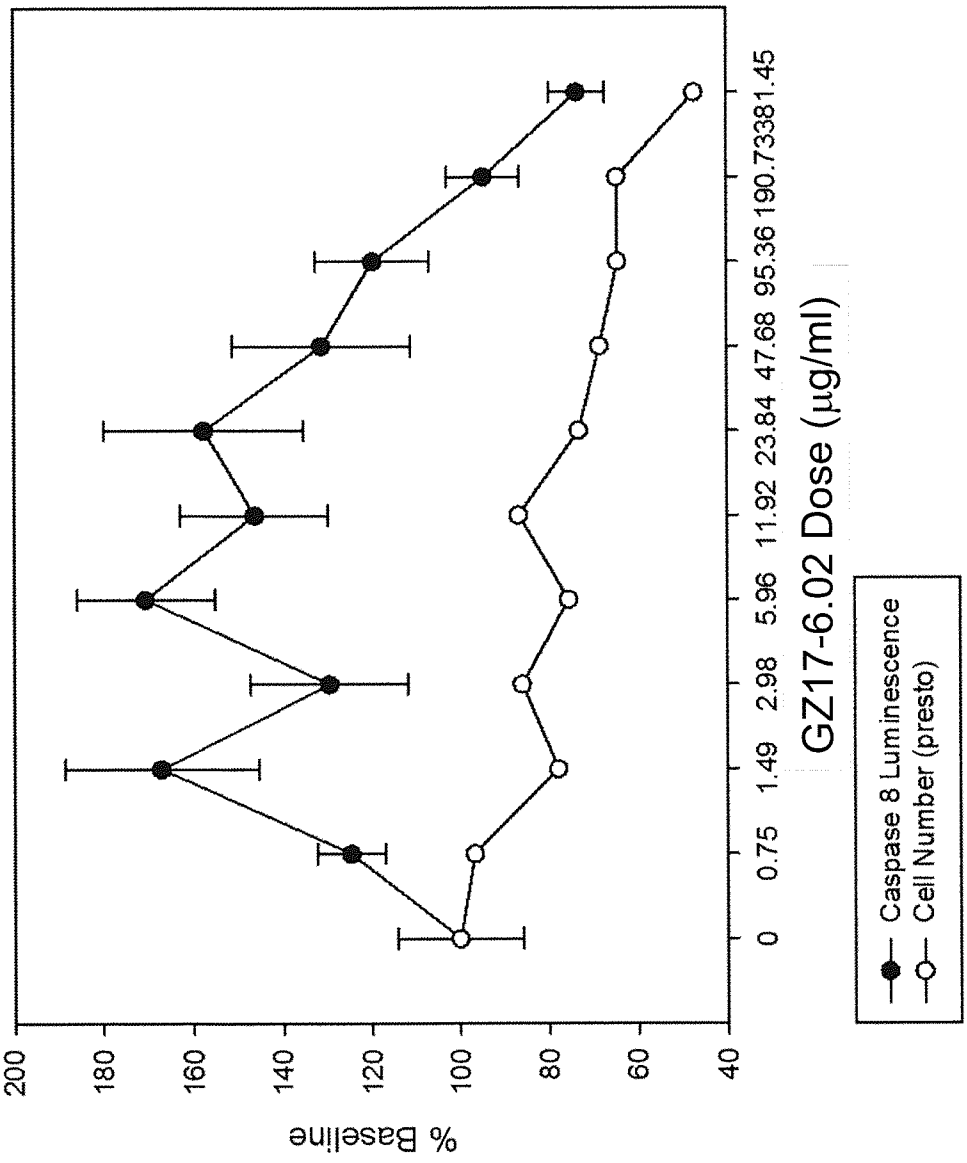

% Baseline
200
180
160
140
120
100
80
60
40
0
0.75
1.49
2.98
5.96
11.92
23.84
47.68
95.36
190.7
381.45
GZ17-6.02 Dose (µg/ml)
Caspase 8 Luminescence
Cell Number (presto)

Fig. 11C

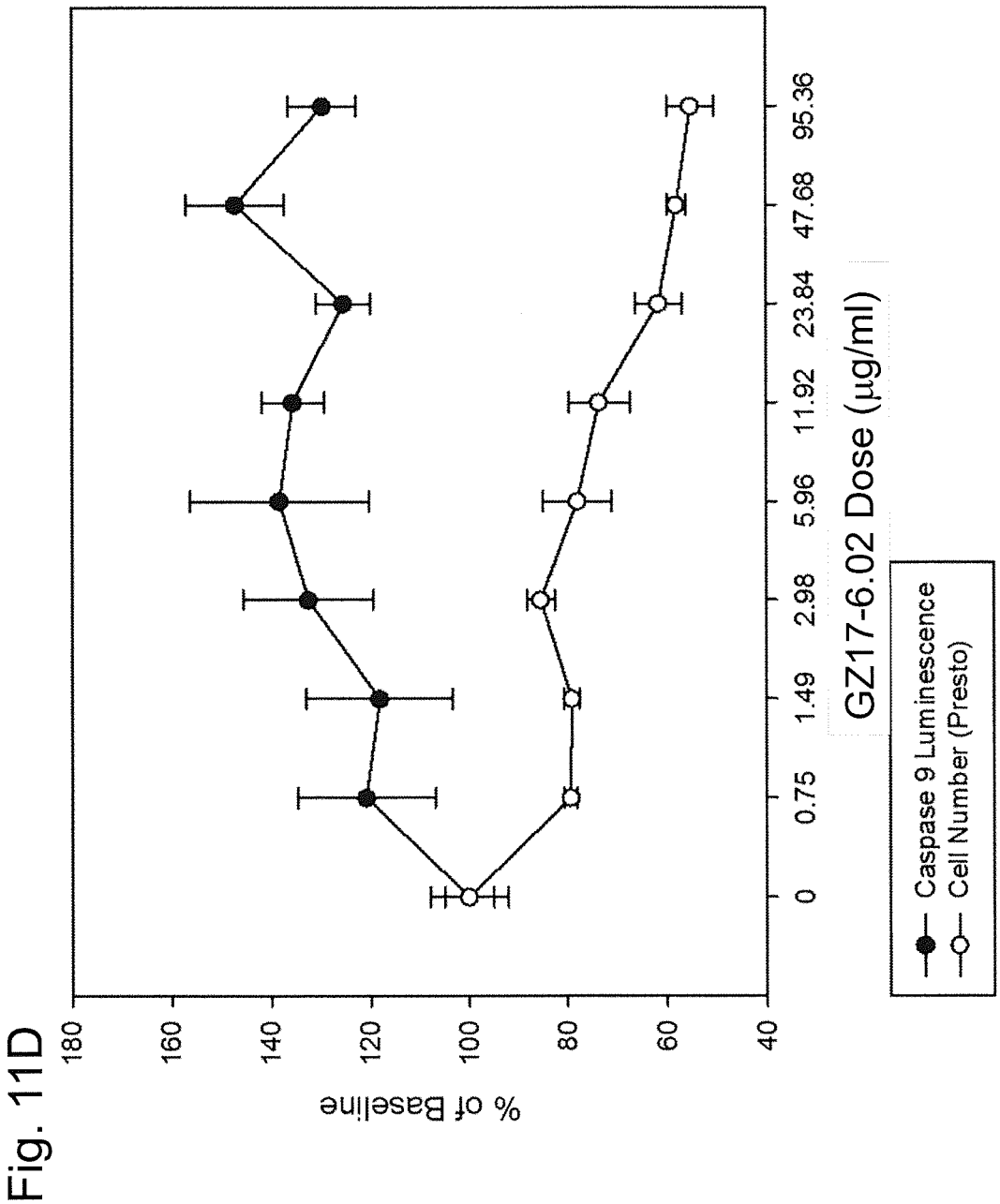

% of Baseline
180
160
140
120
100
80
60
40
0
0.75
1.49
2.98
5.96
11.92
23.84
47.68
95.36
GZ17-6.02 Dose (µg/ml)
Caspase 9 Luminescence
Cell Number (Presto)

Fig. 11D

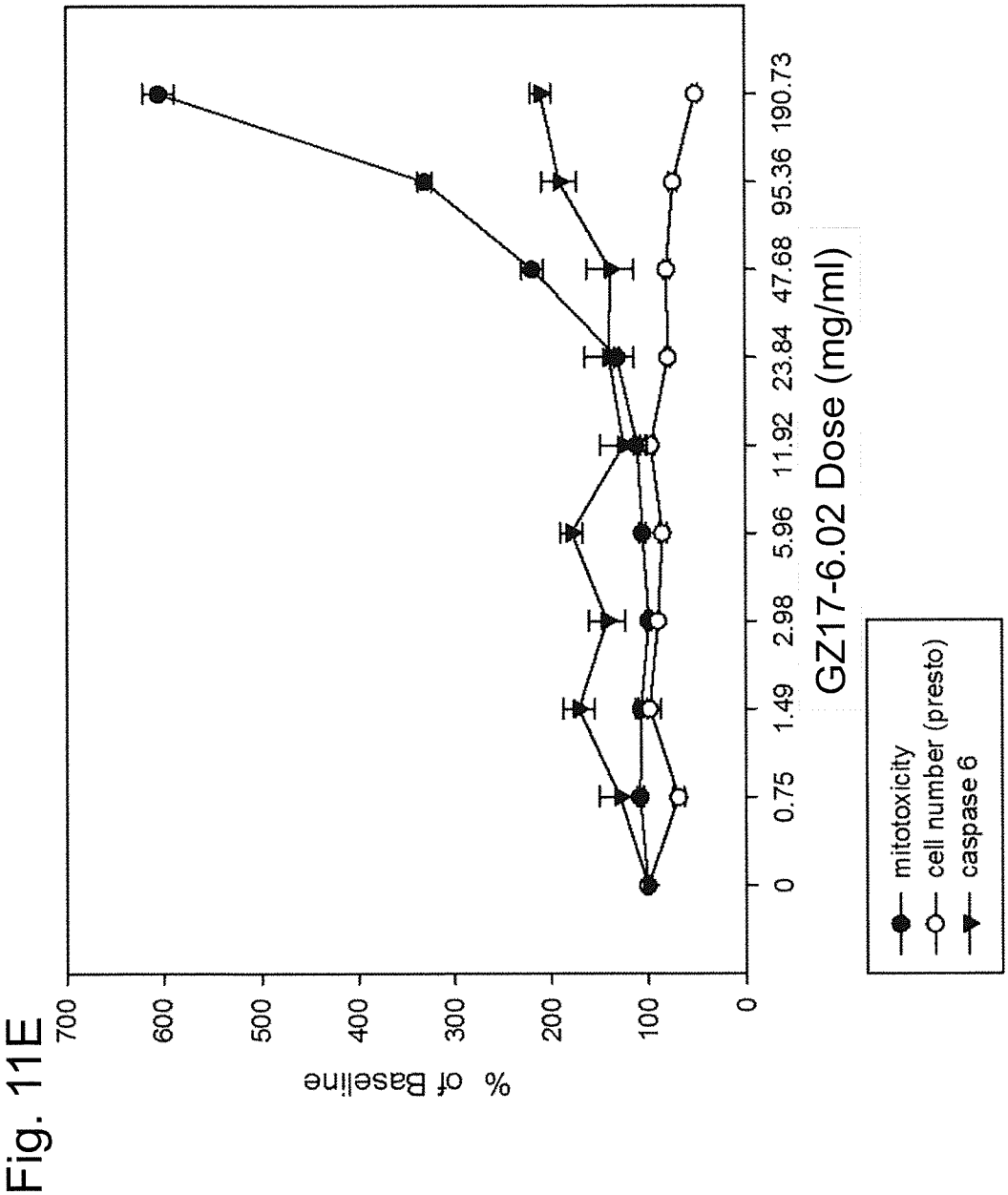
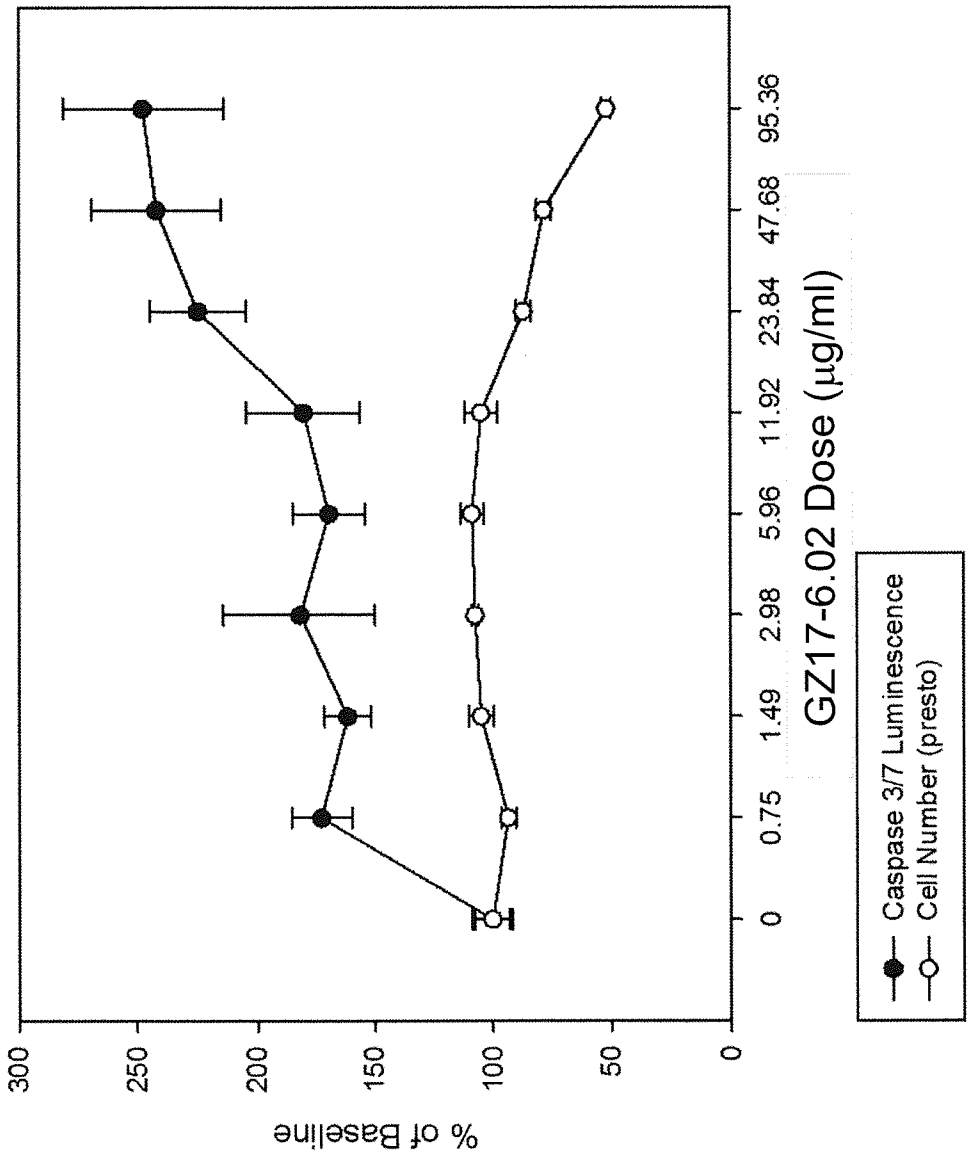

% of Baseline
700
600
500
400
300
200
100
0
0
0.75
1.49
2.98
5.96
11.92
23.84
47.68
95.36
190.73
GZ17-6.02 Dose (mg/ml)
mitotoxicity
cell number (presto)
caspase 6

Fig. 11E

Fig. 12A


% of Baseline
300
250
200
150
100
50
0
0
0.75
1.49
2.98
5.96
11.92
23.84
47.68
95.36
GZ17-6.02 Dose (µg/ml)
Caspase 3/7 Luminescence
Cell Number (presto)

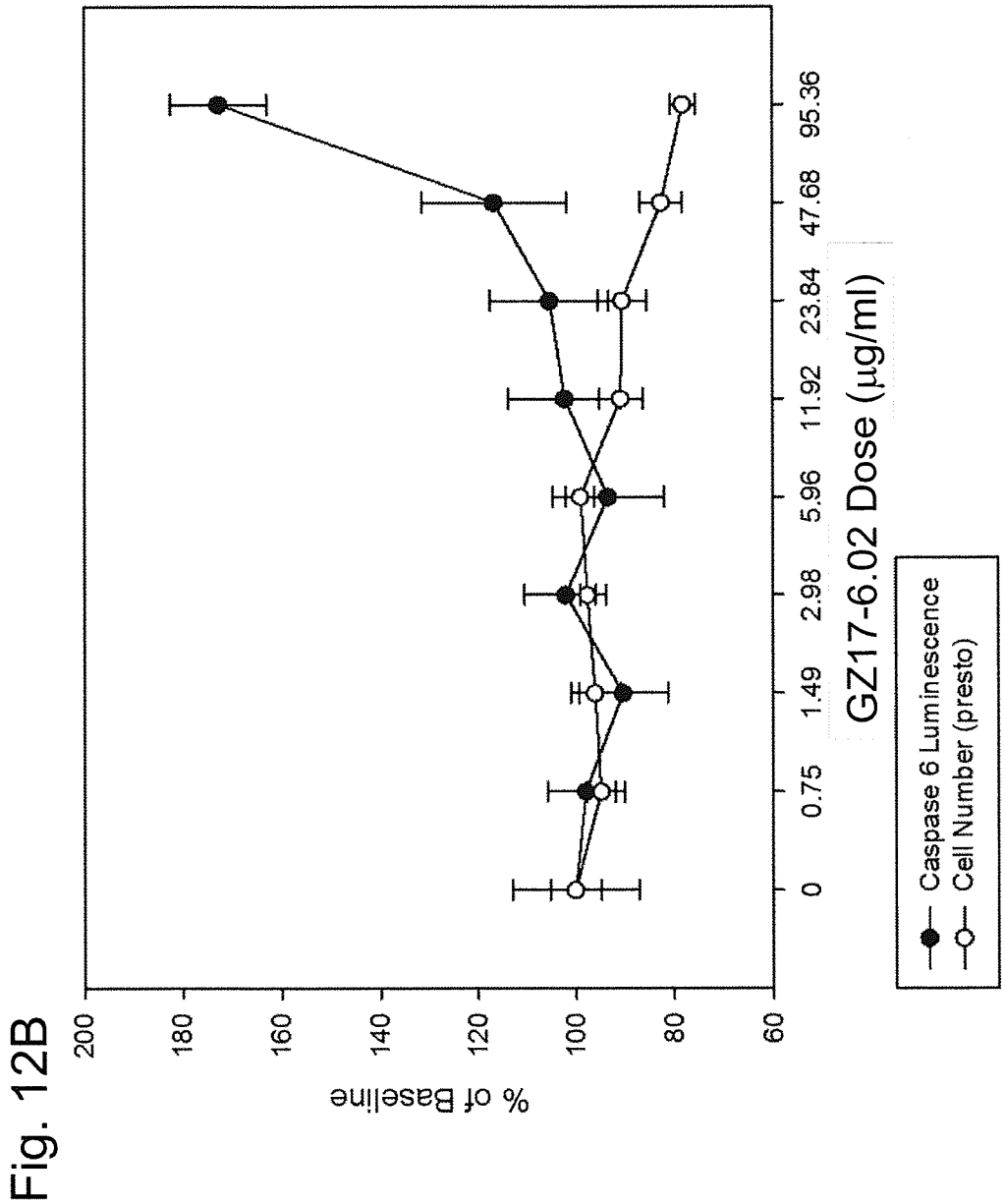

% of Baseline
200
180
160
140
120
100
80
60
0
0.75
1.49
2.98
5.96
11.92
23.84
47.68
95.36
GZ17-6.02 Dose (µg/ml)
Caspase 6 Luminescence
Cell Number (presto)

Fig. 12B

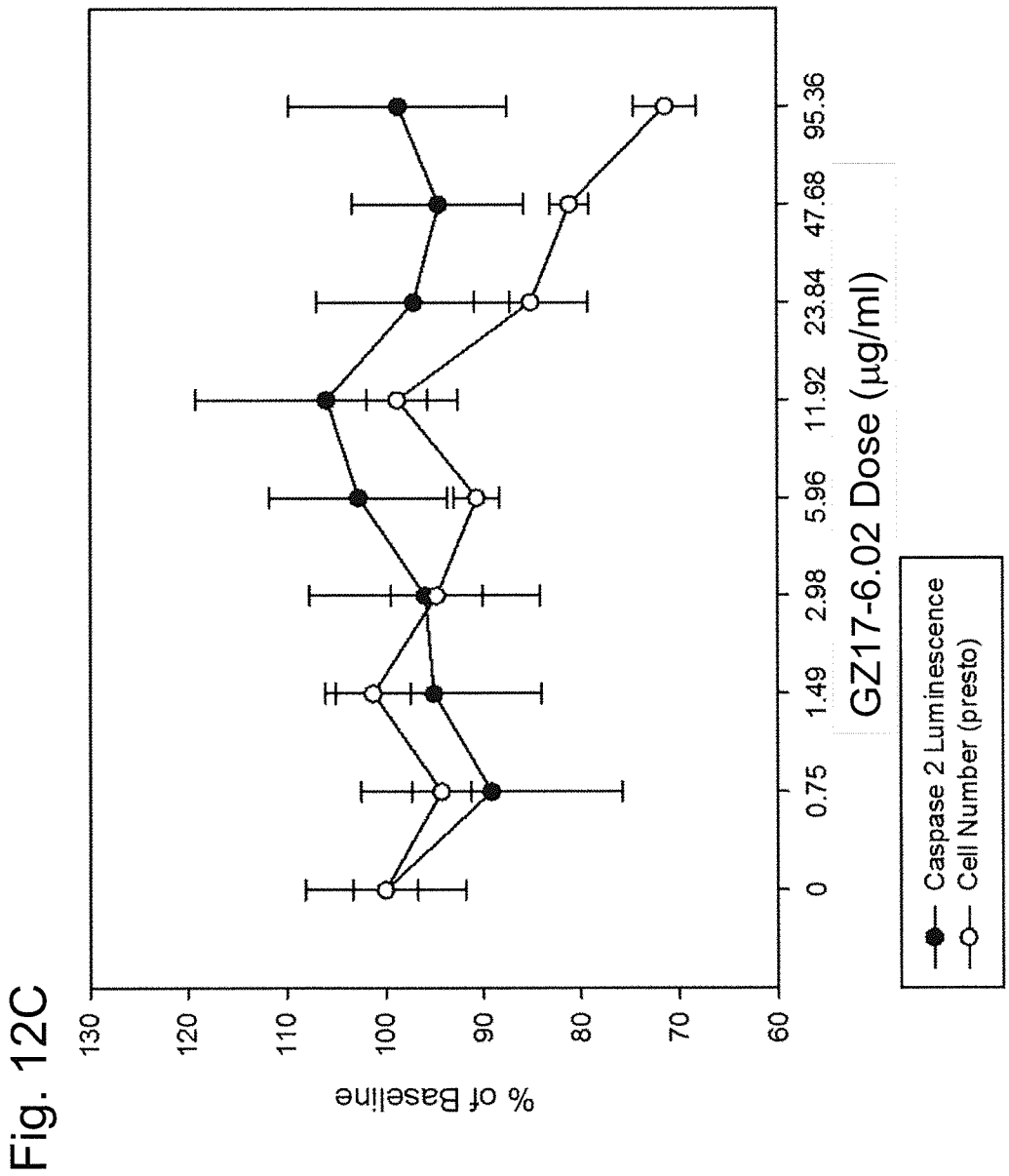

% of Baseline
130
120
110
100
90
80
70
60
0
0.75
1.49
2.98
5.96
11.92
23.84
47.68
95.36
GZ17-6.02 Dose (µg/ml)
Caspase 2 Luminescence
Cell Number (presto)

Fig. 12C

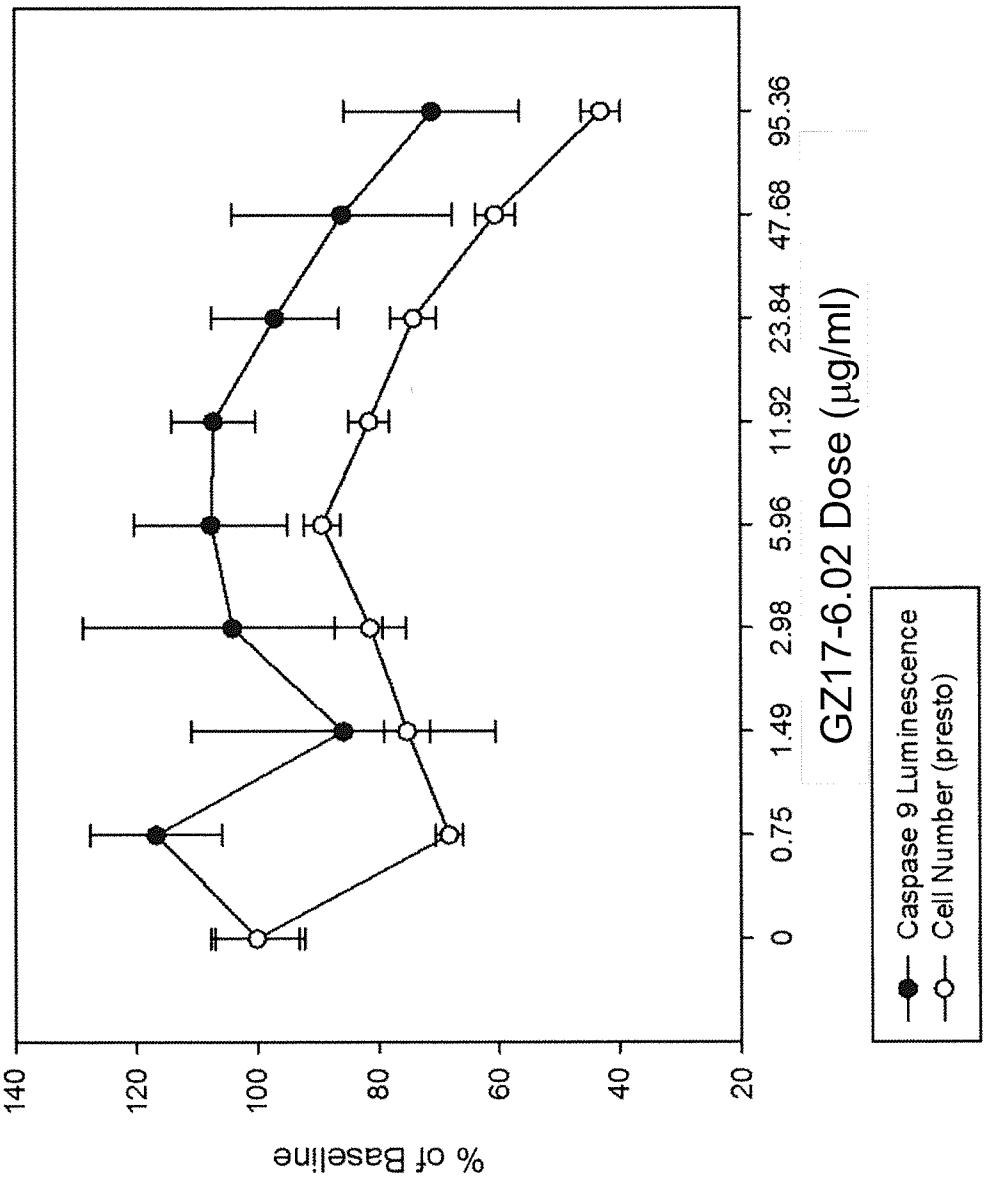

% of Baseline
140
120
100
80
60
40
20
0
0.75
1.49
2.98
5.96
11.92
23.84
47.68
95.36
GZ17-6.02 Dose (µg/ml)
Caspase 9 Luminescence
Cell Number (presto)

Fig. 12D

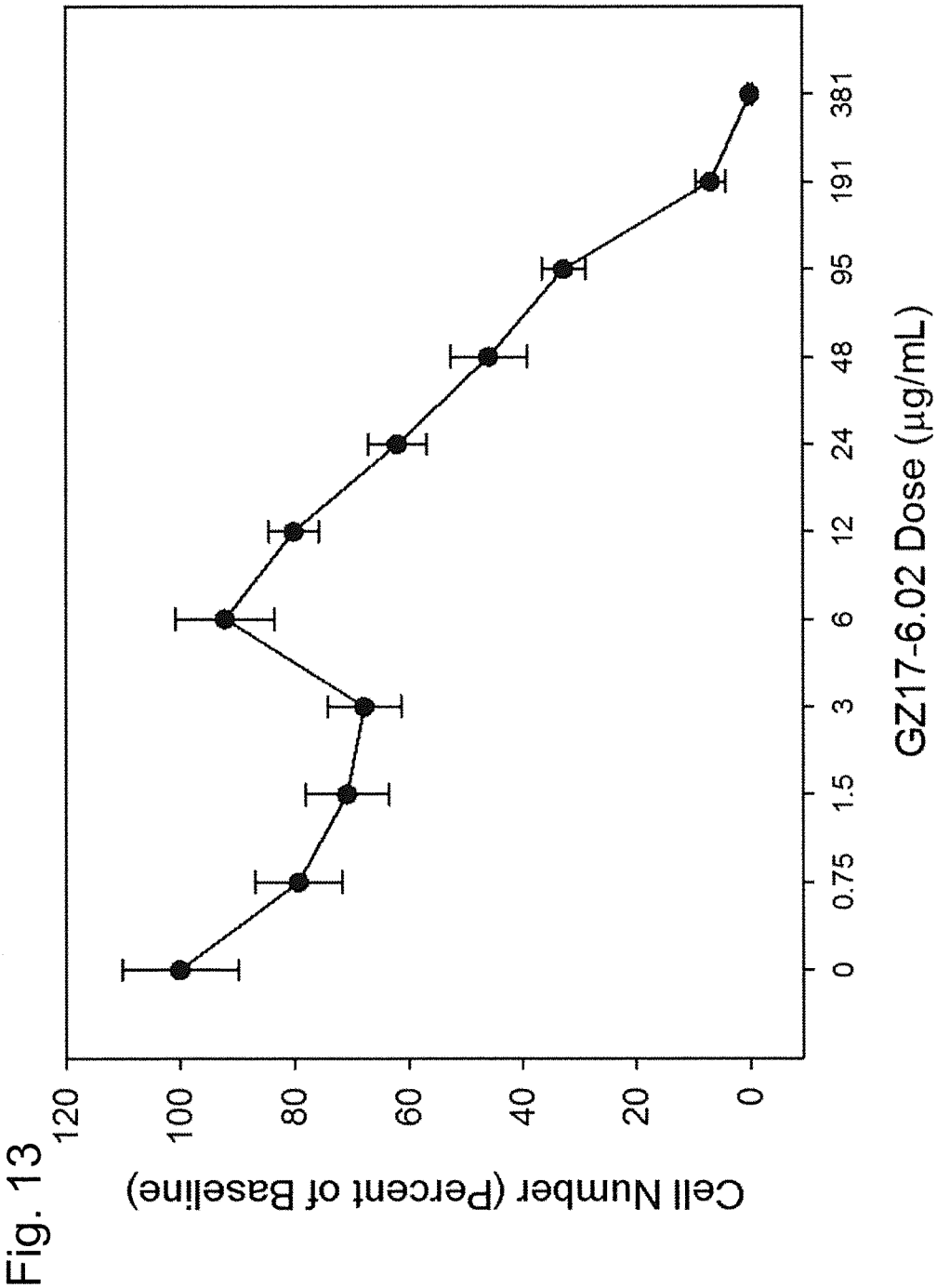

Cell Number (Percent of Baseline)
120
100
80
60
40
20
0
0
0.75
1.5
3
6
12
24
48
95
191
381
GZ17-6.02 Dose (µg/mL)

Fig. 13

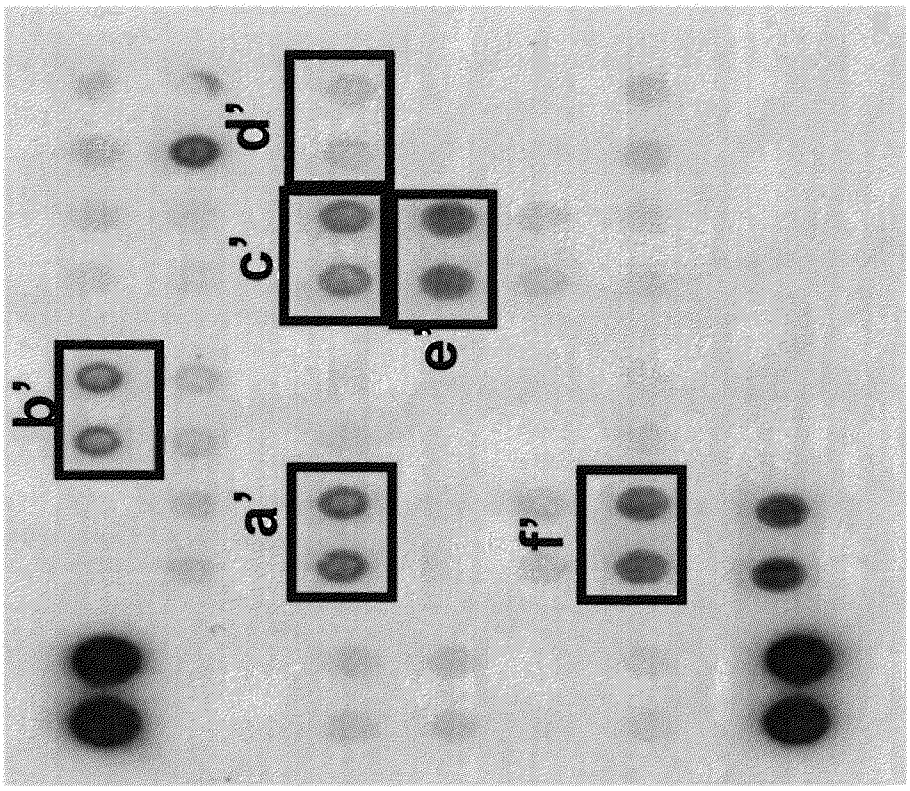


Fig. 14B

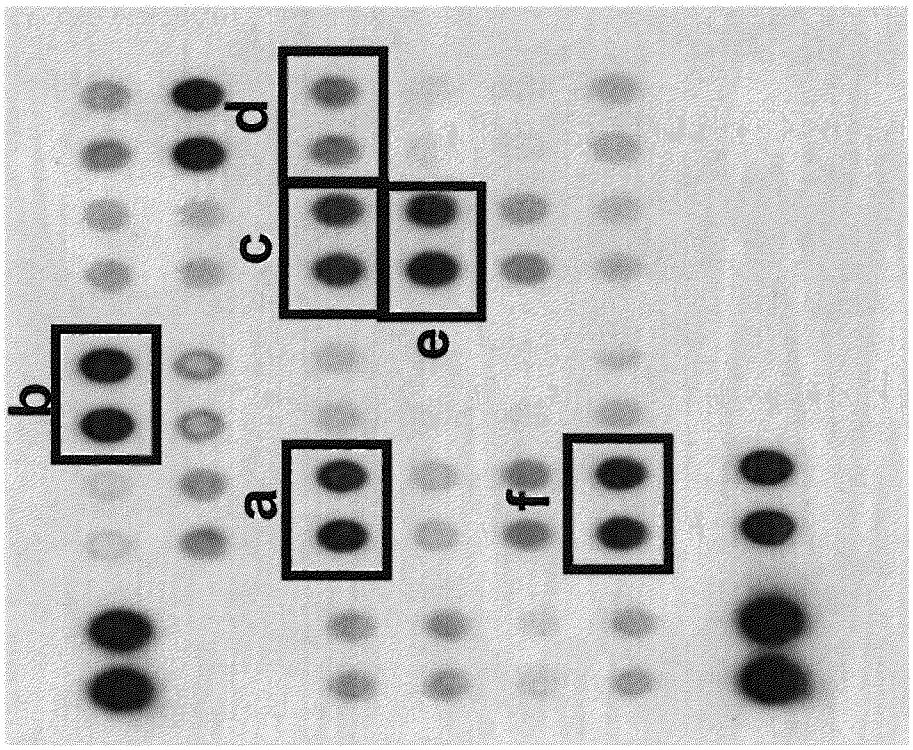


Fig. 14A

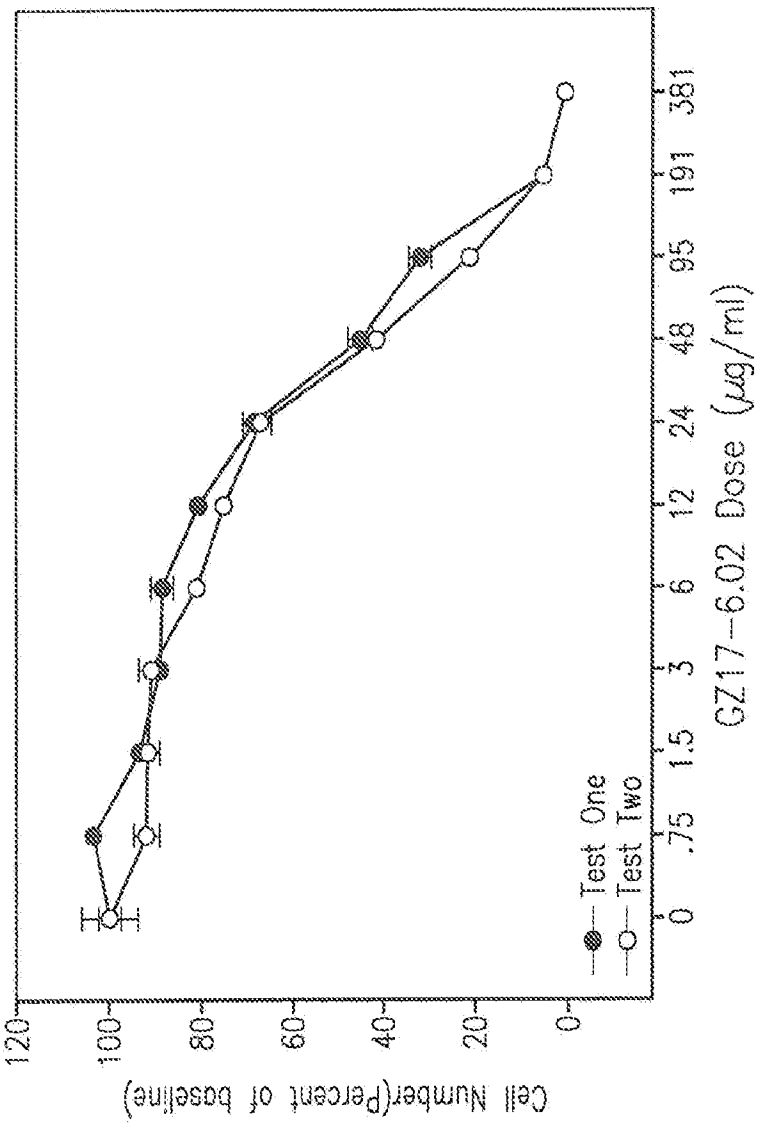

Cell Number(Percent of baseline)
120
100
80
60
40
20
0
0
.75
1.5
3
6
12
24
48
95
191
381
GZ17-6.02 Dose (μg/ml)
Test One
Test Two

Fig. 15A

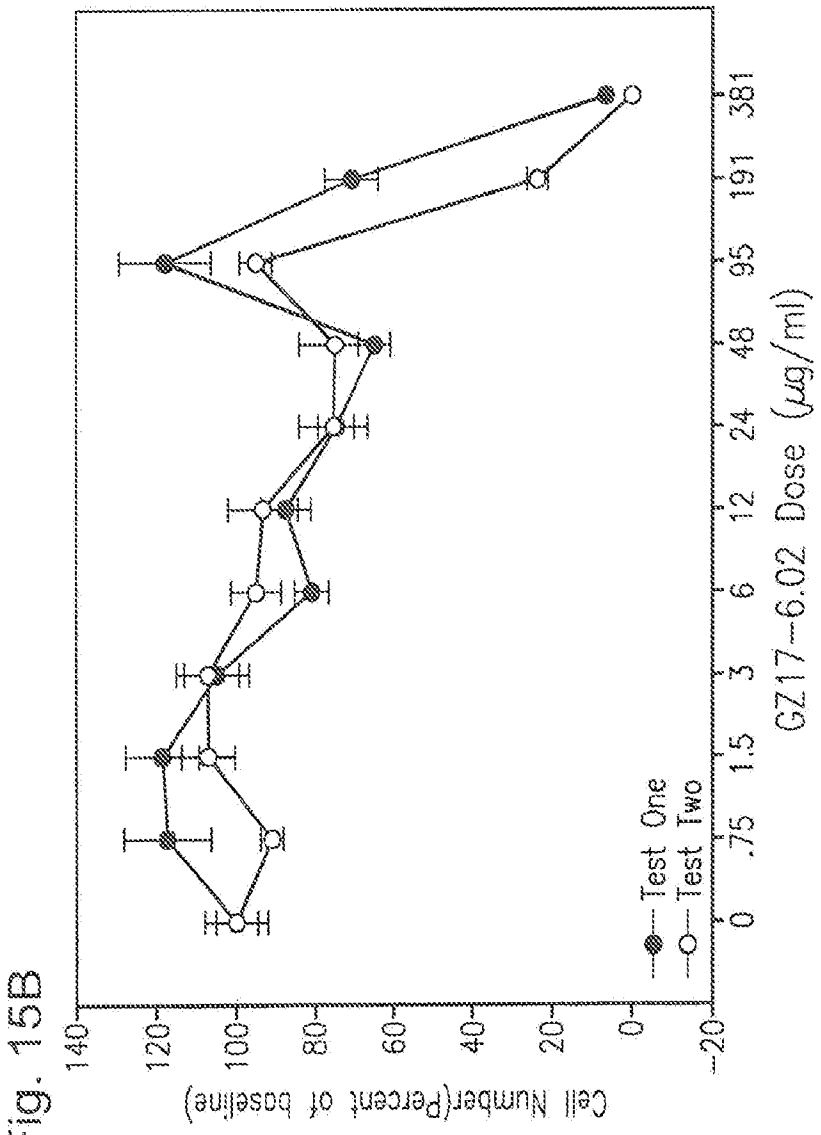

Cell Number(Percent of baseline)
140
120
100
80
60
40
20
0
-20
0
.75
1.5
3
6
12
24
48
95
191
381
GZ17-6.02 Dose (μg/ml)
Test One
Test Two

Fig. 15B

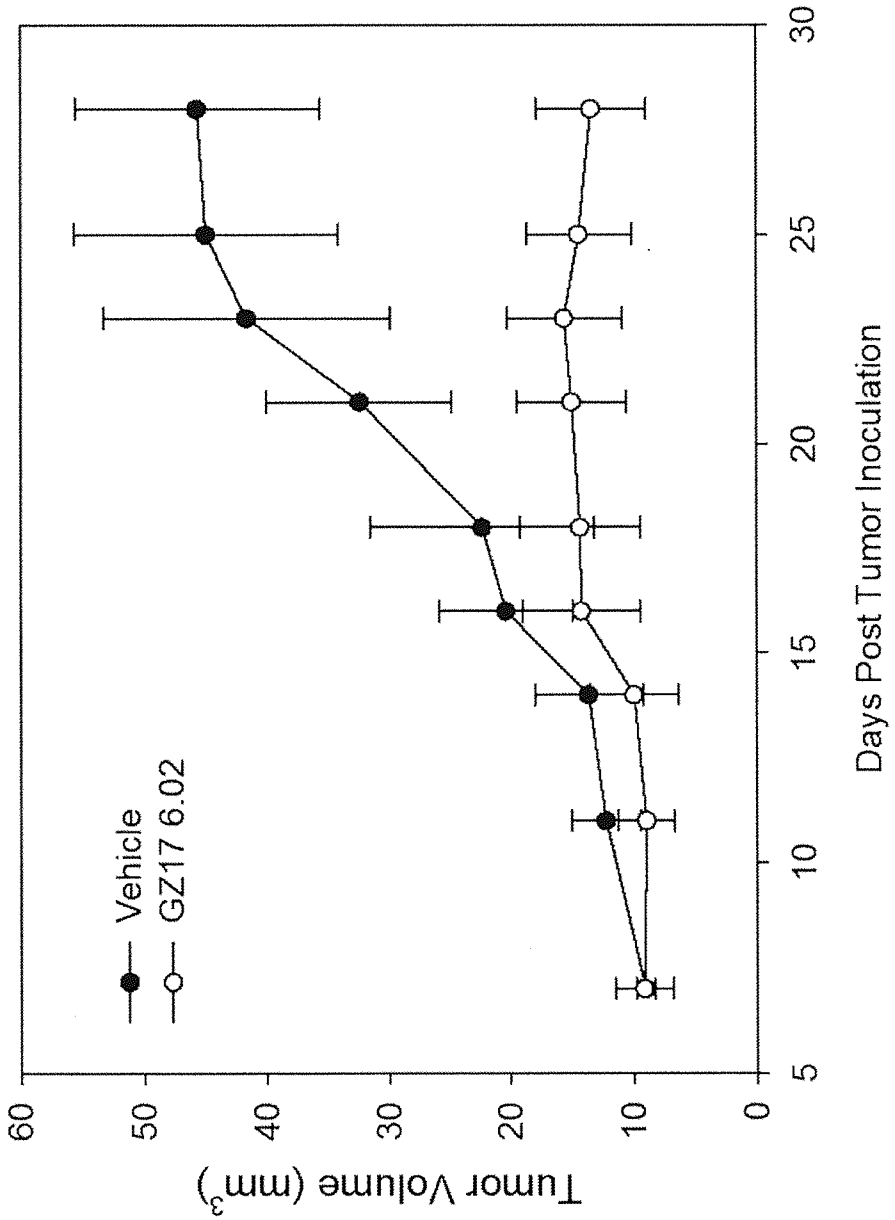

Tumor Volume (mm³)
0
10
20
30
40
50
60
5
10
15
20
25
30
Days Post Tumor Inoculation
Vehicle
GZ17 6.02

Fig. 16A

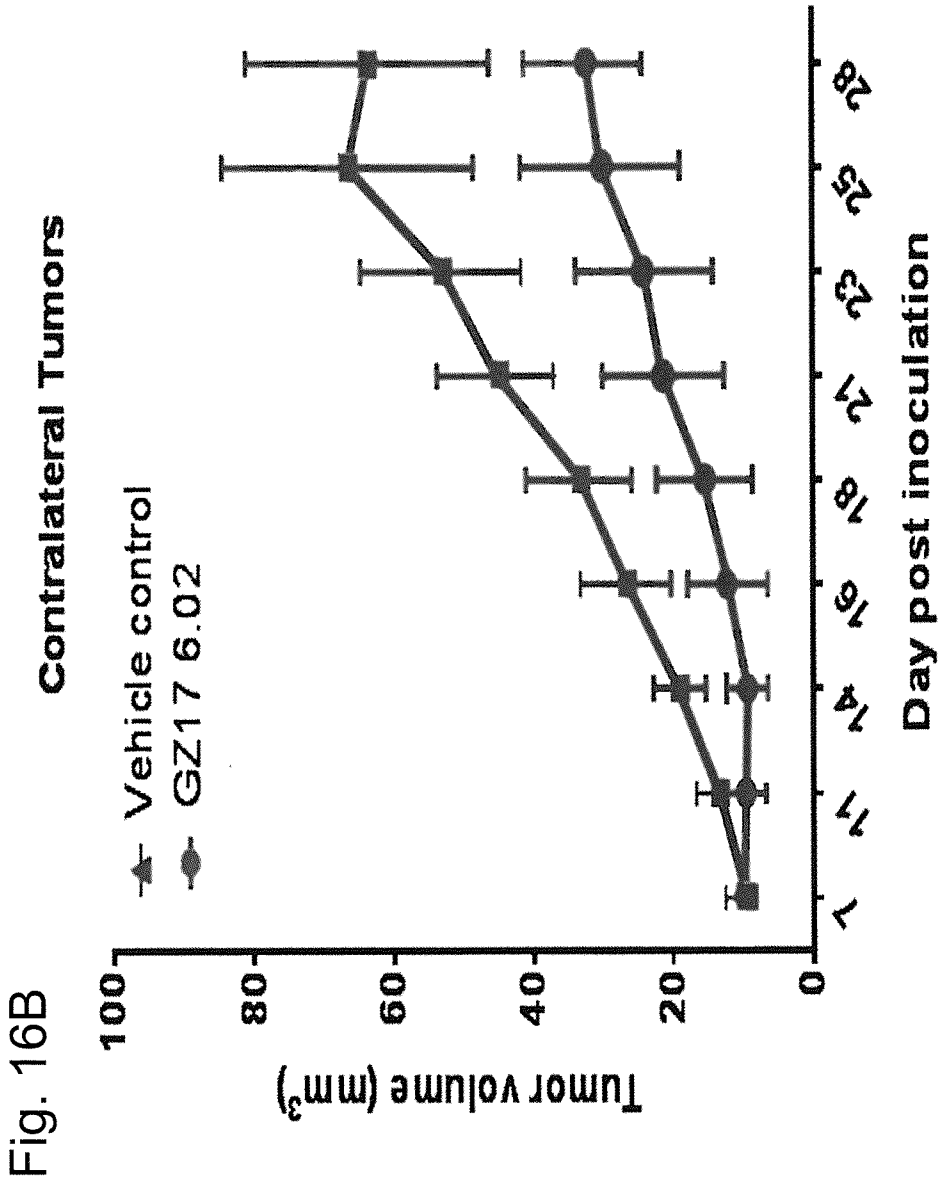

Contralateral Tumors
Vehicle control
GZ17 6.02
Tumor volume (mm³)
100
80
60
40
20
0
1
11
14
16
18
21
23
25
28
Day post inoculation

Fig. 16B

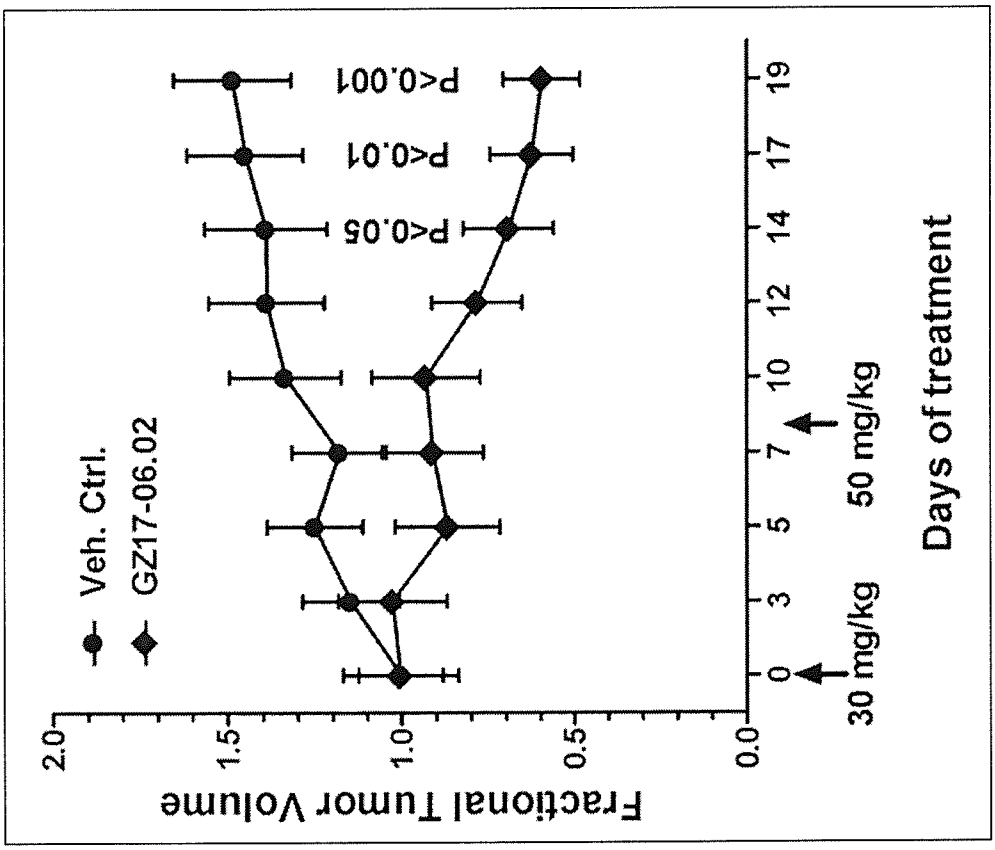

Fractional Tumor Volume
2.0
1.5
1.0
0.5
0.0
0
3
5
7
10
12
14
17
19
Days of treatment
30 mg/kg
50 mg/kg
Veh. Ctrl.
GZ17-06.02
P<0.05
P<0.01
P<0.001

Fig. 16C

Fig. 17A

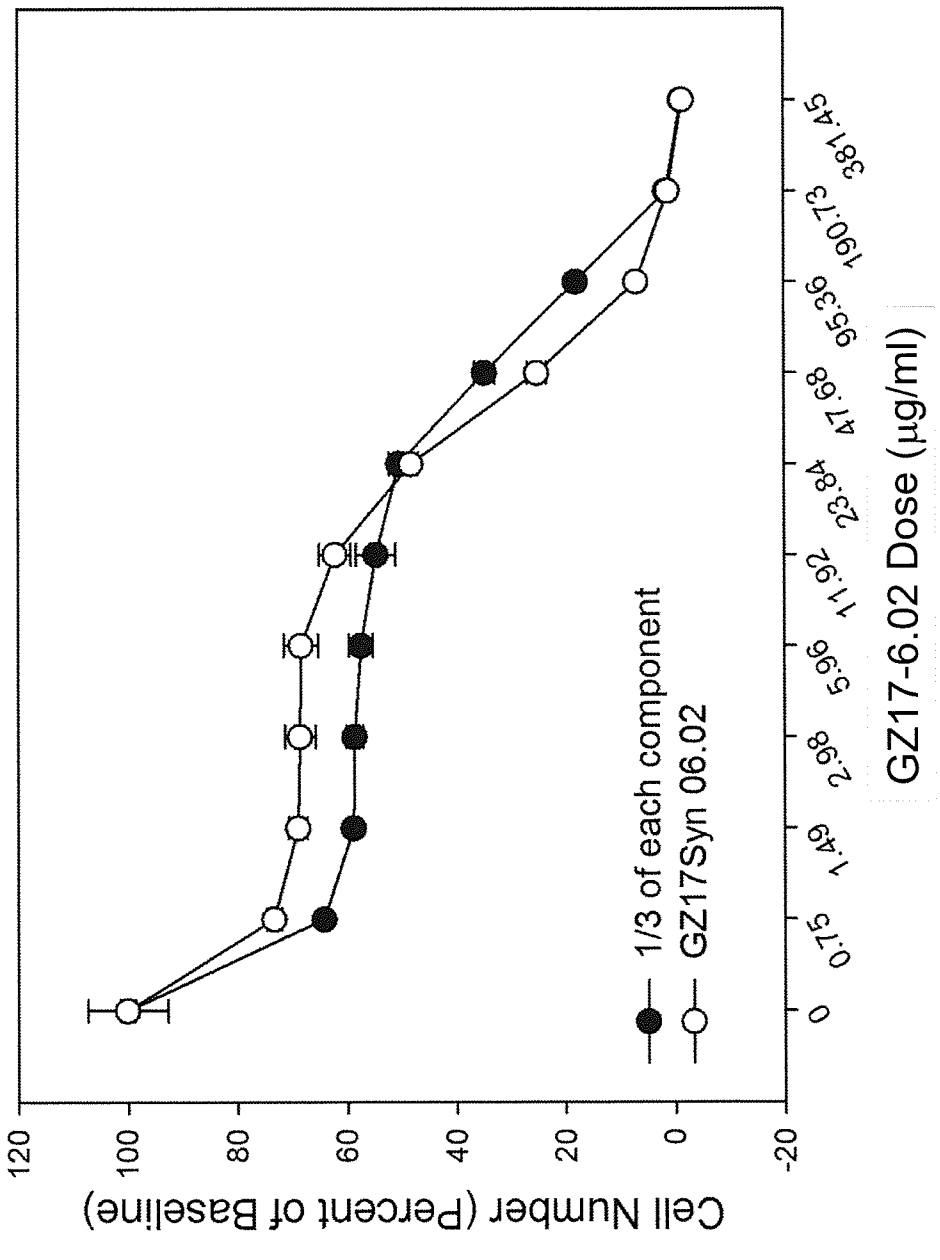

Ovarian Cancer
Cell Number (Percent of Baseline)
120
100
80
60
40
20
0
-20
1/3 of each component
GZ17Syn 06.02
0
0.75
1.49
2.98
5.96
11.92
23.84
47.68
95.36
190.73
381.45
GZ17-6.02 Dose (µg/ml)

Fig. 17B

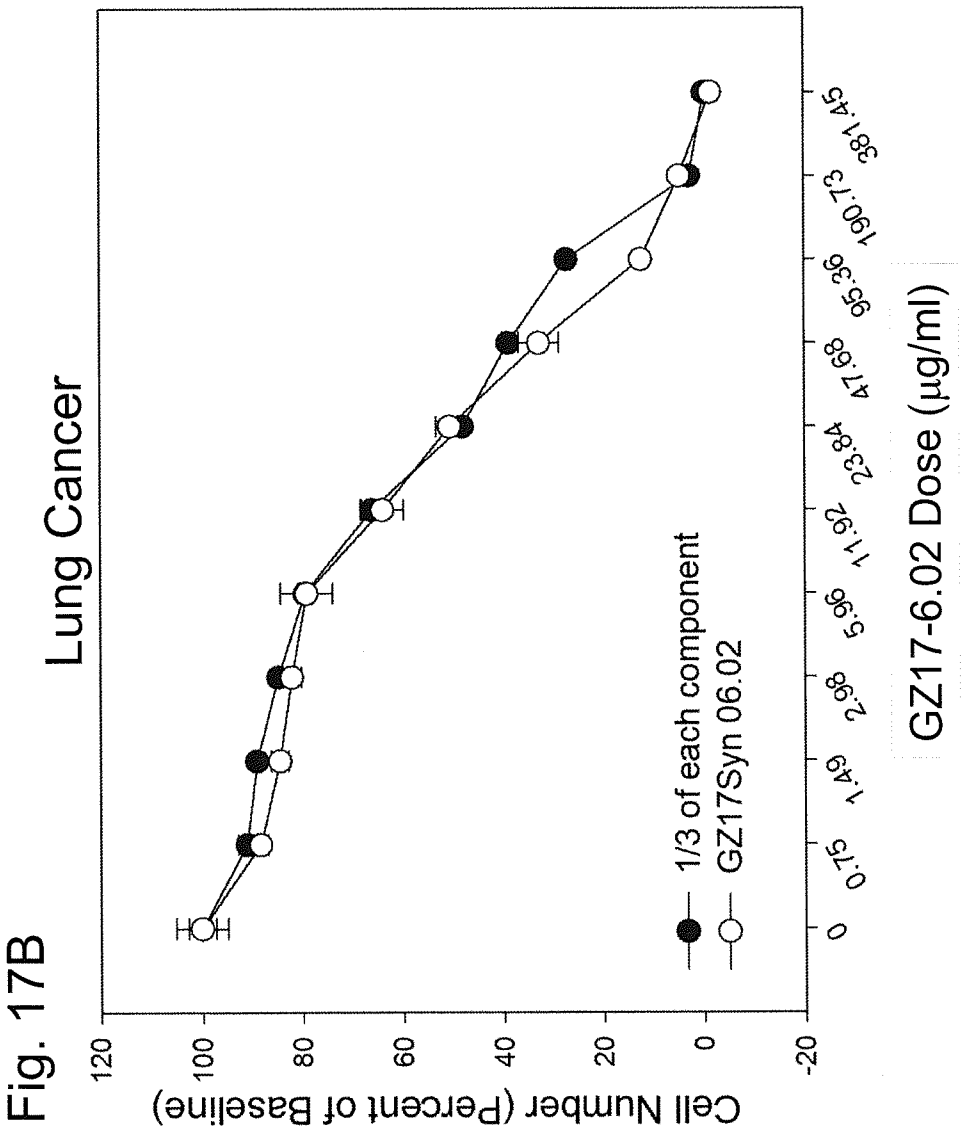

Lung Cancer
Cell Number (Percent of Baseline)
120
100
80
60
40
20
0
-20
1/3 of each component
GZ17Syn 06.02
0
0.15
1.49
2.98
5.96
11.92
23.84
47.68
95.36
190.73
381.45
GZ17-6.02 Dose (µg/ml)

Fig. 17C

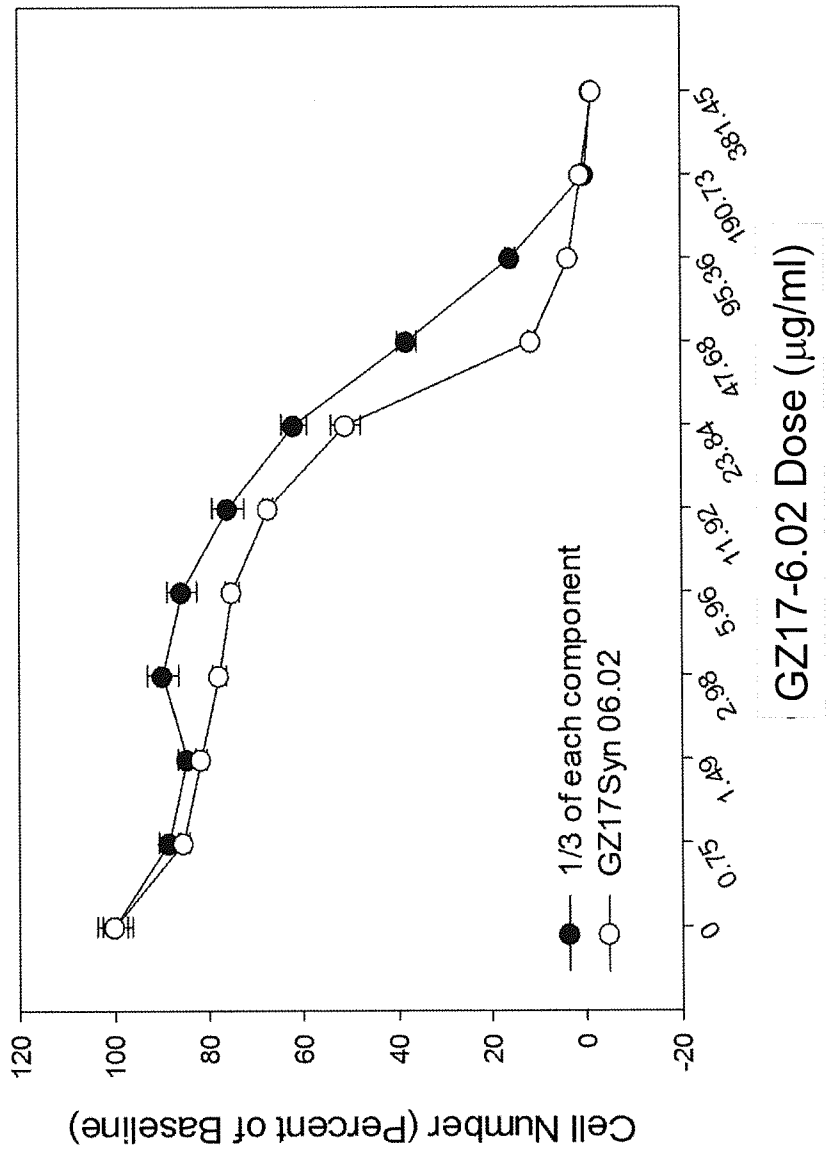
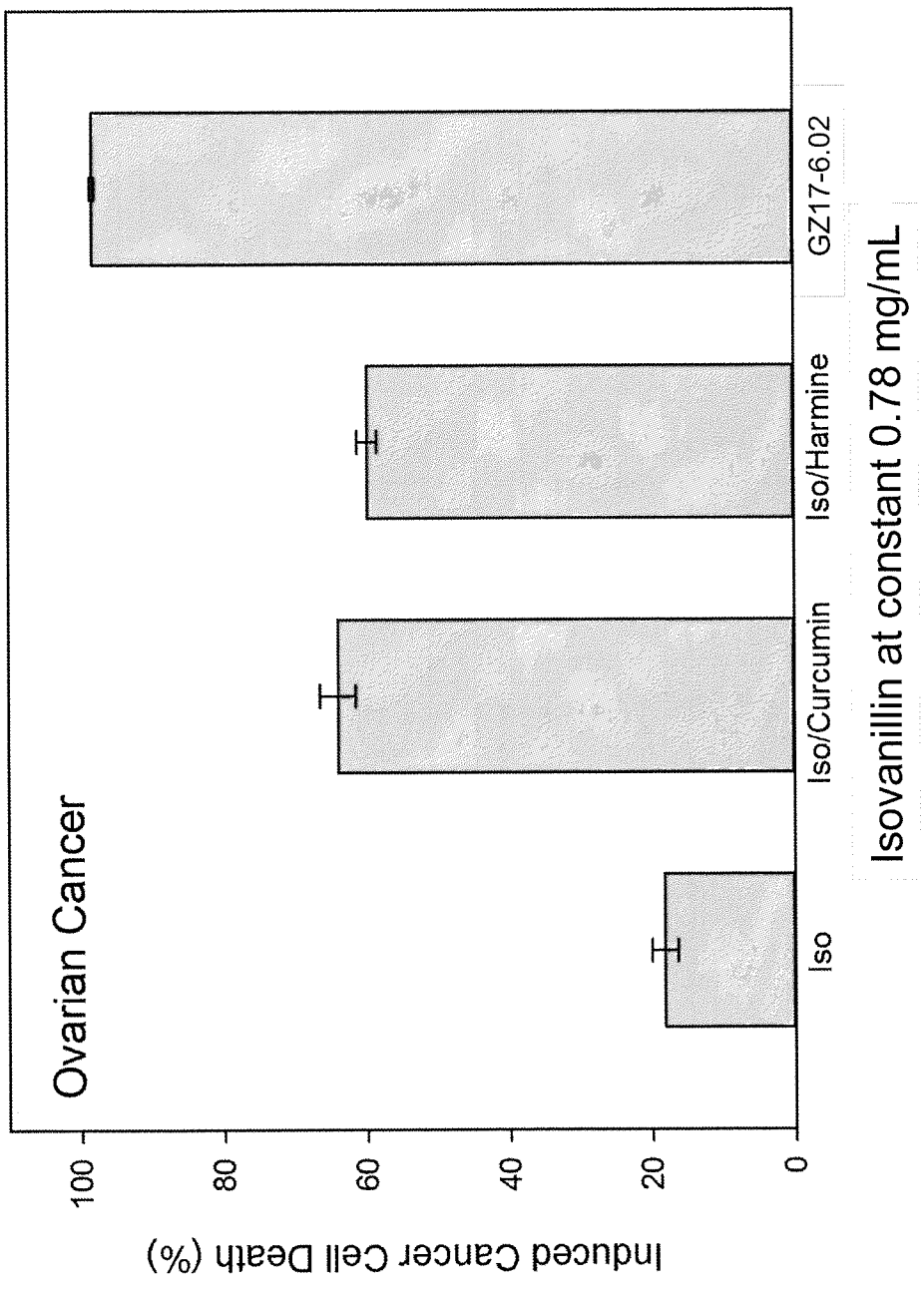

Prostate Cancer
Cell Number (Percent of Baseline)
120
100
80
60
40
20
0
-20
1/3 of each component
GZ17Syn 06.02
0
0.75
1.49
2.98
5.96
11.92
23.84
47.68
95.36
190.73
381.45
GZ17-6.02 Dose (µg/ml)

Fig. 18A


Ovarian Cancer
Induced Cancer Cell Death (%)
0
20
40
60
80
100
Iso
Iso/Curcumin
Iso/Harmine
GZ17-6.02
Isovanillin at constant 0.78 mg/mL

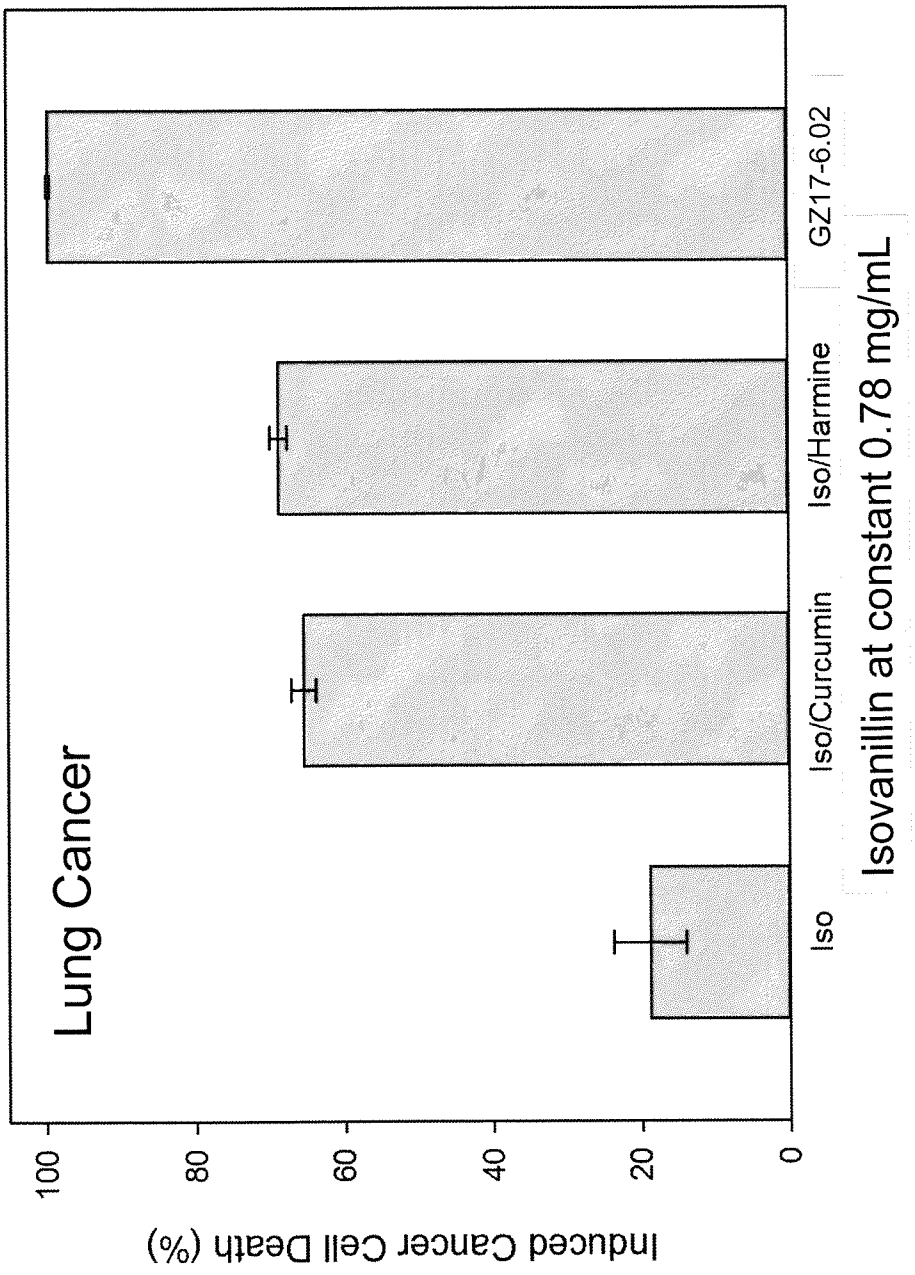

Lung Cancer
Induced Cancer Cell Death (%)
0
20
40
60
80
100
Iso
Iso/Curcumin
Iso/Harmine
GZ17-6.02
Isovanillin at constant 0.78 mg/mL

Fig. 18B

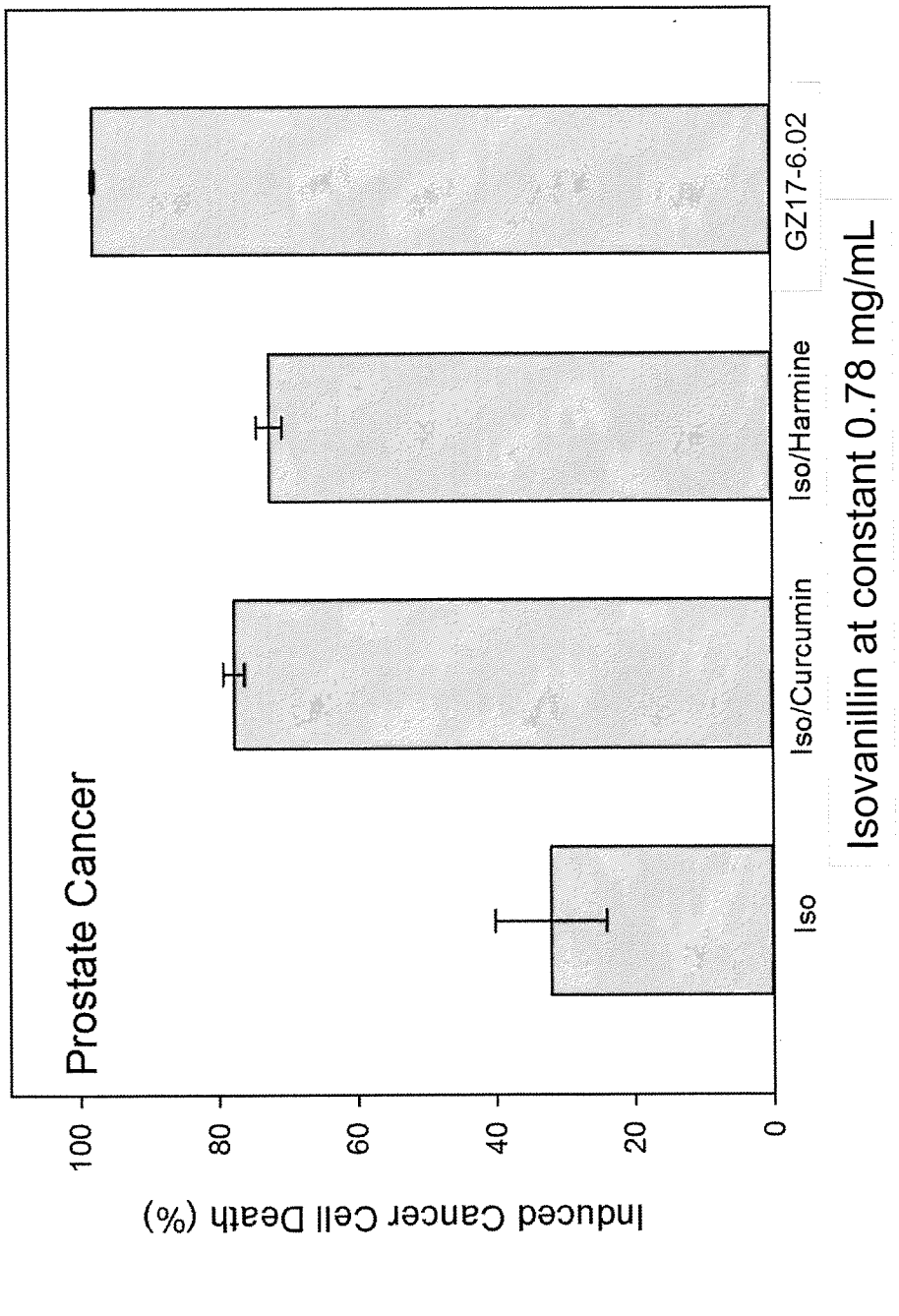

Prostate Cancer
Induced Cancer Cell Death (%)
0
20
40
60
80
100
Iso
Iso/Curcumin
Iso/Harmine
GZ17-6.02
Isovanillin at constant 0.78 mg/mL

Fig. 18C

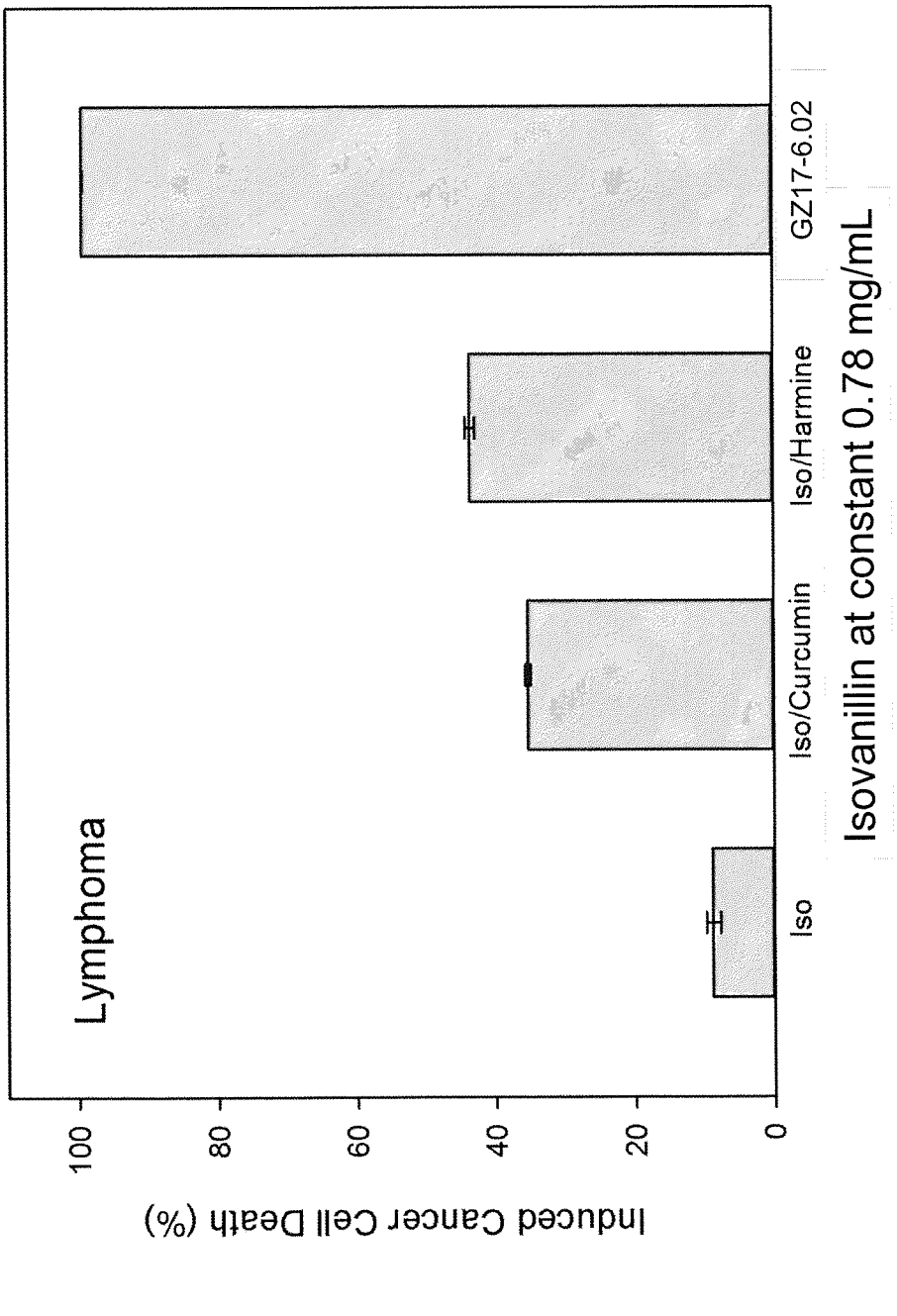

Lymphoma
Induced Cancer Cell Death (%)
0
20
40
60
80
100
Iso
Iso/Curcumin
Iso/Harmine
GZ17-6.02
Isovanillin at constant 0.78 mg/mL

Fig. 18D

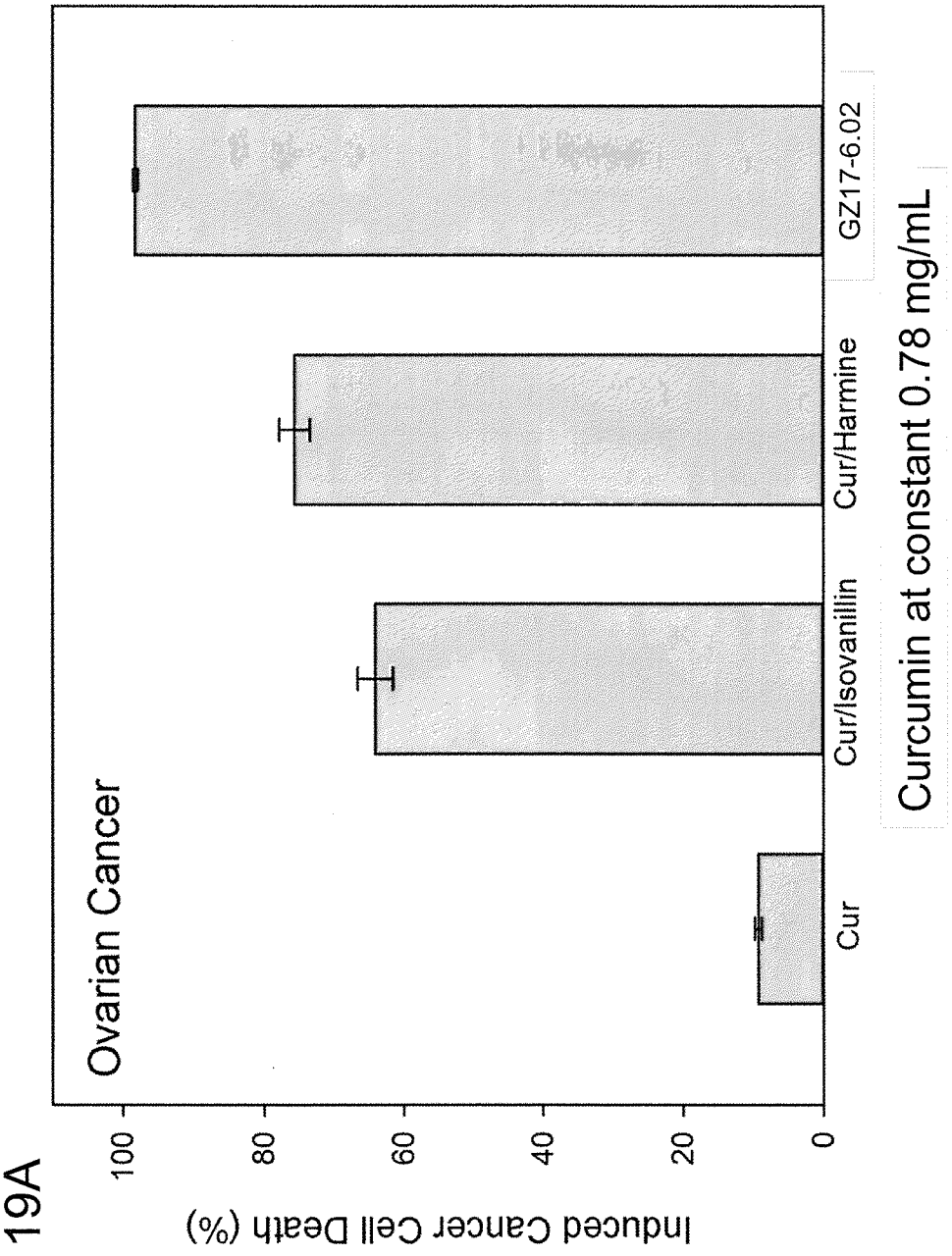

Ovarian Cancer
Induced Cancer Cell Death (%)
0
20
40
60
80
100
Cur
Cur/Isovanillin
Cur/Harmine
GZ17-6.02
Curcumin at constant 0.78 mg/mL

Fig. 19A

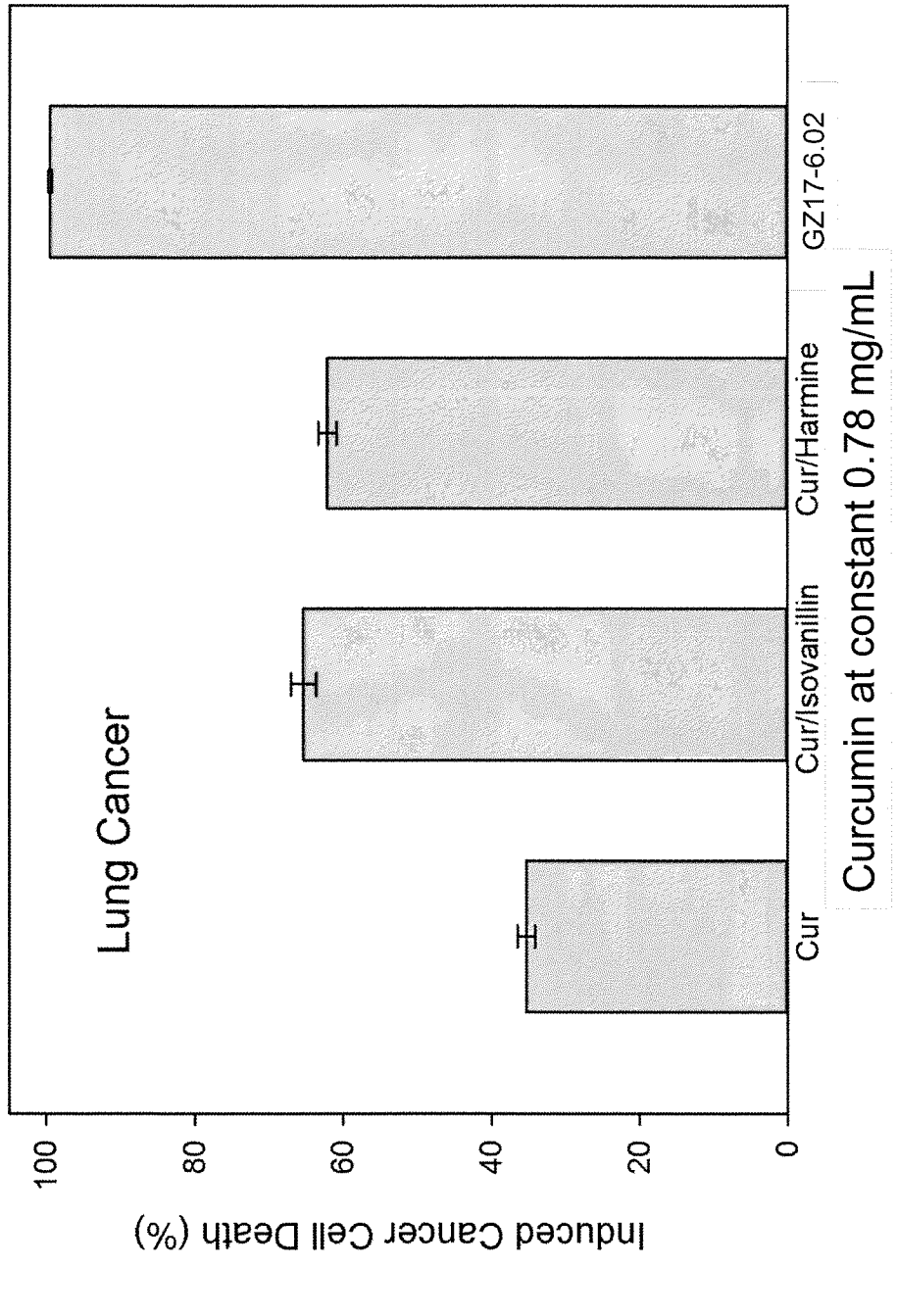

Induced Cancer Cell Death (%)
0
20
40
60
80
100
Lung Cancer
Cur
Cur/Isovanillin
Cur/Harmine
GZ17-6.02
Curcumin at constant 0.78 mg/mL

Fig. 19B

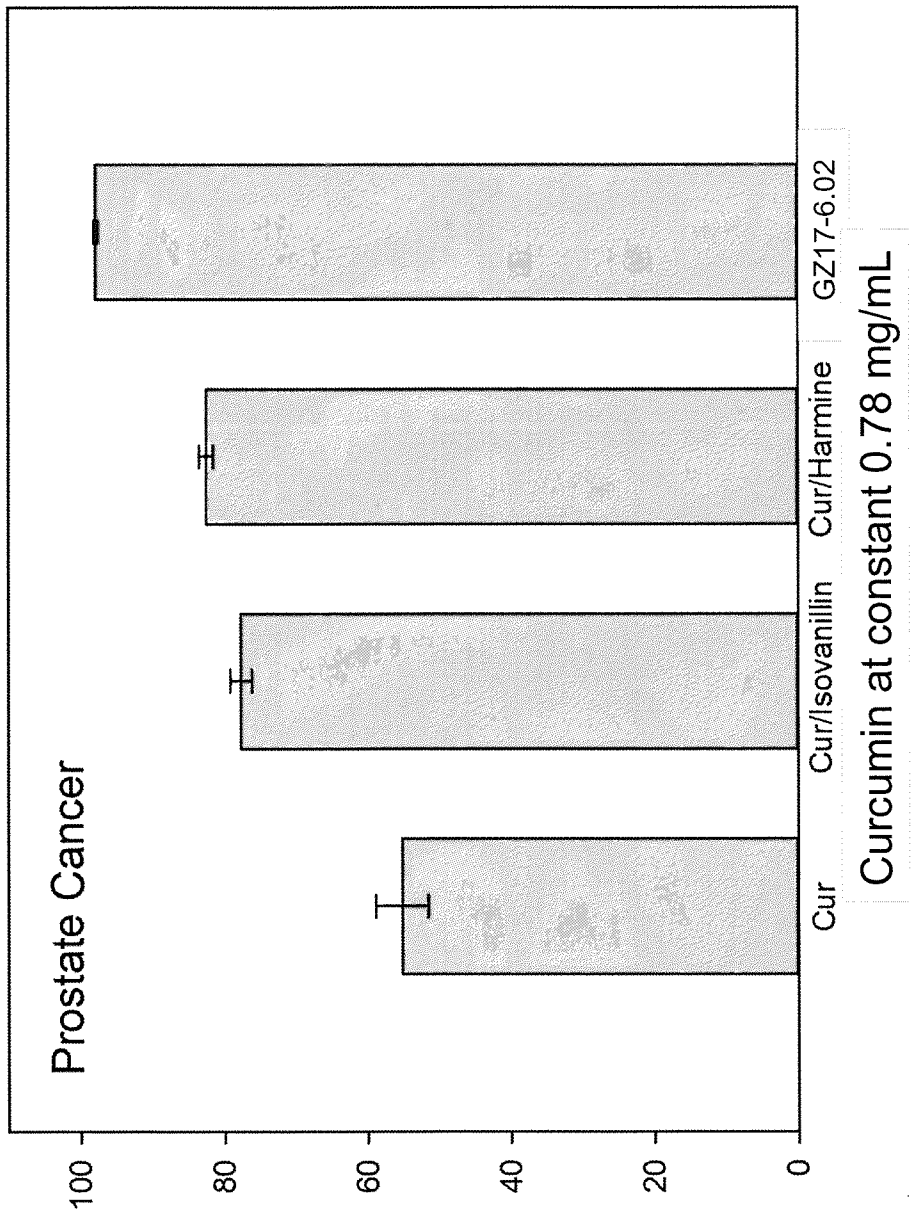

Prostate Cancer
Induced Cancer Cell Death (%)
0
20
40
60
80
100
Cur
Cur/Isovanillin
Cur/Harmine
GZ17-6.02
Curcumin at constant 0.78 mg/mL

Fig. 19C

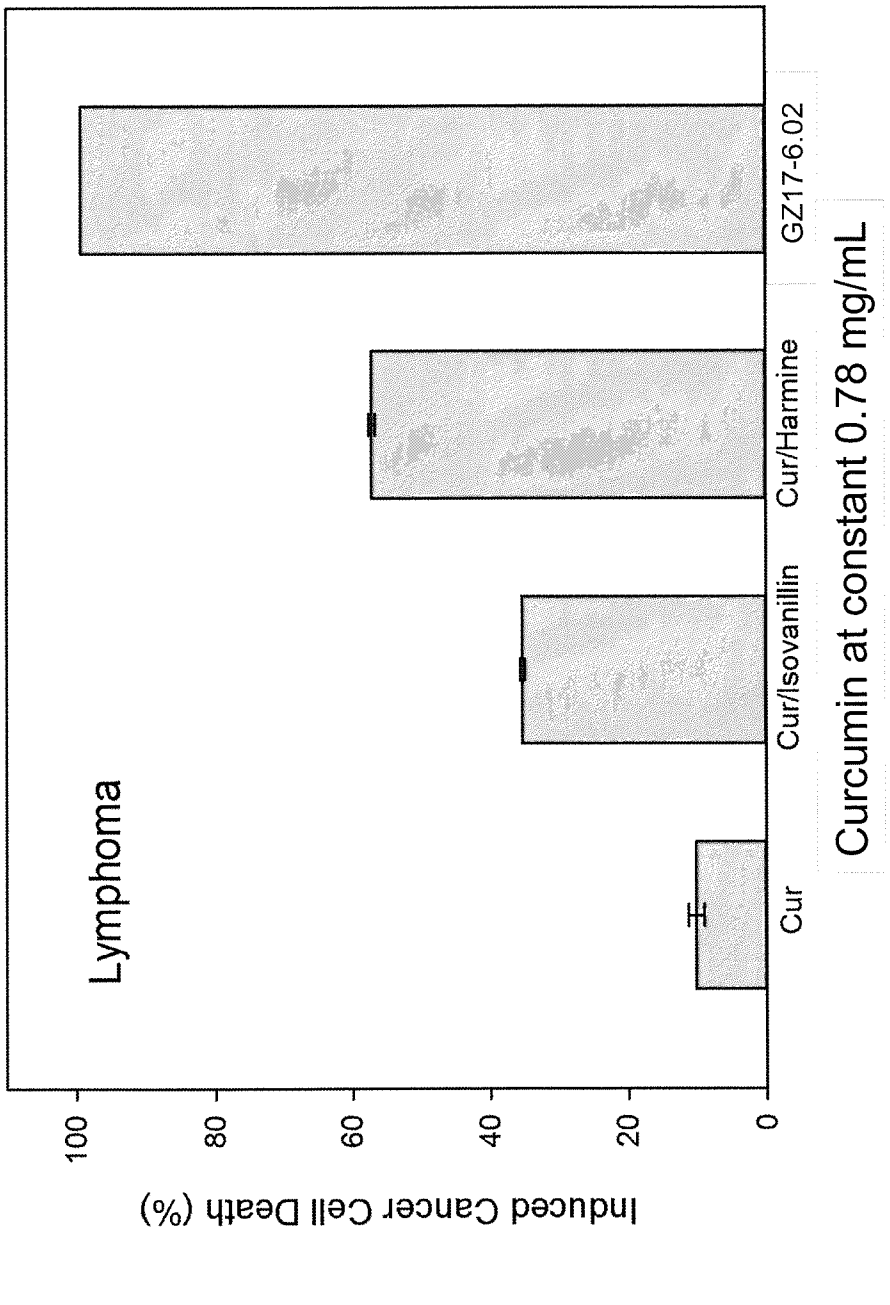

Induced Cancer Cell Death (%)
0
20
40
60
80
100
Lymphoma
Cur
Cur/Isovanillin
Cur/Harmine
GZ17-6.02
Curcumin at constant 0.78 mg/mL

Fig. 19D

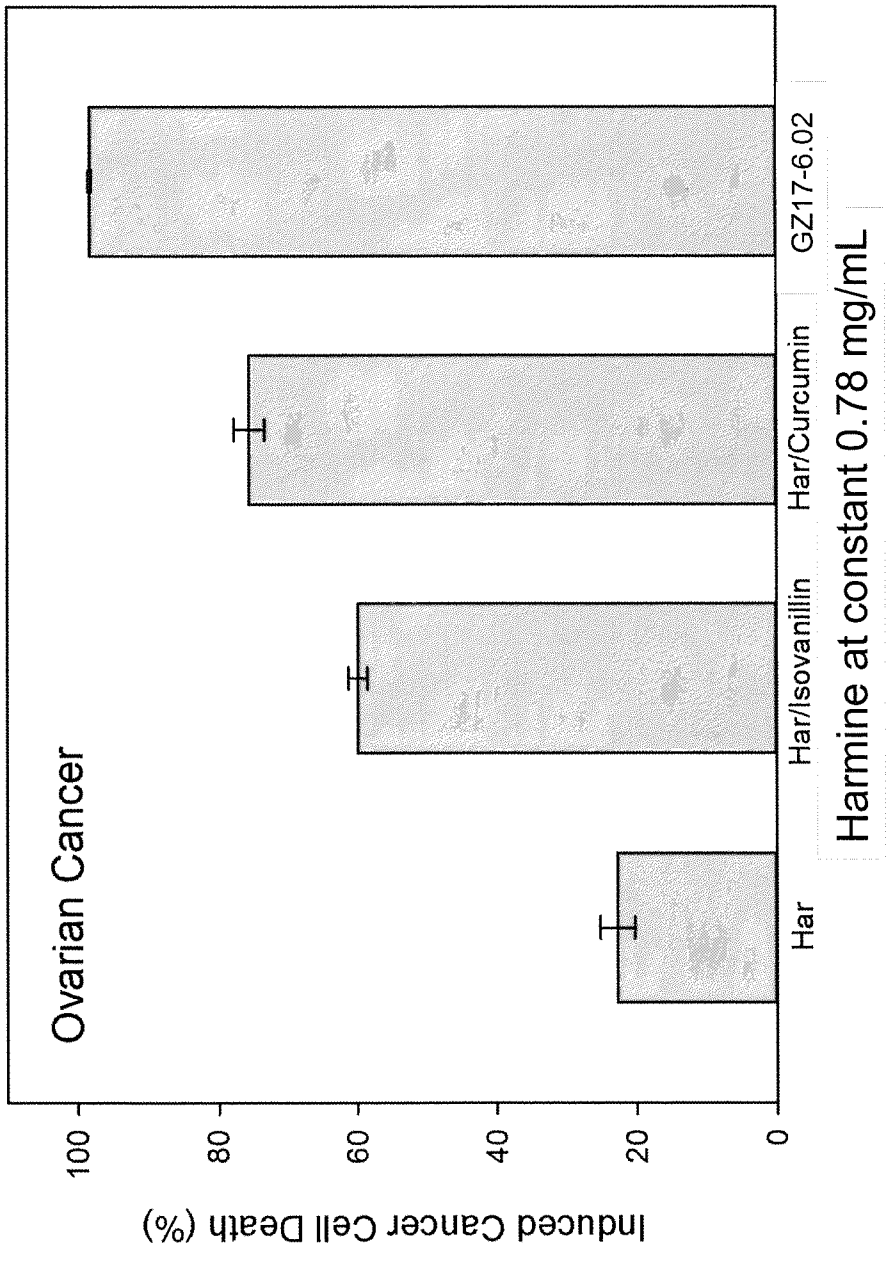

Ovarian Cancer
Induced Cancer Cell Death (%)
0
20
40
60
80
100
Har
Har/Isovanillin
Har/Curcumin
GZ17-6.02
Harmine at constant 0.78 mg/mL

Fig. 20A

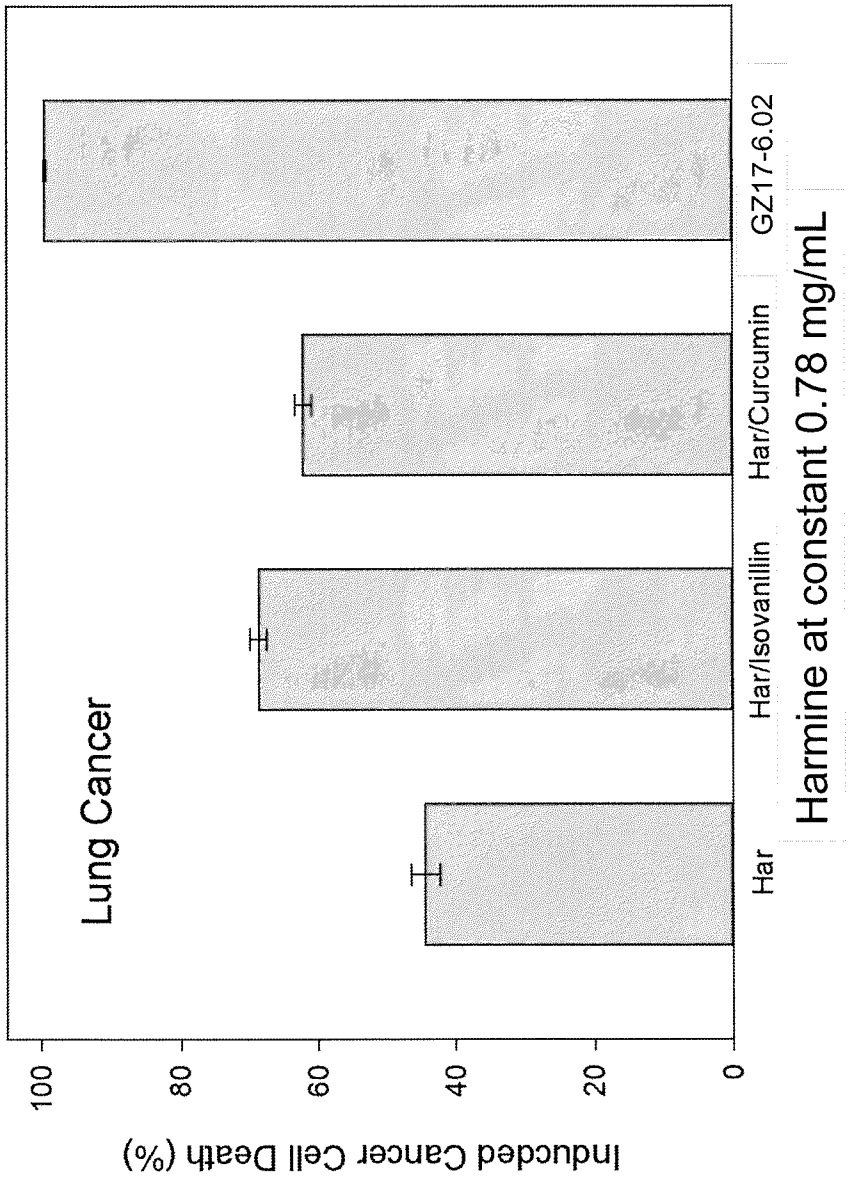

Induced Cancer Cell Death (%)
0
20
40
60
80
100
Lung Cancer
Har
Har/Isovanillin
Har/Curcumin
GZ17-6.02
Harmine at constant 0.78 mg/mL

Fig. 20B

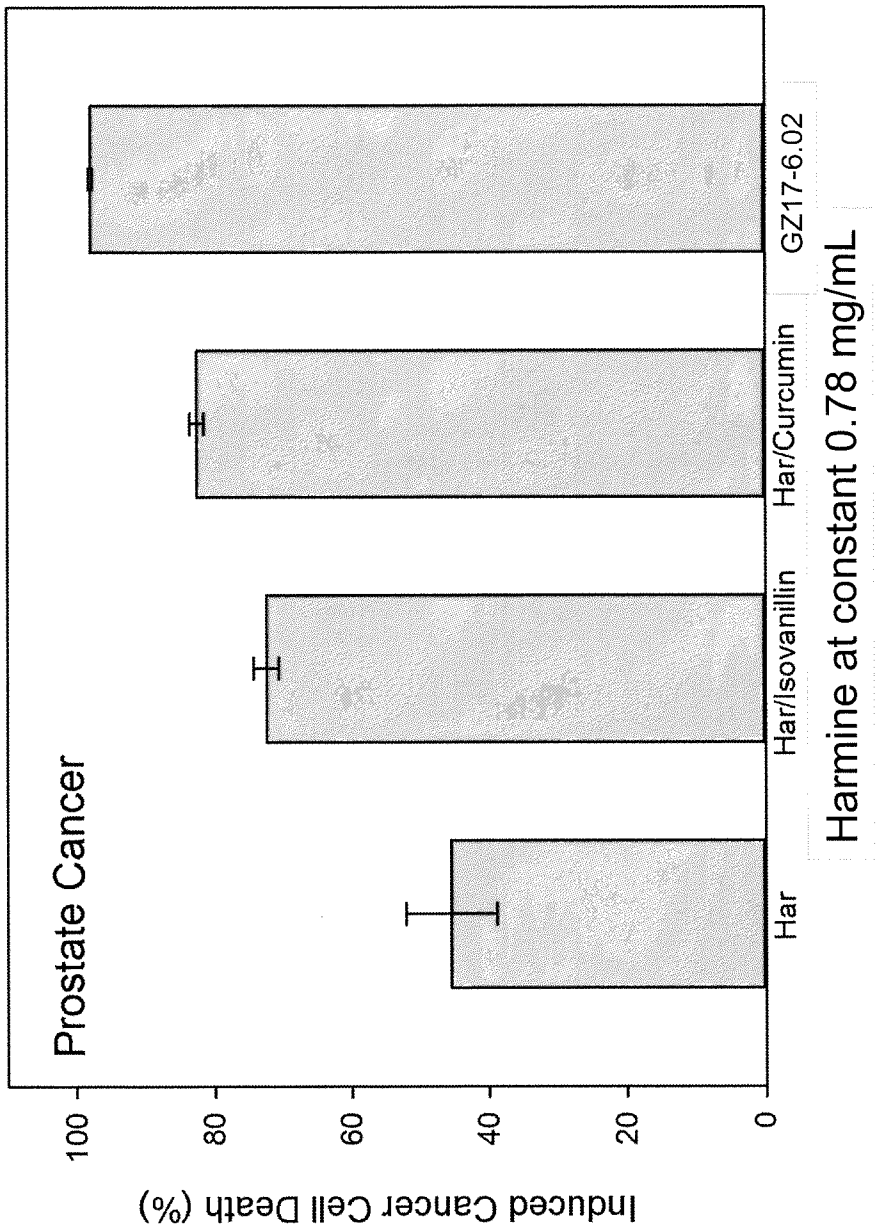

Prostate Cancer
Induced Cancer Cell Death (%)
0
20
40
60
80
100
Har
Har/Isovanillin
Har/Curcumin
GZ17-6.02
Harmine at constant 0.78 mg/mL

Fig. 20C

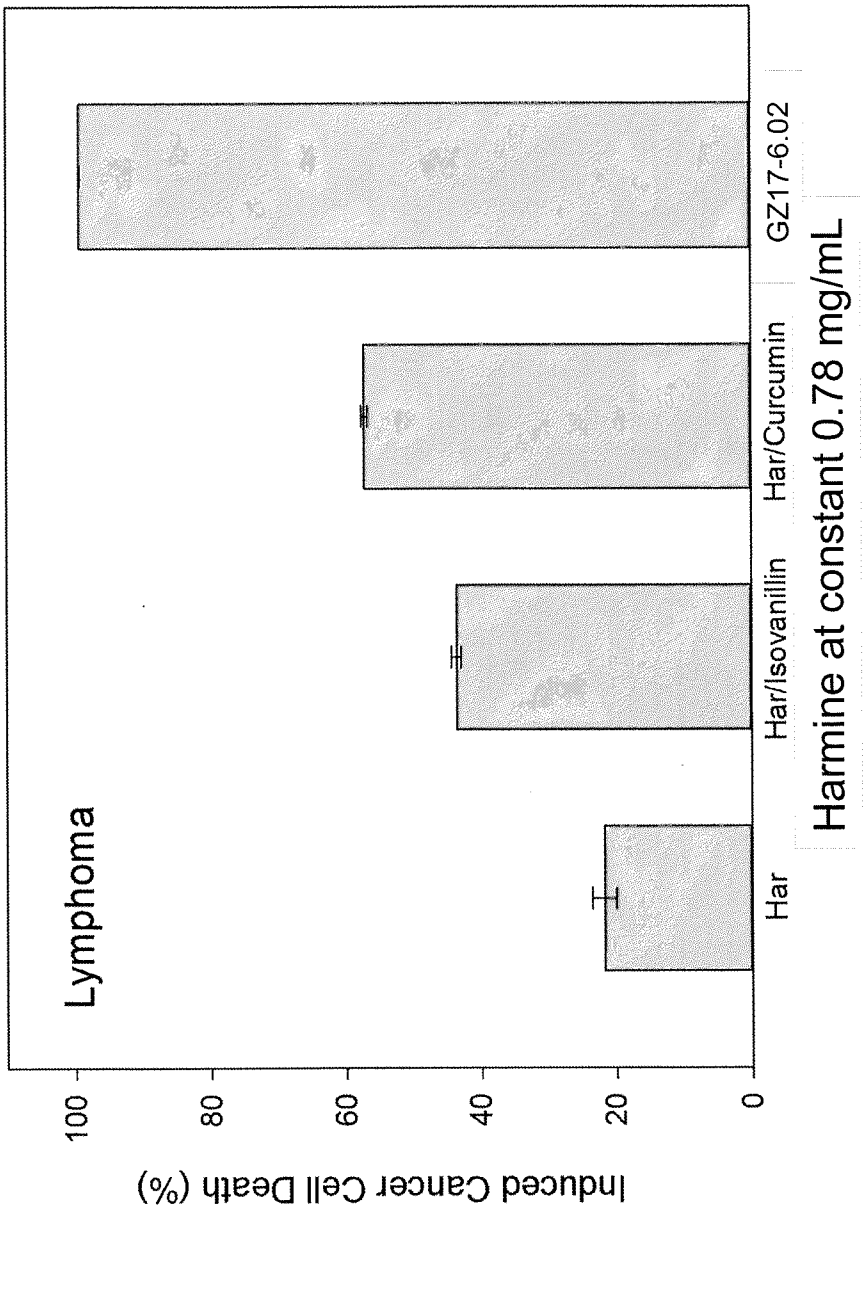
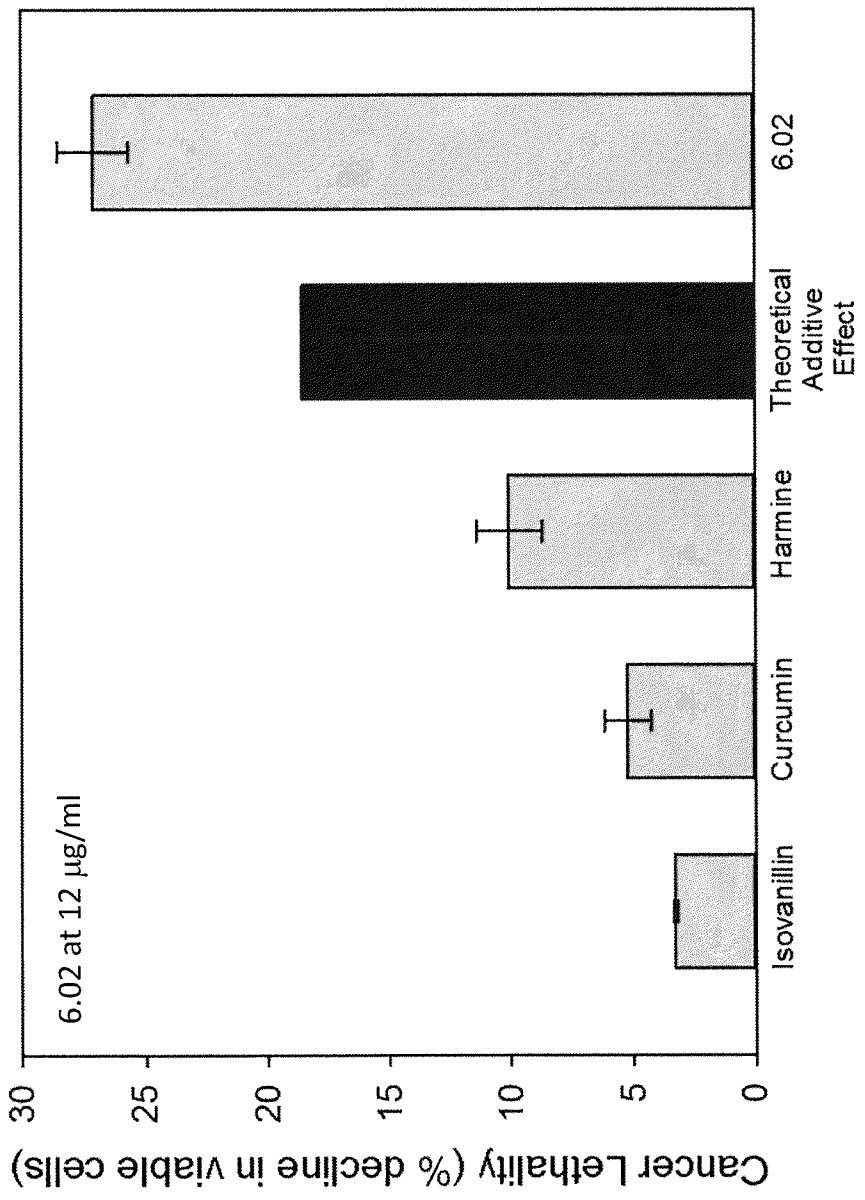

Lymphoma
Induced Cancer Cell Death (%)
0
20
40
60
80
100
Har
Har/Isovanillin
Har/Curcumin
GZ17-6.02
Harmine at constant 0.78 mg/mL

Fig. 20D

Fig. 21A


Cancer Lethality (% decline in viable cells)
0
5
10
15
20
25
30
6.02 at 12 µg/ml
Isovanillin
Curcumin
Harmine
Theoretical Additive Effect
6.02

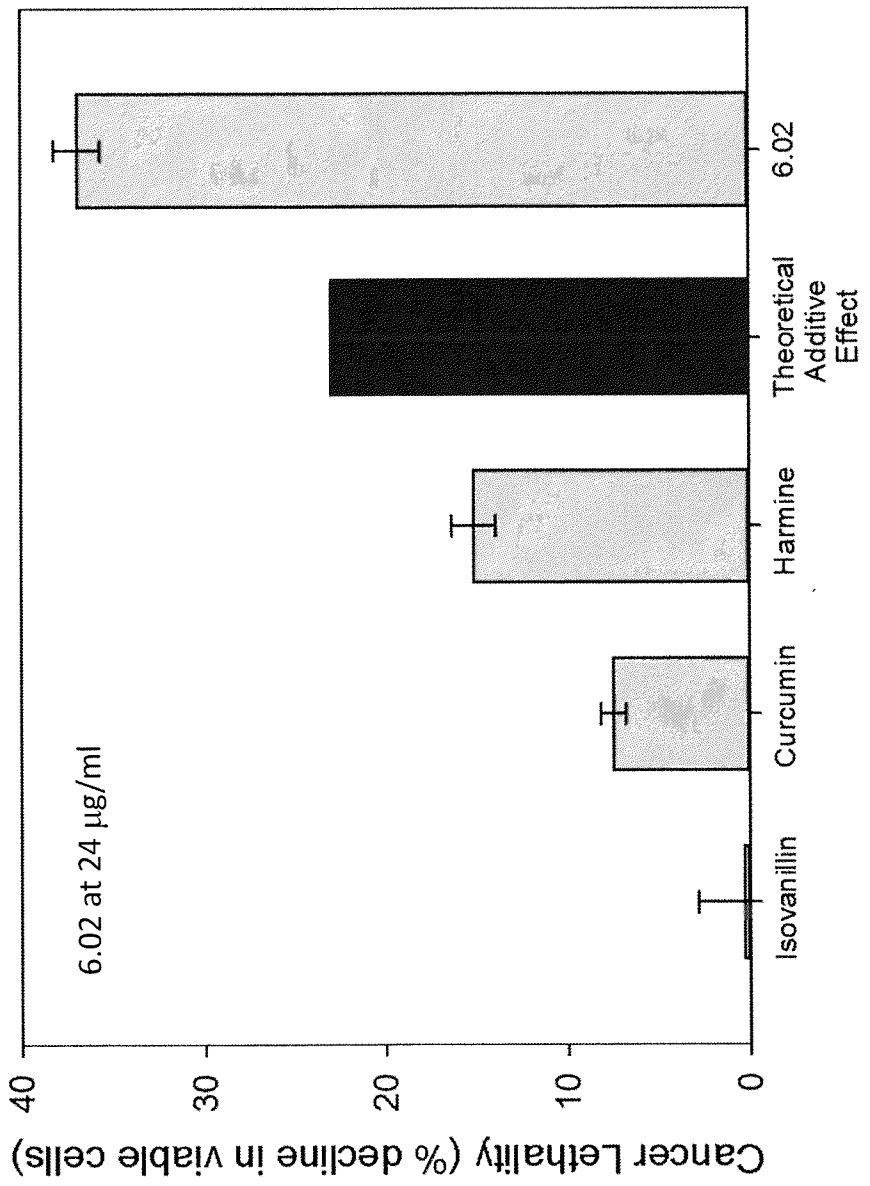

Cancer Lethality (% decline in viable cells)
0
10
20
30
40
6.02 at 24 µg/ml
Isovanillin
Curcumin
Harmine
Theoretical Additive Effect
6.02

Fig. 21B

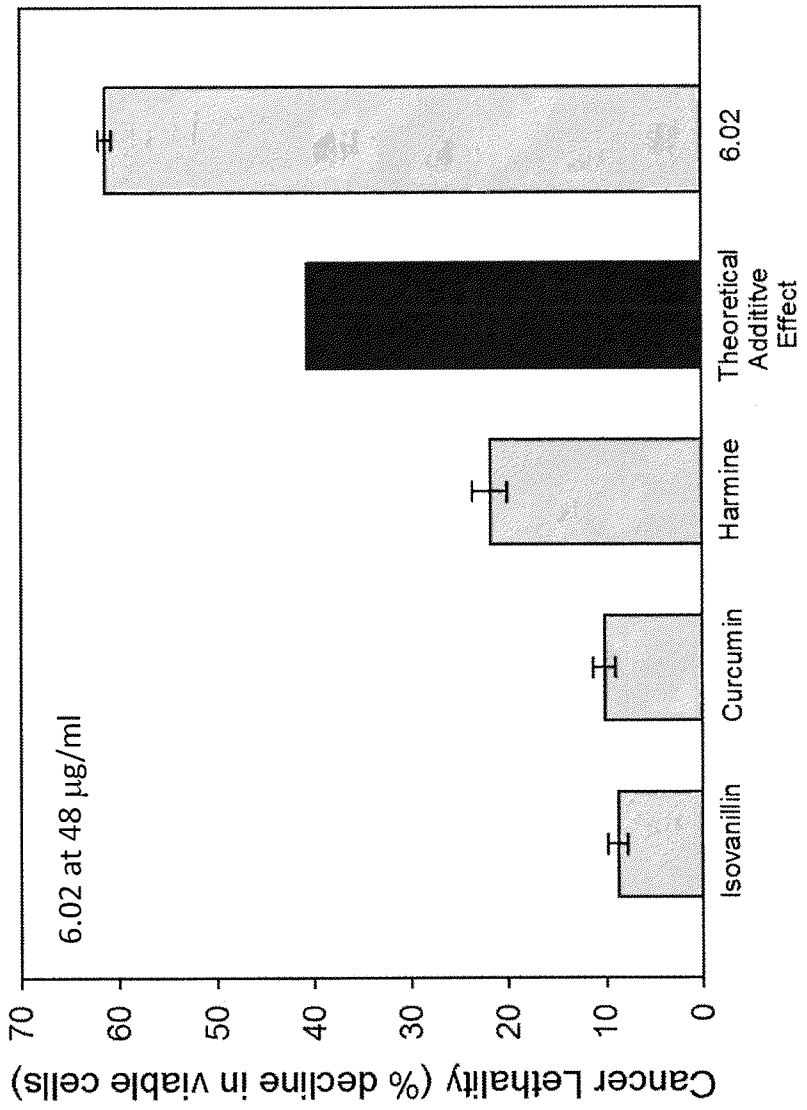
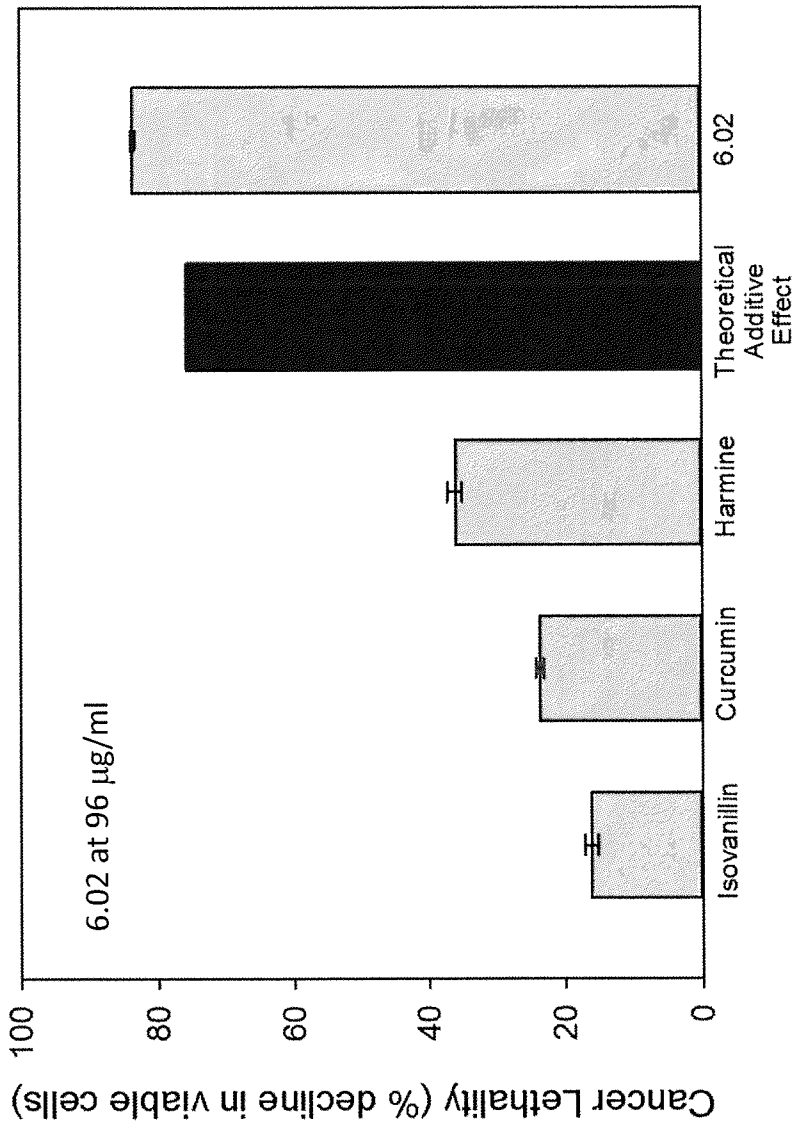

Cancer Lethality (% decline in viable cells)
70
60
50
40
30
20
10
0
6.02 at 48 µg/ml
Isovanillin
Curcumin
Harmine
Theoretical Additive Effect
6.02

Fig. 21C

Fig. 21D


Cancer Lethality (% decline in viable cells)
100
80
60
40
20
0
6.02 at 96 µg/ml
Isovanillin
Curcumin
Harmine
Theoretical Additive Effect
6.02

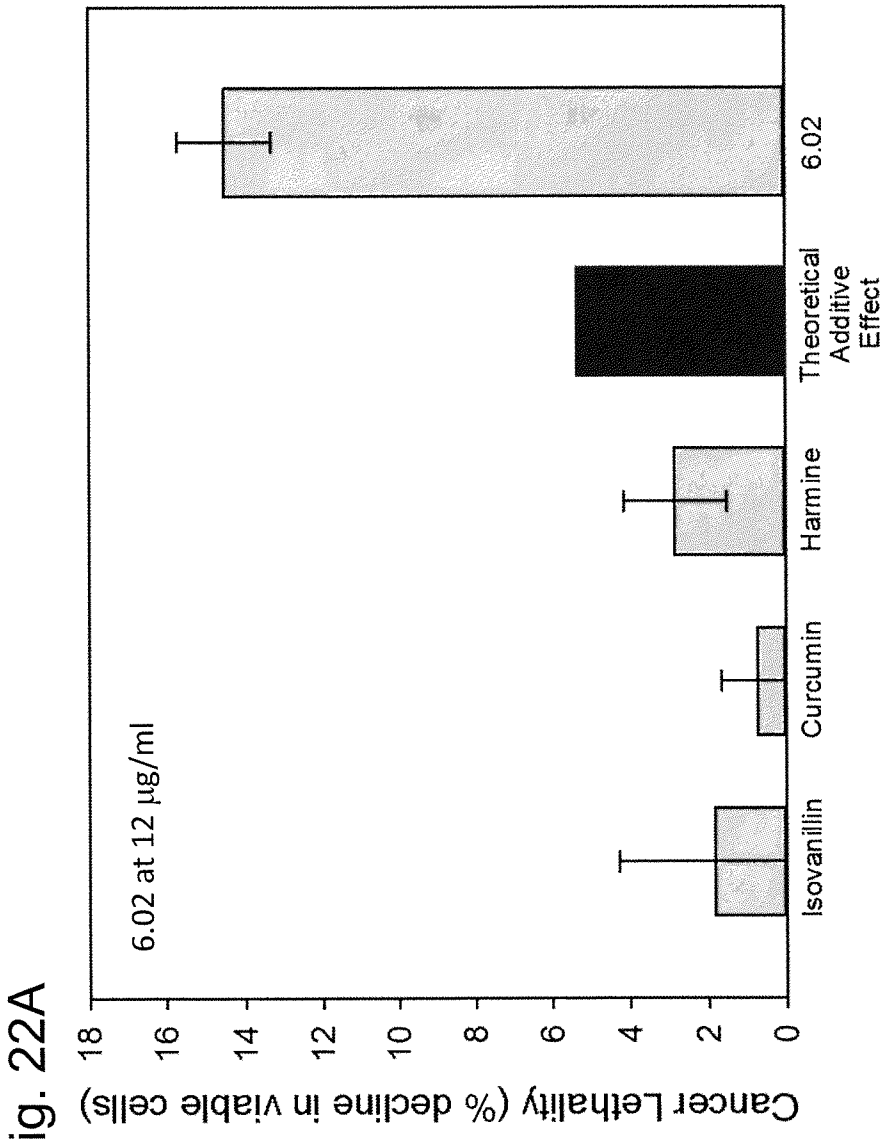

Cancer Lethality (% decline in viable cells)
0
2
4
6
8
10
12
14
16
18
6.02 at 12 µg/ml
Isovanillin
Curcumin
Harmine
Theoretical Additive Effect
6.02

Fig. 22A

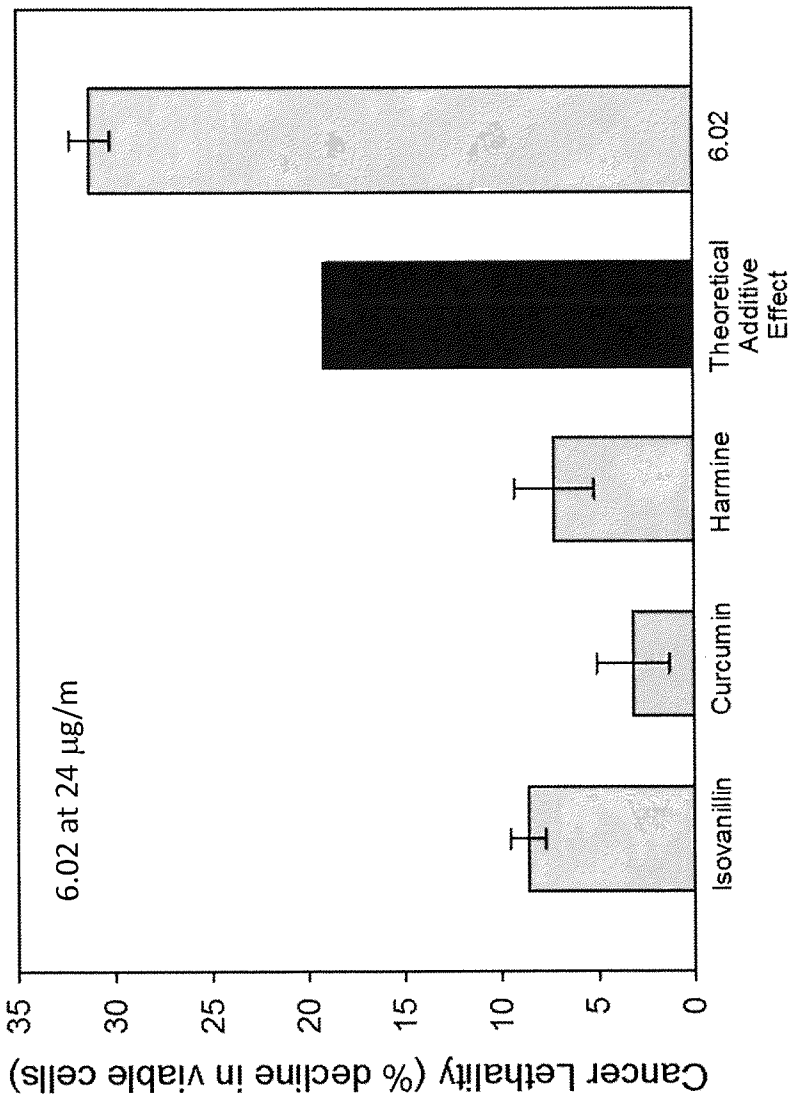
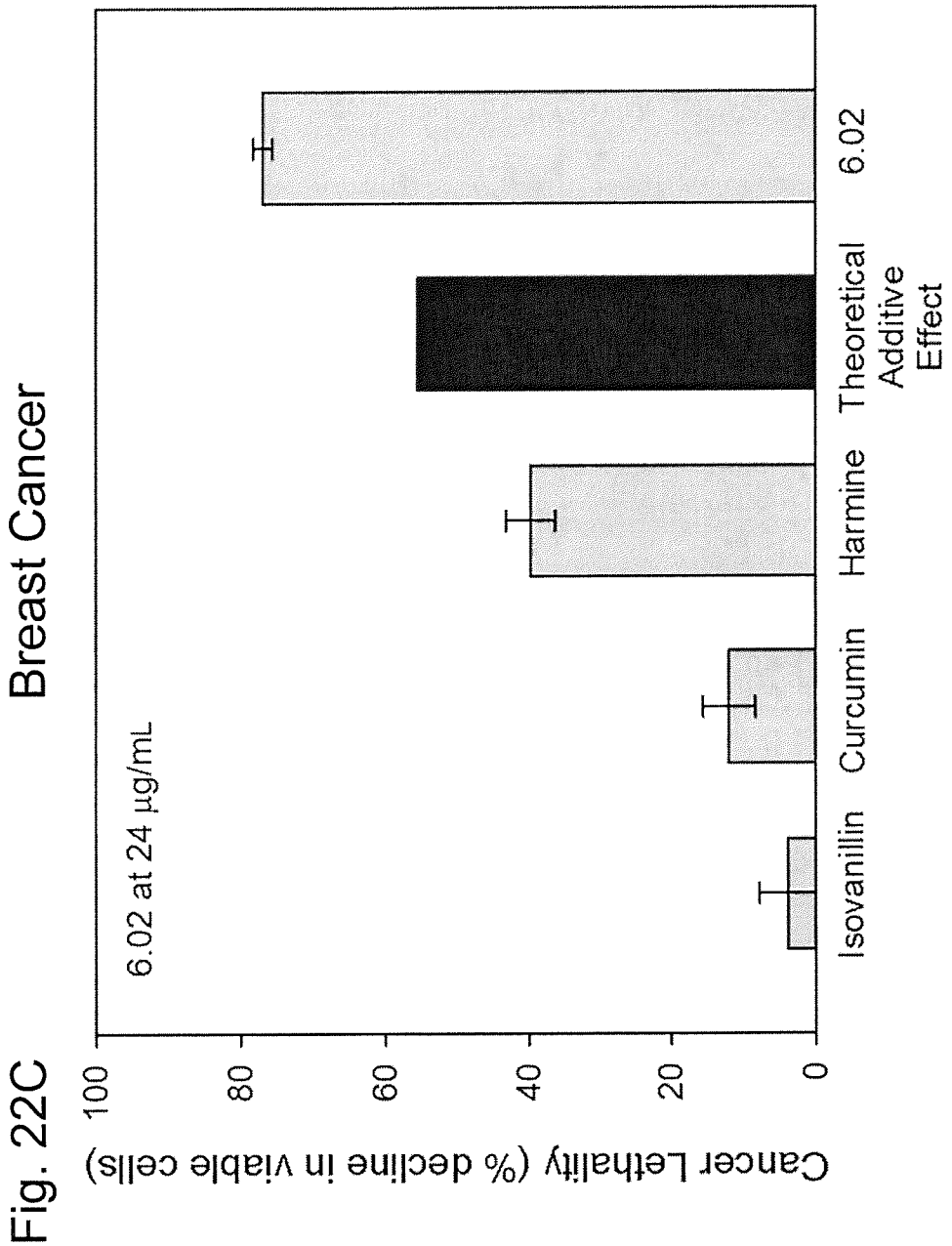

Cancer Lethality (% decline in viable cells)
0
5
10
15
20
25
30
35
6.02 at 24 µg/m
Isovanillin
Curcumin
Harmine
Theoretical Additive Effect
6.02

Fig. 22B

Fig. 22C


Breast Cancer
6.02 at 24 µg/mL
Cancer Lethality (% decline in viable cells)
0
20
40
60
80
100
Isovanillin
Curcumin
Harmine
Theoretical Additive Effect
6.02

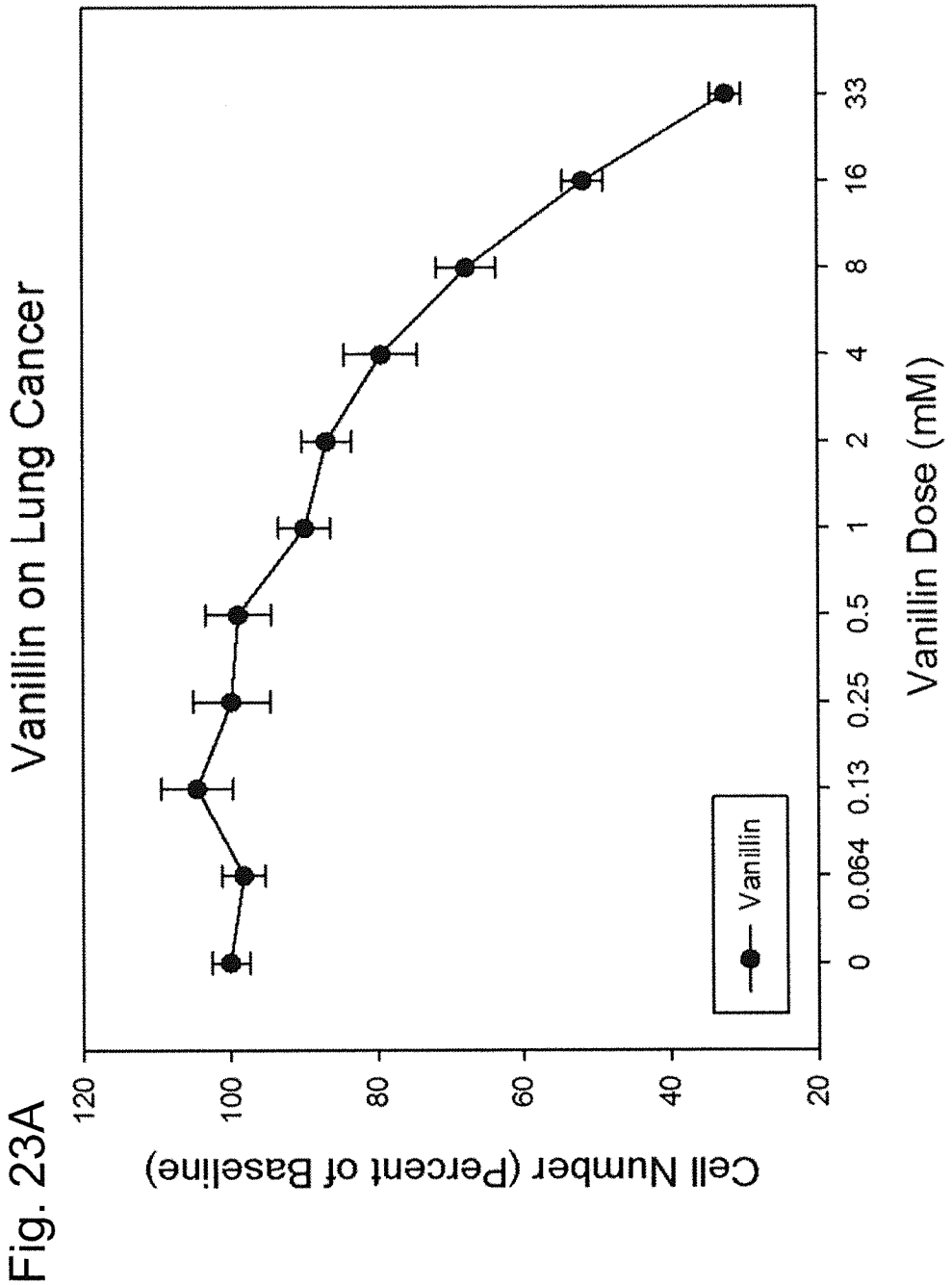

Vanillin on Lung Cancer
Cell Number (Percent of Baseline)
120
100
80
60
40
20
0
0.064
0.13
0.25
0.5
1
2
4
8
16
33
Vanillin Dose (mM)
Vanillin

Fig. 23A

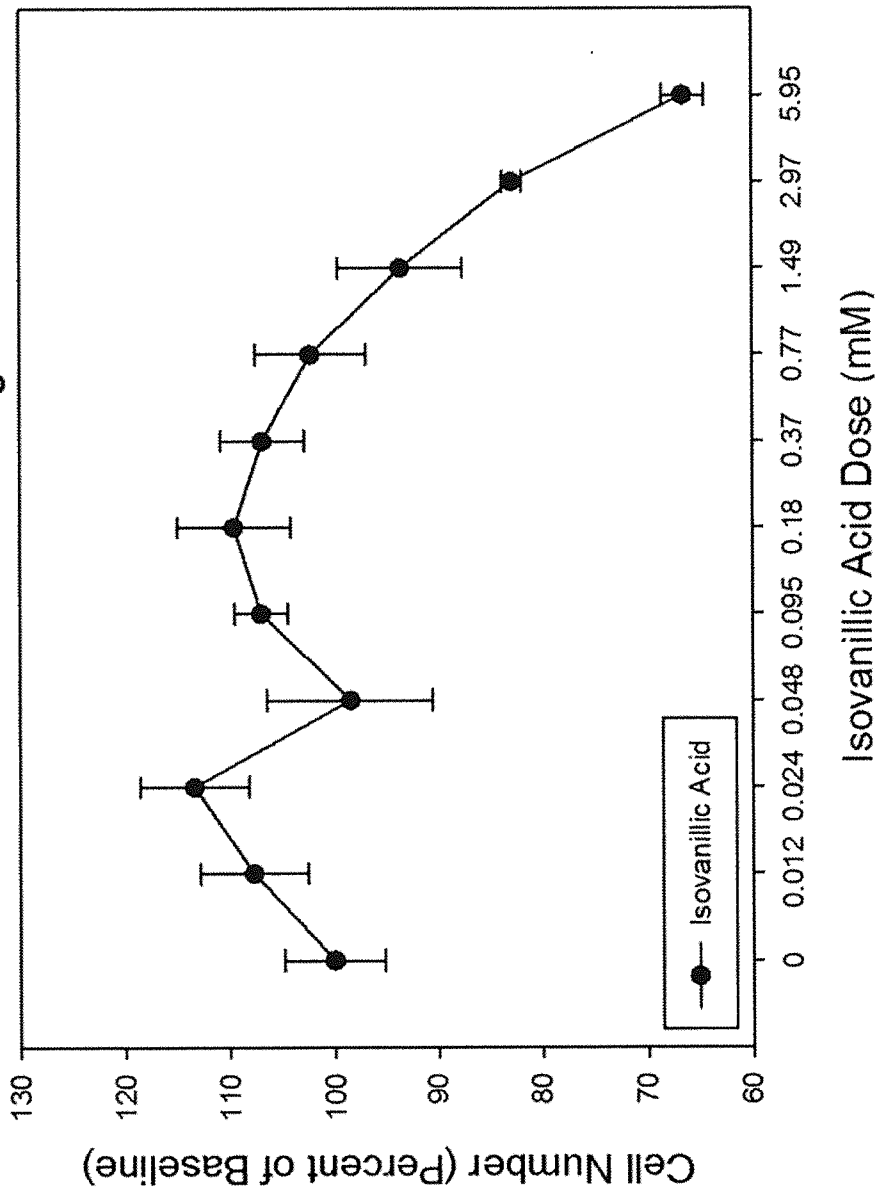

Isovanillic Acid on Lung Cancer
Cell Number (Percent of Baseline)
130
120
110
100
90
80
70
60
0
0.012
0.024
0.048
0.095
0.18
0.37
0.77
1.49
2.97
5.95
Isovanillic Acid Dose (mM)
Isovanillic Acid

Fig. 23B

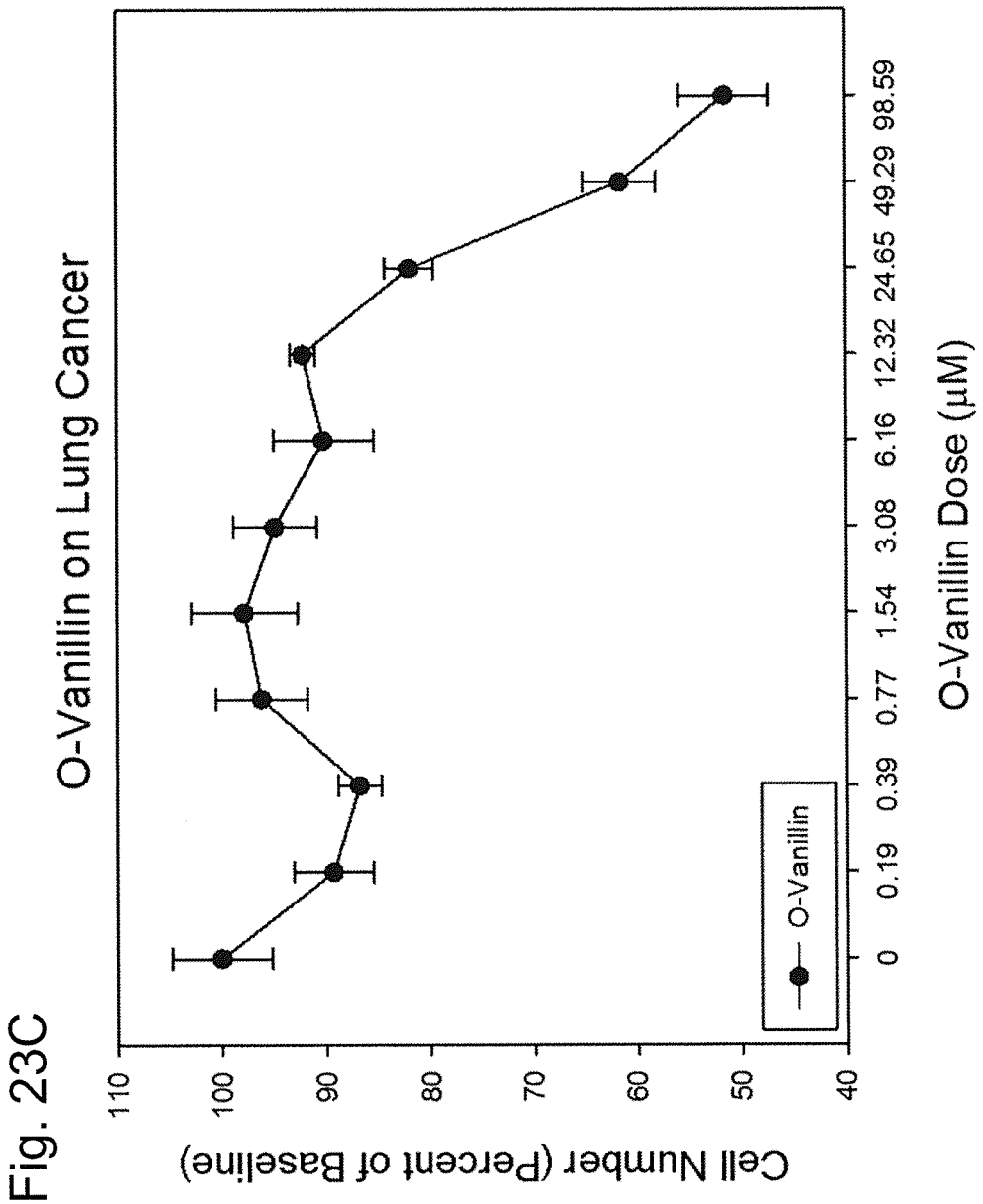

O-Vanillin on Lung Cancer
Cell Number (Percent of Baseline)
110
100
90
80
70
60
50
40
O-Vanillin
0
0.19
0.39
0.77
1.54
3.08
6.16
12.32
24.65
49.29
98.59
O-Vanillin Dose (μM)

Fig. 23C

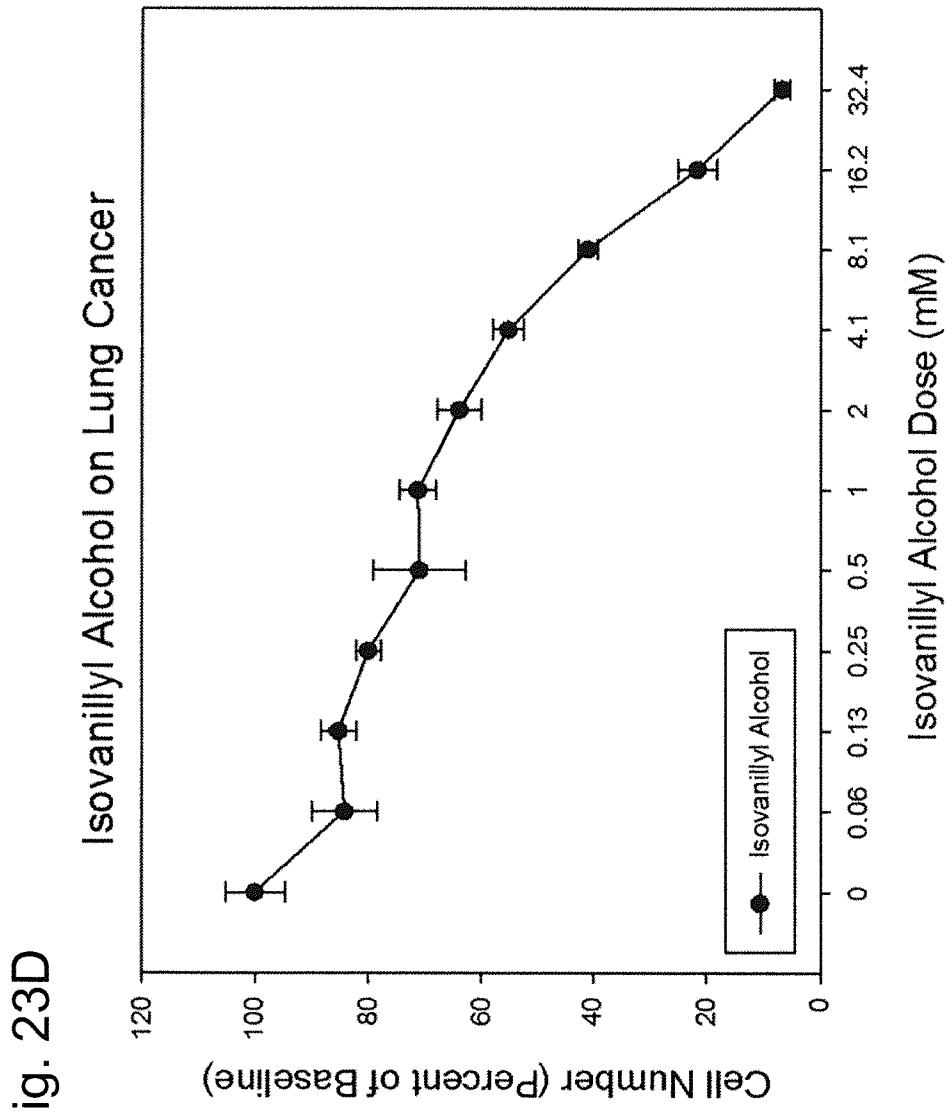

Isovanillyl Alcohol on Lung Cancer
Cell Number (Percent of Baseline)
120
100
80
60
40
20
0
Isovanillyl Alcohol
0
0.06
0.13
0.25
0.5
1
2
4.1
8.1
16.2
32.4
Isovanillyl Alcohol Dose (mM)

Fig. 23D

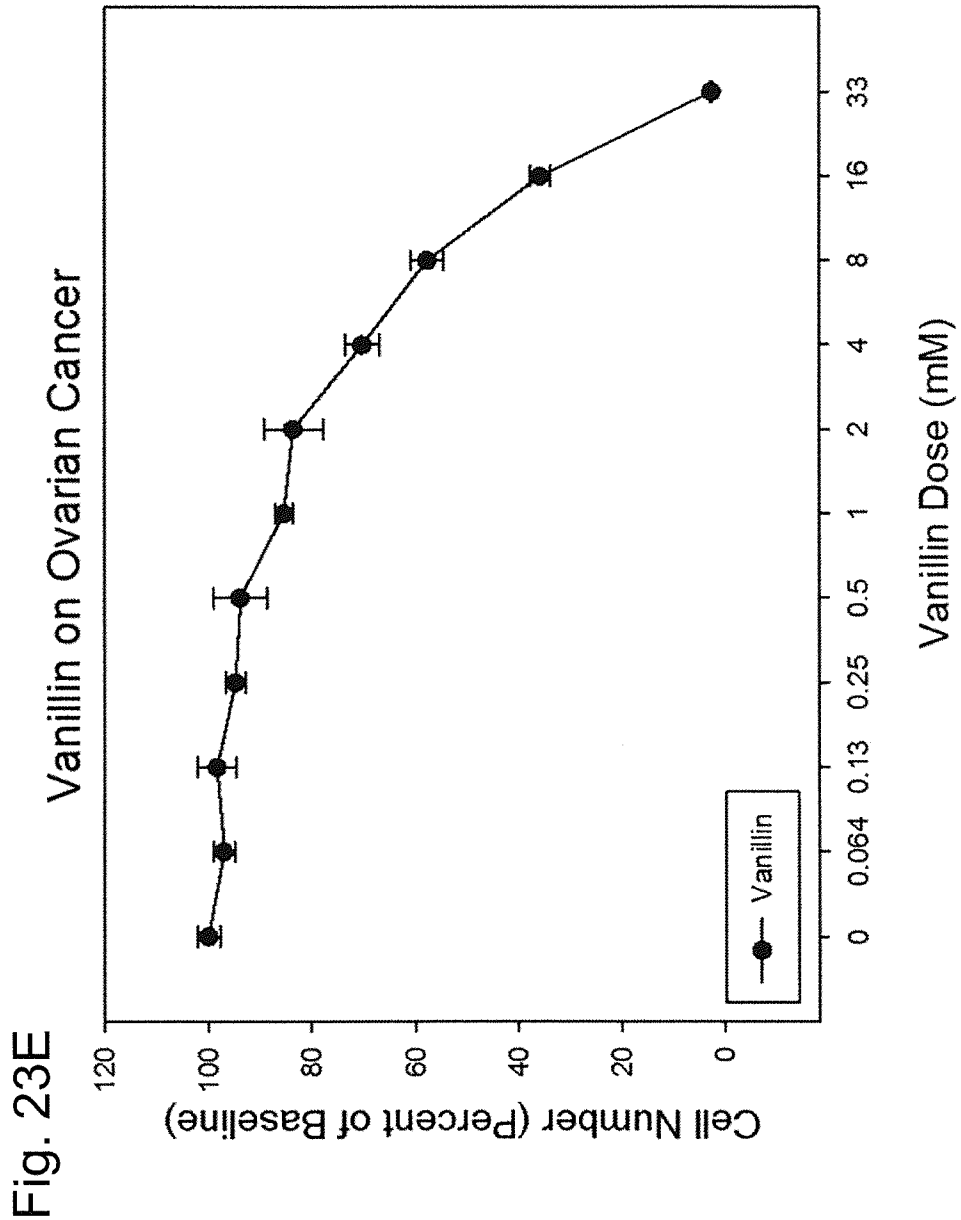

Vanillin on Ovarian Cancer
Cell Number (Percent of Baseline)
120
100
80
60
40
20
0
Vanillin
0
0.064
0.13
0.25
0.5
1
2
4
8
16
33
Vanillin Dose (mM)

Fig. 23E

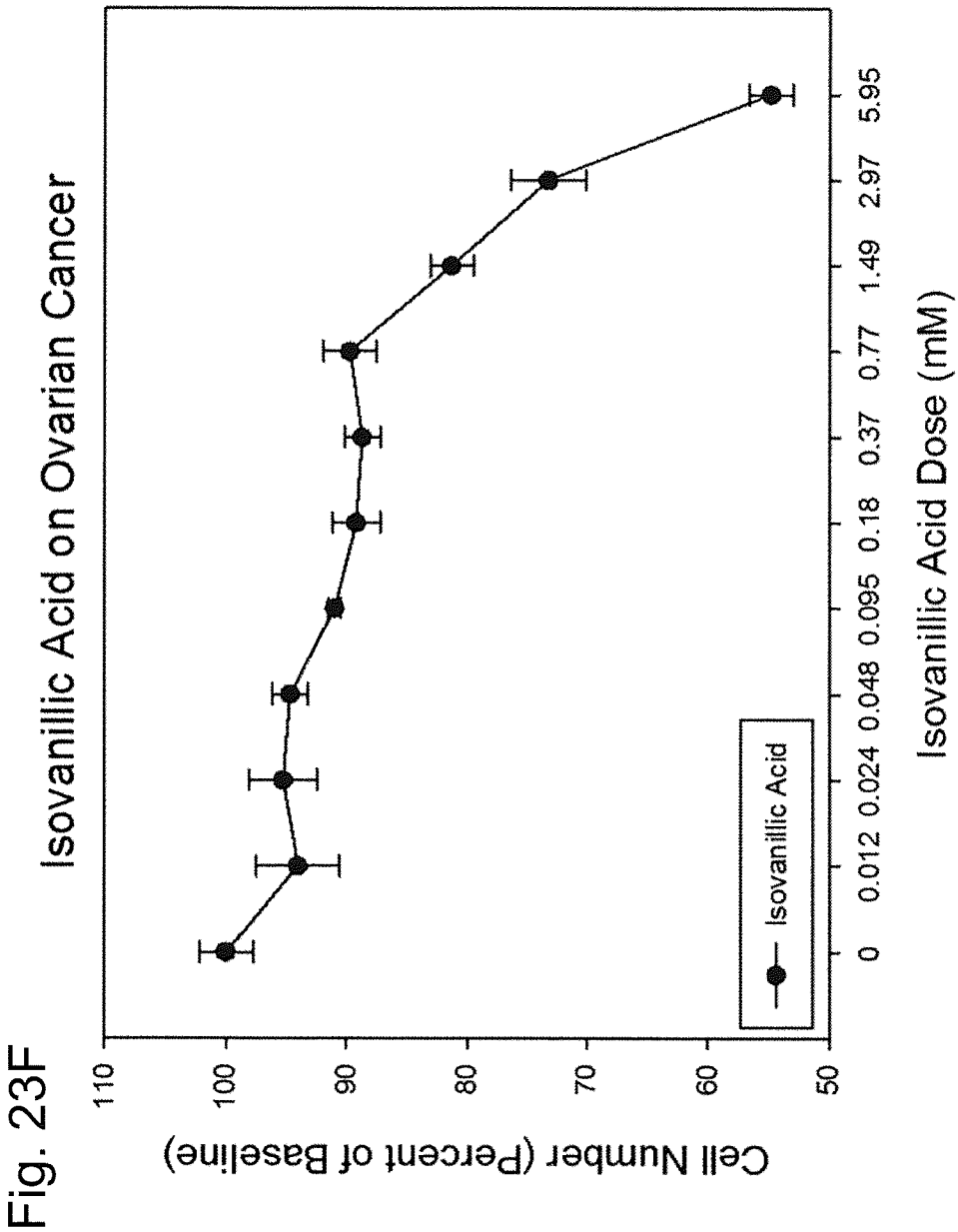

Isovanillic Acid on Ovarian Cancer
Cell Number (Percent of Baseline)
110
100
90
80
70
60
50
0
0.012
0.024
0.048
0.095
0.18
0.37
0.77
1.49
2.97
5.95
Isovanillic Acid Dose (mM)
Isovanillic Acid

Fig. 23F

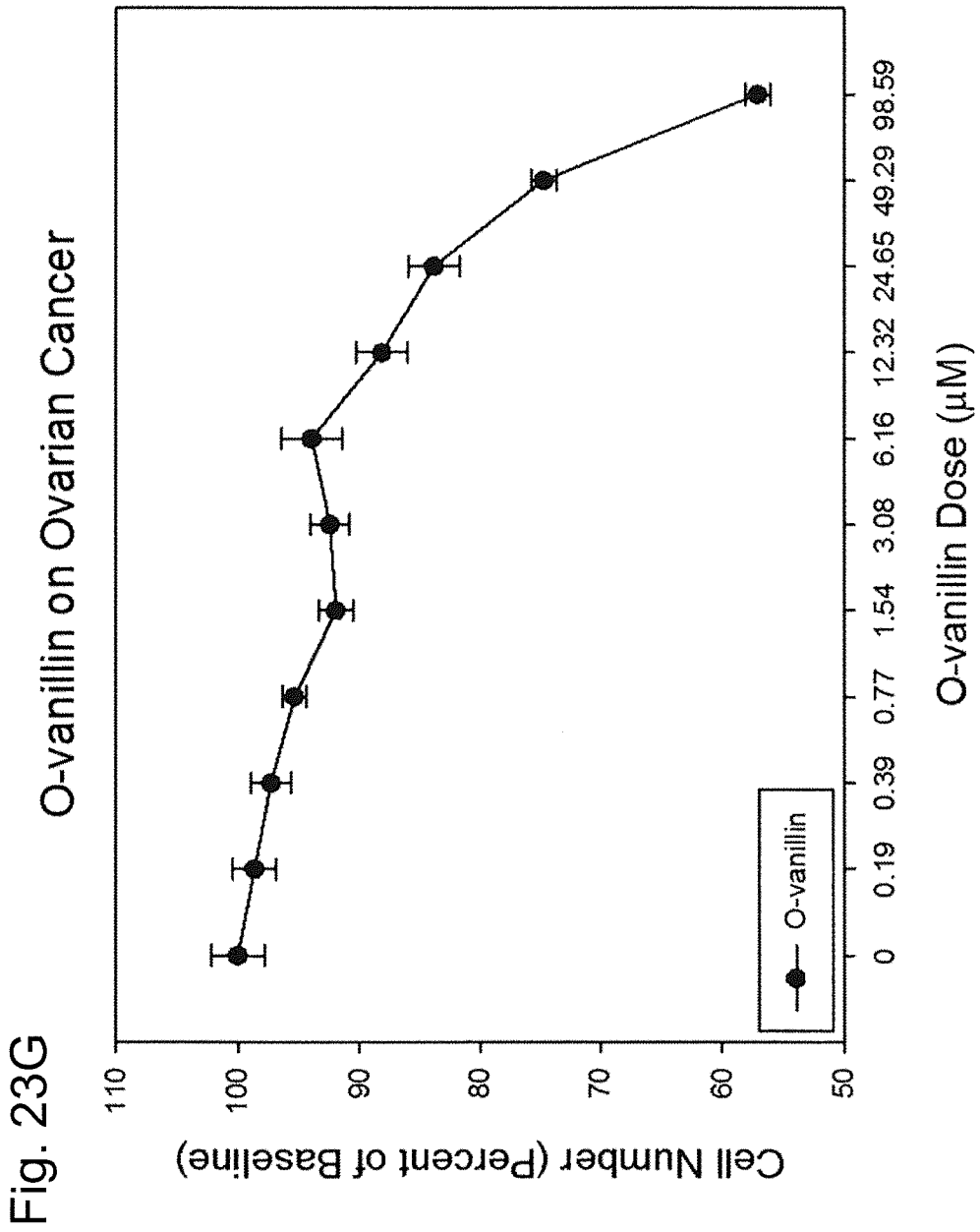

O-vanillin on Ovarian Cancer
Cell Number (Percent of Baseline)
110
100
90
80
70
60
50
O-vanillin
0
0.19
0.39
0.77
1.54
3.08
6.16
12.32
24.65
49.29
98.59
O-vanillin Dose (µM)

Fig. 23G

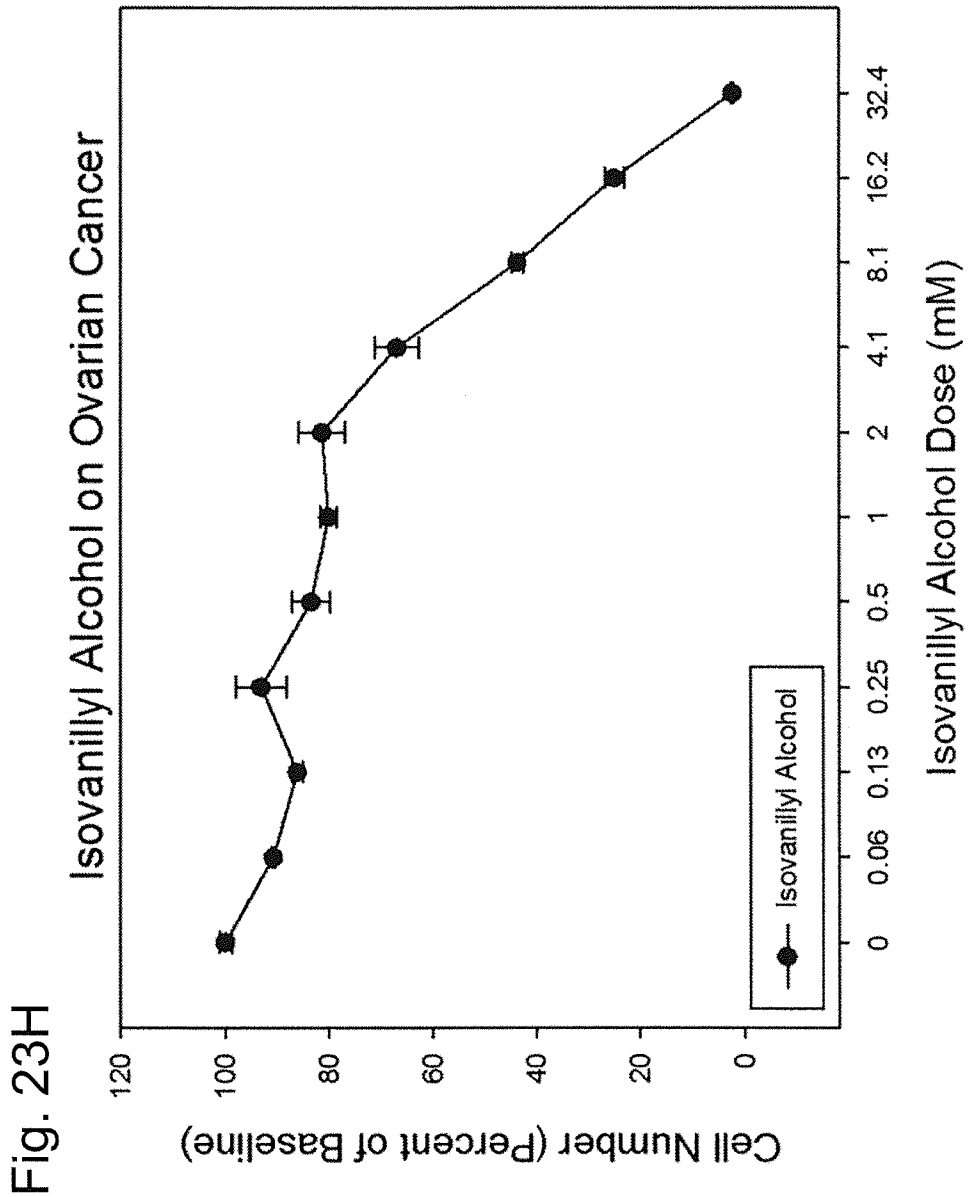

Isovanillyl Alcohol on Ovarian Cancer
Cell Number (Percent of Baseline)
120
100
80
60
40
20
0
Isovanillyl Alcohol
0
0.06
0.13
0.25
0.5
1
2
4.1
8.1
16.2
32.4
Isovanillyl Alcohol Dose (mM)

Fig. 23H

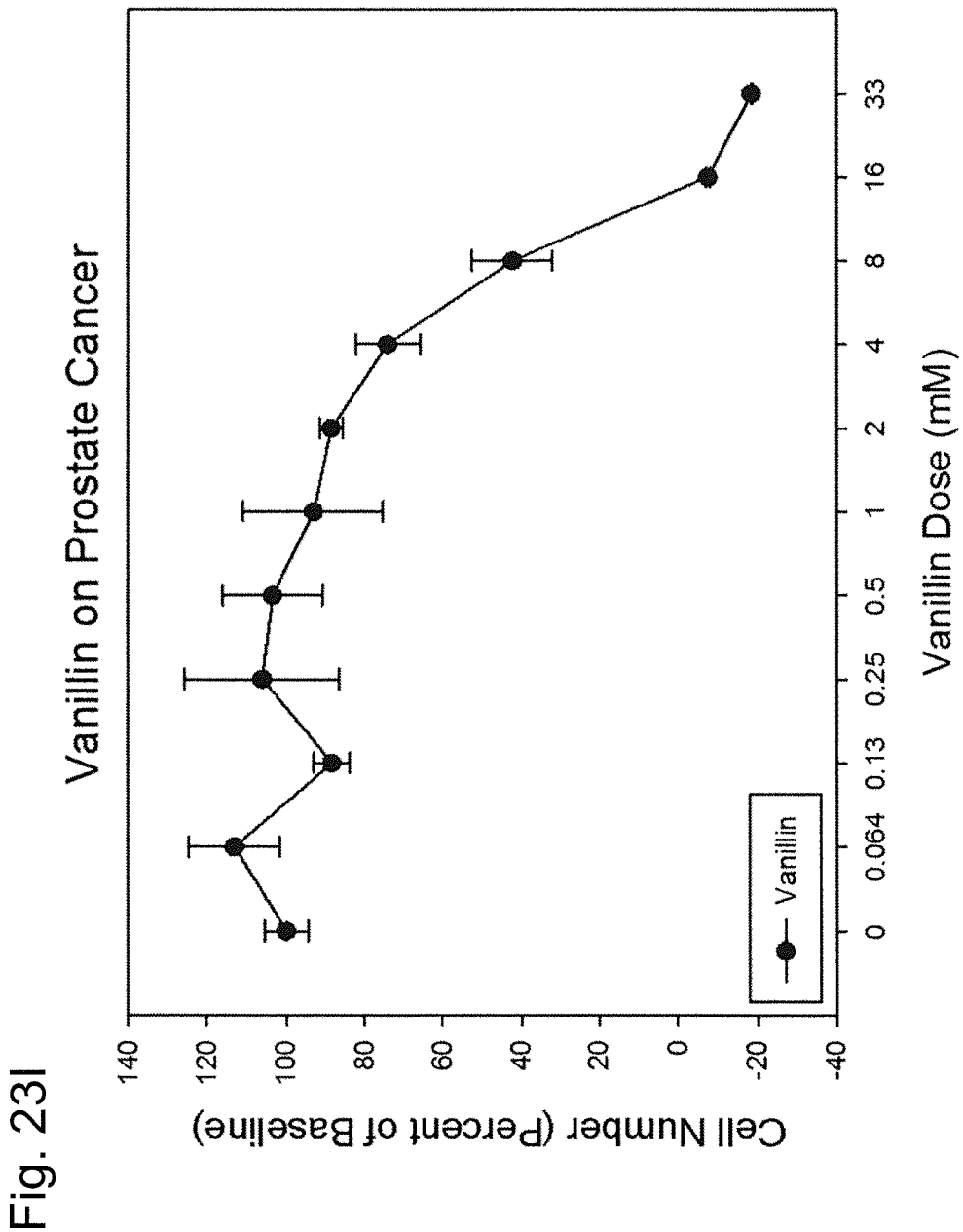

Vanillin on Prostate Cancer
Cell Number (Percent of Baseline)
140
120
100
80
60
40
20
0
-20
-40
0
0.064
0.13
0.25
0.5
1
2
4
8
16
33
Vanillin Dose (mM)
Vanillin

Fig. 23I

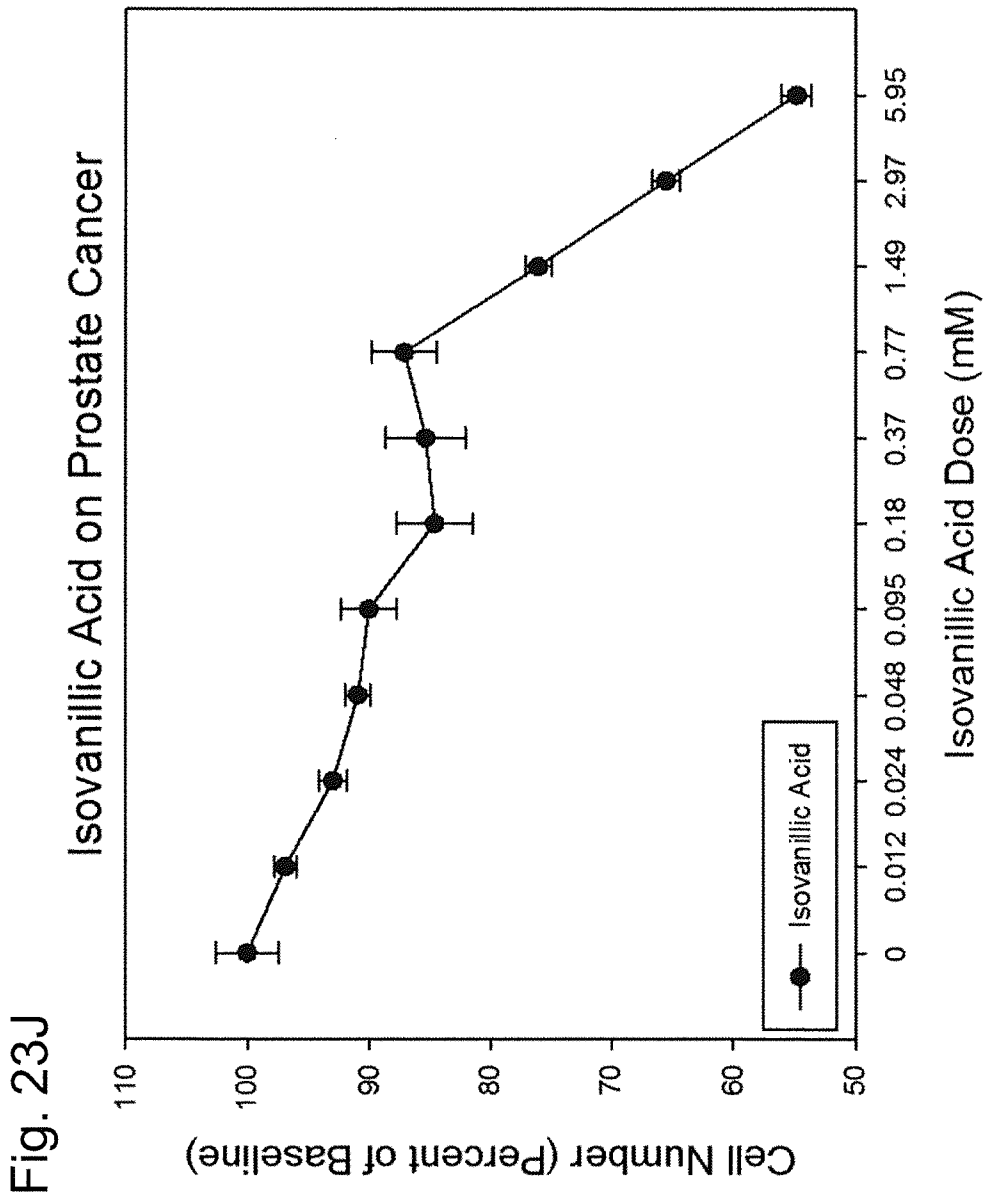

Isovanillic Acid on Prostate Cancer
Cell Number (Percent of Baseline)
110
100
90
80
70
60
50
Isovanillic Acid
0
0.012
0.024
0.048
0.095
0.18
0.37
0.77
1.49
2.97
5.95
Isovanillic Acid Dose (mM)

Fig. 23J

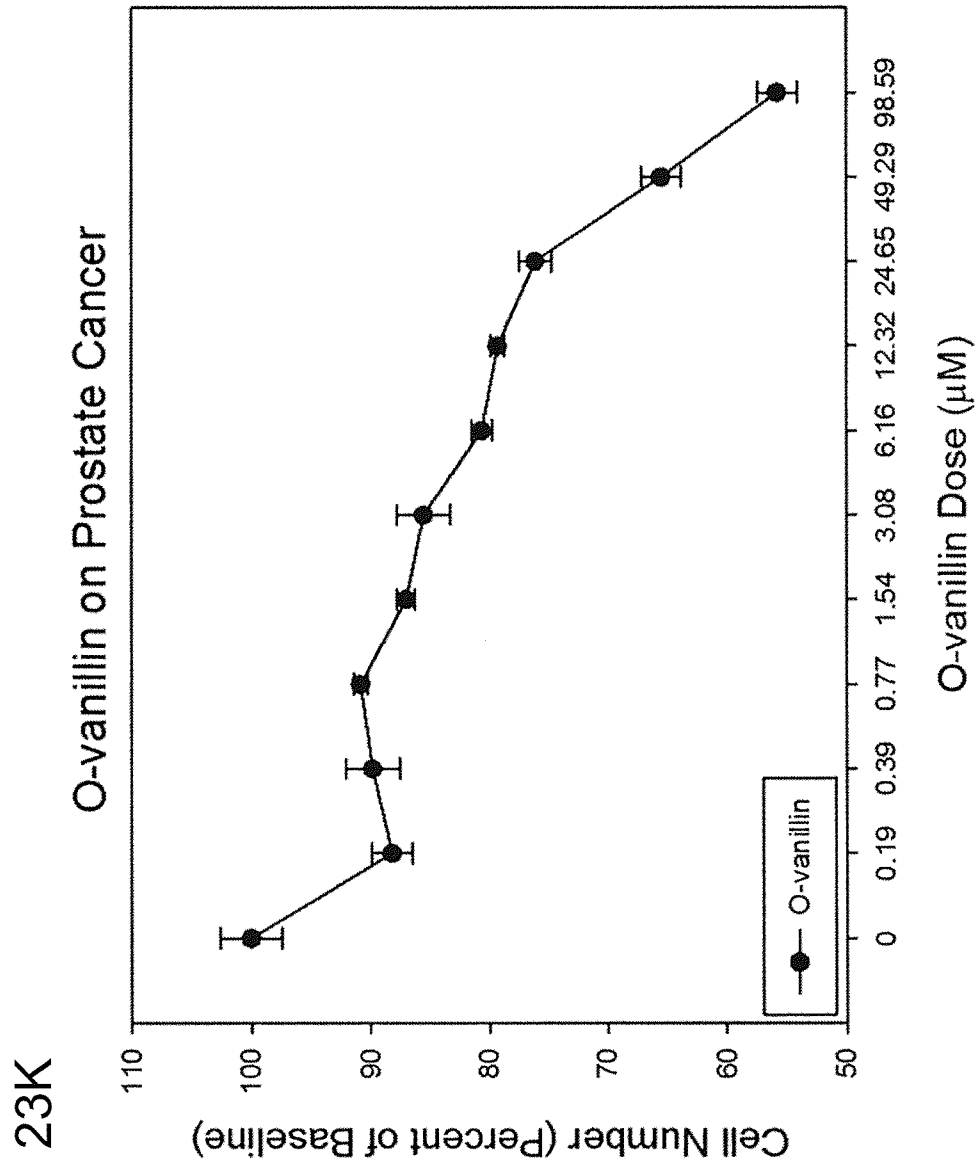

O-vanillin on Prostate Cancer
Cell Number (Percent of Baseline)
110
100
90
80
70
60
50
O-vanillin
0
0.19
0.39
0.77
1.54
3.08
6.16
12.32
24.65
49.29
98.59
O-vanillin Dose (μM)

Fig. 23K

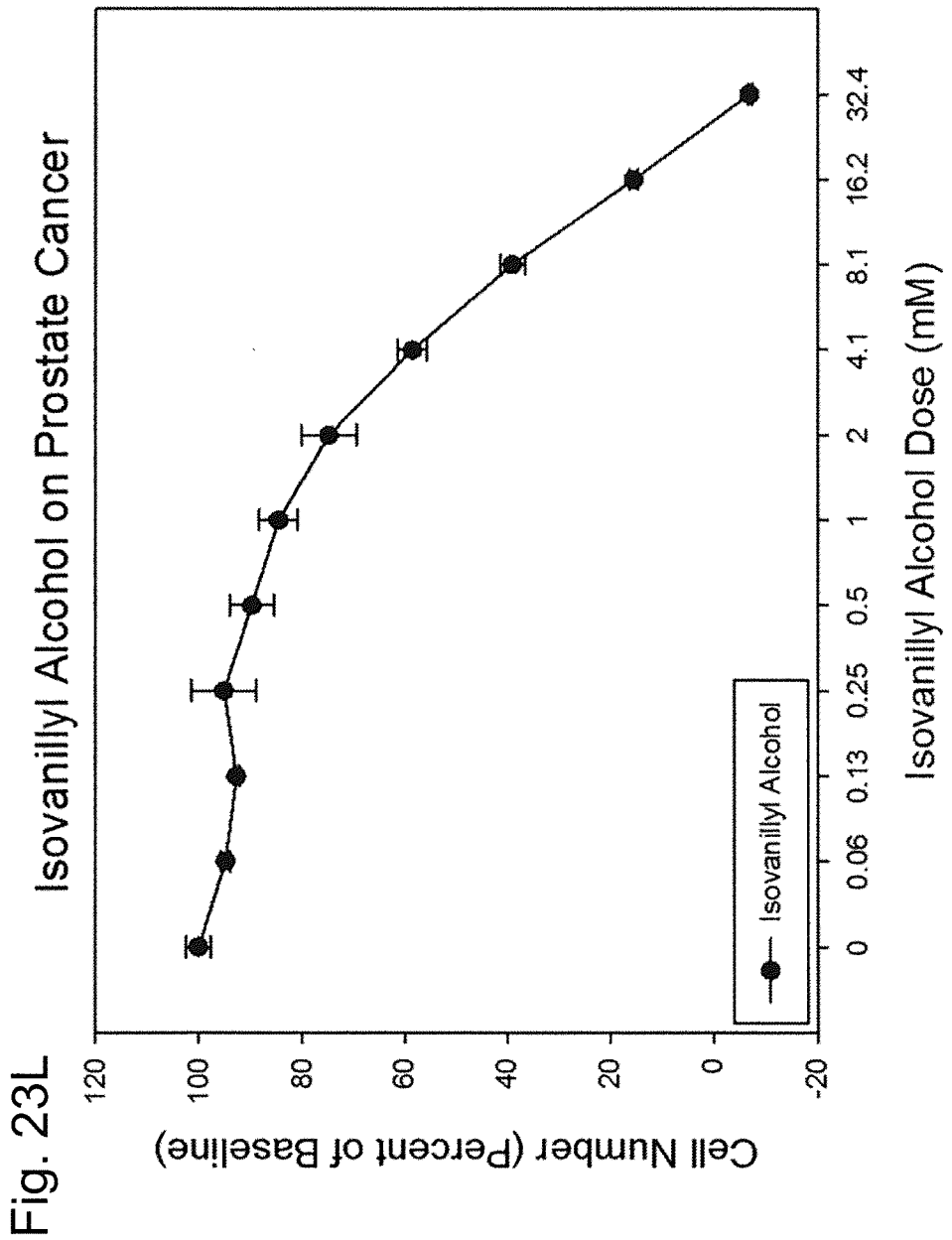

Isovanillyl Alcohol on Prostate Cancer
Cell Number (Percent of Baseline)
120
100
80
60
40
20
0
-20
0
0.06
0.13
0.25
0.5
1
2
4.1
8.1
16.2
32.4
Isovanillyl Alcohol Dose (mM)
Isovanillyl Alcohol

Fig. 23L

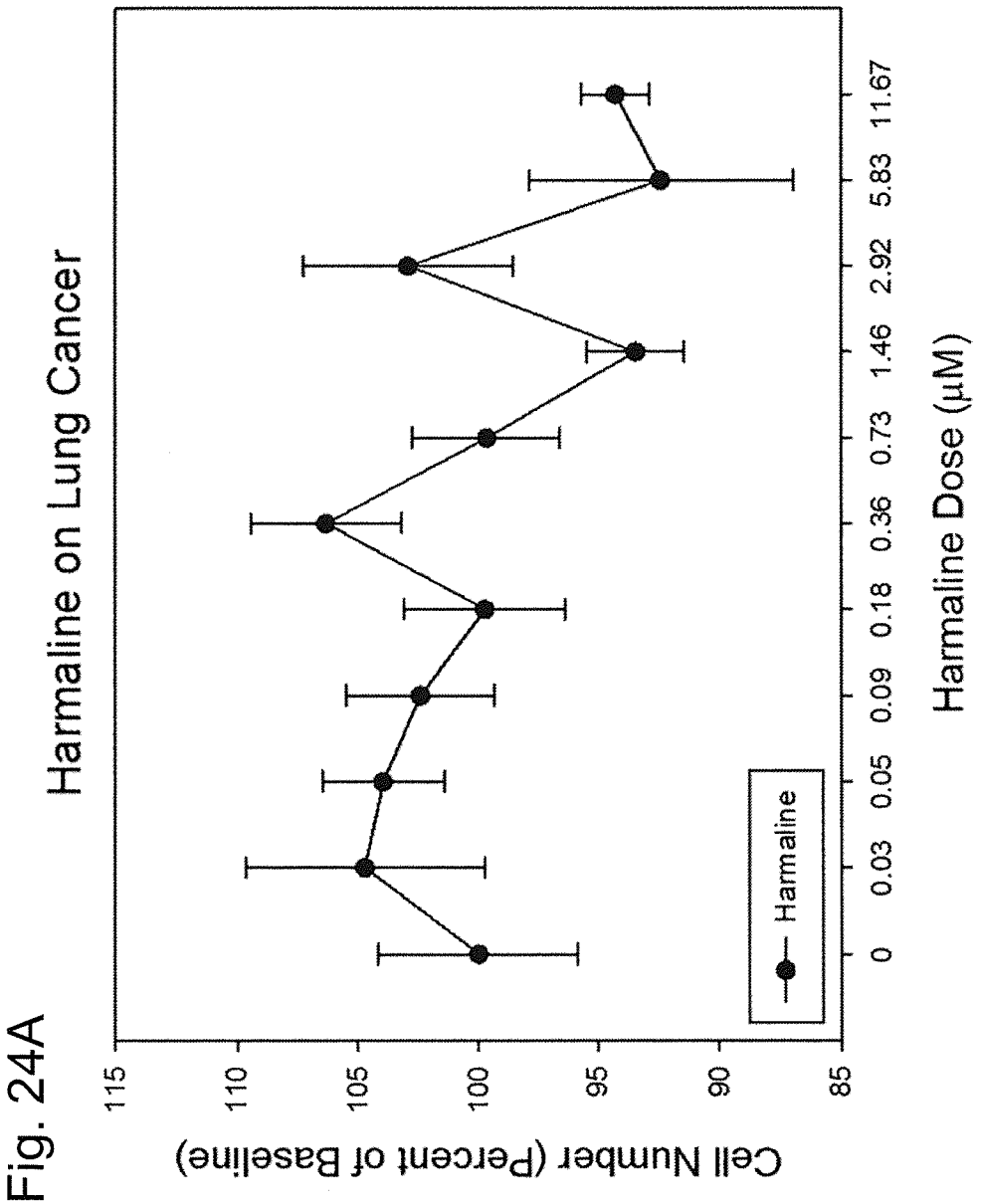

Harmaline on Lung Cancer
Cell Number (Percent of Baseline)
115
110
105
100
95
90
85
Harmaline
0
0.03
0.05
0.09
0.18
0.36
0.73
1.46
2.92
5.83
11.67
Harmaline Dose (μM)

Fig. 24A

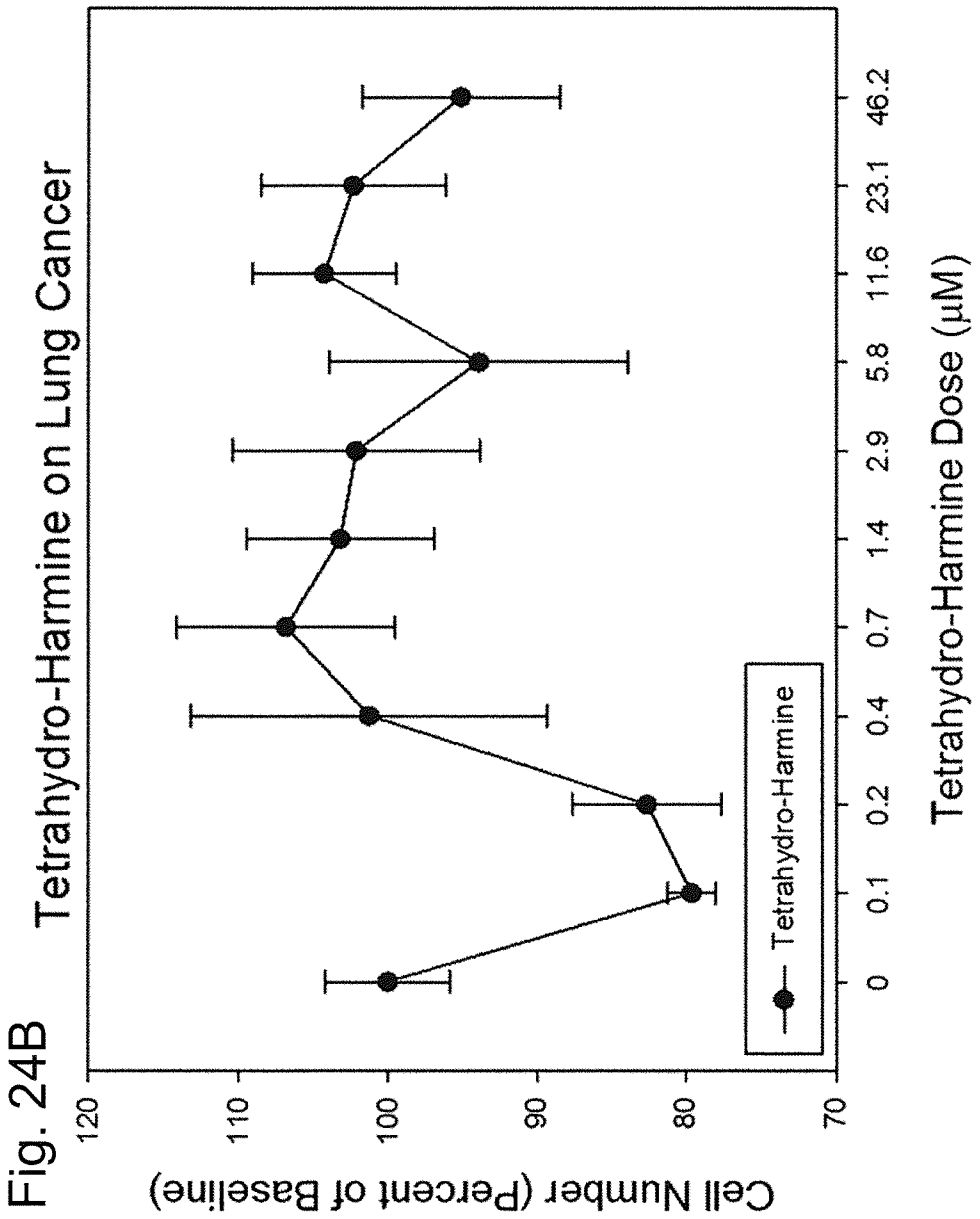

Tetrahydro-Harmine on Lung Cancer
Cell Number (Percent of Baseline)
120
110
100
90
80
70
0
0.1
0.2
0.4
0.7
1.4
2.9
5.8
11.6
23.1
46.2
Tetrahydro-Harmine Dose (μM)
Tetrahydro-Harmine

Fig. 24B

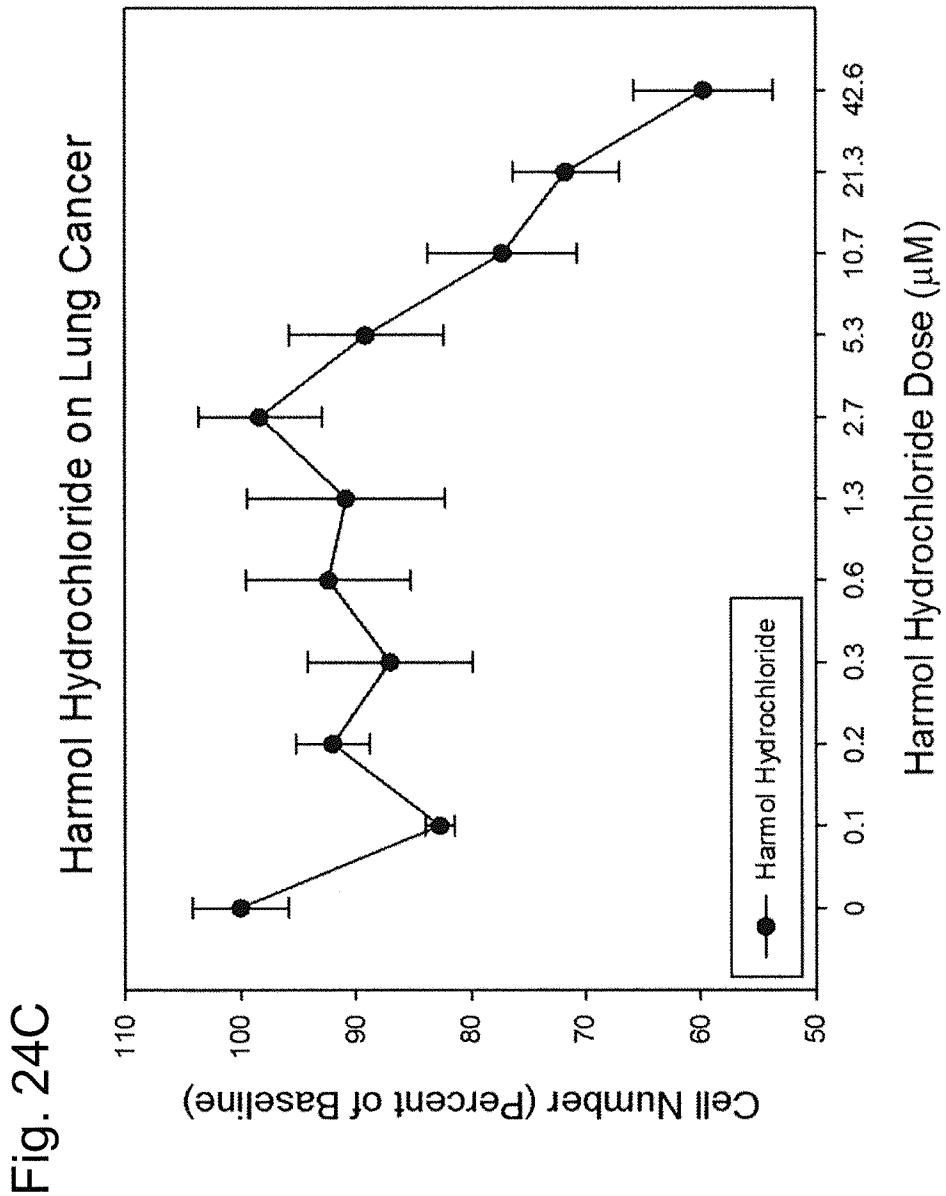

Harmol Hydrochloride on Lung Cancer
Cell Number (Percent of Baseline)
110
100
90
80
70
60
50
Harmol Hydrochloride
0
0.1
0.2
0.3
0.6
1.3
2.7
5.3
10.7
21.3
42.6
Harmol Hydrochloride Dose (μM)

Fig. 24C

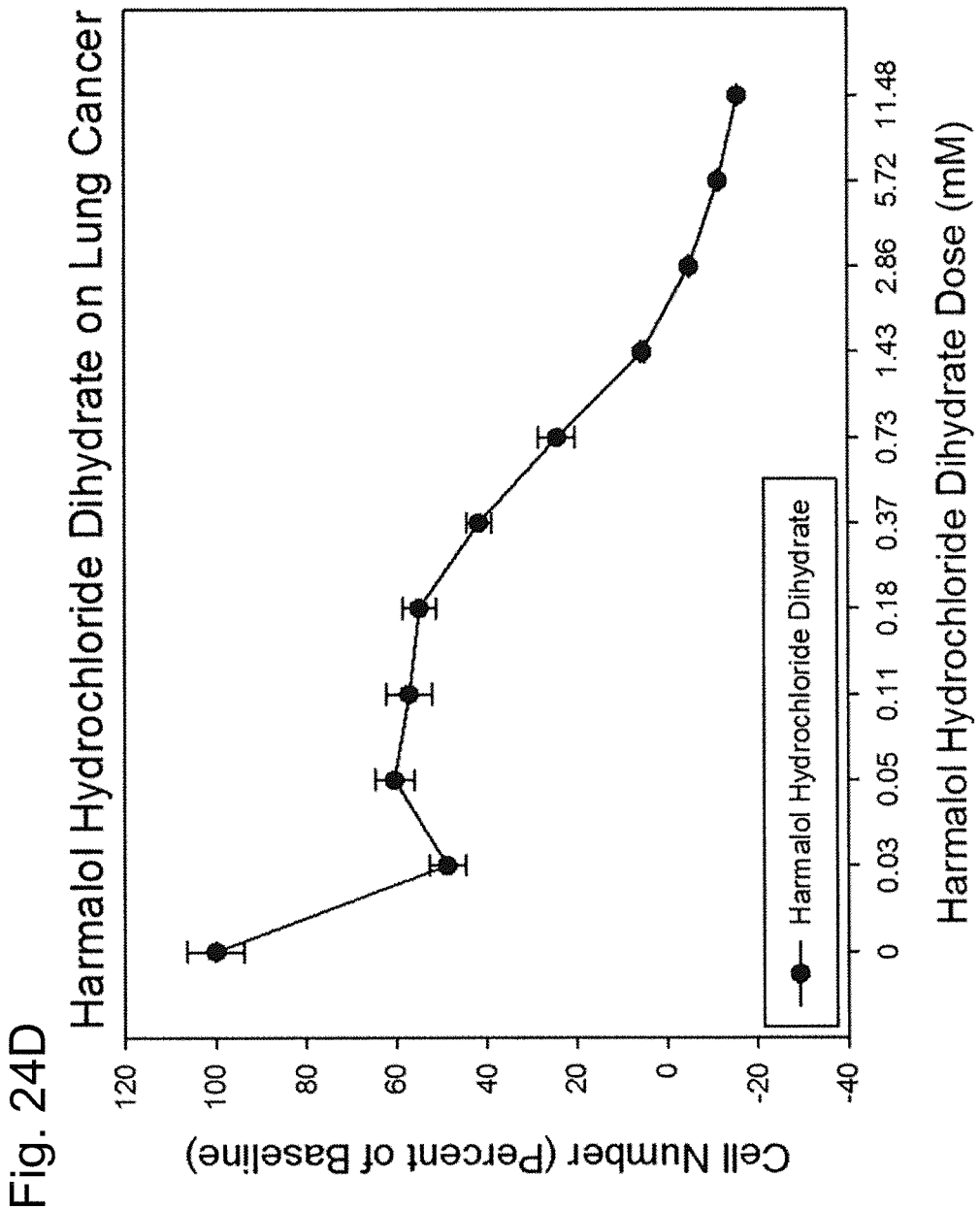

Harmalol Hydrochloride Dihydrate on Lung Cancer
Cell Number (Percent of Baseline)
120
100
80
60
40
20
0
-20
-40
0
0.03
0.05
0.11
0.18
0.37
0.73
1.43
2.86
5.72
11.48
Harmalol Hydrochloride Dihydrate Dose (mM)
Harmalol Hydrochloride Dihydrate

Fig. 24D

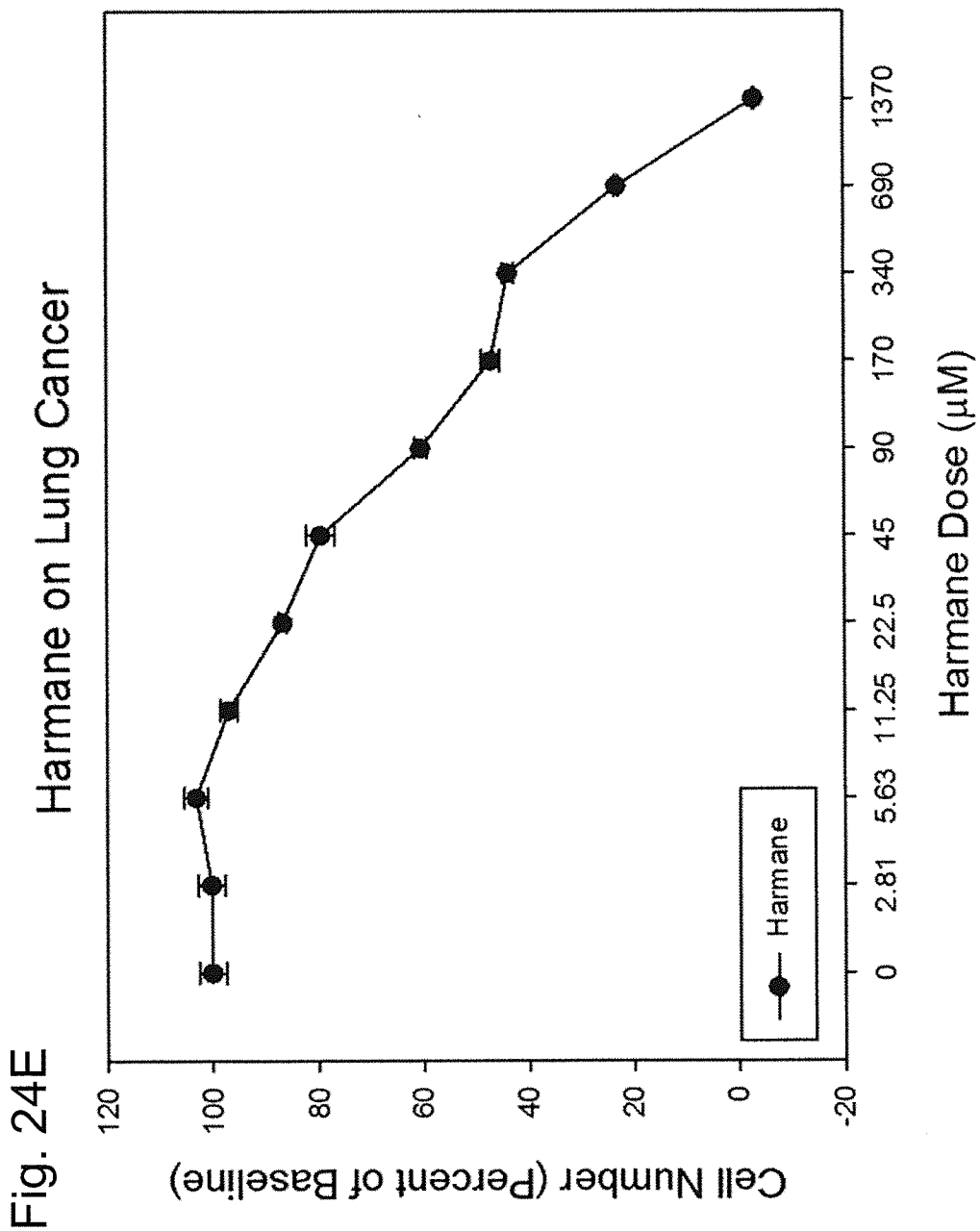

Harmane on Lung Cancer
Cell Number (Percent of Baseline)
120
100
80
60
40
20
0
-20
0
2.81
5.63
11.25
22.5
45
90
170
340
690
1370
Harmane Dose (µM)
Harmane

Fig. 24E

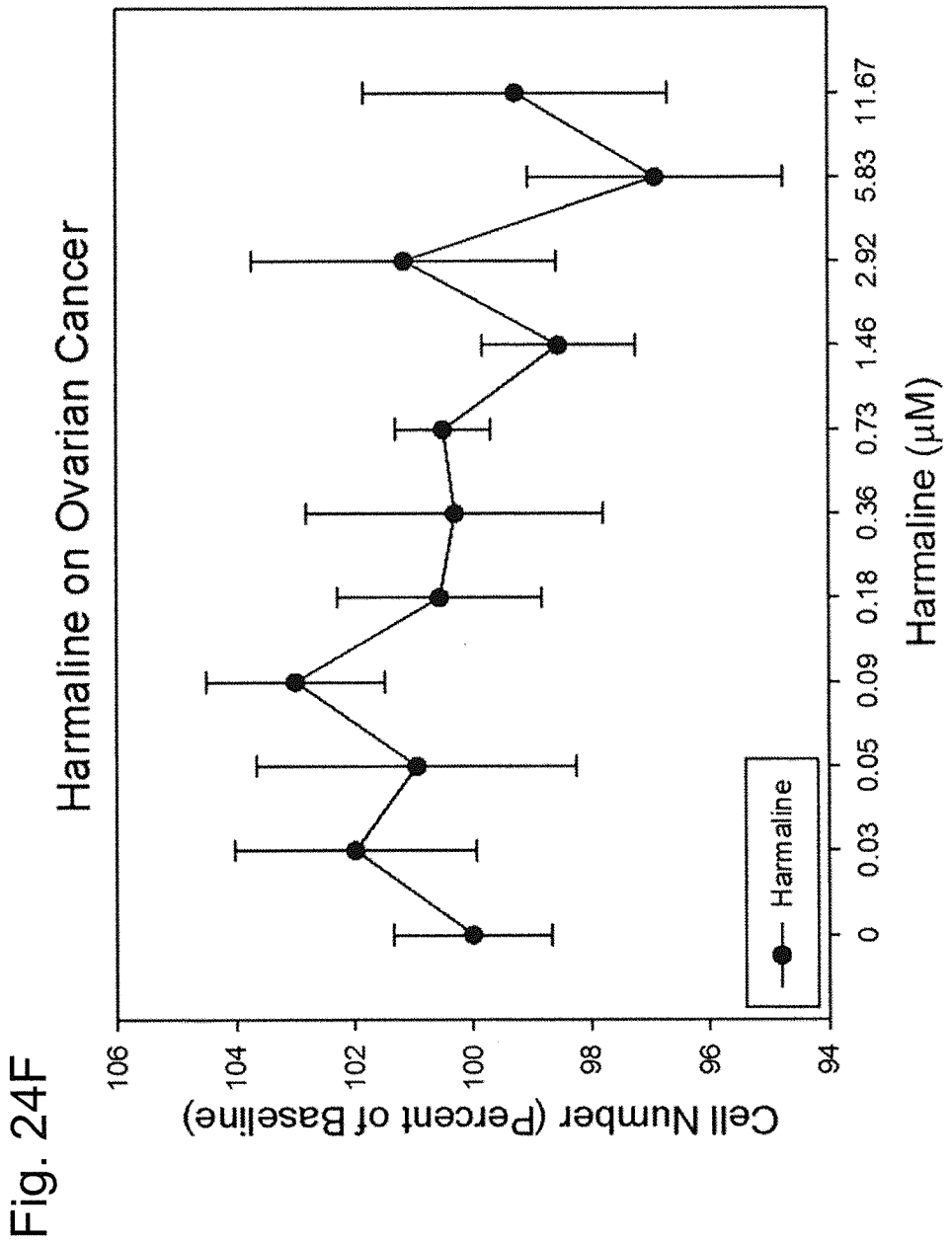
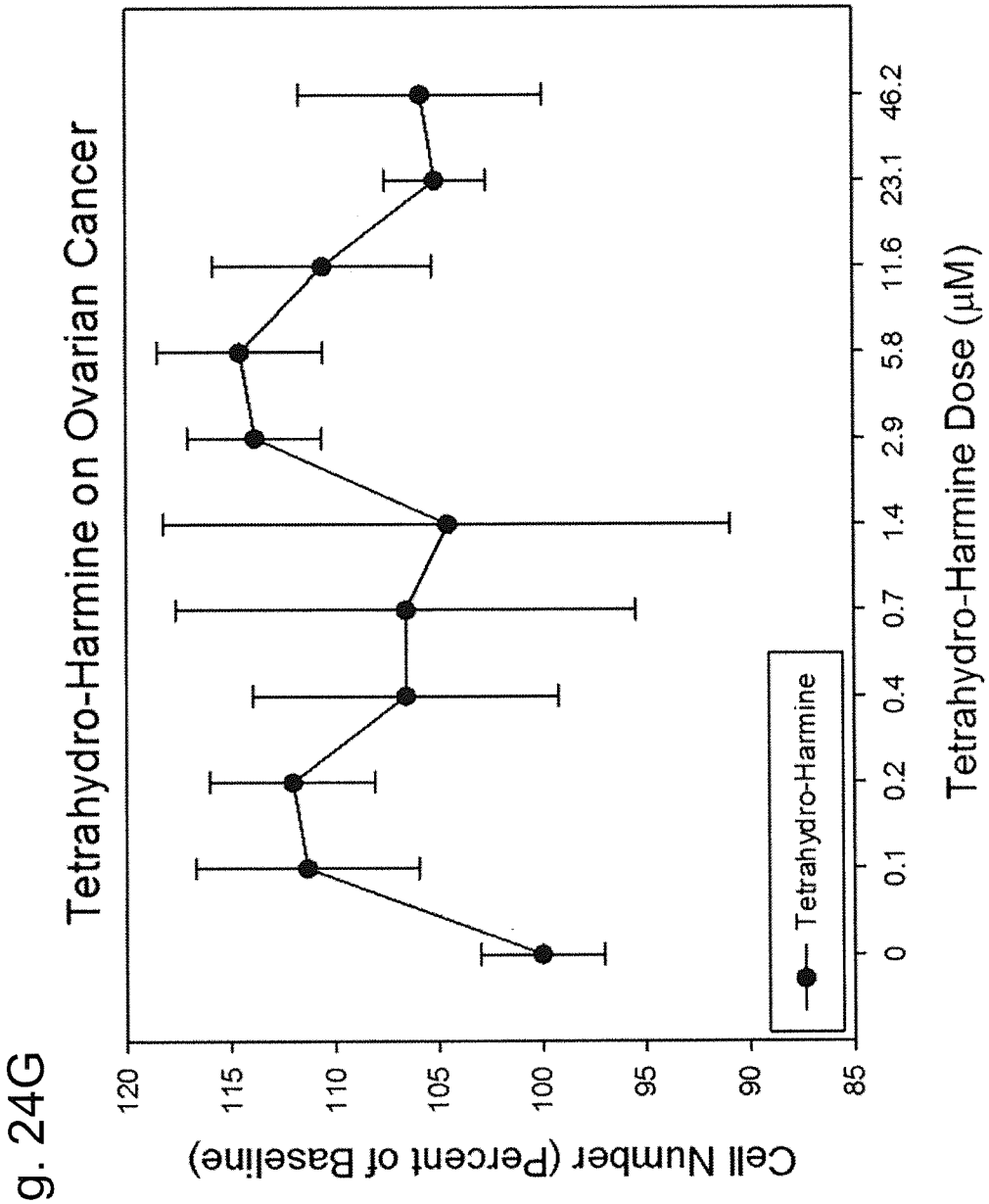

Harmaline on Ovarian Cancer
Cell Number (Percent of Baseline)
106
104
102
100
98
96
94
Harmaline
0
0.03
0.05
0.09
0.18
0.36
0.73
1.46
2.92
5.83
11.67
Harmaline (μM)

Fig. 24F

Fig. 24G


Tetrahydro-Harmine on Ovarian Cancer
Cell Number (Percent of Baseline)
120
115
110
105
100
95
90
85
Tetrahydro-Harmine
0
0.1
0.2
0.4
0.7
1.4
2.9
5.8
11.6
23.1
46.2
Tetrahydro-Harmine Dose (µM)

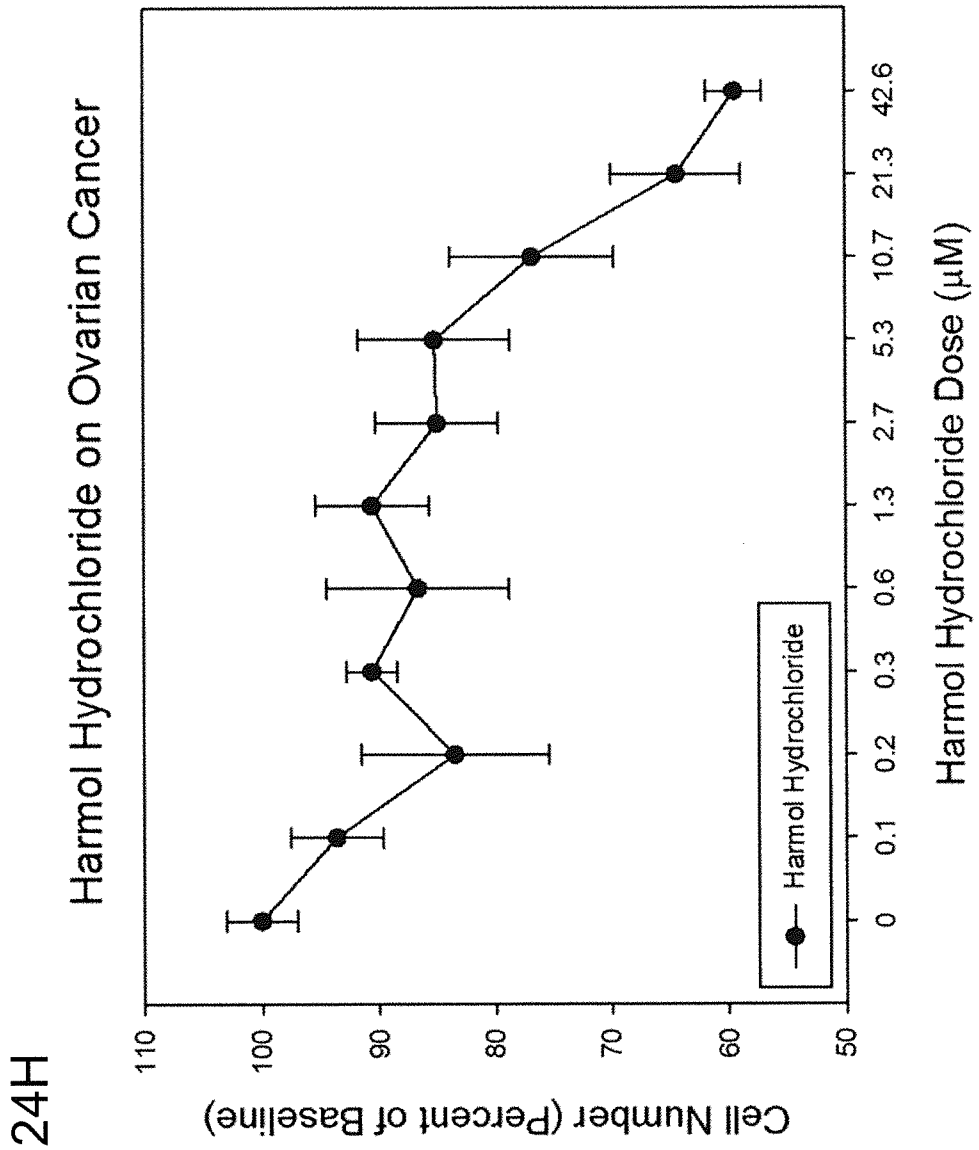

Harmol Hydrochloride on Ovarian Cancer
Cell Number (Percent of Baseline)
110
100
90
80
70
60
50
Harmol Hydrochloride
0
0.1
0.2
0.3
0.6
1.3
2.7
5.3
10.7
21.3
42.6
Harmol Hydrochloride Dose (μM)

Fig. 24H

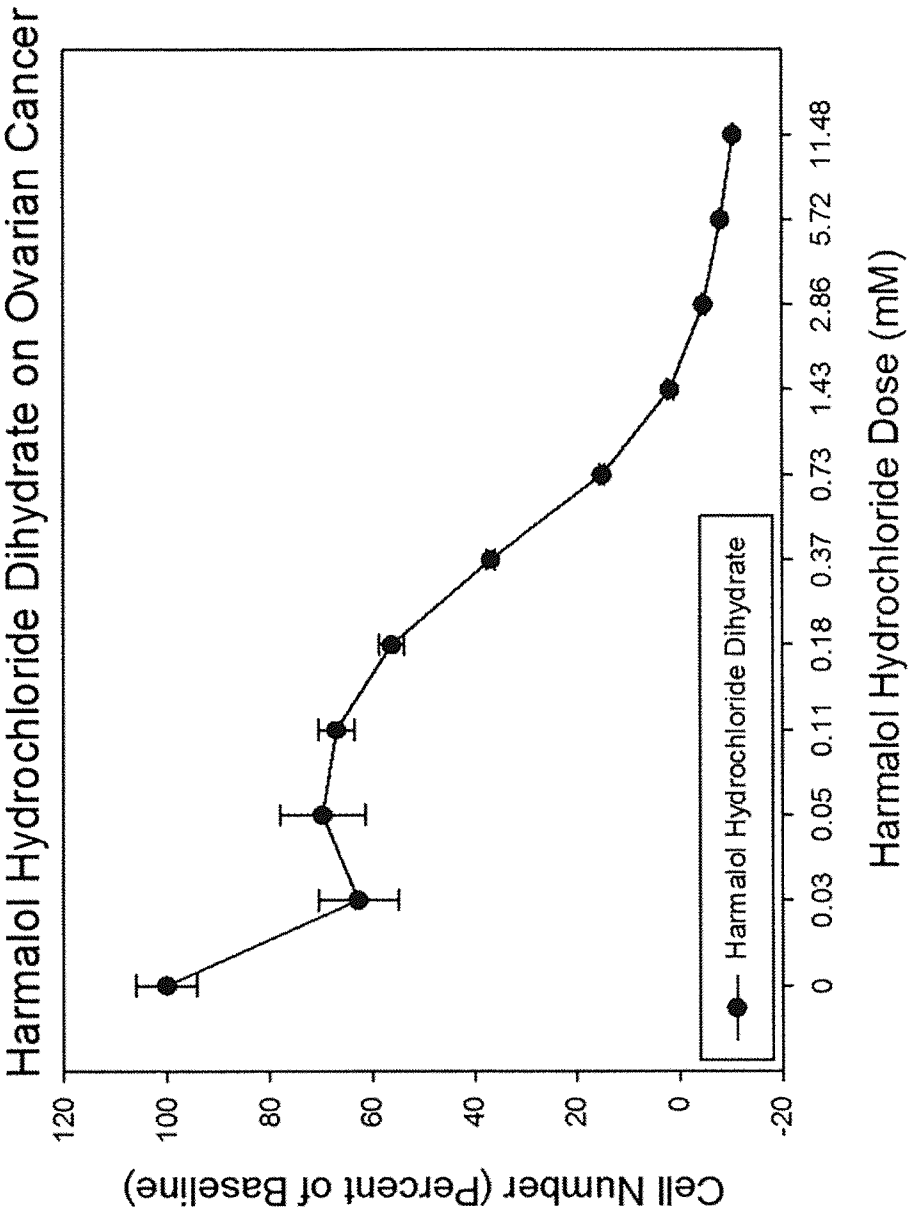

Harmalol Hydrochloride Dihydrate on Ovarian Cancer
Cell Number (Percent of Baseline)
120
100
80
60
40
20
0
-20
0
0.03
0.05
0.11
0.18
0.37
0.73
1.43
2.86
5.72
11.48
Harmalol Hydrochloride Dose (mM)
Harmalol Hydrochloride Dihydrate

Fig. 24I

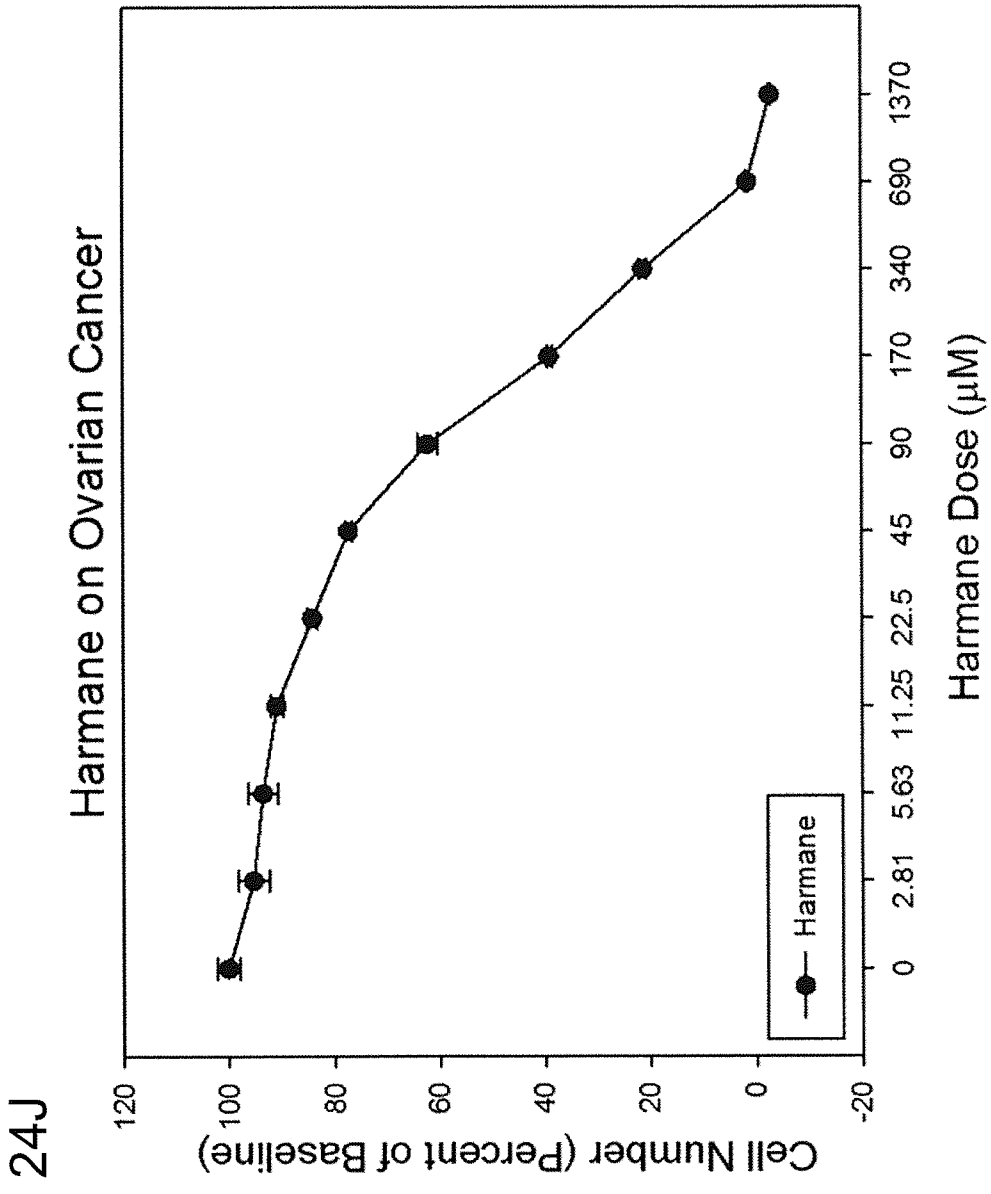

Harmane on Ovarian Cancer
Cell Number (Percent of Baseline)
120
100
80
60
40
20
0
-20
0
2.81
5.63
11.25
22.5
45
90
170
340
690
1370
Harmane Dose (µM)
Harmane

Fig. 24J

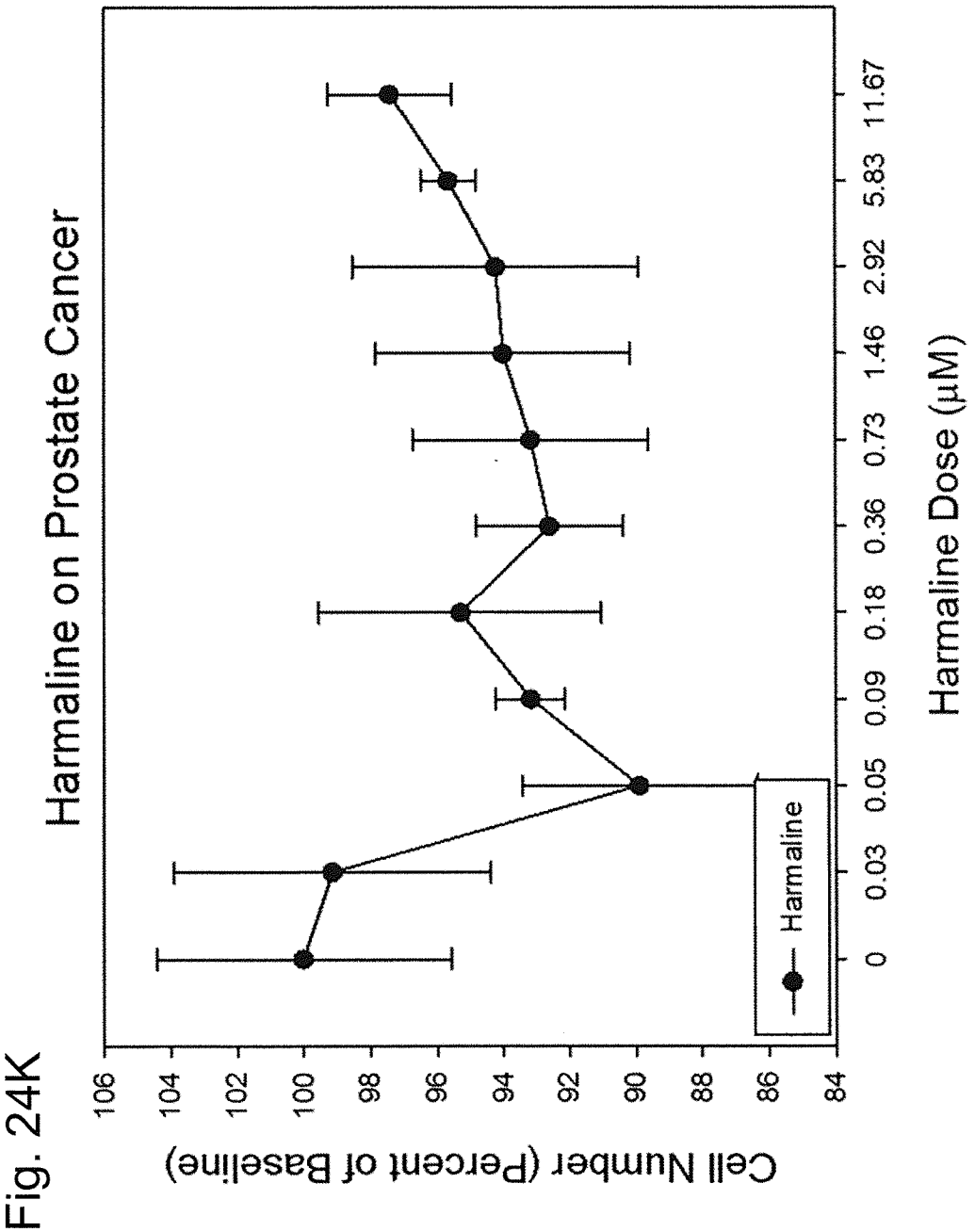

Harmaline on Prostate Cancer
Cell Number (Percent of Baseline)
106
104
102
100
98
96
94
92
90
88
86
84
0
0.03
0.05
0.09
0.18
0.36
0.73
1.46
2.92
5.83
11.67
Harmaline Dose (μM)
Harmaline

Fig. 24K

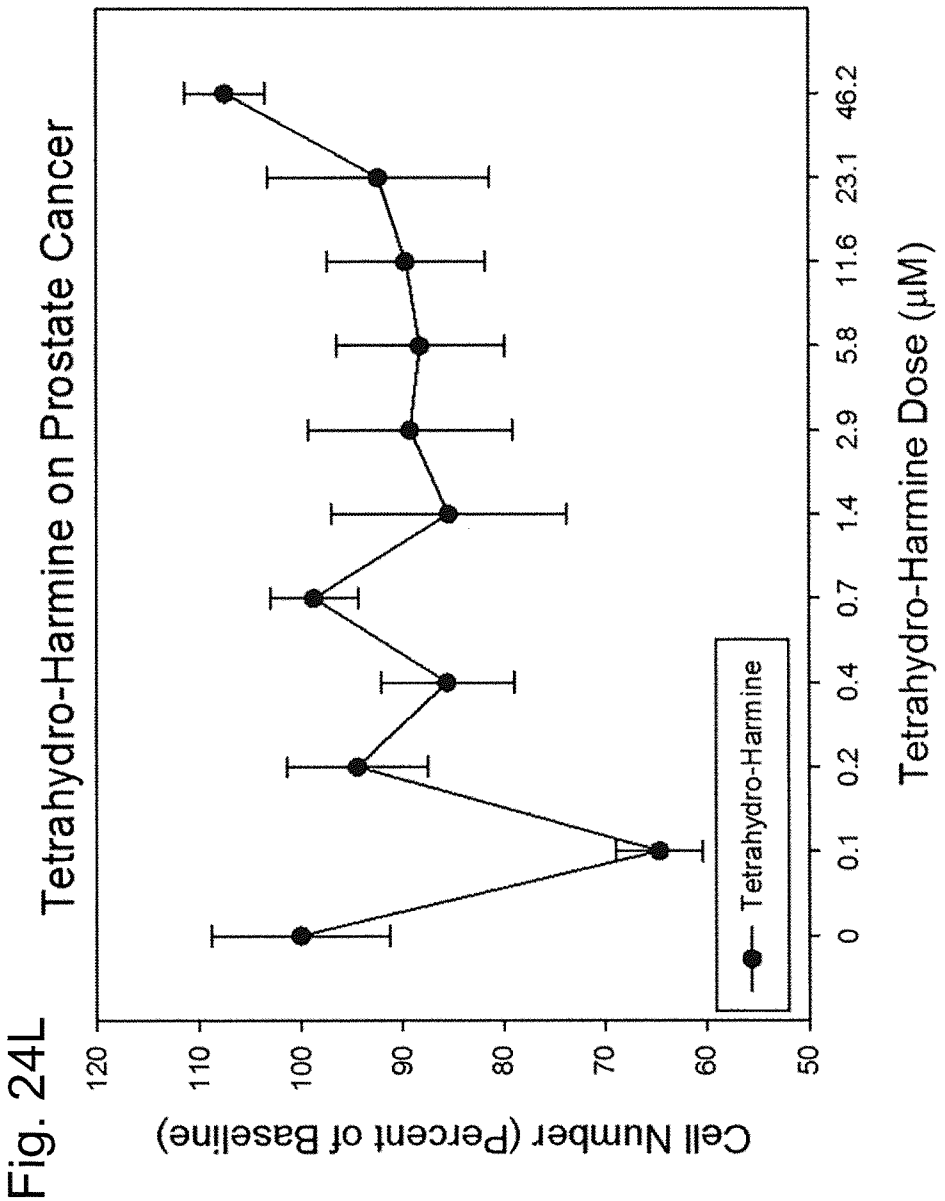
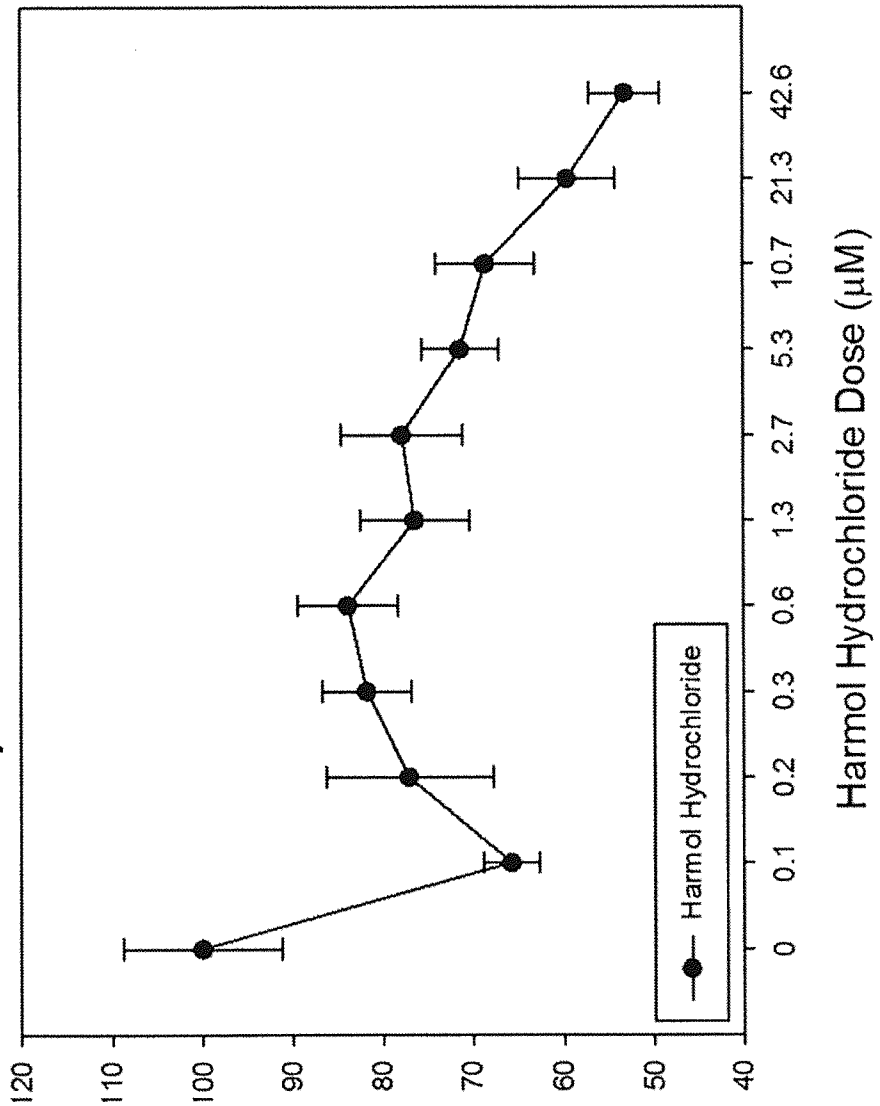

Tetrahydro-Harmine on Prostate Cancer
Cell Number (Percent of Baseline)
120
110
100
90
80
70
60
50
Tetrahydro-Harmine
0
0.1
0.2
0.4
0.7
1.4
2.9
5.8
11.6
23.1
46.2
Tetrahydro-Harmine Dose (μM)

Fig. 24L

Fig. 24M


Harmol Hydrochloride on Prostate Cancer
120
110
100
90
80
70
60
50
40
0
0.1
0.2
0.3
0.6
1.3
2.7
5.3
10.7
21.3
42.6
Harmol Hydrochloride
Harmol Hydrochloride Dose (μM)

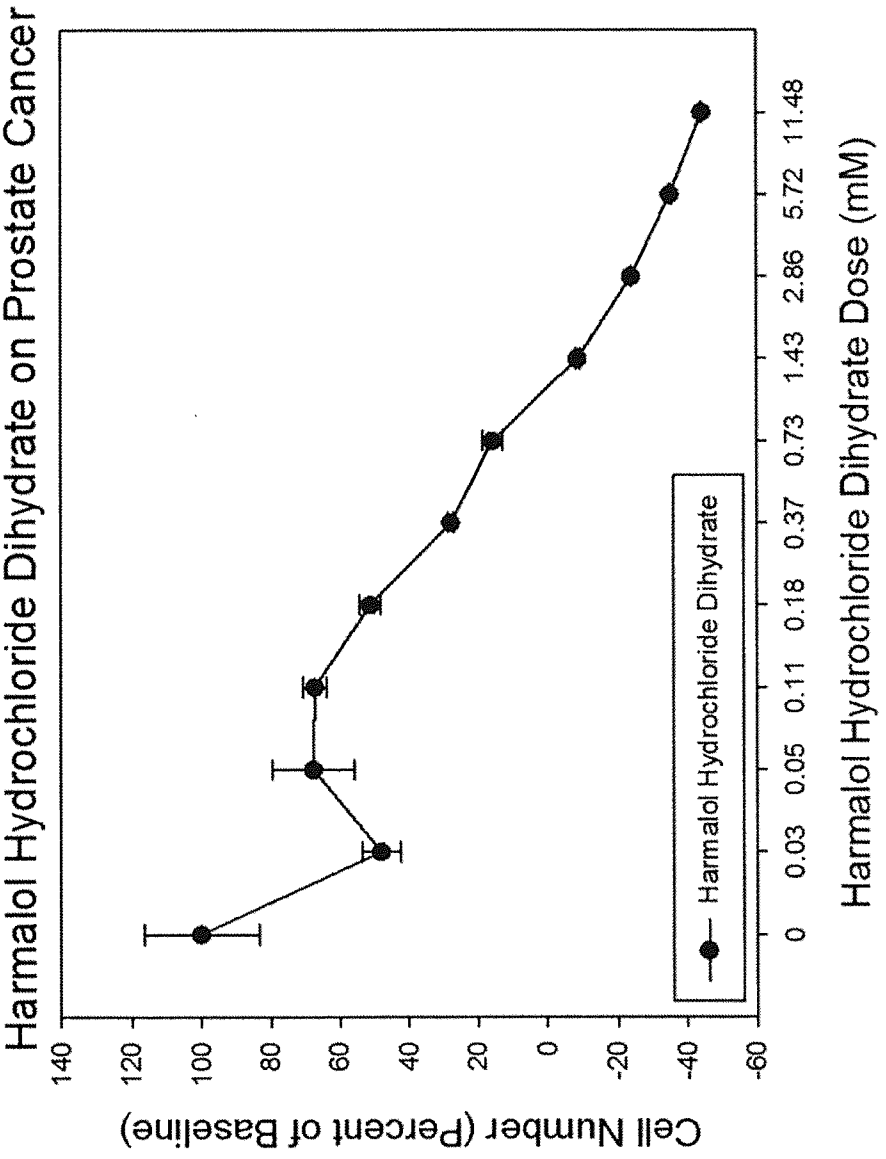

Harmalol Hydrochloride Dihydrate on Prostate Cancer
Cell Number (Percent of Baseline)
140
120
100
80
60
40
20
0
-20
-40
-60
0
0.03
0.05
0.11
0.18
0.37
0.73
1.43
2.86
5.72
11.48
Harmalol Hydrochloride Dihydrate Dose (mM)
Harmalol Hydrochloride Dihydrate

Fig. 24N

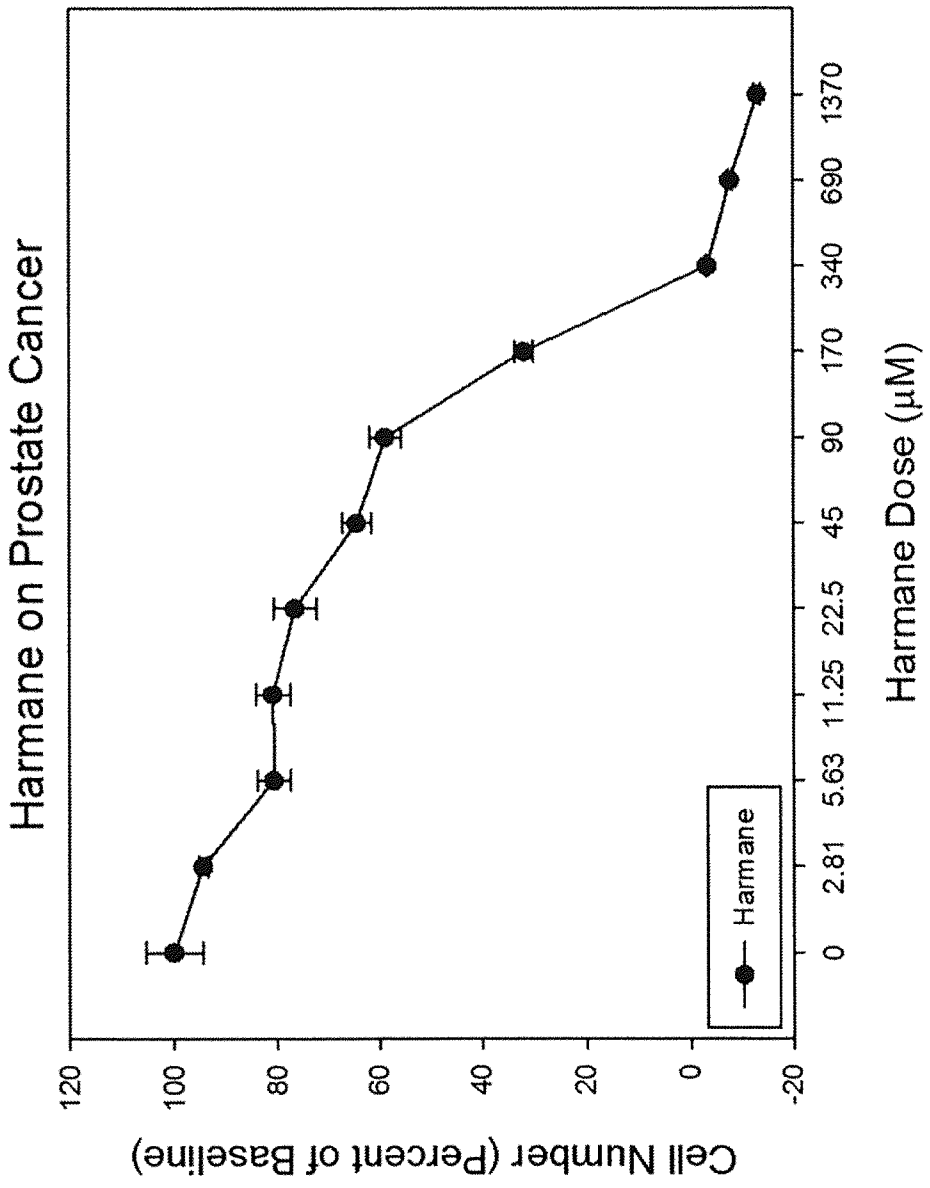

Harmane on Prostate Cancer
Cell Number (Percent of Baseline)
120
100
80
60
40
20
0
-20
0
2.81
5.63
11.25
22.5
45
90
170
340
690
1370
Harmane Dose (µM)
Harmane

Fig. 24O

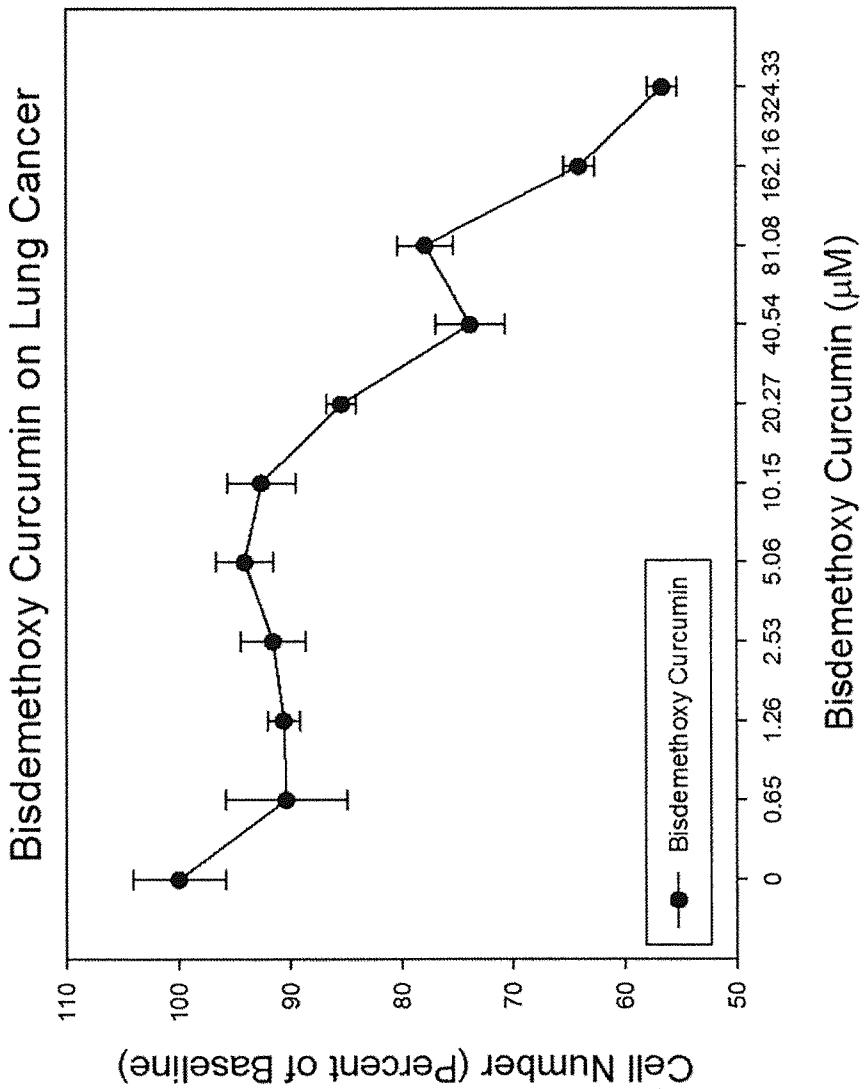

Bisdemethoxy Curcumin on Lung Cancer
Cell Number (Percent of Baseline)
110
100
90
80
70
60
50
Bisdemethoxy Curcumin
0
0.65
1.26
2.53
5.06
10.15
20.27
40.54
81.08
162.16
324.33
Bisdemethoxy Curcumin (µM)

Fig. 25A

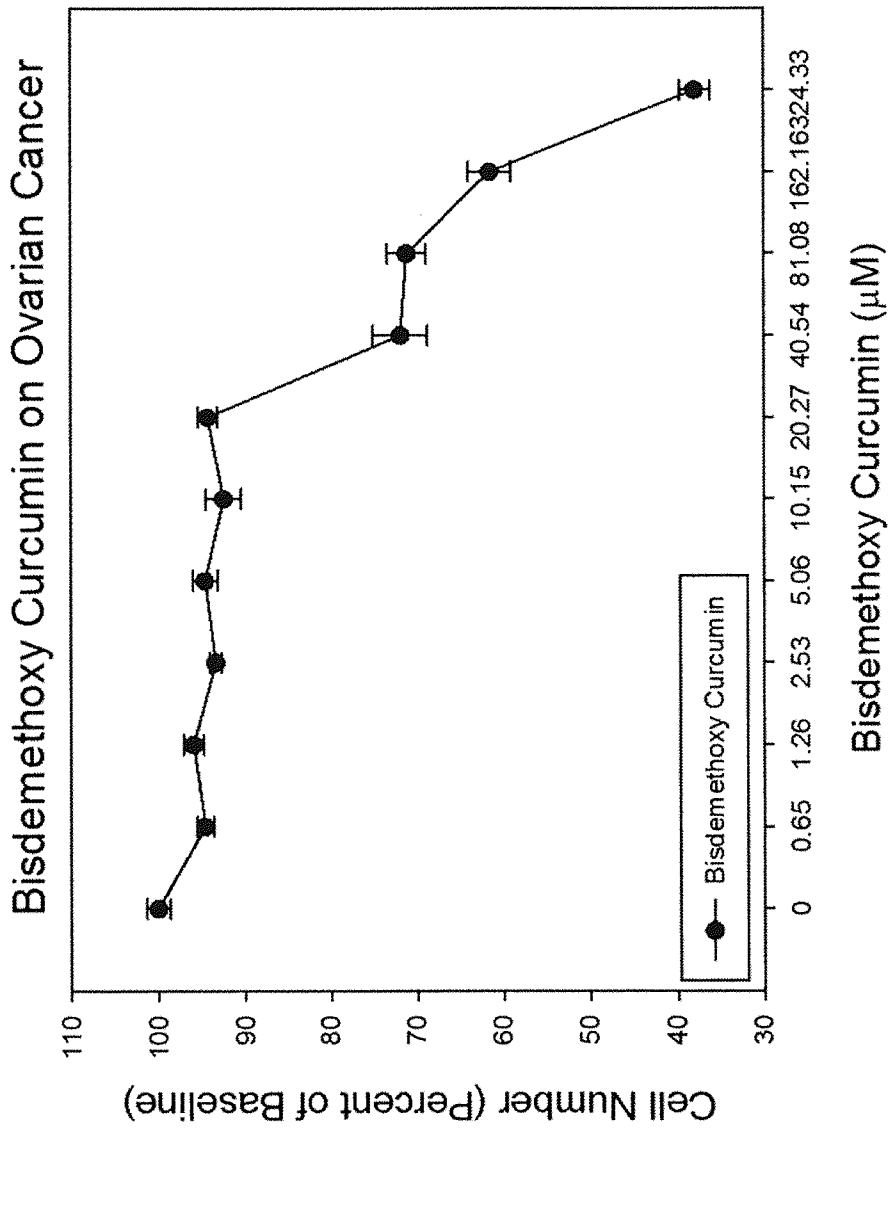

Bisdemethoxy Curcumin on Ovarian Cancer
Cell Number (Percent of Baseline)
110
100
90
80
70
60
50
40
30
Bisdemethoxy Curcumin
0 0.65 1.26 2.53 5.06 10.15 20.27 40.54 81.08 162.16324.33
Bisdemethoxy Curcumin (μM)

Fig. 25B

Fig. 25C

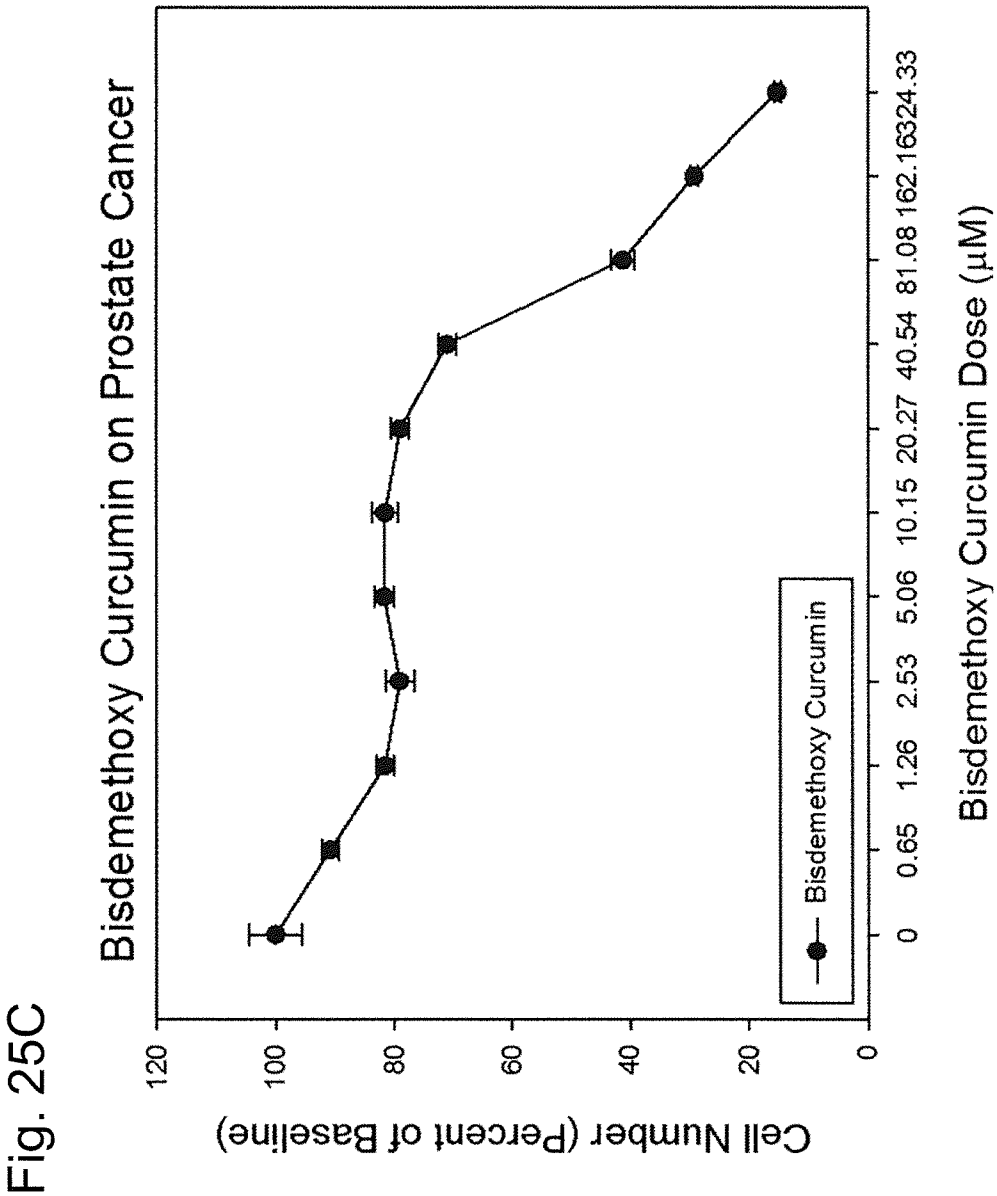
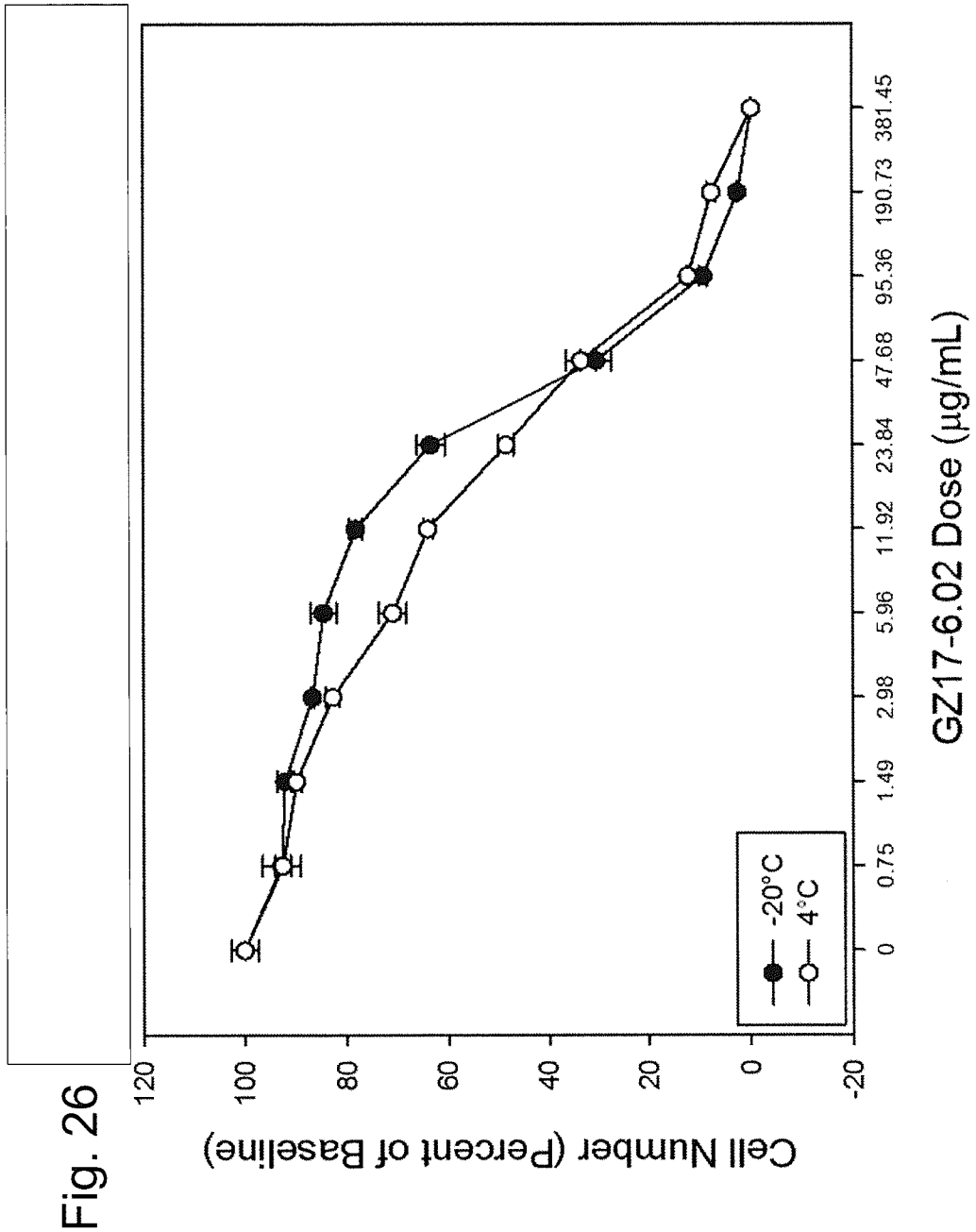

Bisdemethoxy Curcumin on Prostate Cancer
Cell Number (Percent of Baseline)
120
100
80
60
40
20
0
Bisdemethoxy Curcumin
0
0.65
1.26
2.53
5.06
10.15
20.27
40.54
81.08
162.16
324.33
Bisdemethoxy Curcumin Dose (μM)

Fig. 26


Cell Number (Percent of Baseline)
120
100
80
60
40
20
0
-20
0
0.75
1.49
2.98
5.96
11.92
23.84
47.68
95.36
190.73
381.45
GZ17-6.02 Dose (µg/mL)
-20°C
4°C

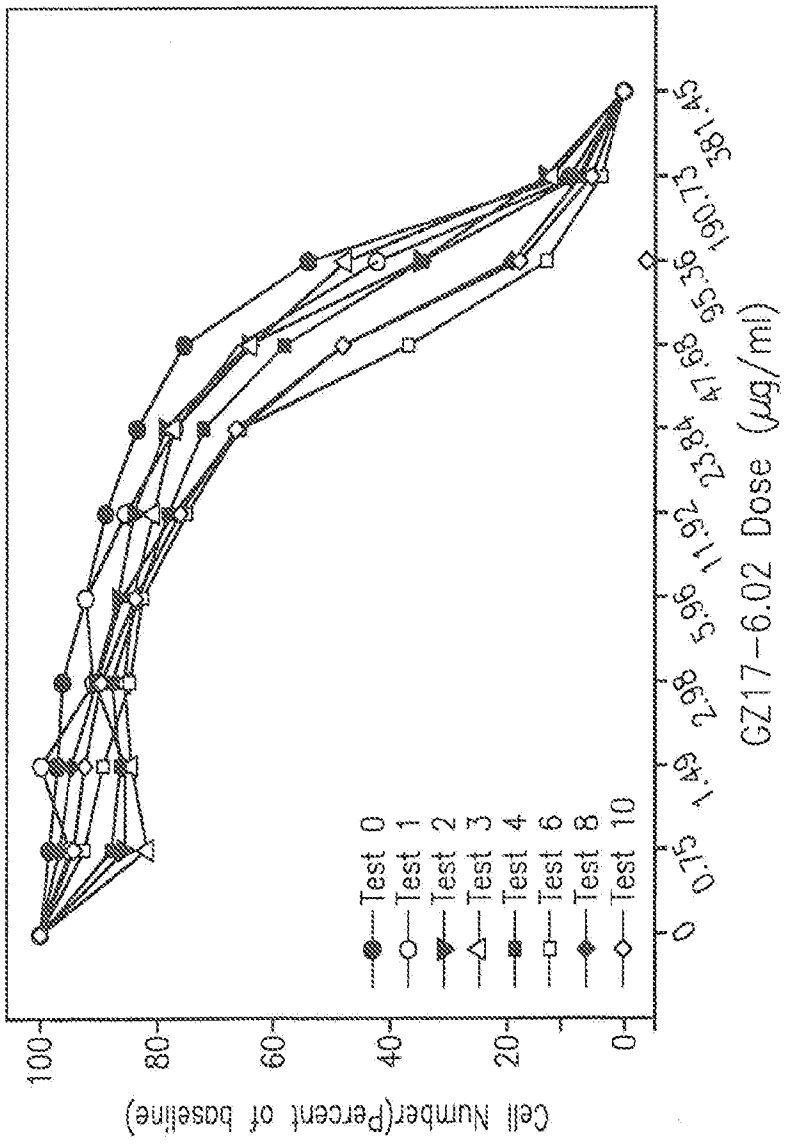

Cell Number(Percent of baseline)
100
80
60
40
20
0
Test 0
Test 1
Test 2
Test 3
Test 4
Test 6
Test 8
Test 10
0
0.75
1.49
2.98
5.96
11.92
23.84
47.68
95.36
190.73
381.45
GZ17-6.02 Dose (μg/ml)

Fig. 27

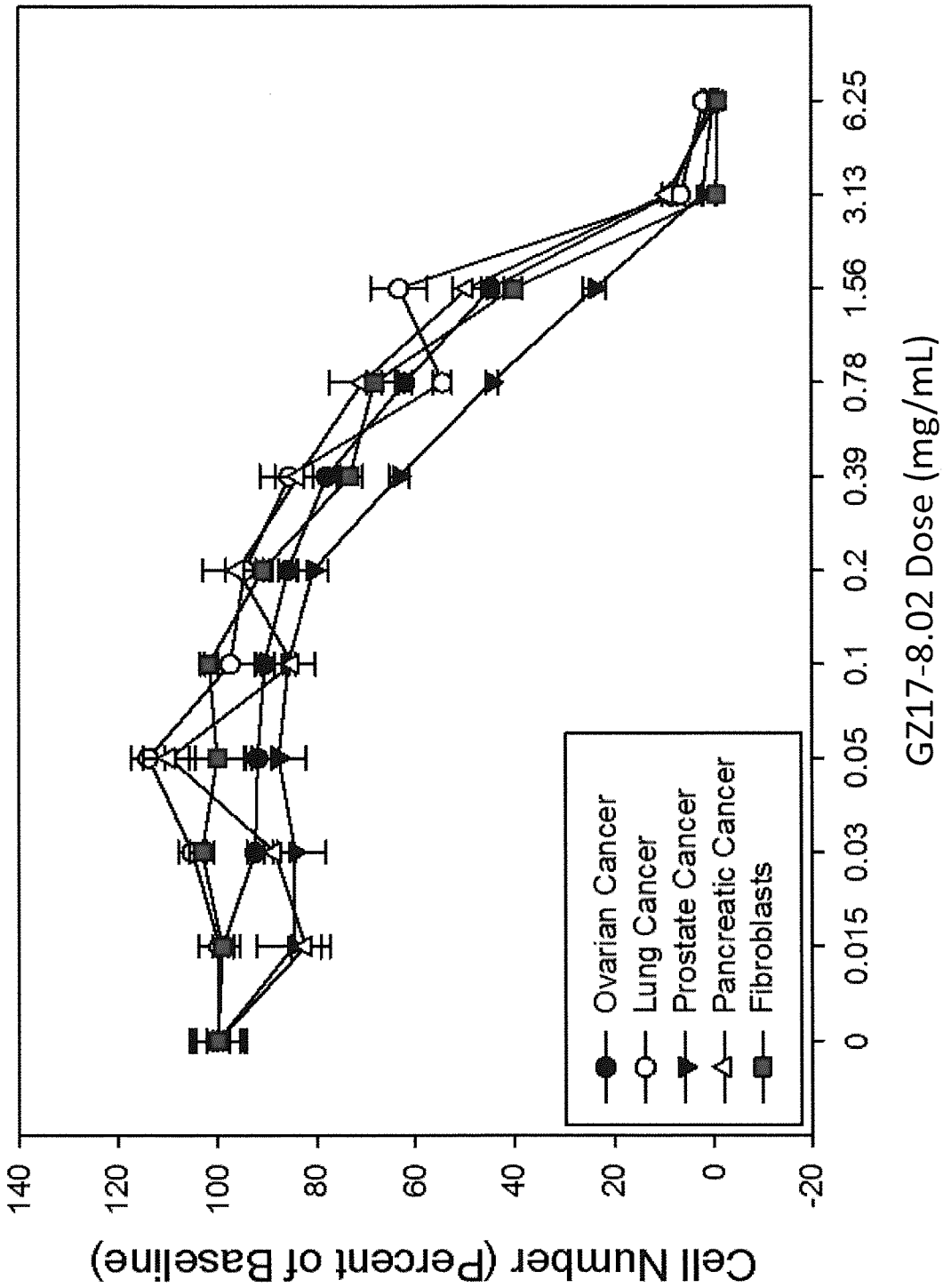

GZ17-8.02
Cell Number (Percent of Baseline)
140
120
100
80
60
40
20
0
-20
0
0.015
0.03
0.05
0.1
0.2
0.39
0.78
1.56
3.13
6.25
GZ17-8.02 Dose (mg/mL)
Ovarian Cancer
Lung Cancer
Prostate Cancer
Pancreatic Cancer
Fibroblasts

Figure 28A

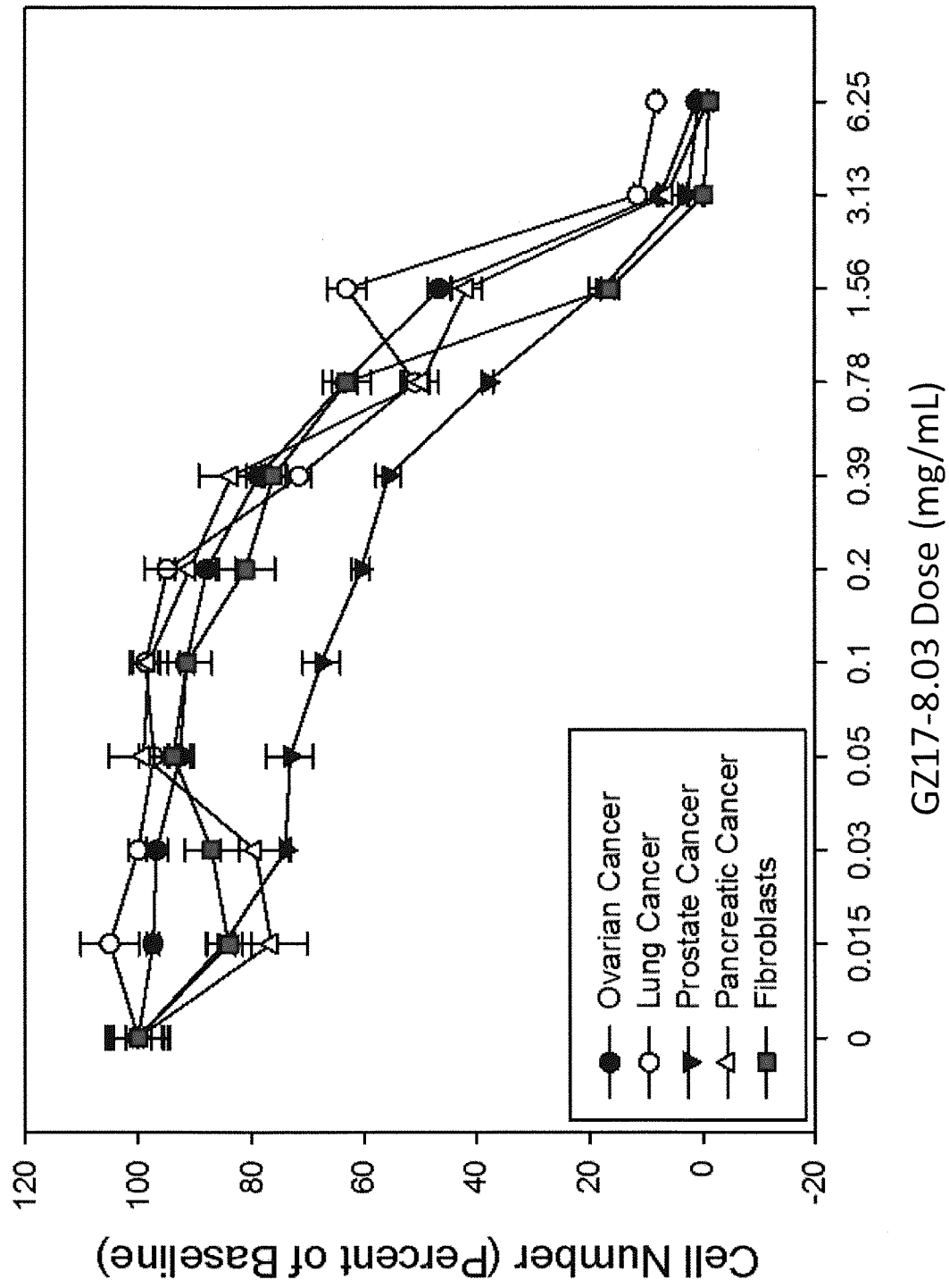

GZ17-8.03
Cell Number (Percent of Baseline)
120
100
80
60
40
20
0
-20
0
0.015
0.03
0.05
0.1
0.2
0.39
0.78
1.56
3.13
6.25
GZ17-8.03 Dose (mg/mL)
Ovarian Cancer
Lung Cancer
Prostate Cancer
Pancreatic Cancer
Fibroblasts

Figure 28B

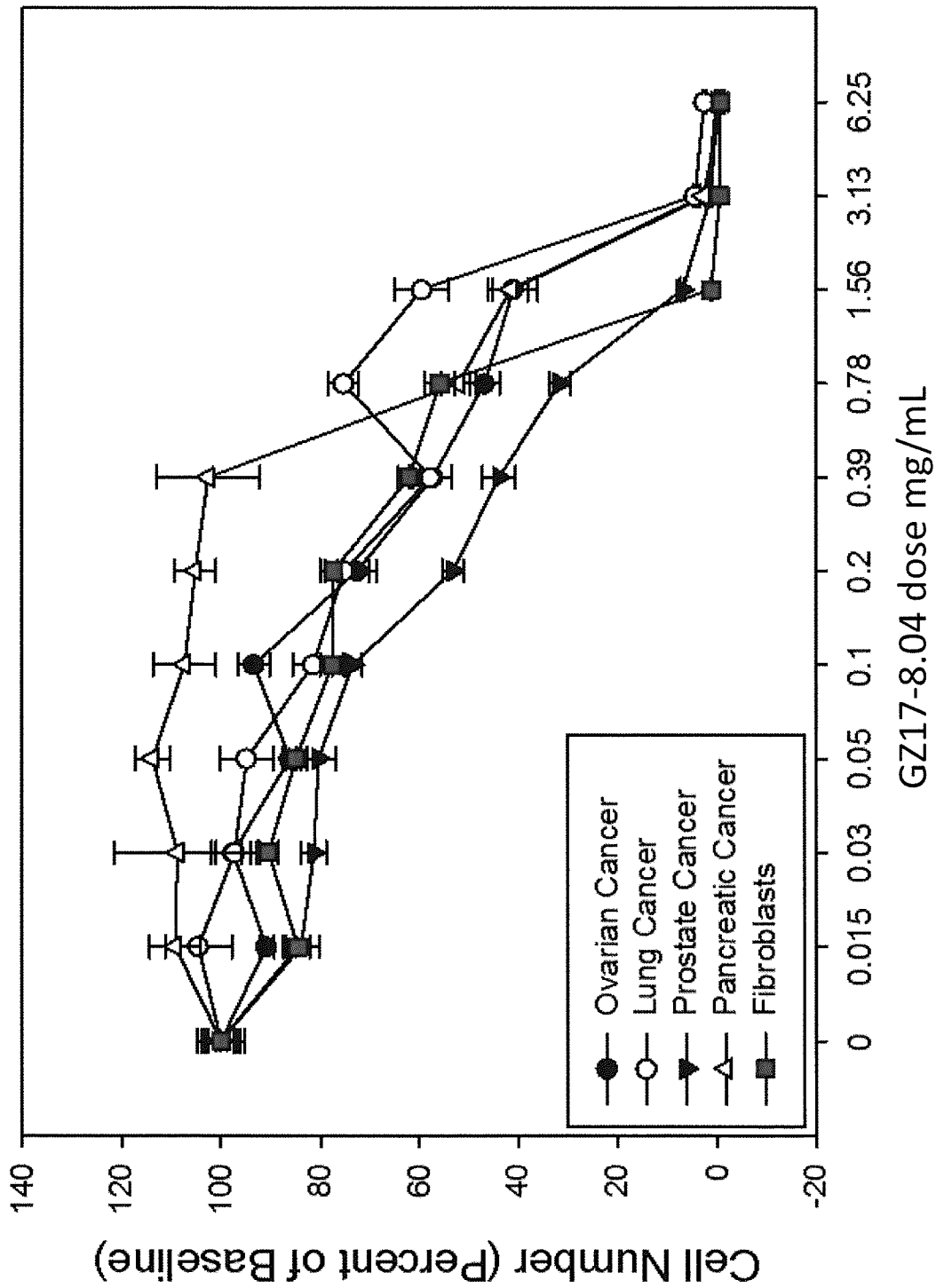

GZ17-8.04
Cell Number (Percent of Baseline)
140
120
100
80
60
40
20
0
-20
0
0.015
0.03
0.05
0.1
0.2
0.39
0.78
1.56
3.13
6.25
GZ17-8.04 dose mg/mL
Ovarian Cancer
Lung Cancer
Prostate Cancer
Pancreatic Cancer
Fibroblasts

Figure 28C

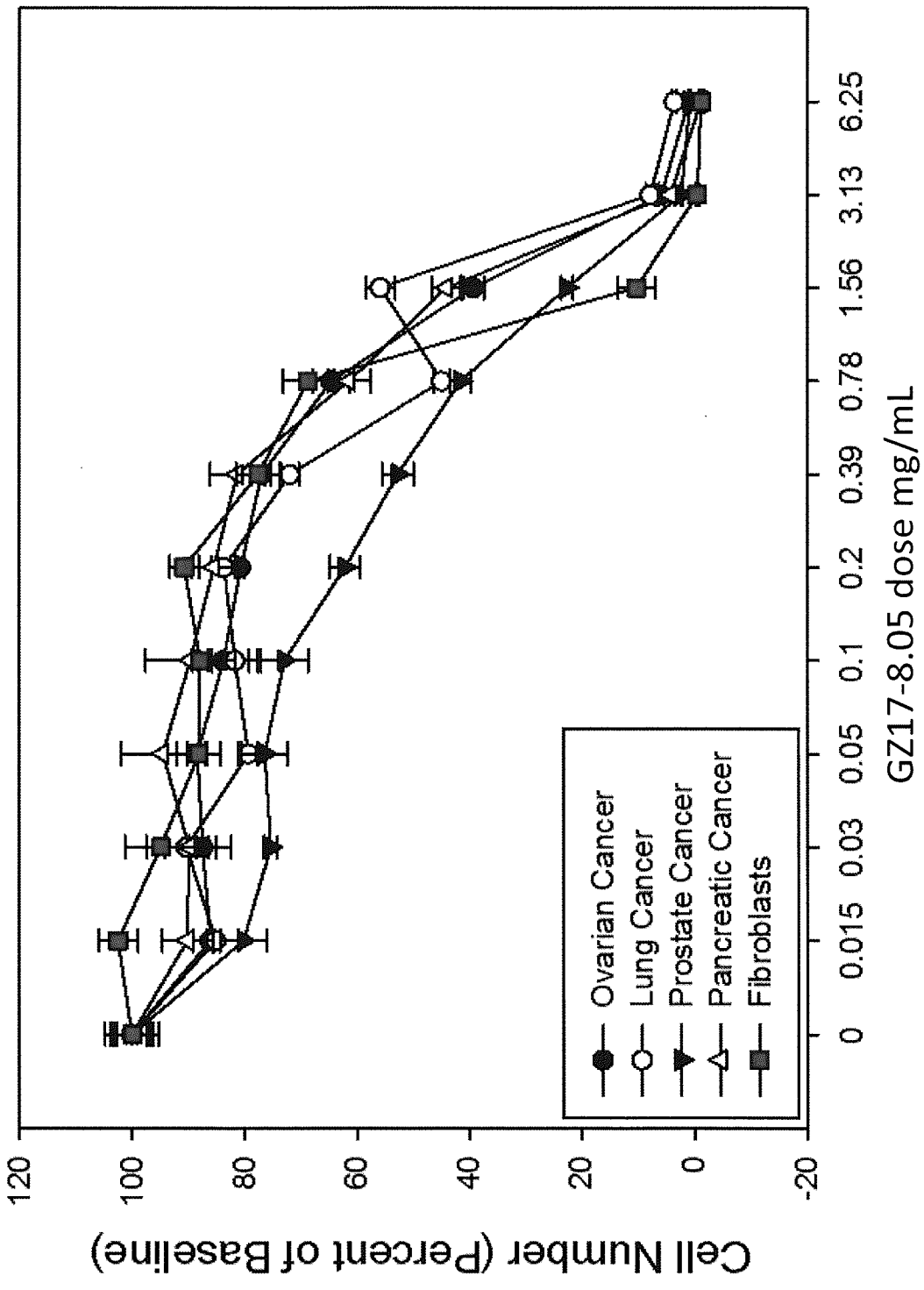

GZ17-8.05
Cell Number (Percent of Baseline)
120
100
80
60
40
20
0
-20
0
0.015
0.03
0.05
0.1
0.2
0.39
0.78
1.56
3.13
6.25
GZ17-8.05 dose mg/mL
Ovarian Cancer
Lung Cancer
Prostate Cancer
Pancreatic Cancer
Fibroblasts

Figure 28D

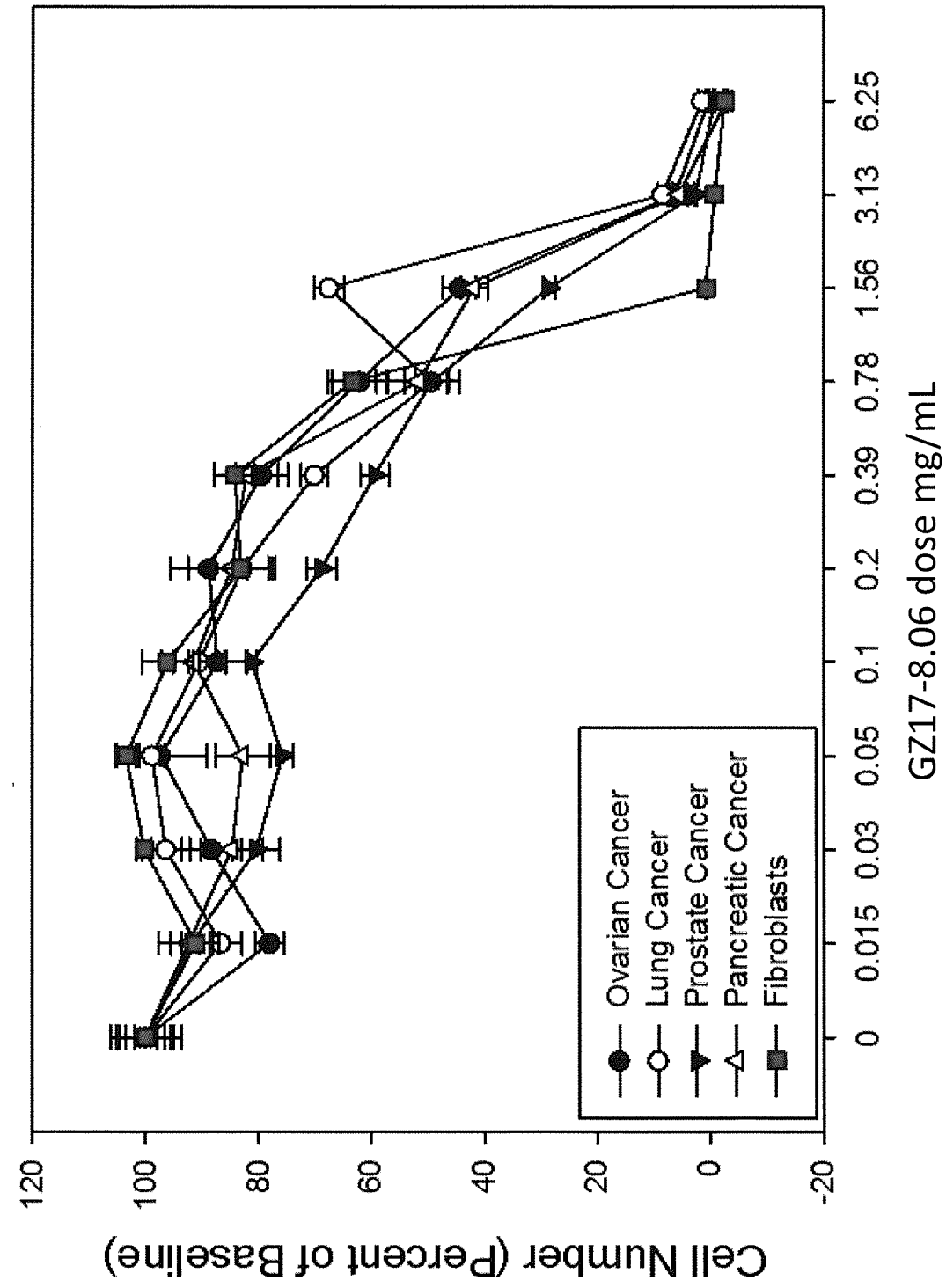

GZ17-8.06
Cell Number (Percent of Baseline)
120
100
80
60
40
20
0
-20
0
0.015
0.03
0.05
0.1
0.2
0.39
0.78
1.56
3.13
6.25
GZ17-8.06 dose mg/mL
Ovarian Cancer
Lung Cancer
Prostate Cancer
Pancreatic Cancer
Fibroblasts

Figure 28E

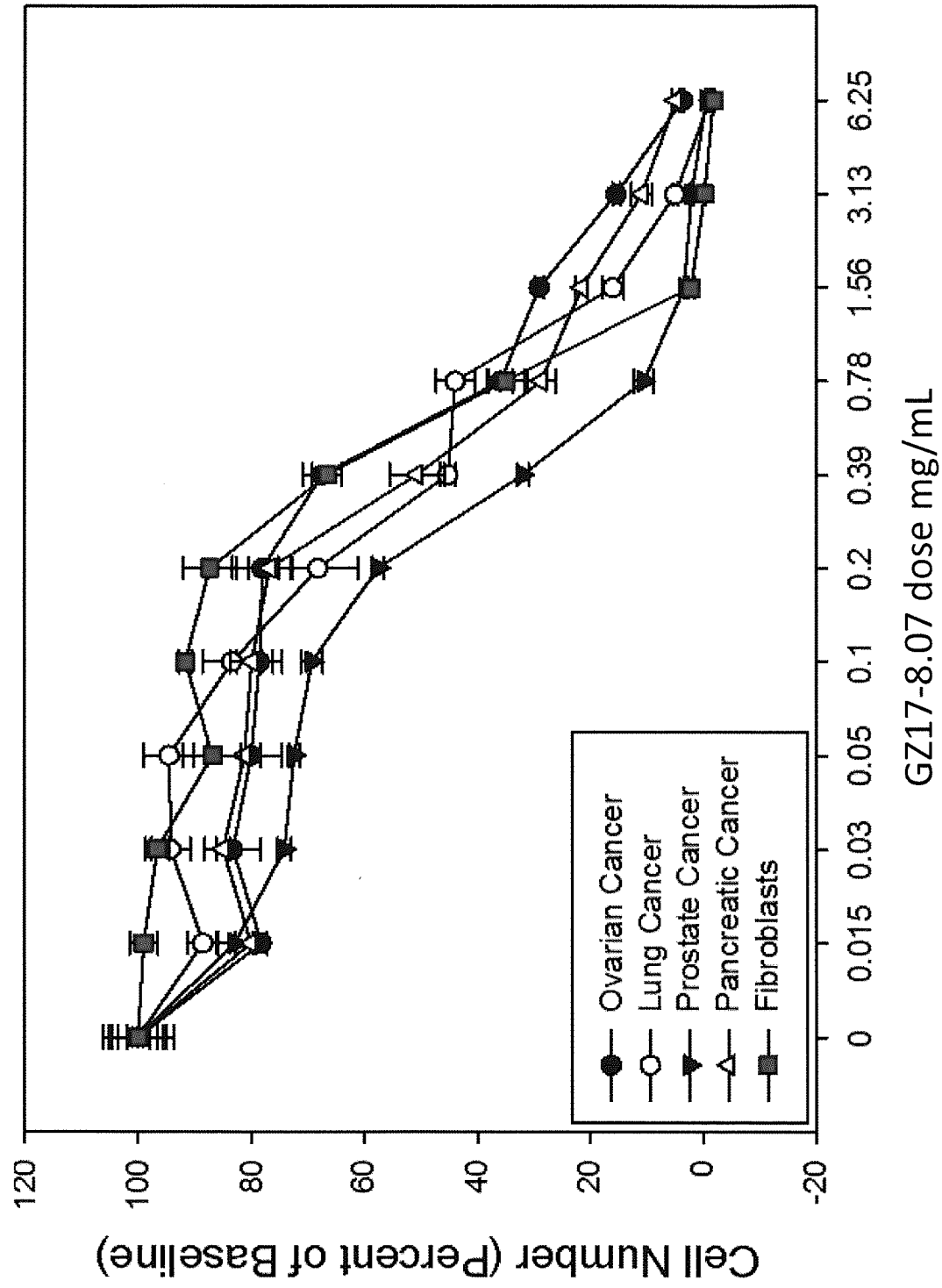

GZ17-8.07
Cell Number (Percent of Baseline)
120
100
80
60
40
20
0
-20
0
0.015
0.03
0.05
0.1
0.2
0.39
0.78
1.56
3.13
6.25
GZ17-8.07 dose mg/mL
Ovarian Cancer
Lung Cancer
Prostate Cancer
Pancreatic Cancer
Fibroblasts

Figure 28F

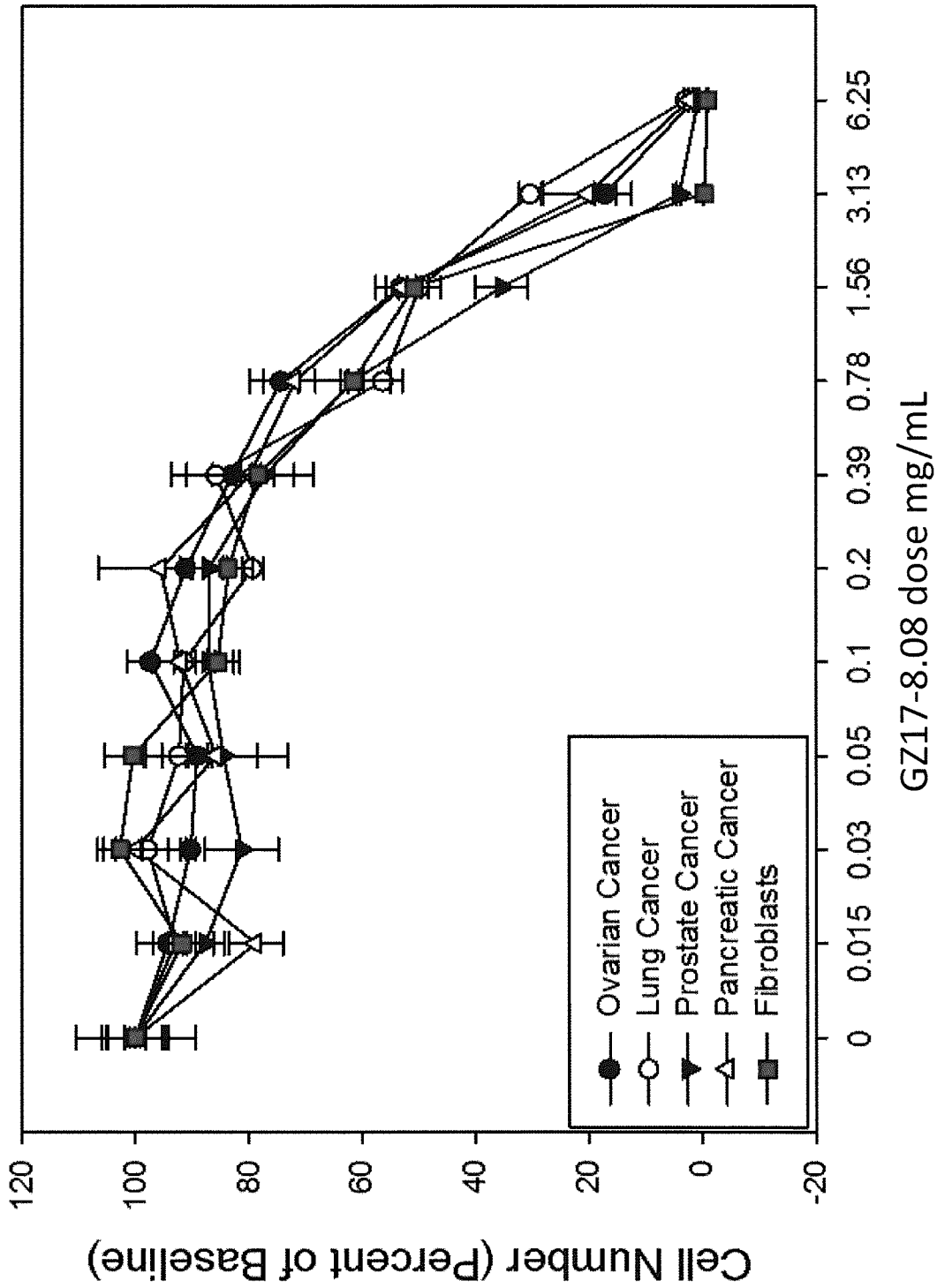

GZ17-8.08
Cell Number (Percent of Baseline)
120
100
80
60
40
20
0
-20
0
0.015
0.03
0.05
0.1
0.2
0.39
0.78
1.56
3.13
6.25
GZ17-8.08 dose mg/mL
Ovarian Cancer
Lung Cancer
Prostate Cancer
Pancreatic Cancer
Fibroblasts

Figure 28G

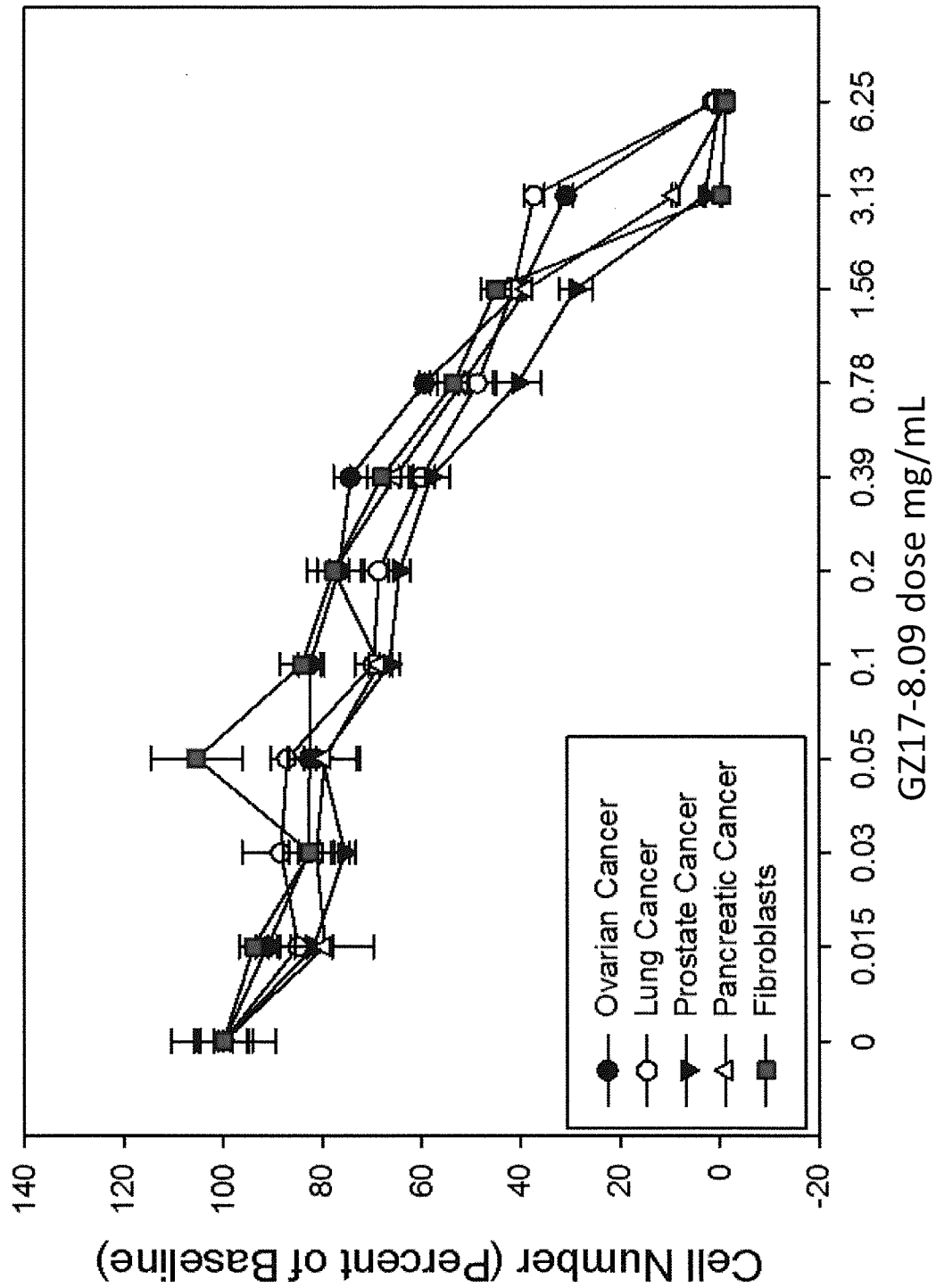

GZ17-8.09
Cell Number (Percent of Baseline)
140
120
100
80
60
40
20
0
-20
0
0.015
0.03
0.05
0.1
0.2
0.39
0.78
1.56
3.13
6.25
GZ17-8.09 dose mg/mL
Ovarian Cancer
Lung Cancer
Prostate Cancer
Pancreatic Cancer
Fibroblasts

Figure 28H

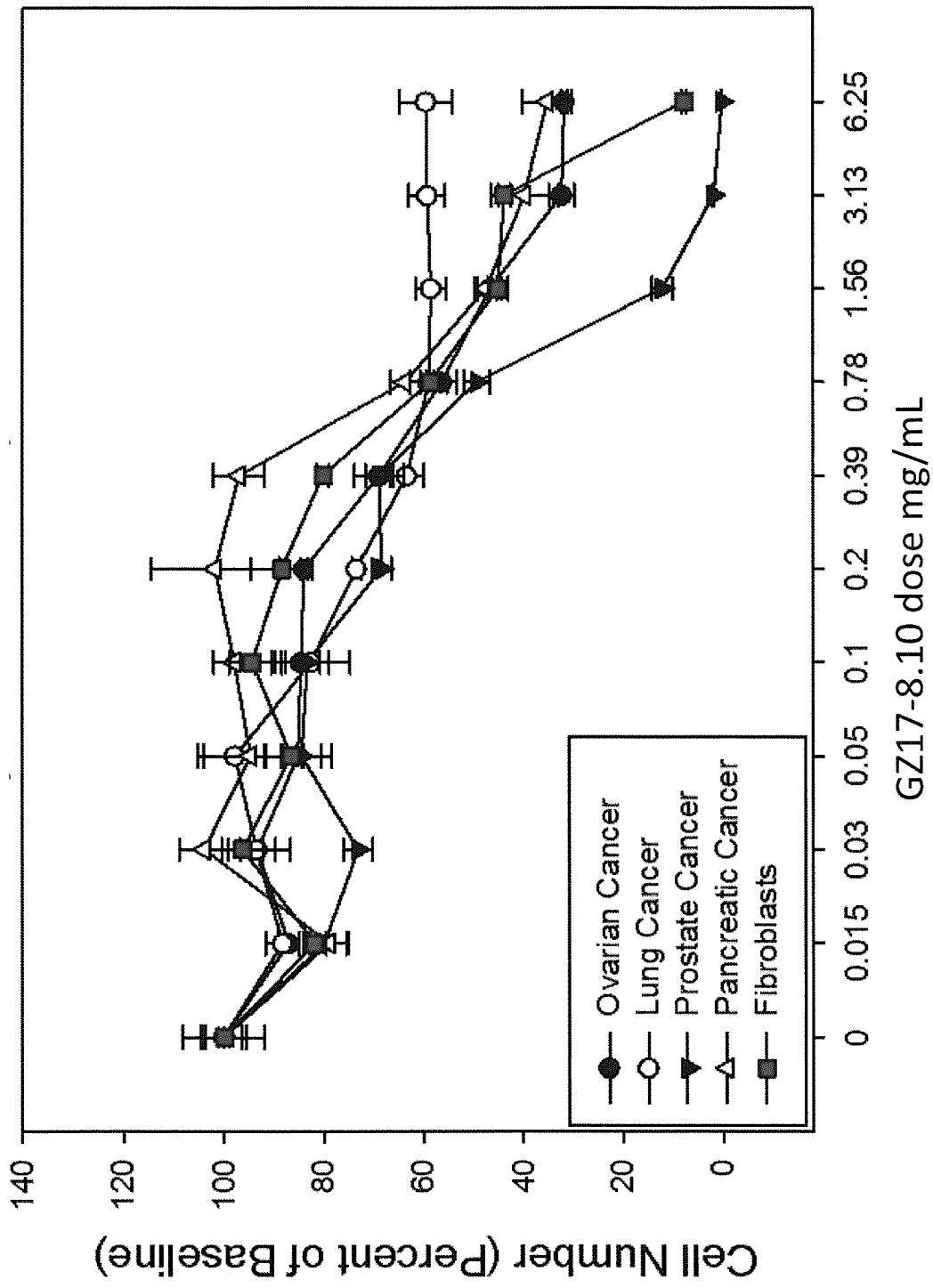

GZ17-8.10
Cell Number (Percent of Baseline)
140
120
100
80
60
40
20
0
0
0.015
0.03
0.05
0.1
0.2
0.39
0.78
1.56
3.13
6.25
GZ17-8.10 dose mg/mL
Ovarian Cancer
Lung Cancer
Prostate Cancer
Pancreatic Cancer
Fibroblasts

Figure 28I

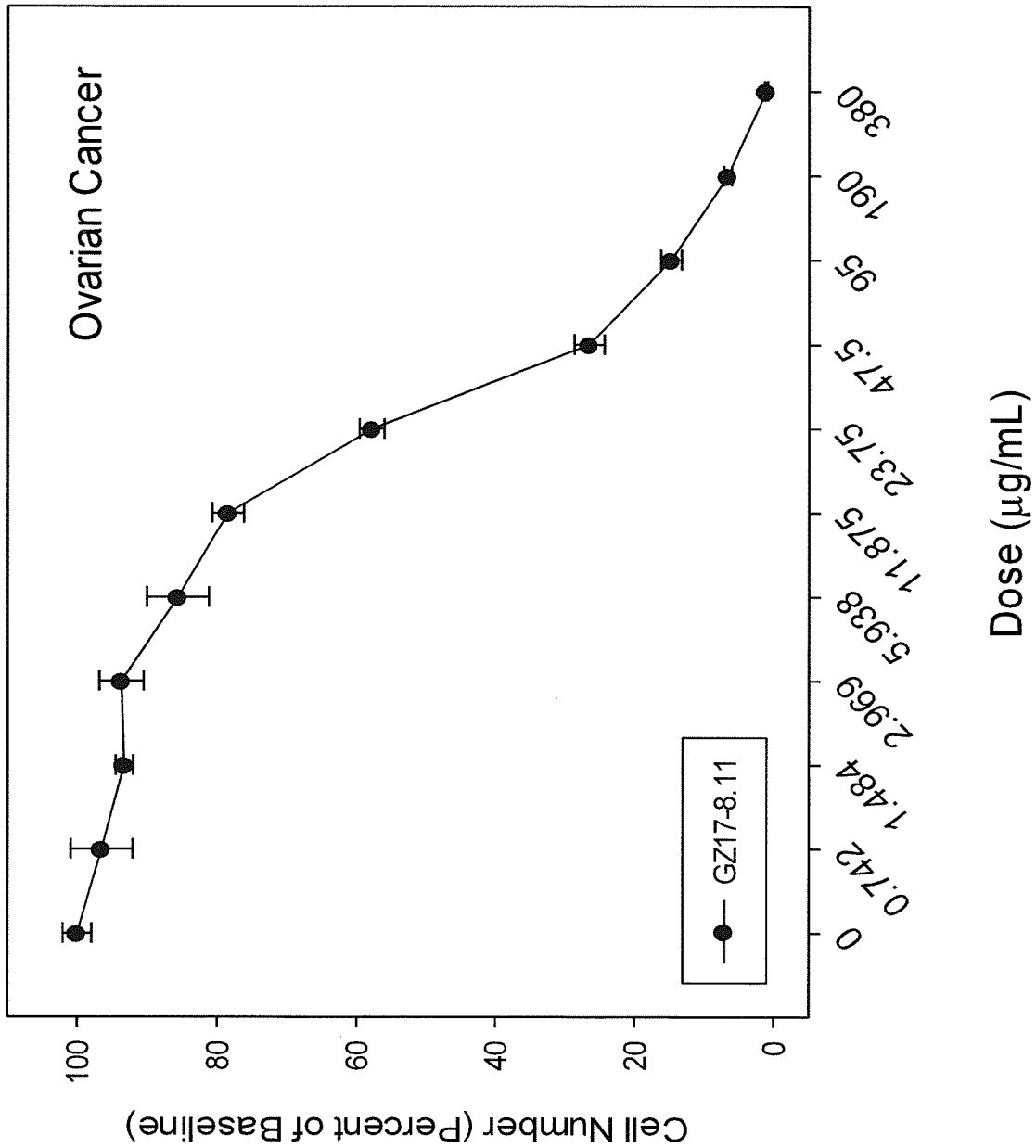

Ovarian Cancer
Cell Number (Percent of Baseline)
0
20
40
60
80
100
GZ17-8.11
0
0.742
1.484
2.969
5.938
11.875
23.75
47.5
95
190
380
Dose (µg/mL)

Fig. 29A

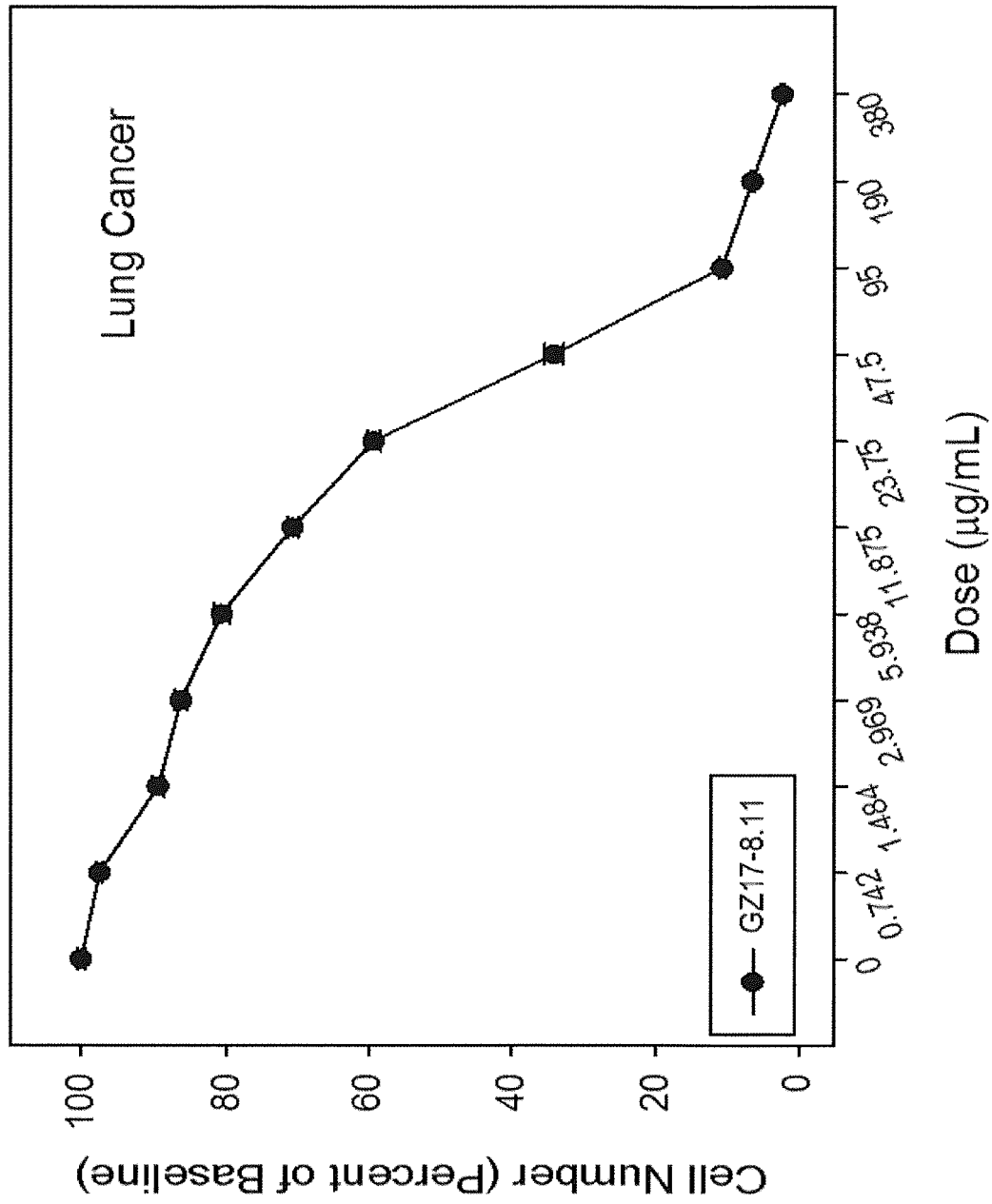

Lung Cancer
Cell Number (Percent of Baseline)
0
20
40
60
80
100
GZ17-8.11
0
0.742
1.484
2.969
5.938
11.875
23.75
47.5
95
190
380
Dose (µg/mL)

Fig. 29B

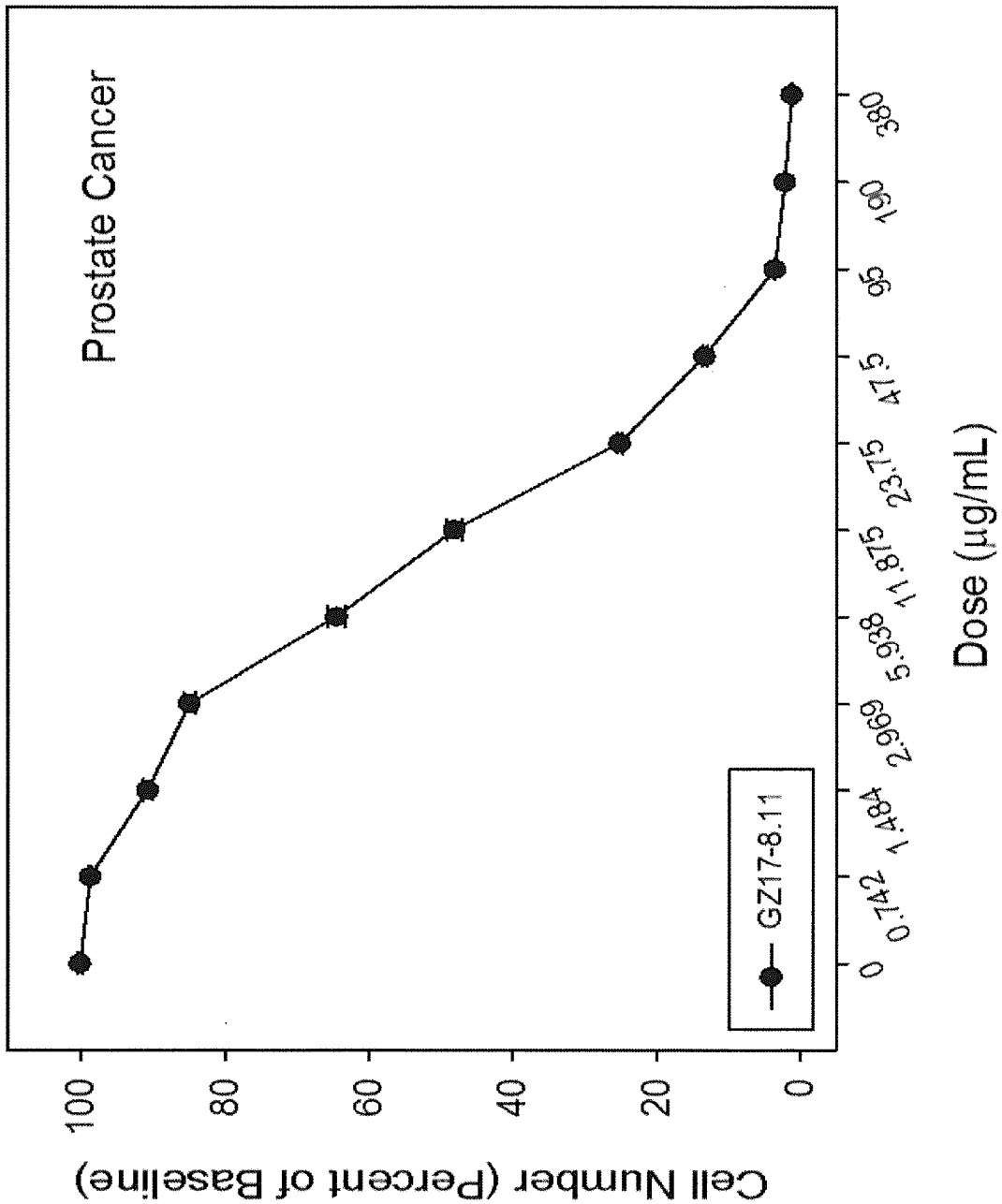

Prostate Cancer
Cell Number (Percent of Baseline)
0
20
40
60
80
100
GZ17-8.11
0
0.742
1.484
2.969
5.938
11.875
23.75
47.5
95
190
380
Dose (µg/mL)

Fig. 29C

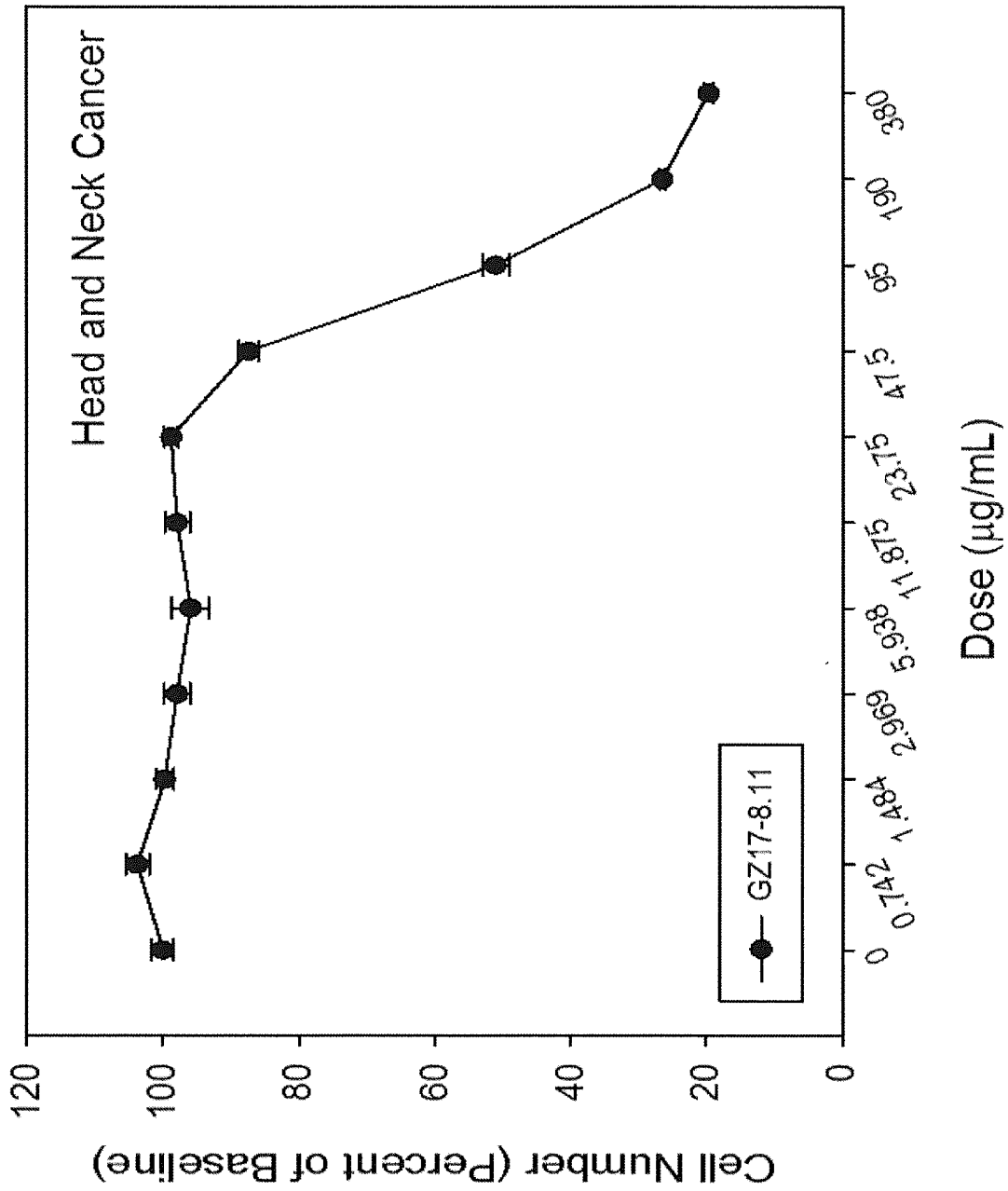

Head and Neck Cancer
Cell Number (Percent of Baseline)
120
100
80
60
40
20
0
GZ17-8.11
0
0.742
1.484
2.969
5.938
11.875
23.75
47.5
95
190
380
Dose (µg/mL)

Fig. 29D

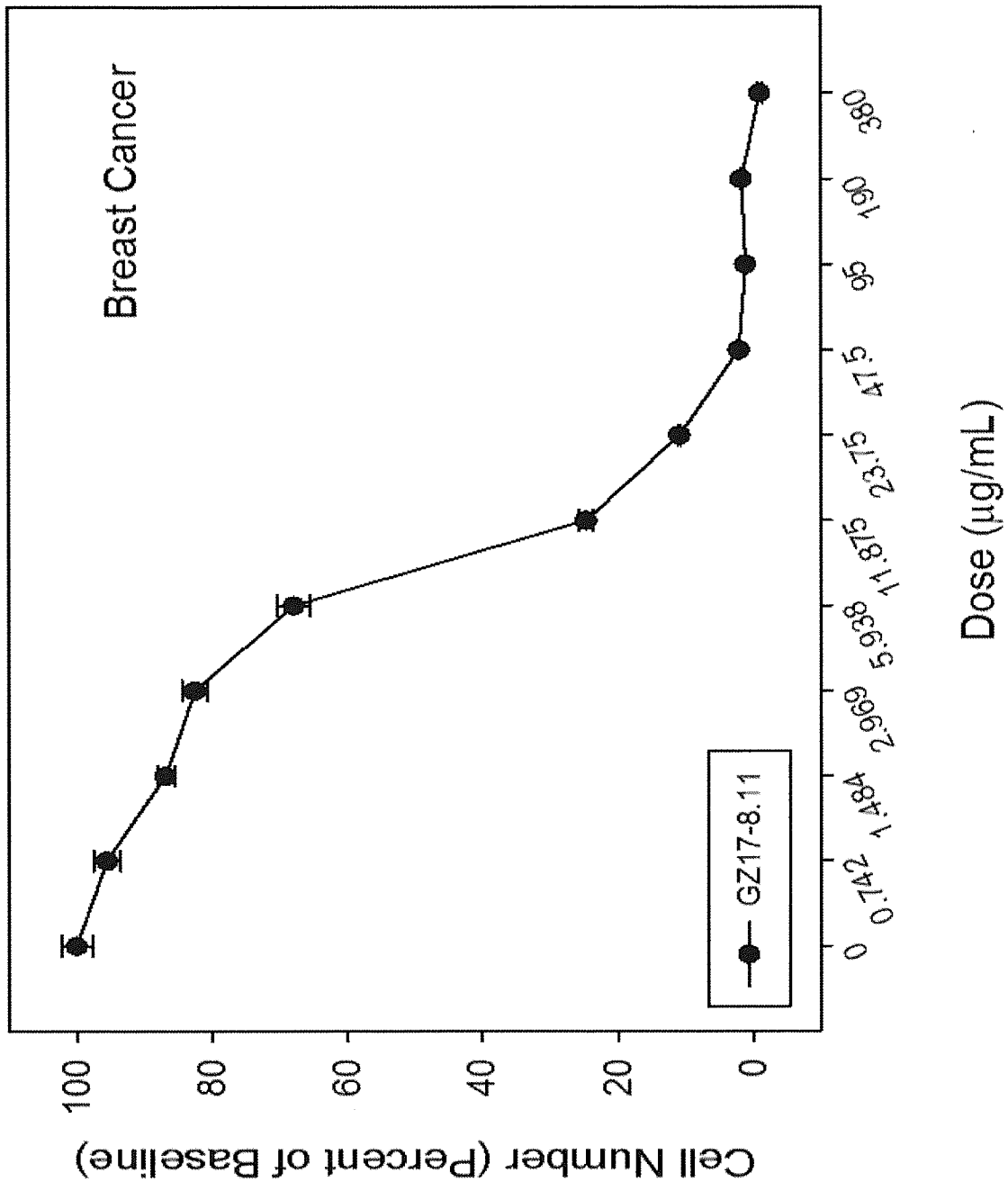

Breast Cancer
Cell Number (Percent of Baseline)
0
20
40
60
80
100
GZ17-8.11
0
0.742
1.484
2.969
5.938
11.875
23.75
47.5
95
190
380
Dose (µg/mL)

Fig. 29E

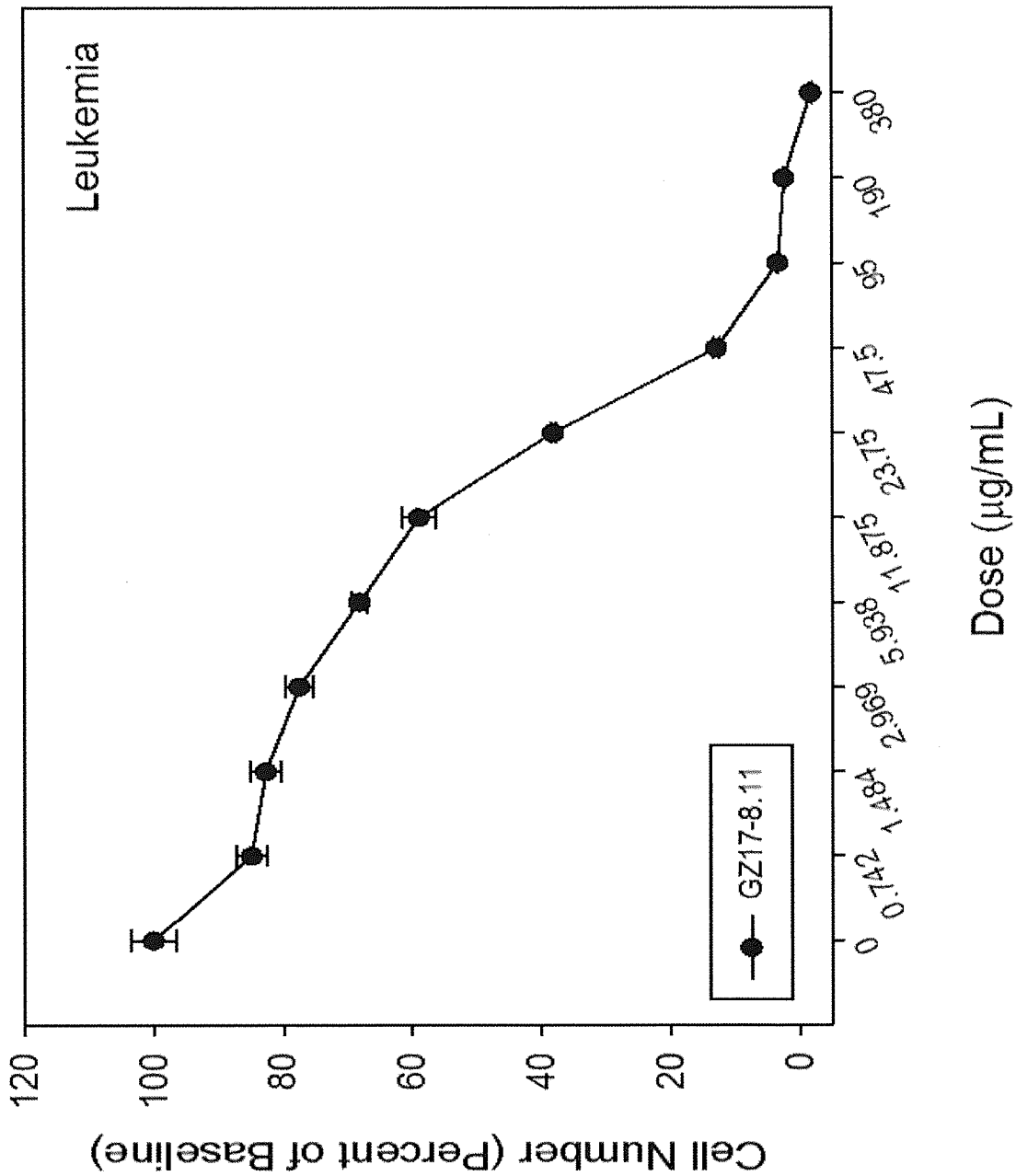

Leukemia
GZ17-8.11
Cell Number (Percent of Baseline)
0
20
40
60
80
100
120
0
0.742
1.484
2.969
5.938
11.875
23.75
47.5
95
190
380
Dose (µg/mL)

Fig. 29F

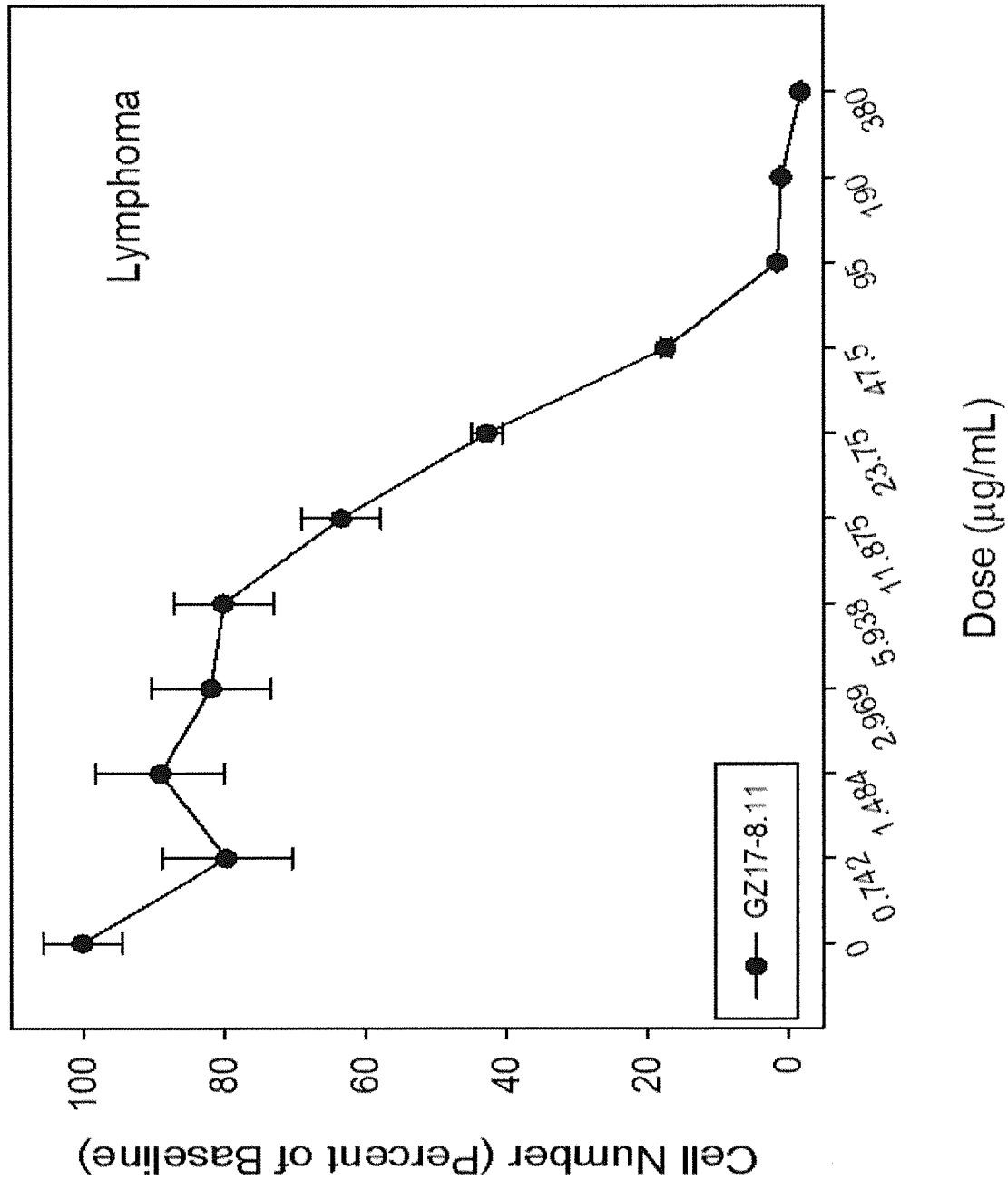

Lymphoma
Cell Number (Percent of Baseline)
100
80
60
40
20
0
GZ17-8.11
0
0.742
1.484
2.969
5.938
11.875
23.75
47.5
95
190
380
Dose (µg/mL)

Fig. 29G

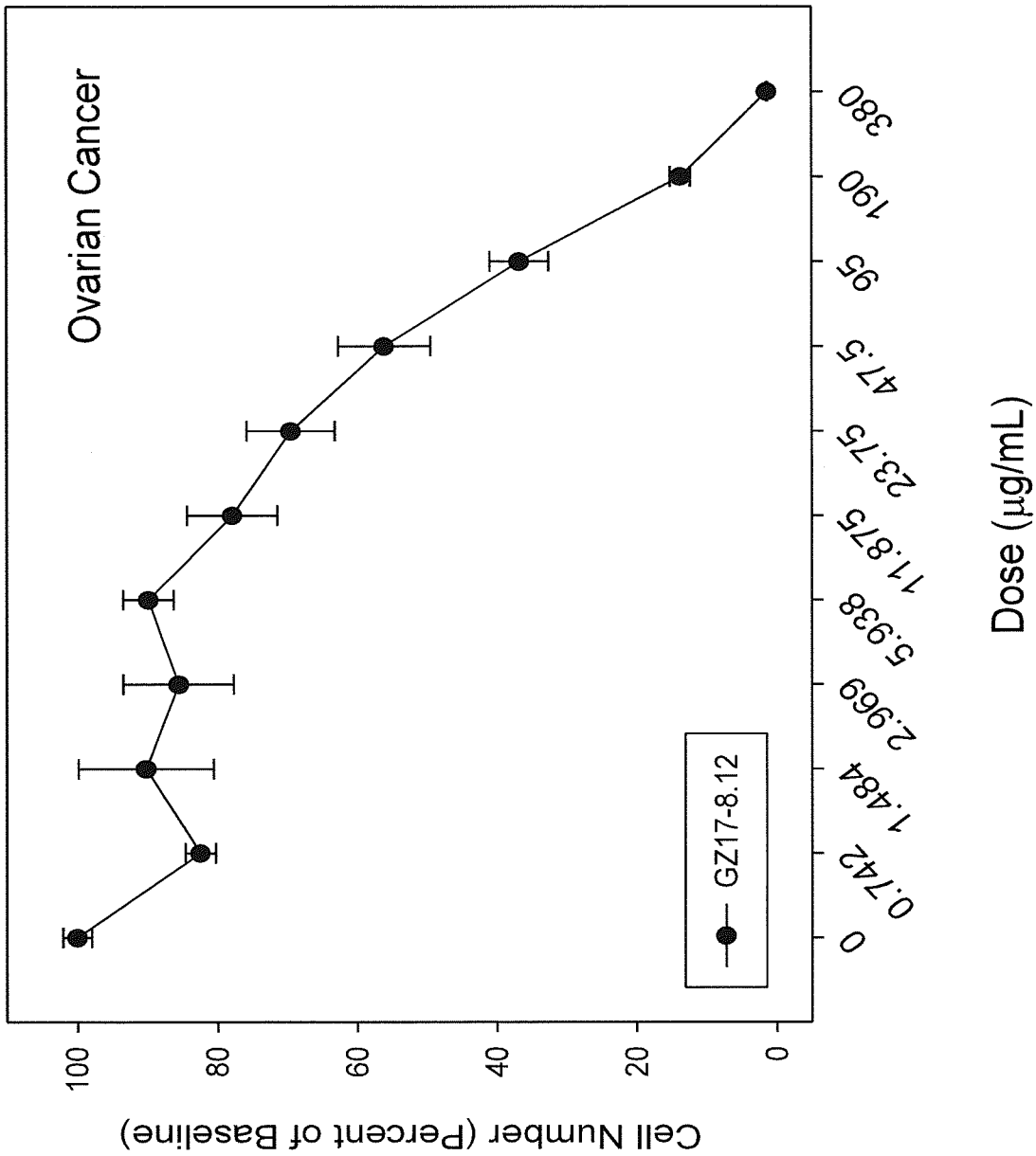

Ovarian Cancer
Cell Number (Percent of Baseline)
0
20
40
60
80
100
GZ17-8.12
0
0.742
1.484
2.969
5.938
11.875
23.75
47.5
95
190
380
Dose (µg/mL)

Fig. 30A

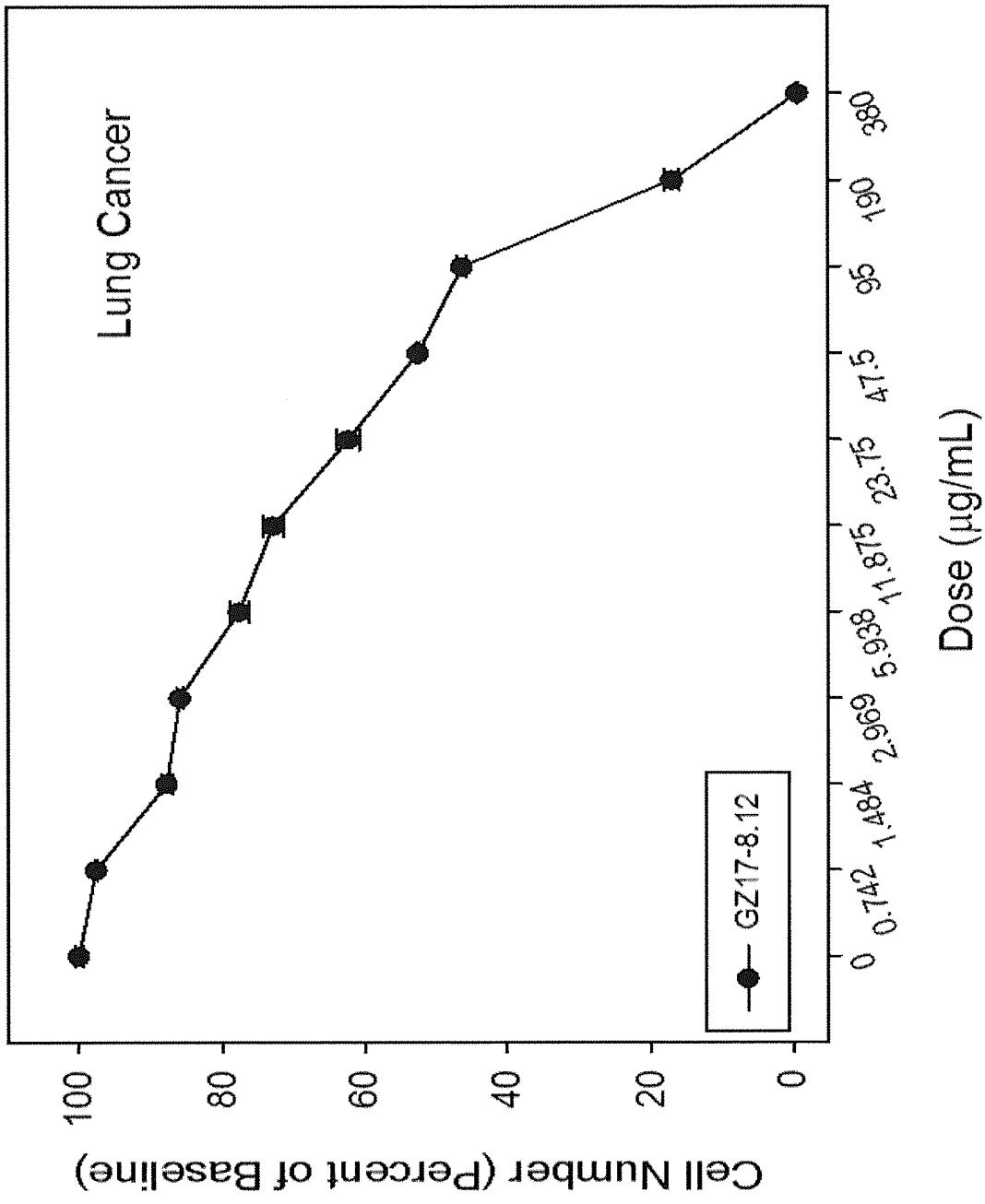

Lung Cancer
Cell Number (Percent of Baseline)
0
20
40
60
80
100
GZ17-8.12
0
0.742
1.484
2.969
5.938
11.875
23.75
47.5
95
190
380
Dose (µg/mL)

Fig. 30B

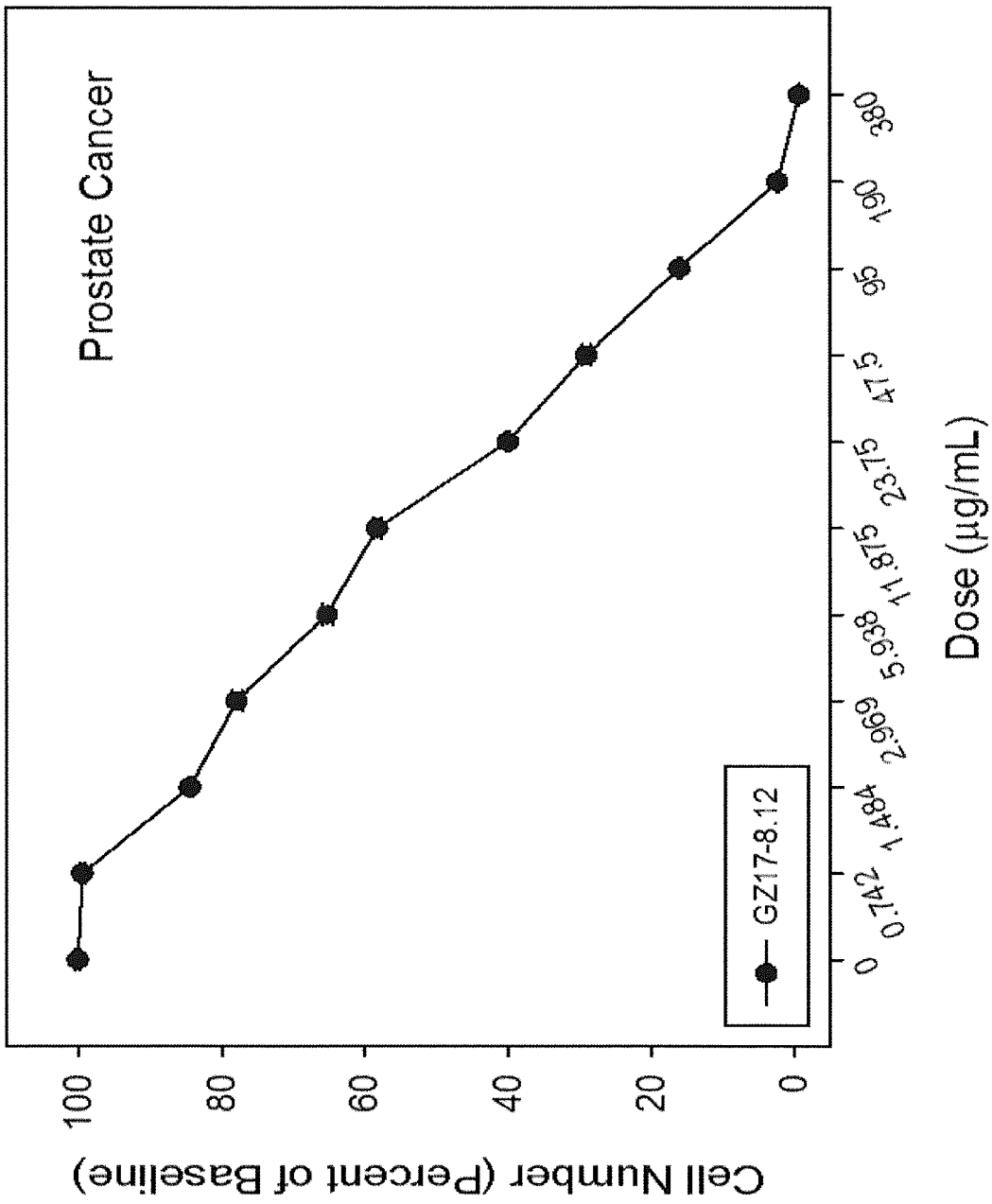

Prostate Cancer
Cell Number (Percent of Baseline)
100
80
60
40
20
0
GZ17-8.12
0
0.742
1.484
2.969
5.938
11.875
23.75
47.5
95
190
380
Dose (µg/mL)

Fig. 30C

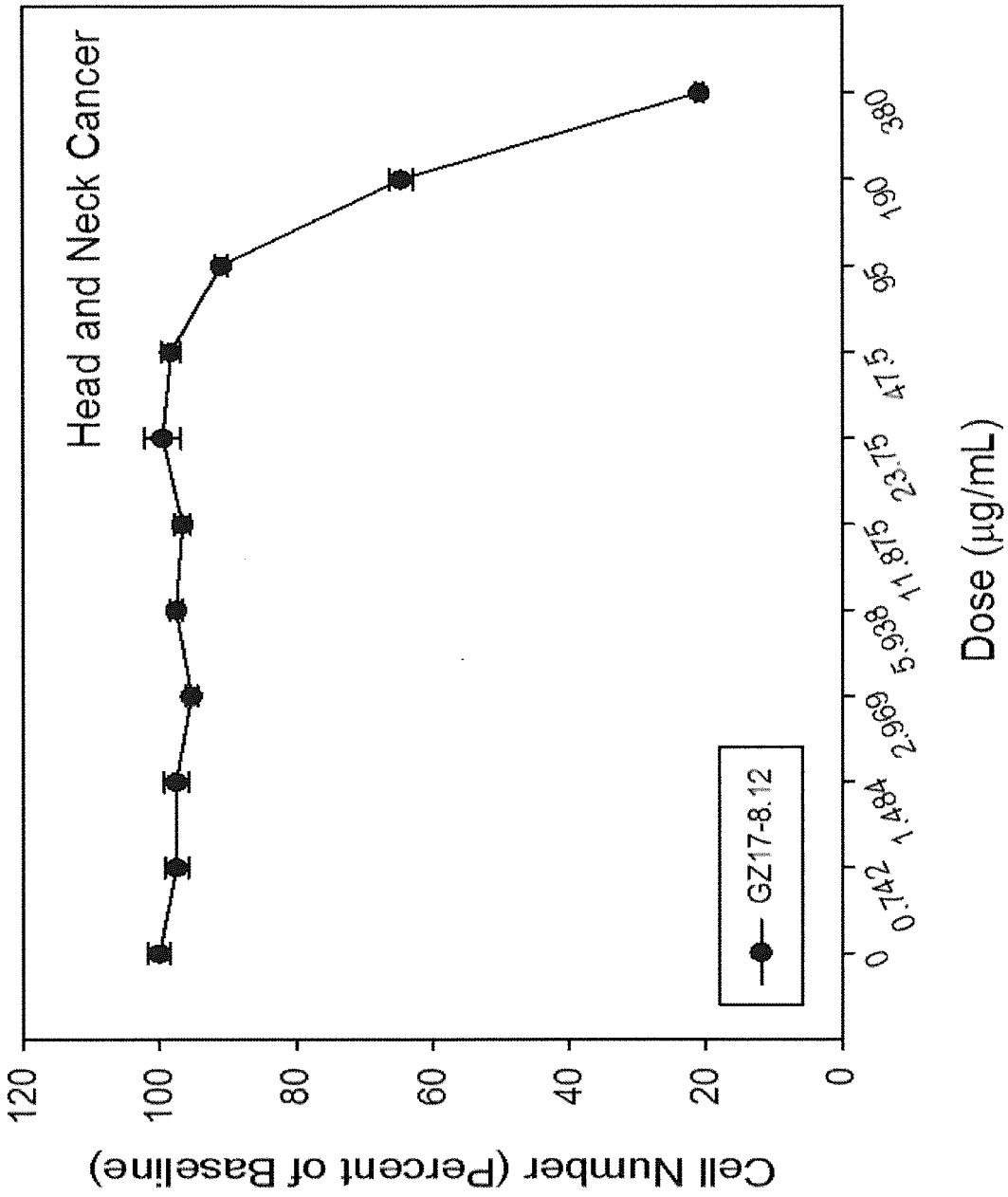

Head and Neck Cancer
GZ17-8.12
Cell Number (Percent of Baseline)
0
20
40
60
80
100
120
0
0.742
1.484
2.969
5.938
11.875
23.75
47.5
95
190
380
Dose (µg/mL)

Fig. 30D

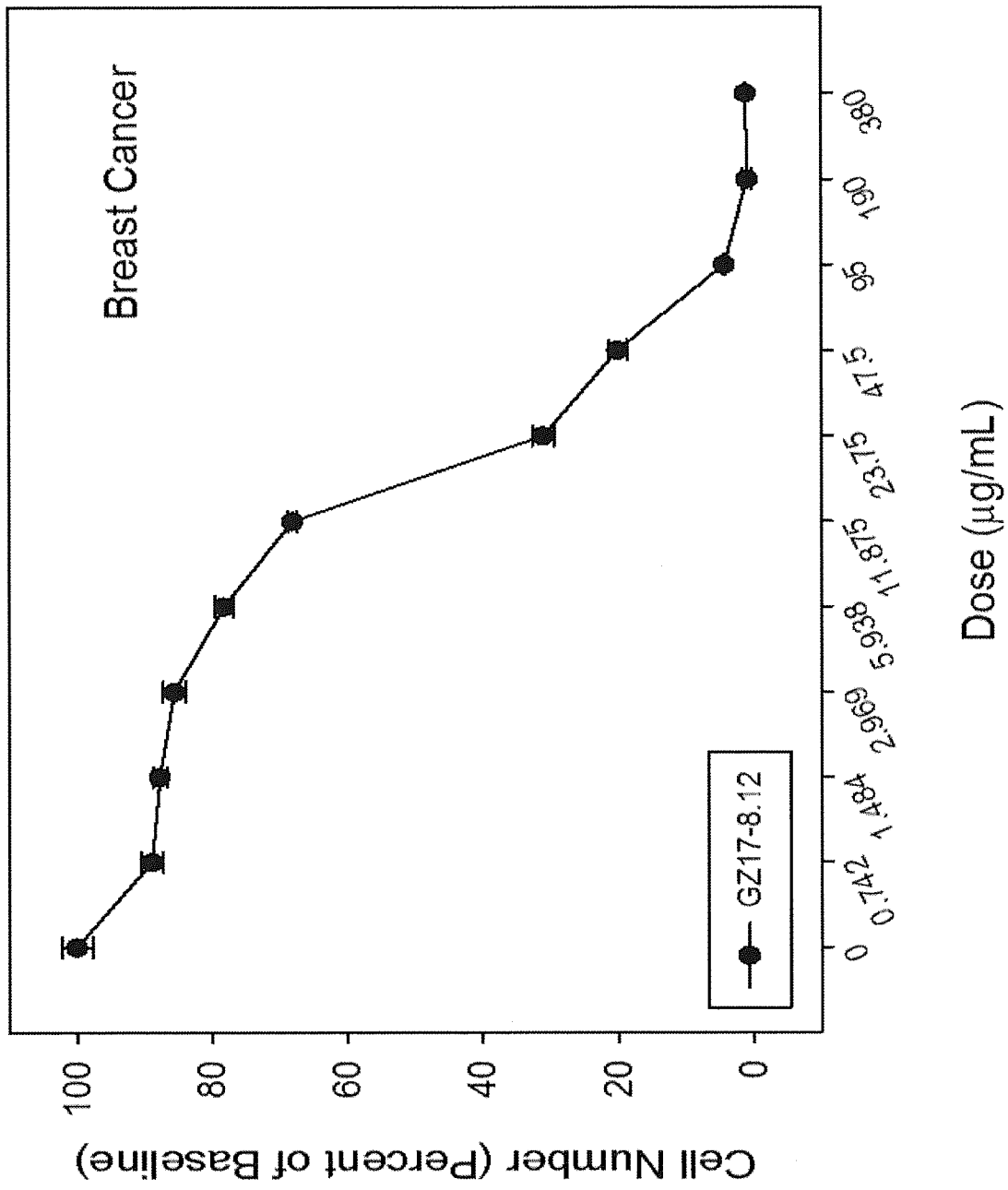

Breast Cancer
Cell Number (Percent of Baseline)
100
80
60
40
20
0
GZ17-8.12
0
0.742
1.484
2.969
5.938
11.875
23.75
47.5
95
190
380
Dose (µg/mL)

Fig. 30E

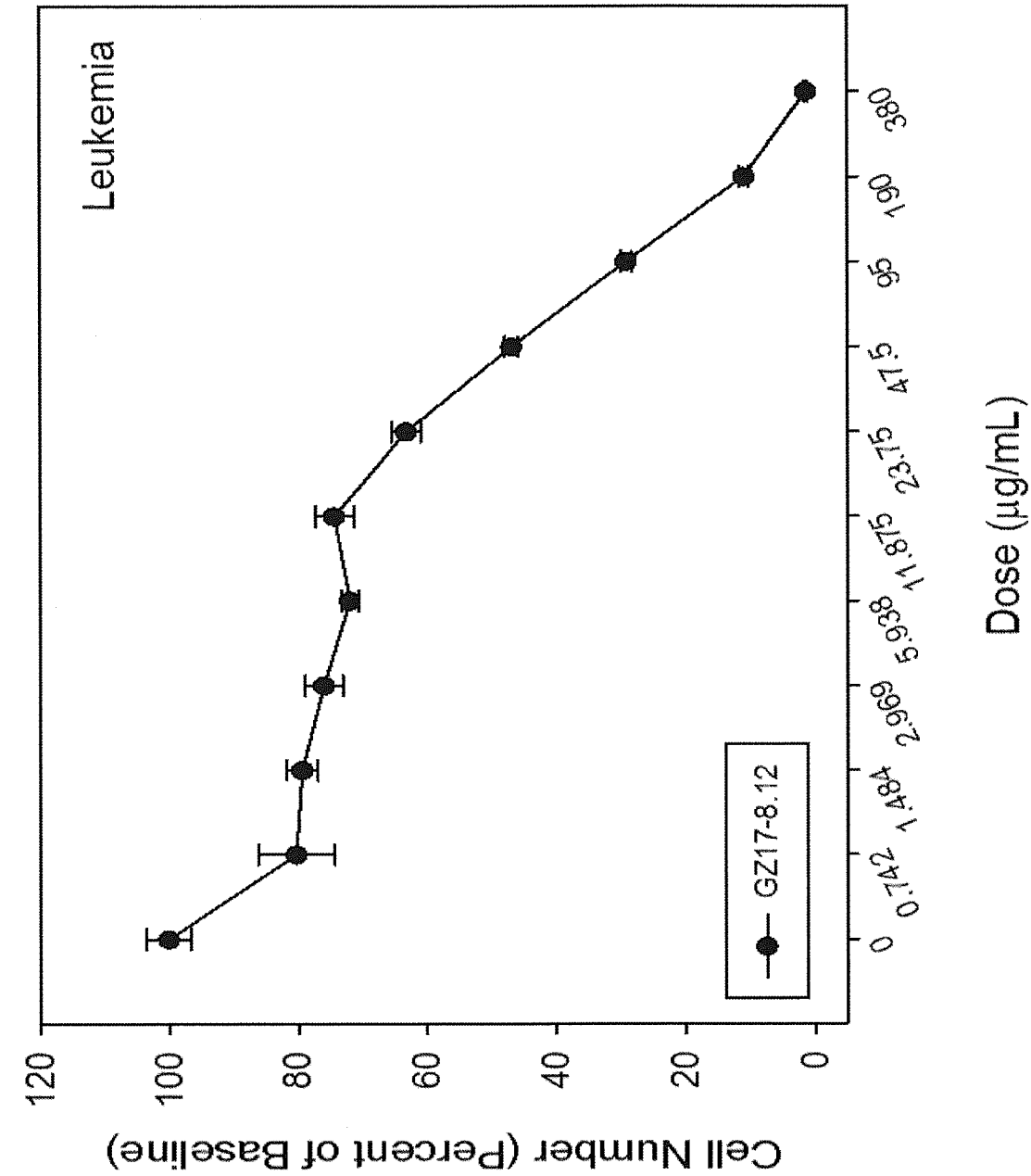

Leukemia
Cell Number (Percent of Baseline)
120
100
80
60
40
20
0
GZ17-8.12
0
0.742
1.484
2.969
5.938
11.875
23.75
47.5
95
190
380
Dose (µg/mL)

Fig. 30F

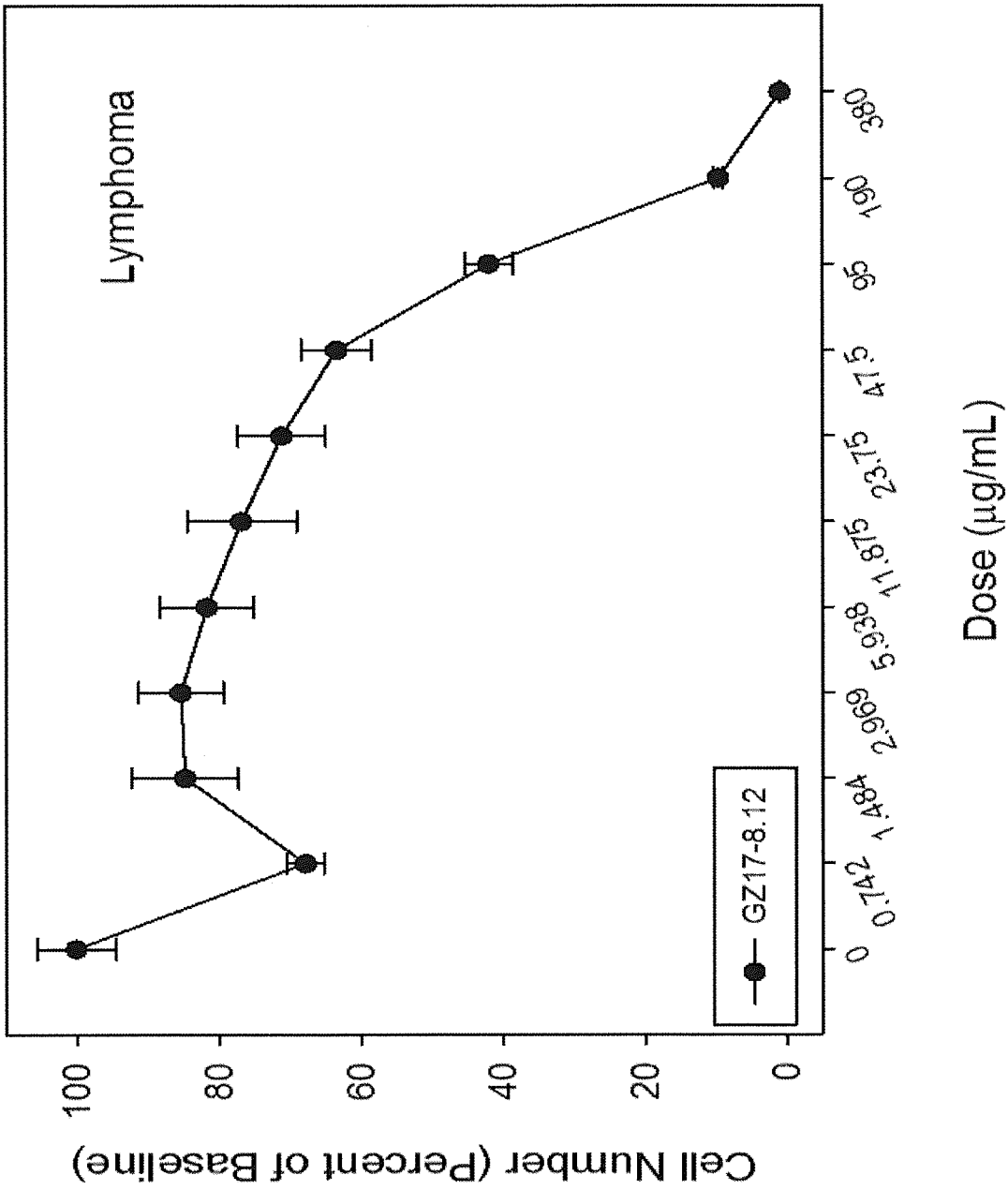

Lymphoma
Cell Number (Percent of Baseline)
100
80
60
40
20
0
GZ17-8.12
0
0.142
1.484
2.969
5.938
11.875
23.75
47.5
95
190
380
Dose (µg/mL)

Fig. 30G

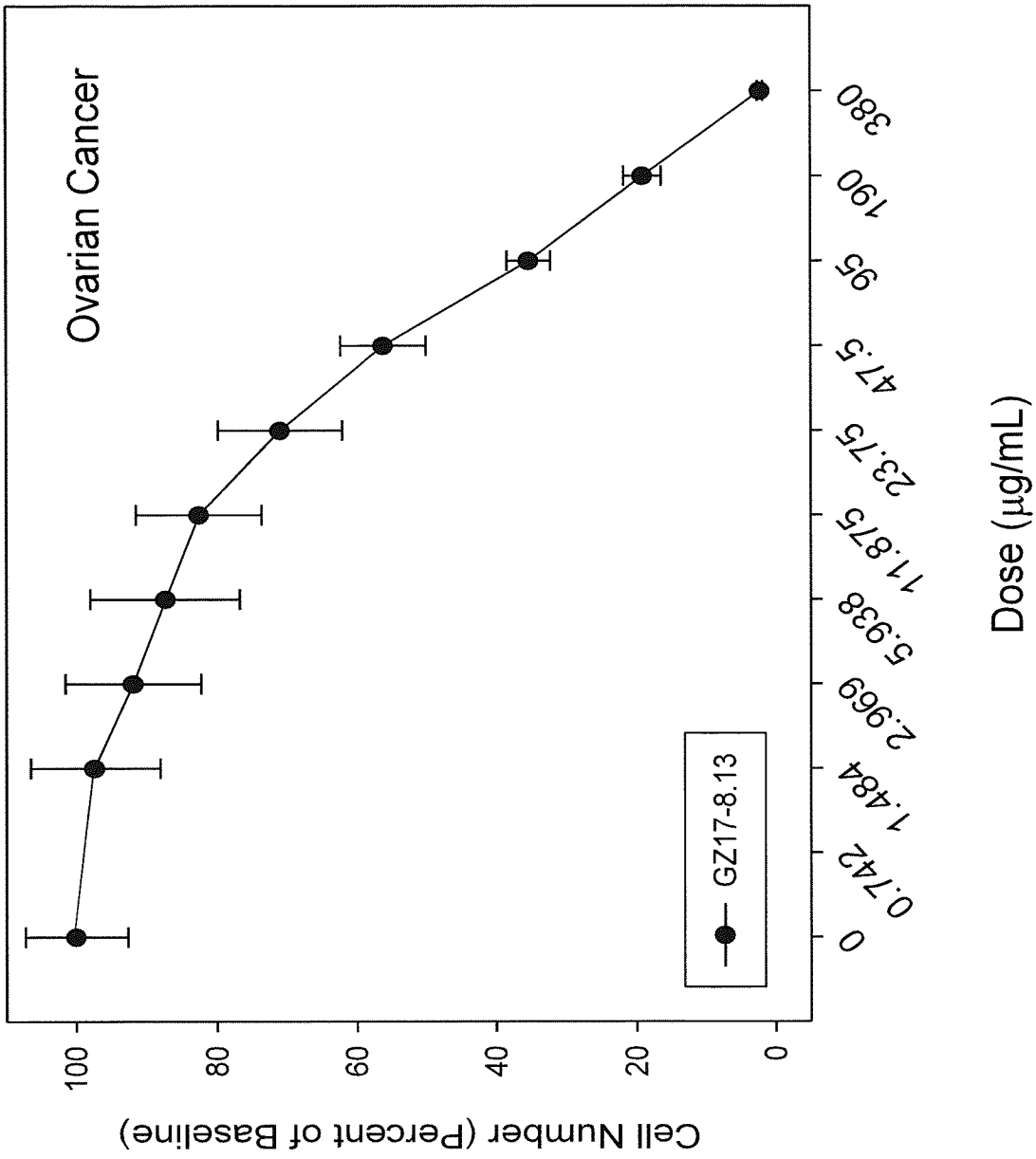

Ovarian Cancer
Cell Number (Percent of Baseline)
0
20
40
60
80
100
GZ17-8.13
0
0.742
1.484
2.969
5.938
11.875
23.75
47.5
95
190
380
Dose (µg/mL)

Fig. 31A

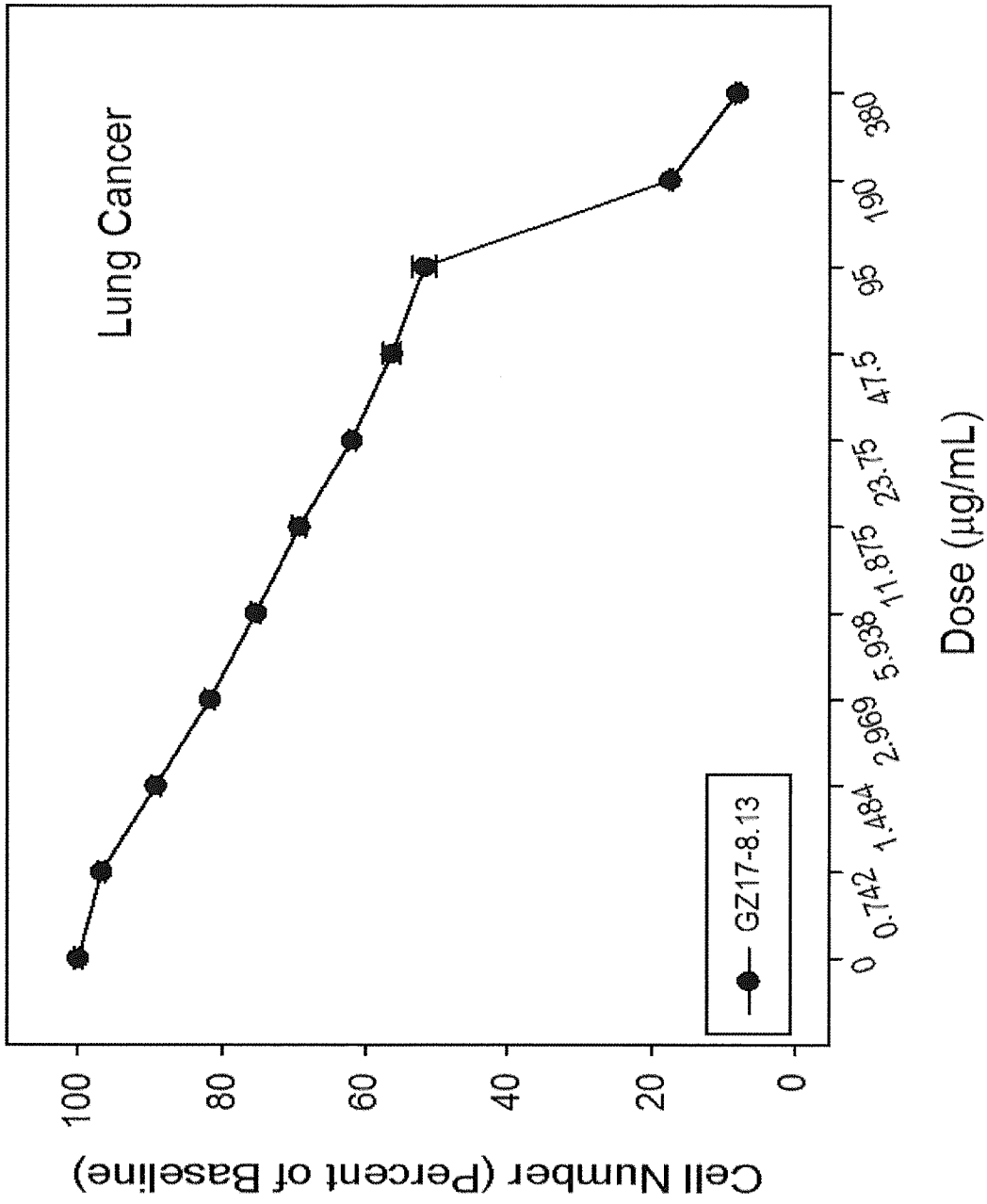

Lung Cancer
Cell Number (Percent of Baseline)
0
20
40
60
80
100
GZ17-8.13
0
0.742
1.484
2.969
5.938
11.875
23.75
47.5
95
190
380
Dose (µg/mL)

Fig. 31B

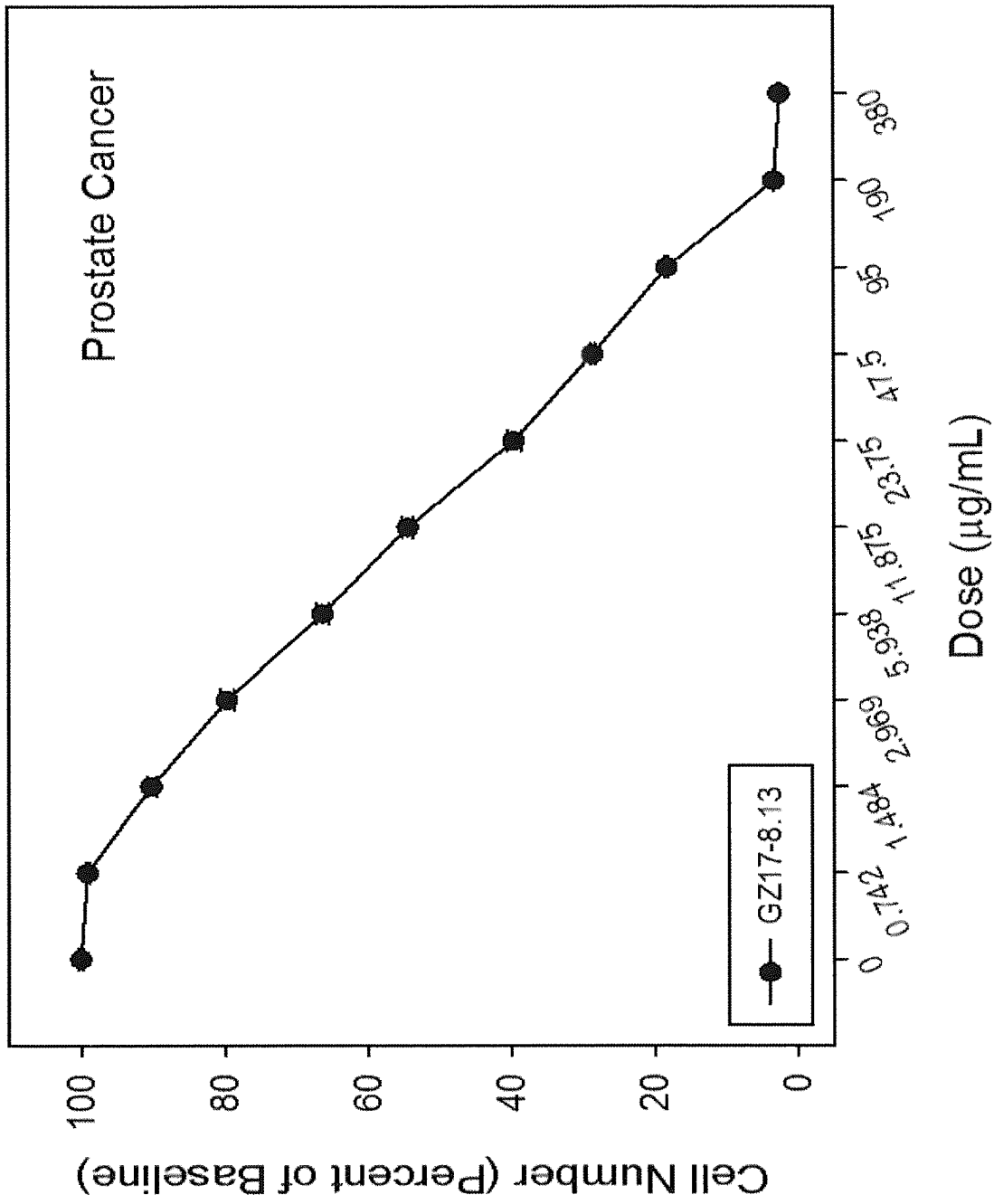

Prostate Cancer
Cell Number (Percent of Baseline)
0
20
40
60
80
100
GZ17-8.13
0
0.142
1.484
2.969
5.938
11.875
23.75
47.5
95
190
380
Dose (µg/mL)

Fig. 31C

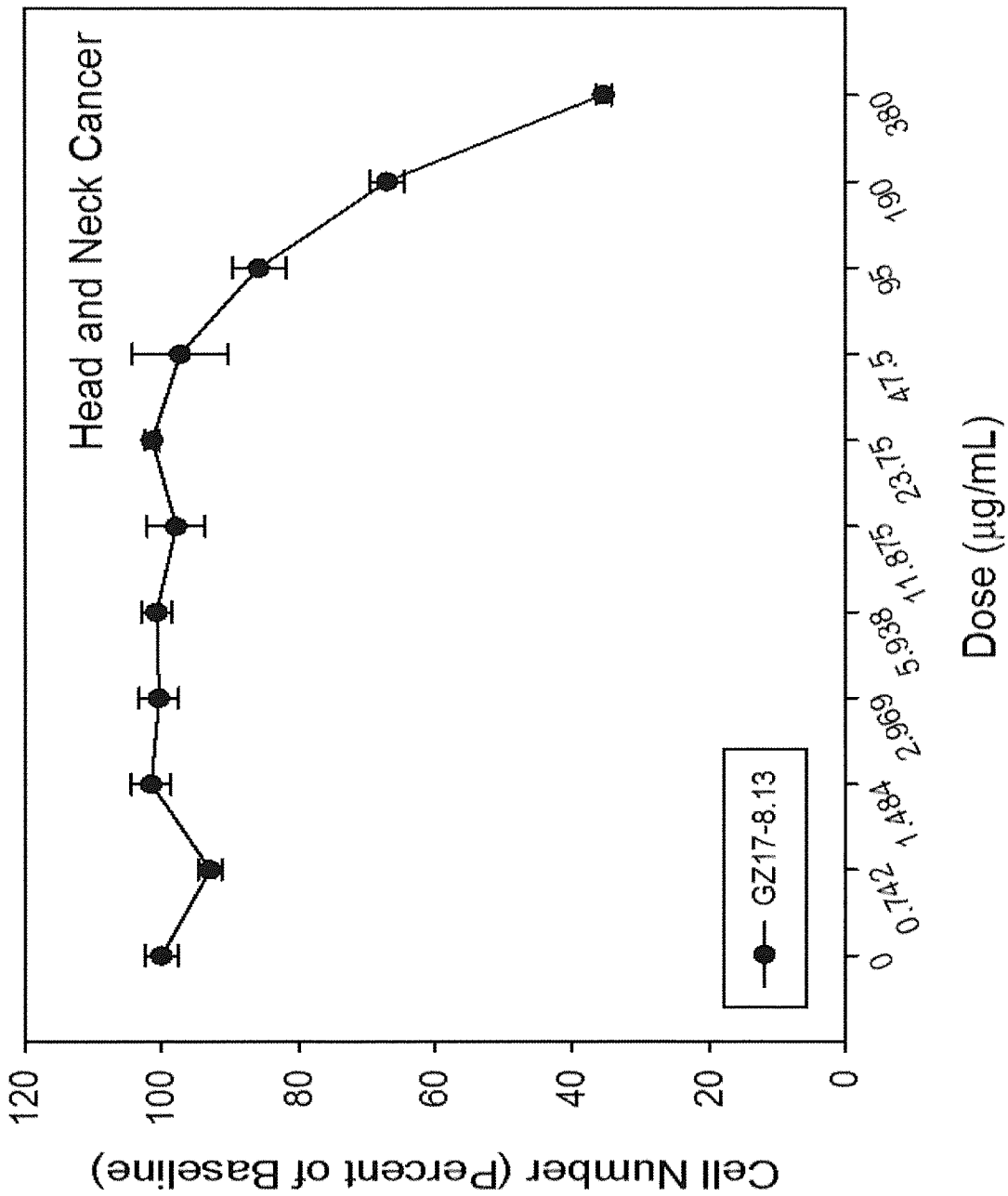

Head and Neck Cancer
Cell Number (Percent of Baseline)
120
100
80
60
40
20
0
GZ17-8.13
0
0.742
1.484
2.969
5.938
11.875
23.75
47.5
95
190
380
Dose (µg/mL)

Fig. 31D

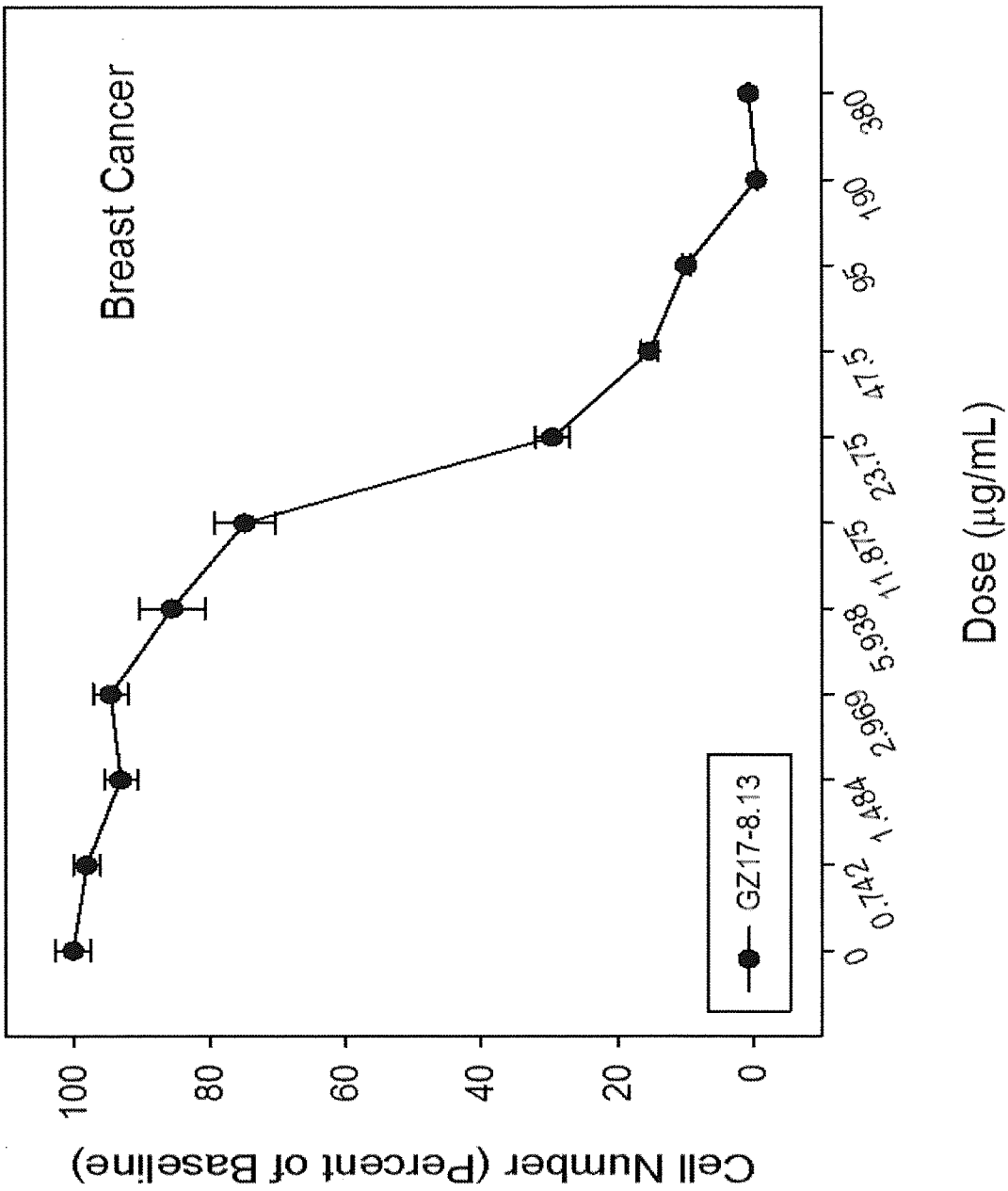

Breast Cancer
Cell Number (Percent of Baseline)
0
20
40
60
80
100
GZ17-8.13
0
0.742
1.484
2.969
5.938
11.875
23.75
47.5
95
190
380
Dose (µg/mL)

Fig. 31E

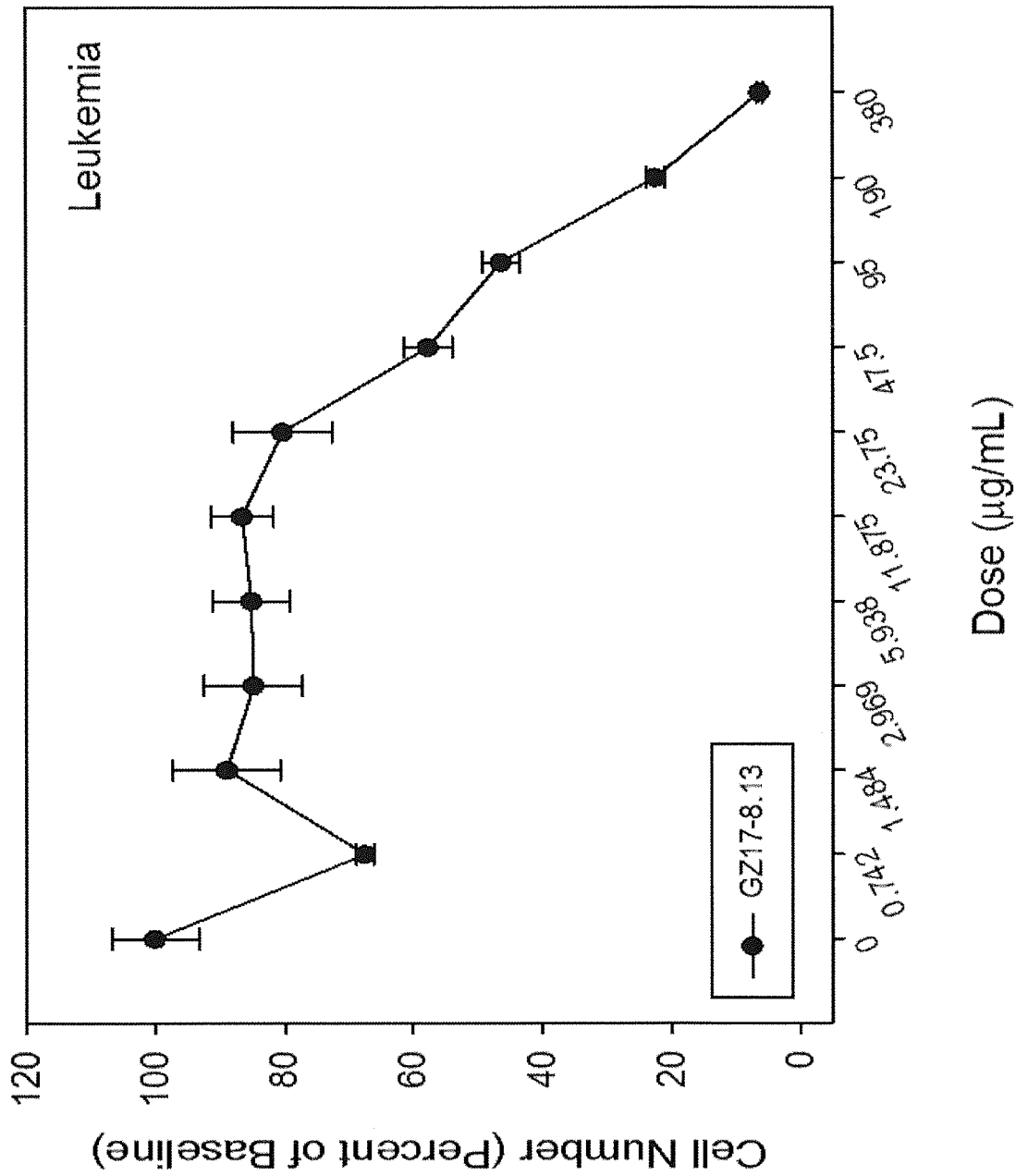

Leukemia
Cell Number (Percent of Baseline)
120
100
80
60
40
20
0
GZ17-8.13
0
0.742
1.484
2.969
5.938
11.875
23.75
47.5
95
190
380
Dose (µg/mL)

Fig. 31F

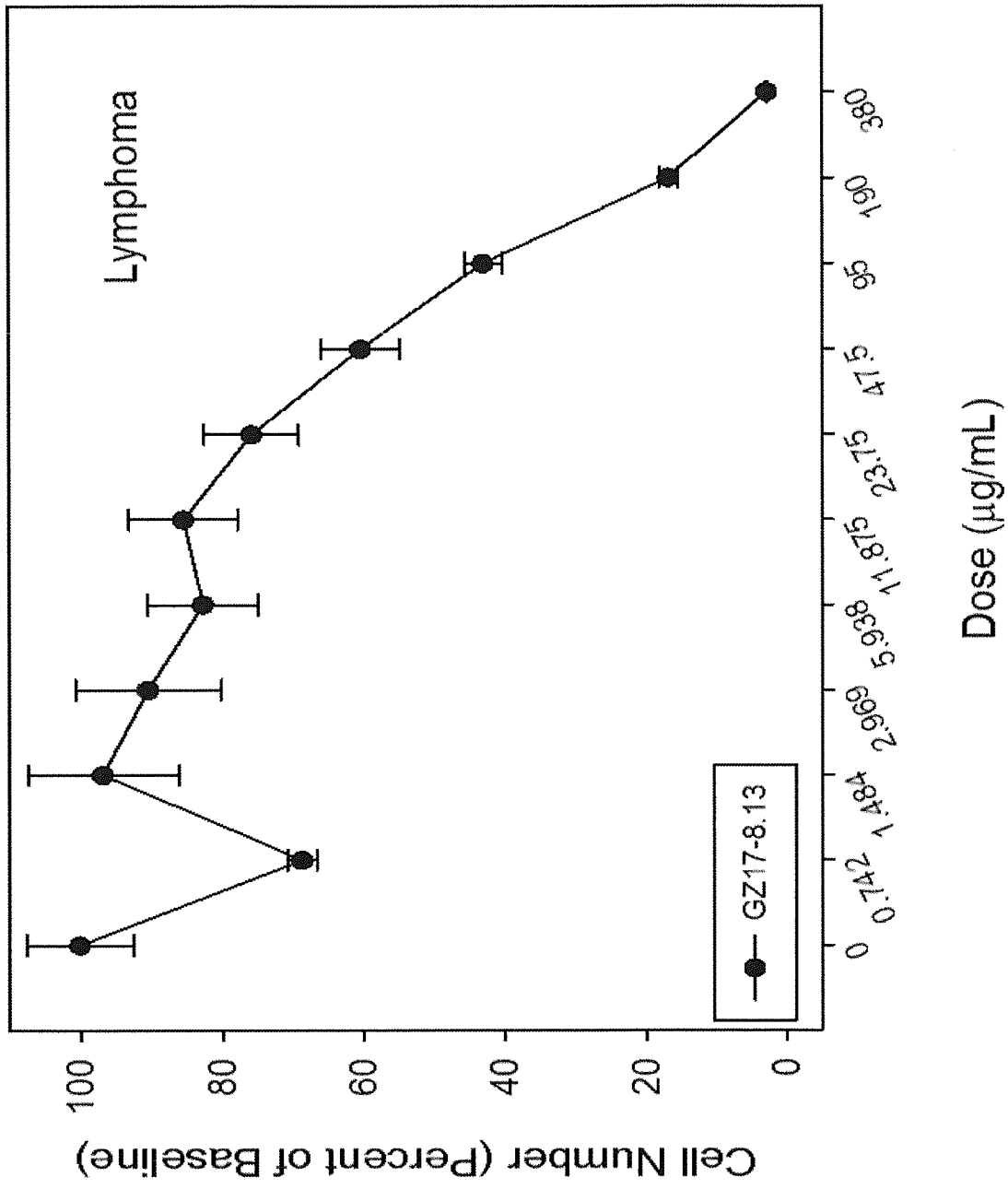

Lymphoma
Cell Number (Percent of Baseline)
0
20
40
60
80
100
GZ17-8.13
0
0.742
1.484
2.969
5.938
11.875
23.75
47.5
95
190
380
Dose (µg/mL)

Fig. 31G

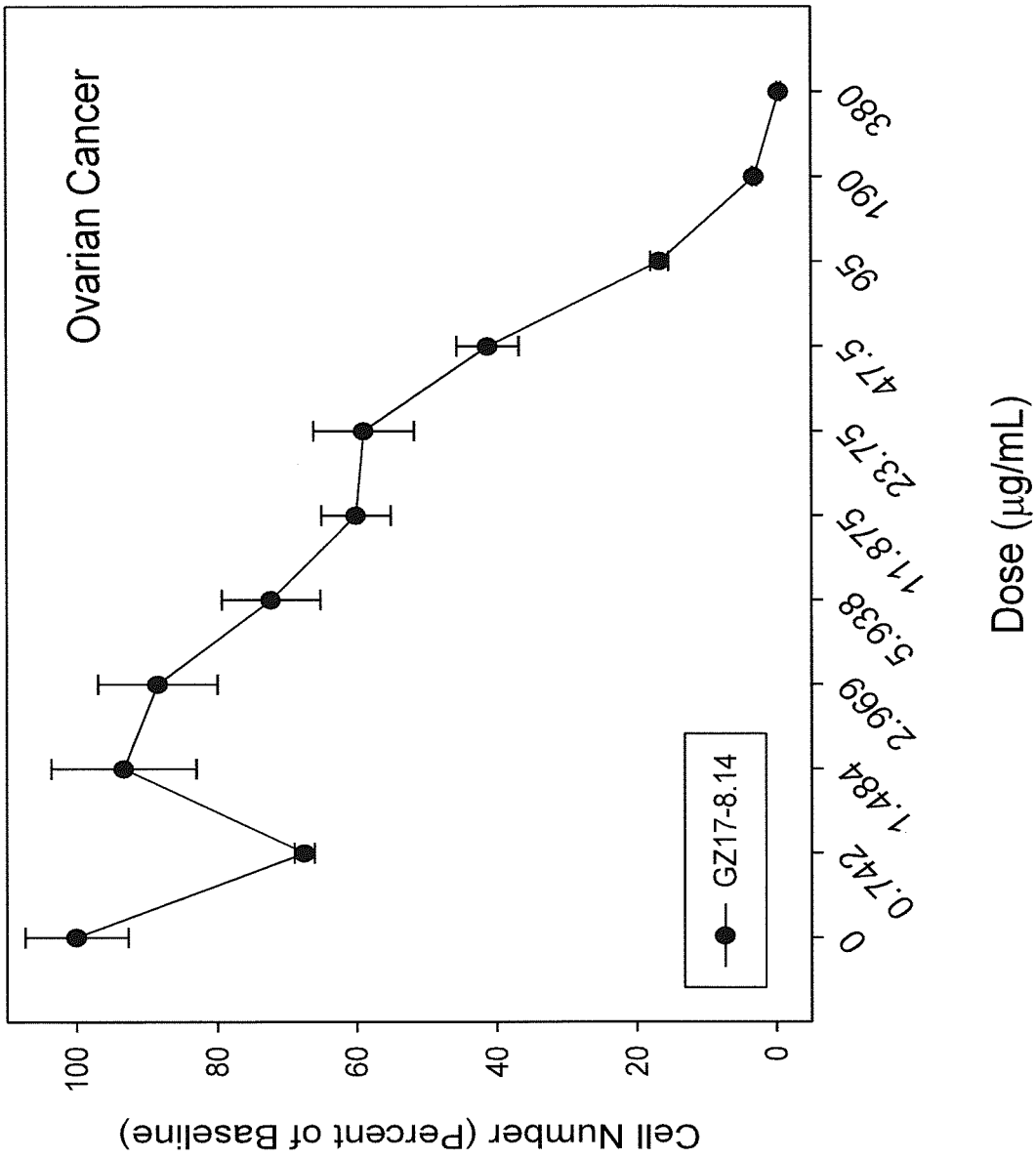

Ovarian Cancer
Cell Number (Percent of Baseline)
0
20
40
60
80
100
GZ17-8.14
0
0.742
1.484
2.969
5.938
11.875
23.75
47.5
95
190
380
Dose (µg/mL)

Fig. 32A

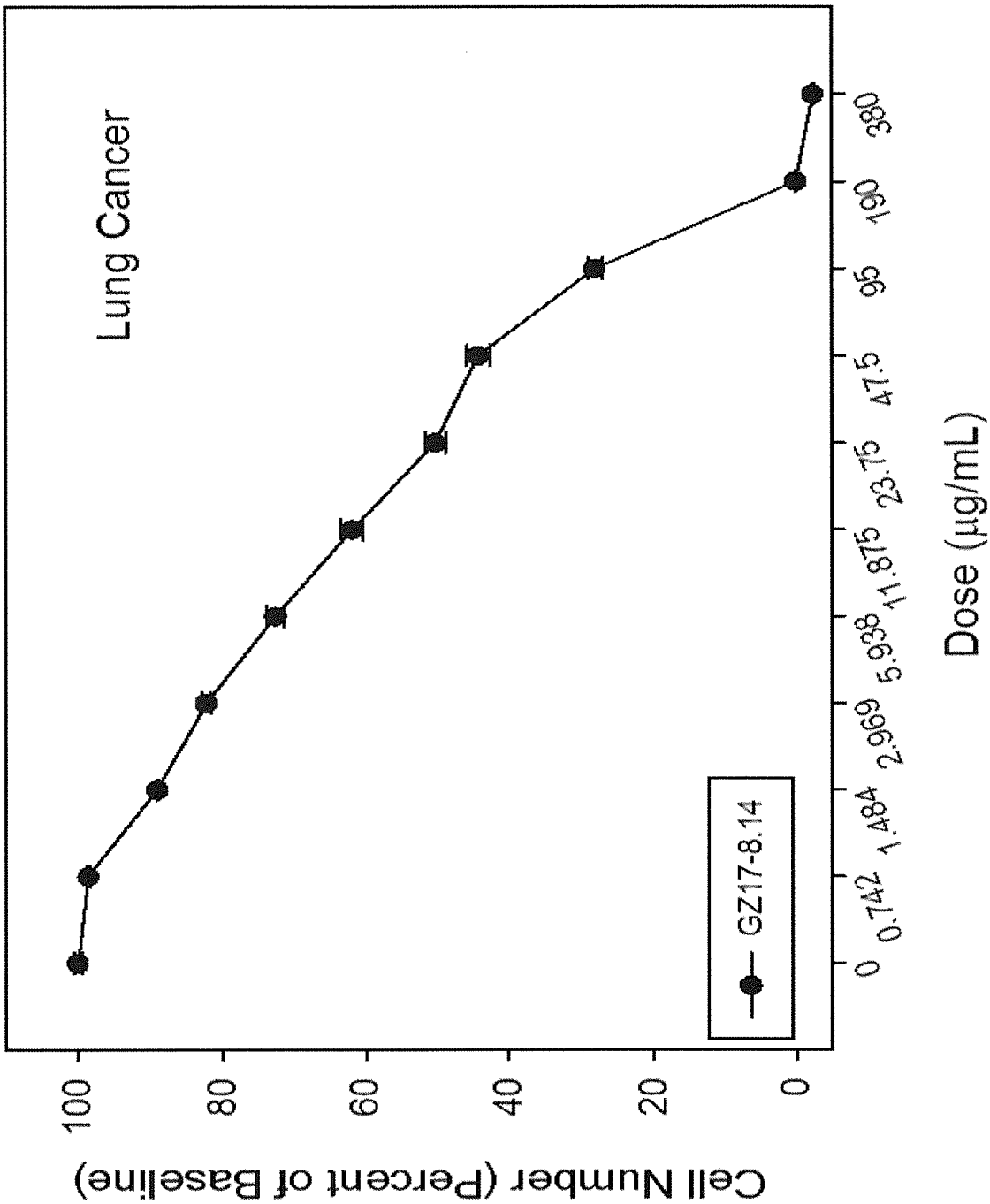

Lung Cancer
Cell Number (Percent of Baseline)
0
20
40
60
80
100
GZ17-8.14
0
0.742
1.484
2.969
5.938
11.875
23.75
47.5
95
190
380
Dose (µg/mL)

Fig. 32B

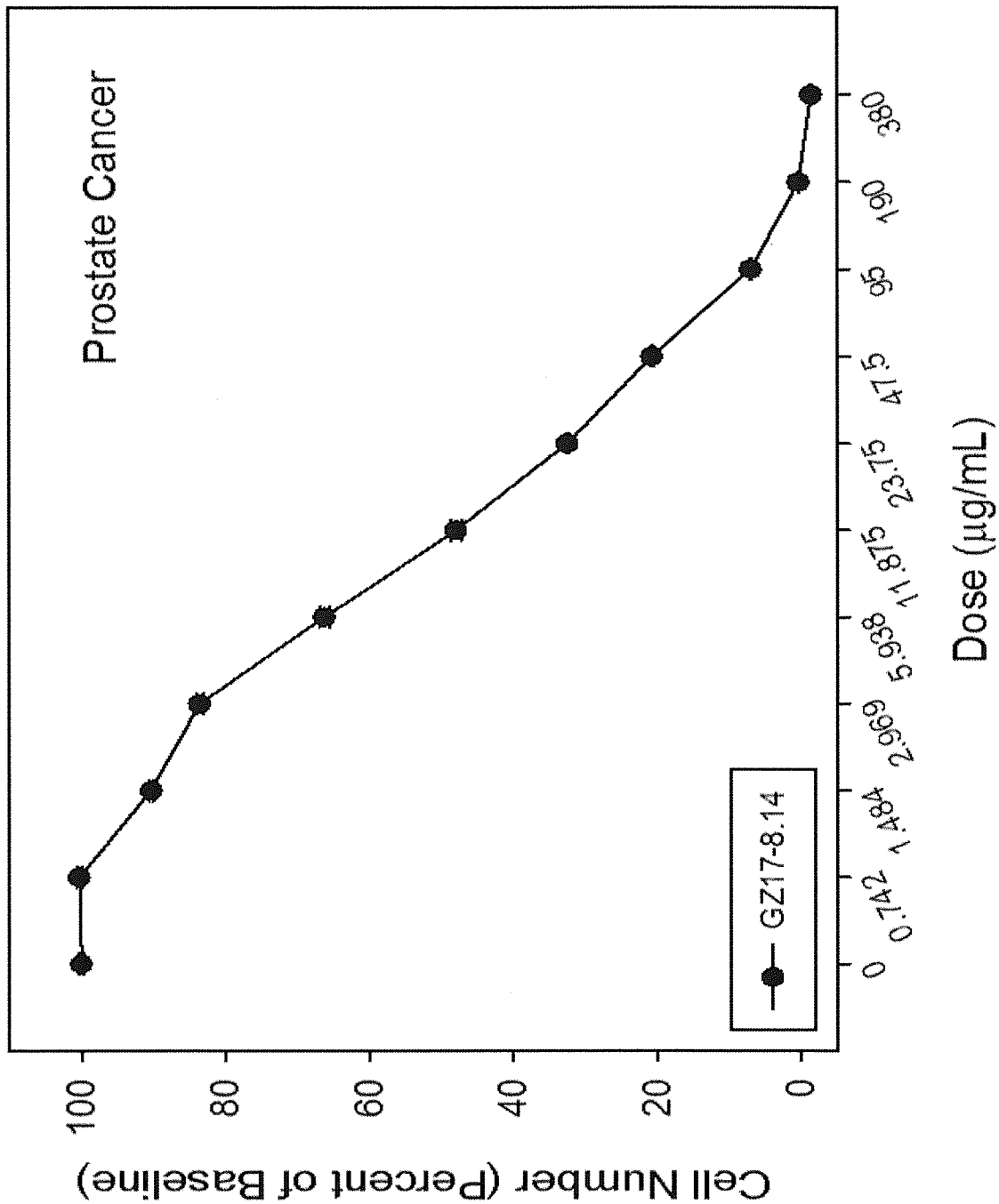

Prostate Cancer
Cell Number (Percent of Baseline)
100
80
60
40
20
0
GZ17-8.14
0
0.742
1.484
2.969
5.938
11.875
23.75
47.5
95
190
380
Dose (µg/mL)

Fig. 32C

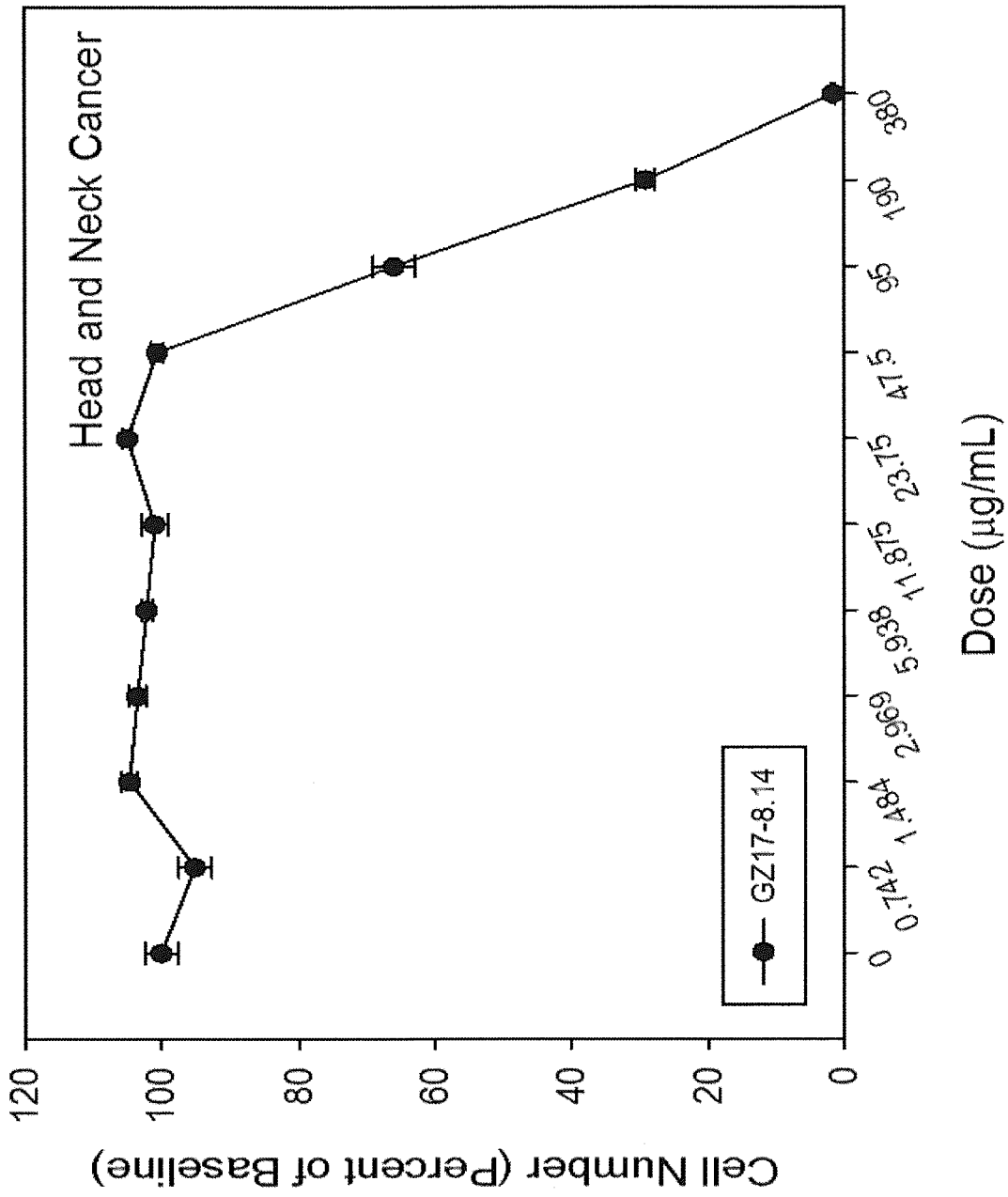

Head and Neck Cancer
Cell Number (Percent of Baseline)
120
100
80
60
40
20
0
GZ17-8.14
0
0.742
1.484
2.969
5.938
11.875
23.75
47.5
95
190
380
Dose (µg/mL)

Fig. 32D

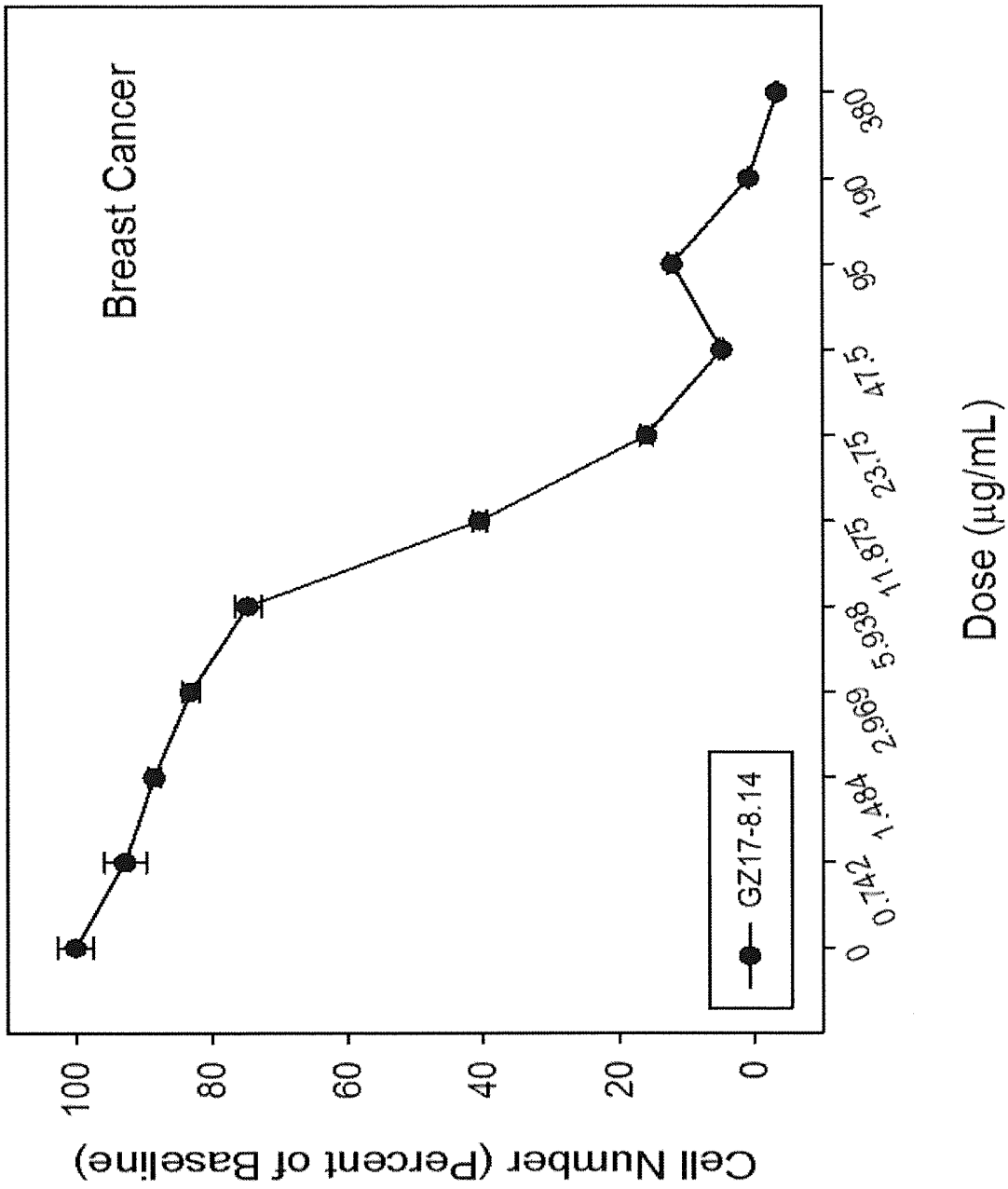

Breast Cancer
Cell Number (Percent of Baseline)
0
20
40
60
80
100
GZ17-8.14
0
0.142
1.484
2.969
5.938
11.875
23.75
47.5
95
190
380
Dose (µg/mL)

Fig. 32E

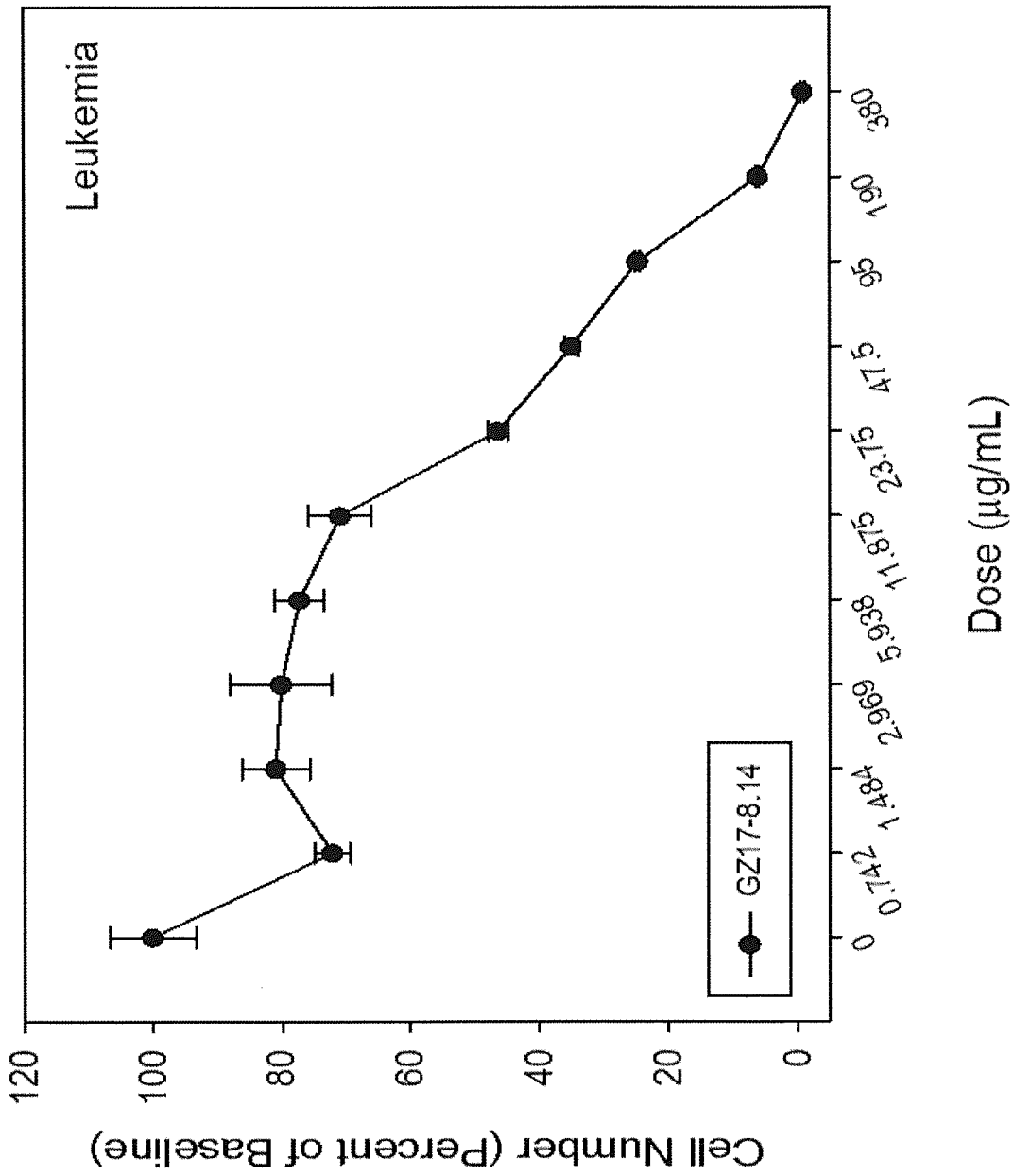

Leukemia
Cell Number (Percent of Baseline)
120
100
80
60
40
20
0
GZ17-8.14
0
0.142
1.484
2.969
5.938
11.875
23.75
47.5
95
190
380
Dose (µg/mL)

Fig. 32F

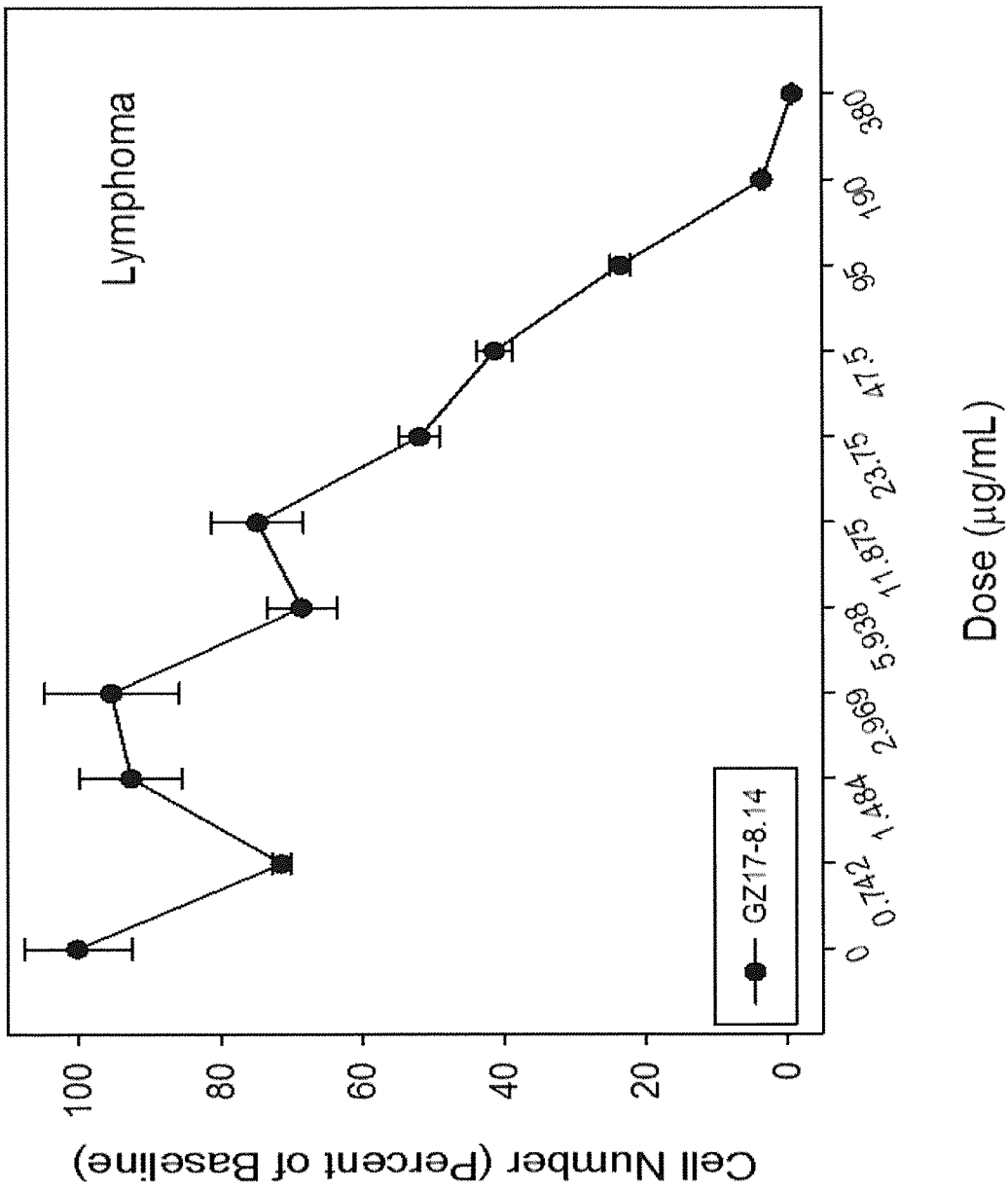

Lymphoma
GZ17-8.14
Cell Number (Percent of Baseline)
0
20
40
60
80
100
0
0.742
1.484
2.969
5.938
11.875
23.75
47.5
95
190
380
Dose (µg/mL)

Fig. 32G

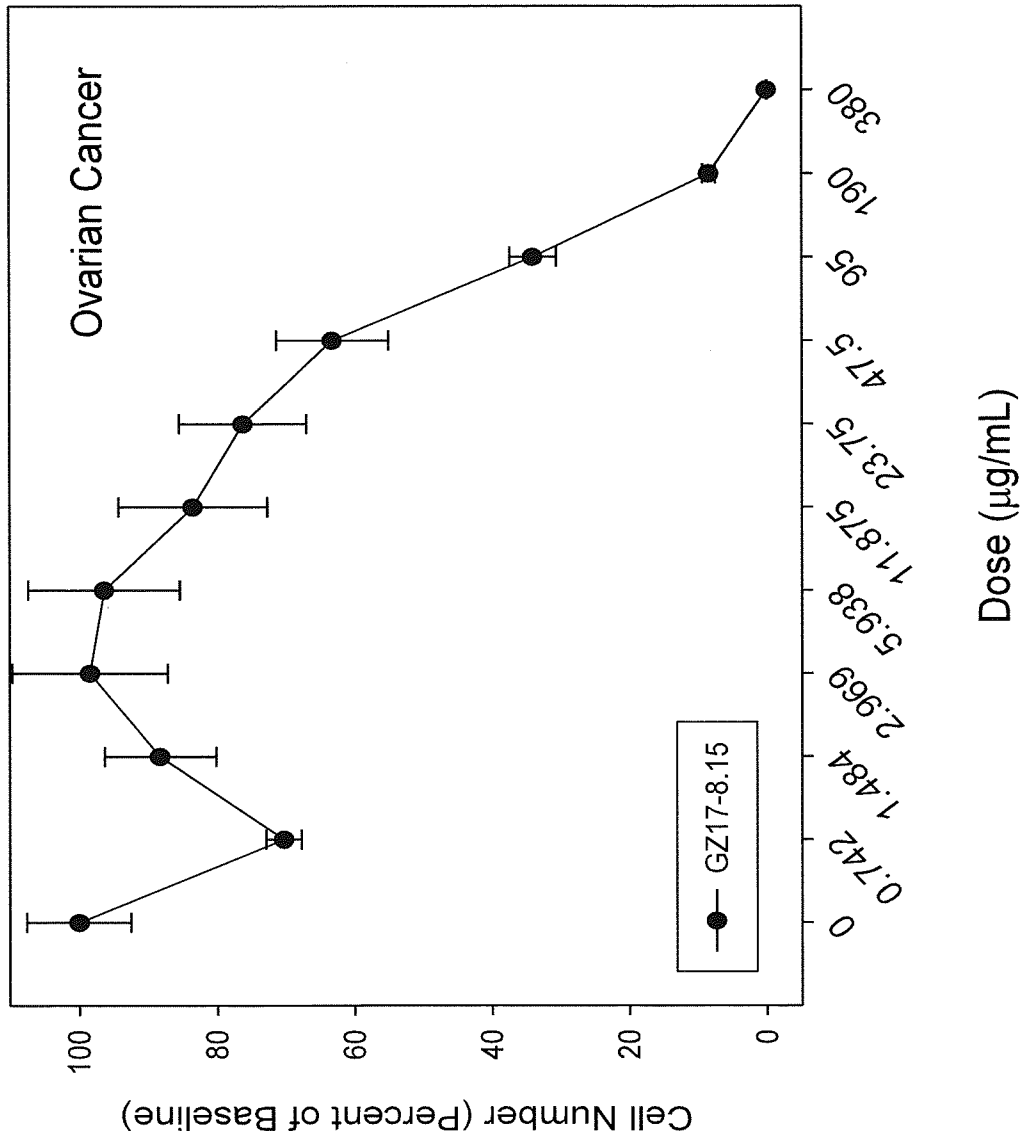

Ovarian Cancer
Cell Number (Percent of Baseline)
0
20
40
60
80
100
GZ17-8.15
0
0.742
1.484
2.969
5.938
11.875
23.75
47.5
95
190
380
Dose (µg/mL)

Fig. 33A

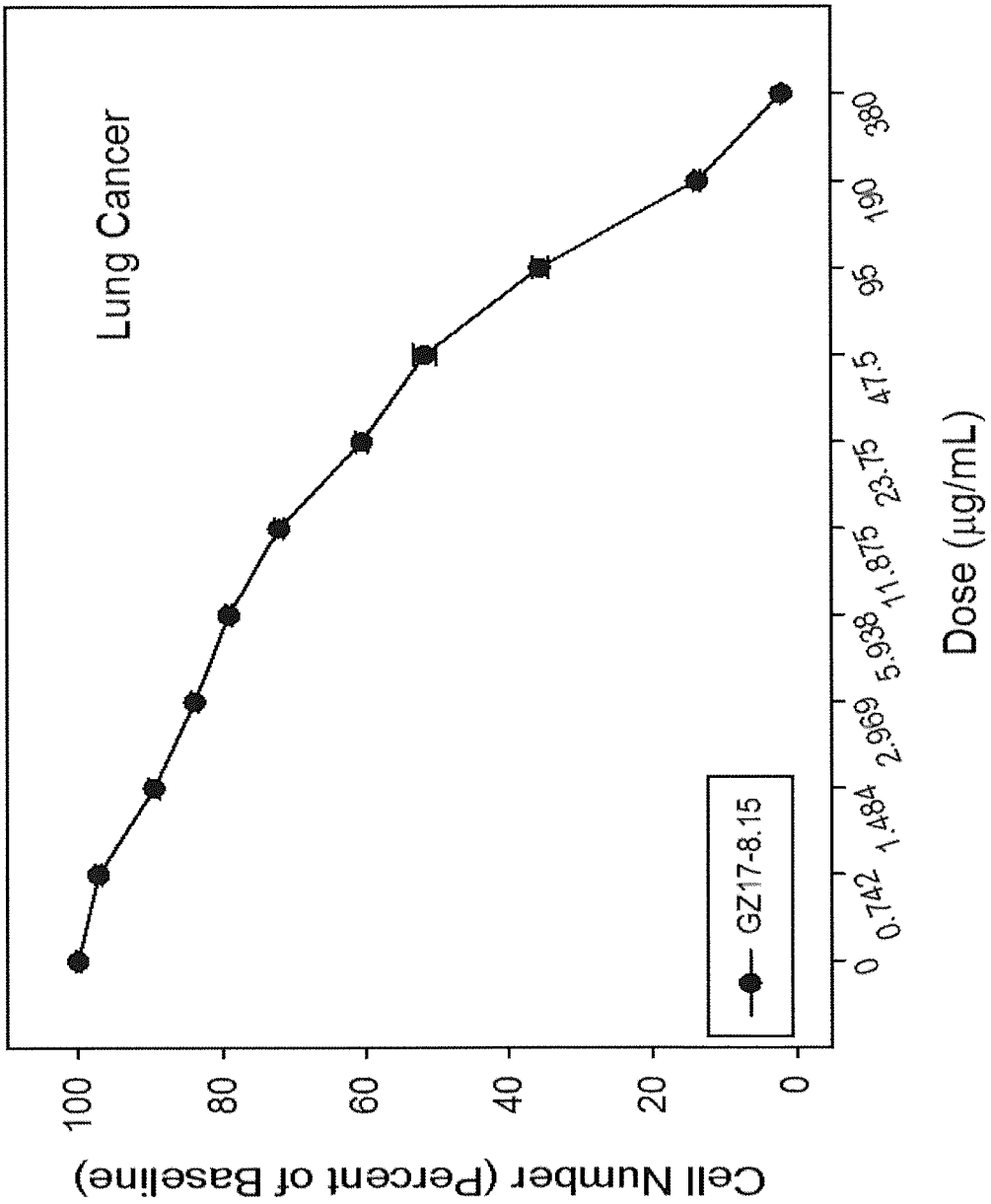

Lung Cancer
GZ17-8.15
Cell Number (Percent of Baseline)
0
20
40
60
80
100
0
0.742
1.484
2.969
5.938
11.875
23.75
47.5
95
190
380
Dose (µg/mL)

Fig. 33B

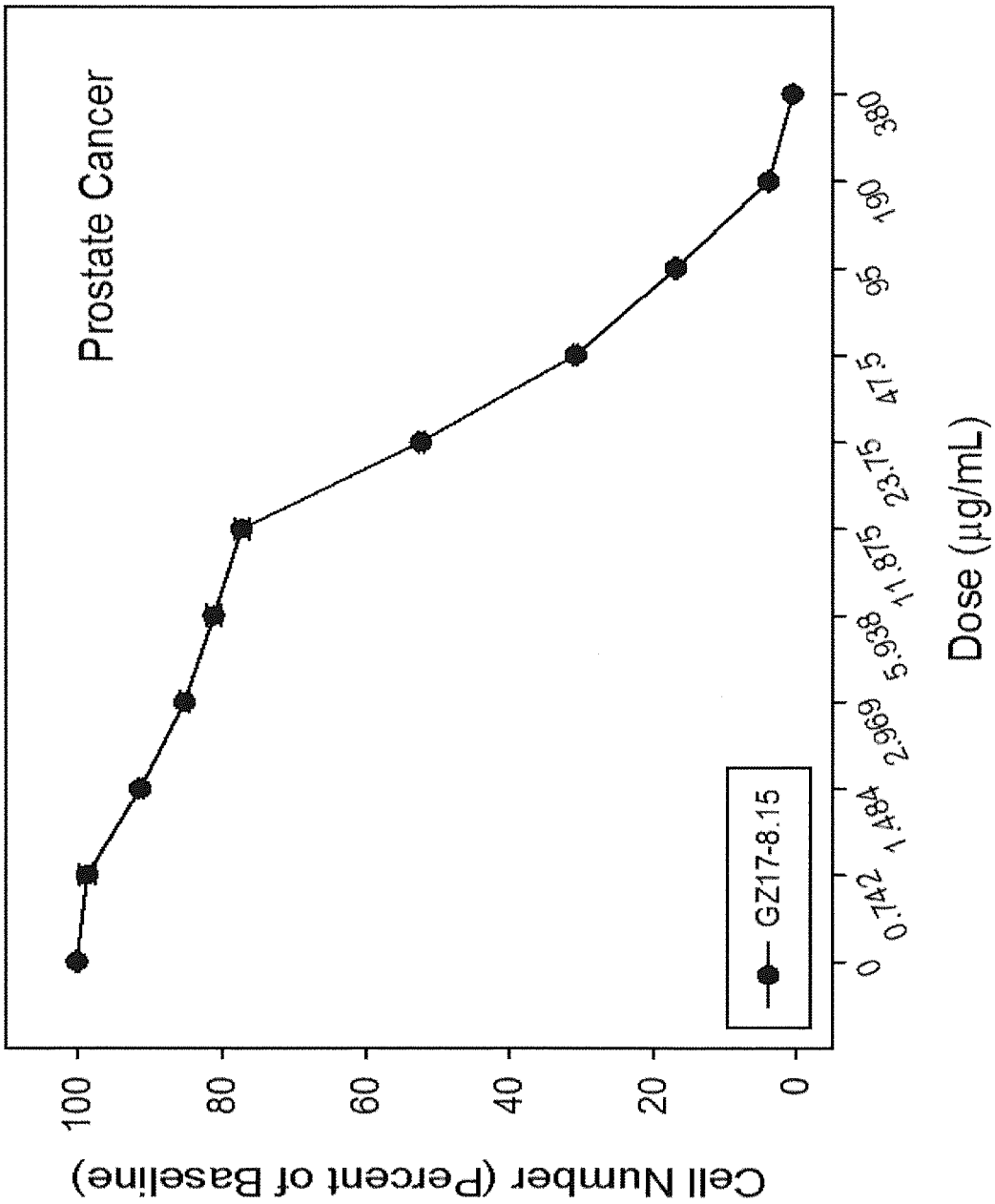

Prostate Cancer
Cell Number (Percent of Baseline)
100
80
60
40
20
0
GZ17-8.15
0
0.142
0.284
0.569
1.138
2.275
4.5
9
18
36
Dose (µg/mL)

Fig. 33C

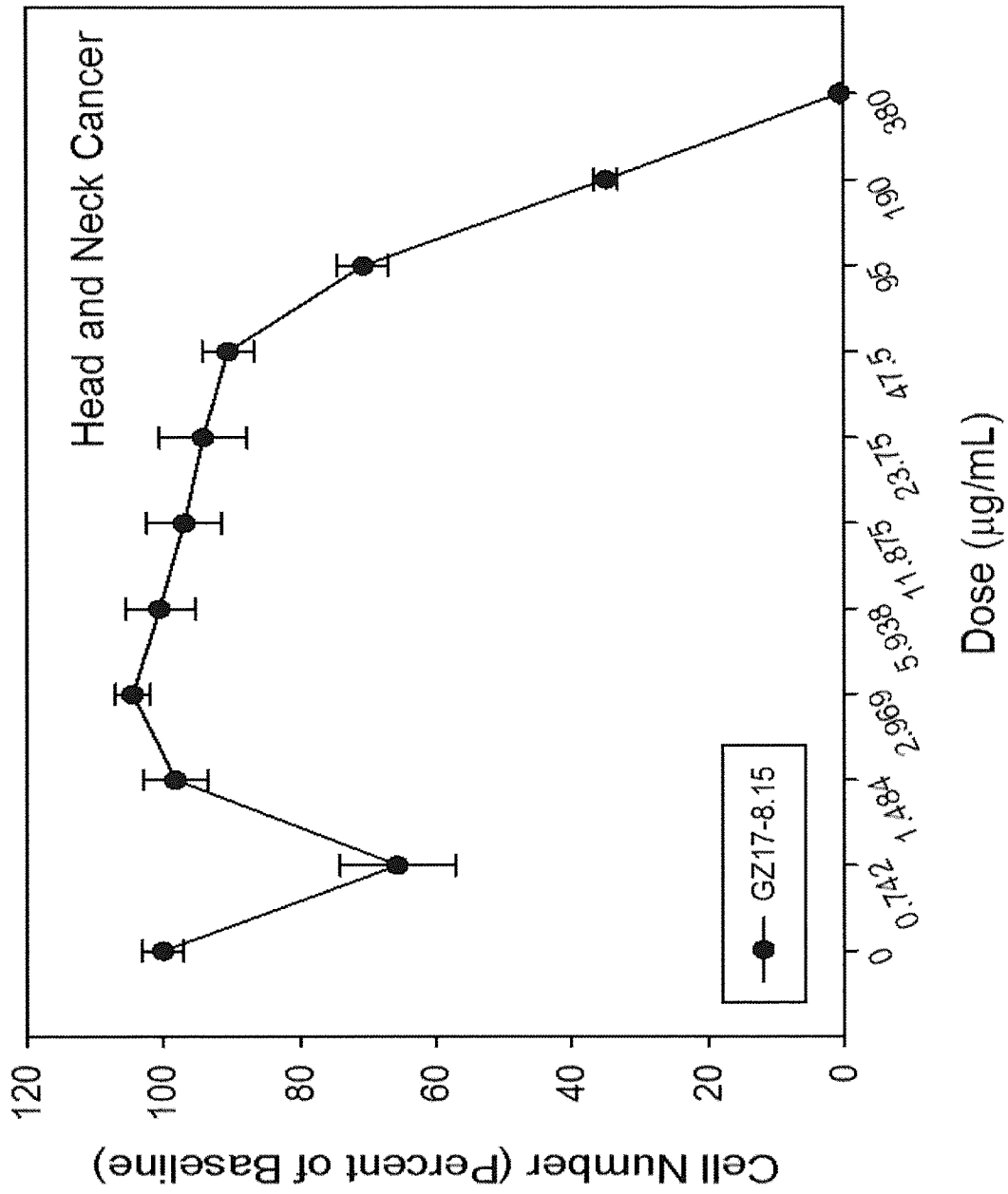

Head and Neck Cancer
Cell Number (Percent of Baseline)
120
100
80
60
40
20
0
GZ17-8.15
0
0.742
1.484
2.969
5.938
11.875
23.75
47.5
95
190
380
Dose (µg/mL)

Fig. 33D

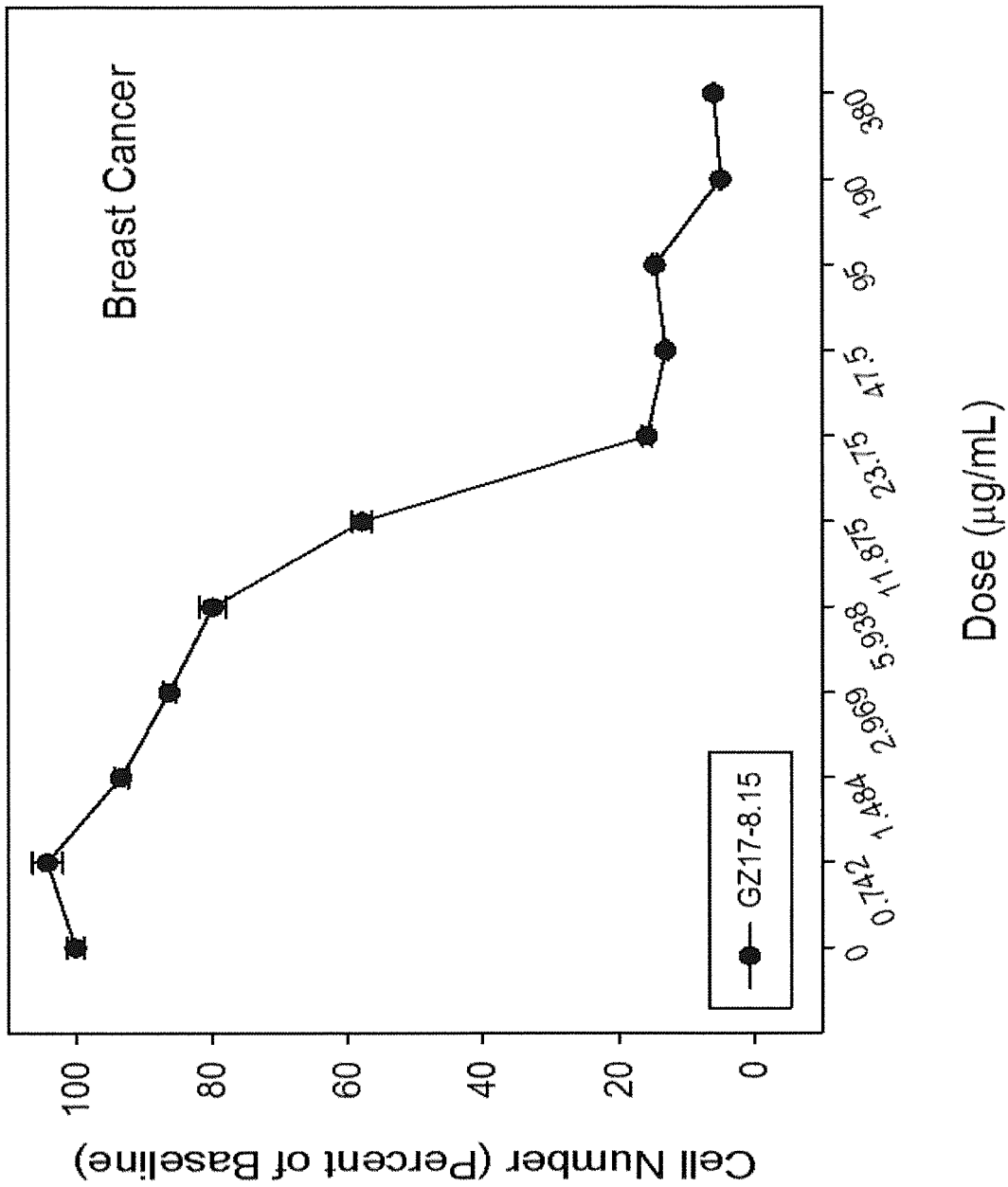

Breast Cancer
Cell Number (Percent of Baseline)
0
20
40
60
80
100
GZ17-8.15
0
0.742
1.484
2.969
5.938
11.875
23.75
47.5
95
190
380
Dose (µg/mL)

Fig. 33E

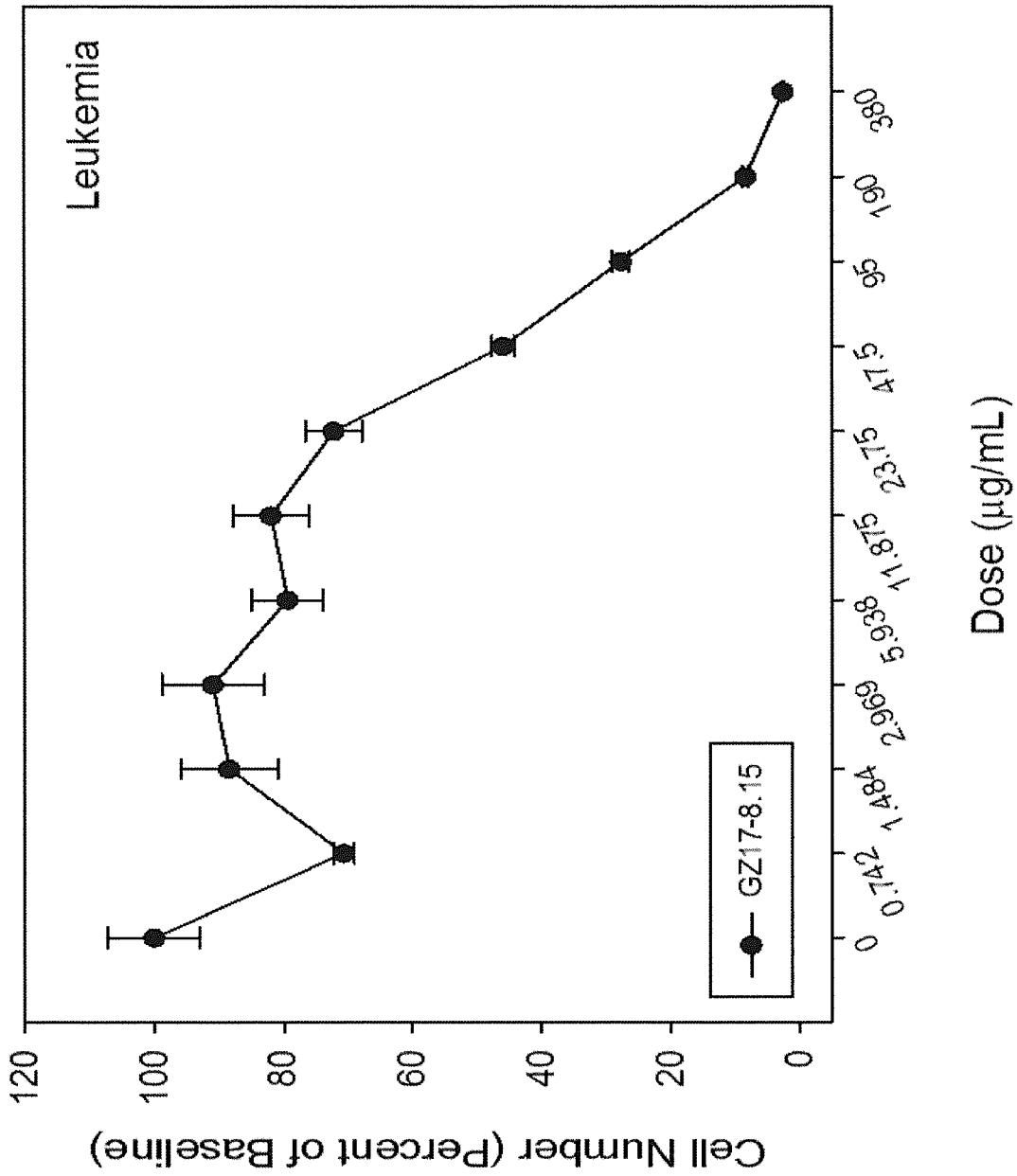

Leukemia
GZ17-8.15
Cell Number (Percent of Baseline)
120
100
80
60
40
20
0
0
0.742
1.484
2.969
5.938
11.875
23.75
47.5
95
190
380
Dose (µg/mL)

Fig. 33F

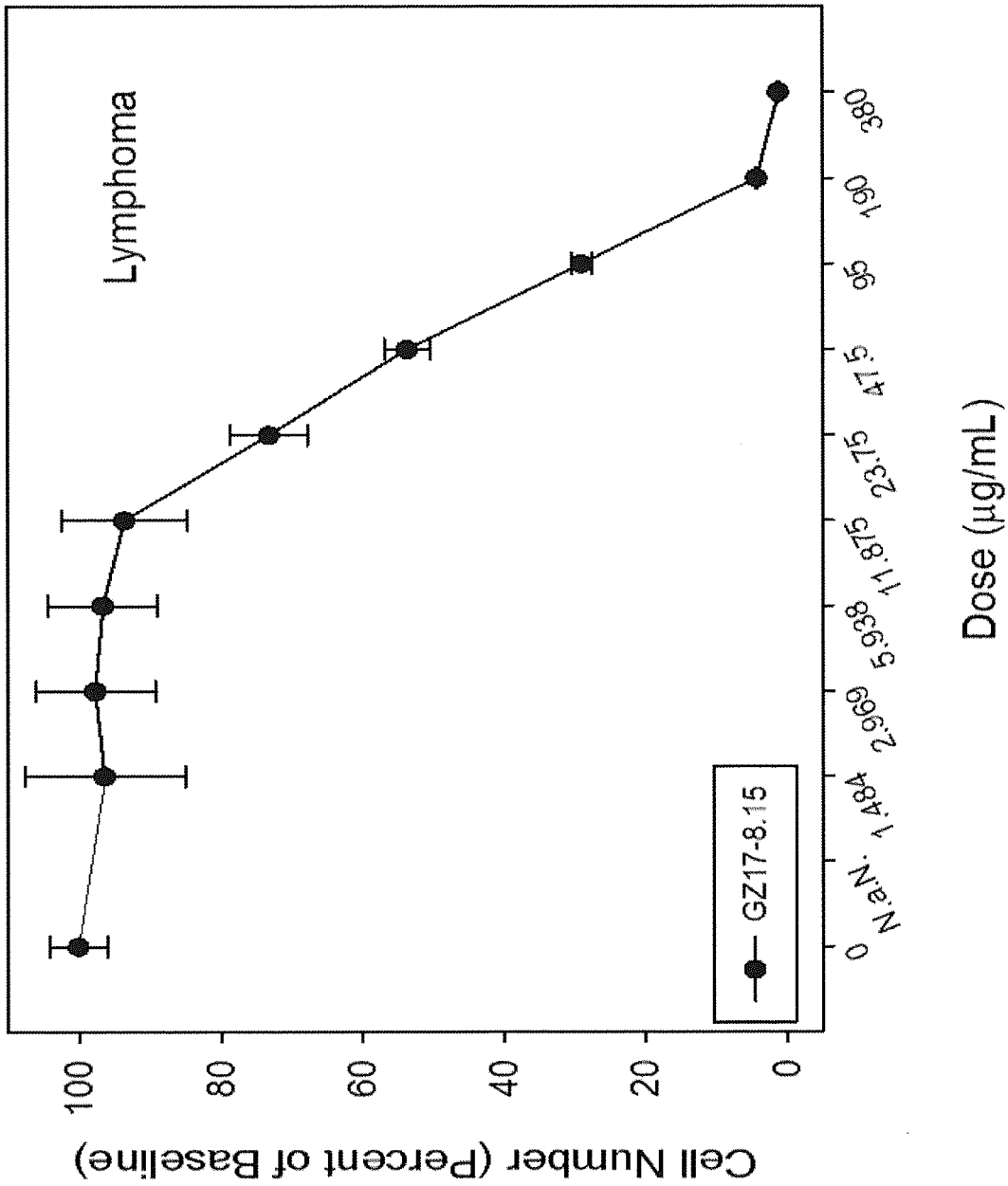

Lymphoma
Cell Number (Percent of Baseline)
100
80
60
40
20
0
GZ17-8.15
0
N.e.N.
1.484
2.969
5.938
11.875
23.75
47.5
95
190
380
Dose (µg/mL)

Fig. 33G

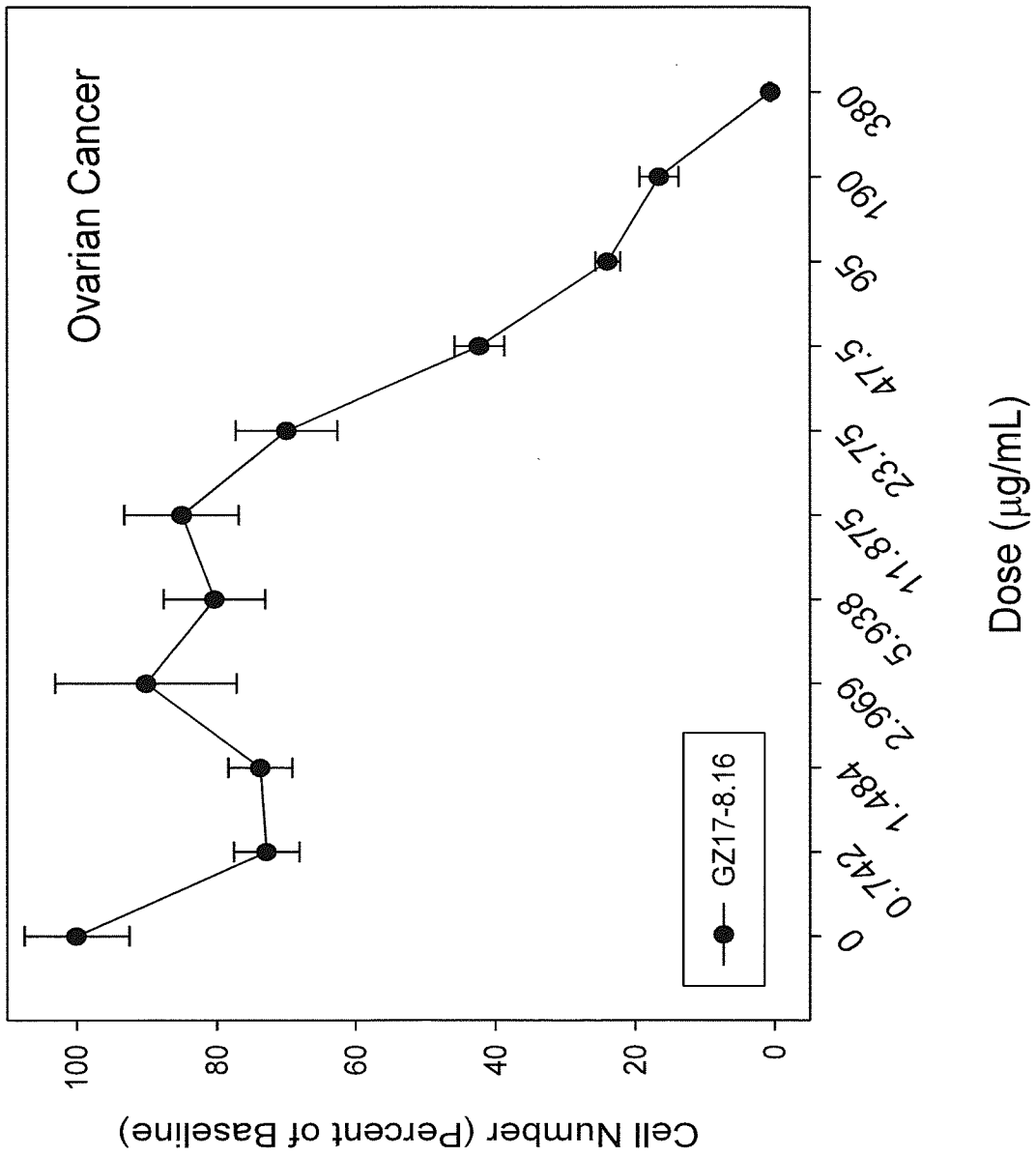

Ovarian Cancer
Cell Number (Percent of Baseline)
0
20
40
60
80
100
GZ17-8.16
0
0.742
1.484
2.969
5.938
11.875
23.75
47.5
95
190
380
Dose (µg/mL)

Fig. 34A

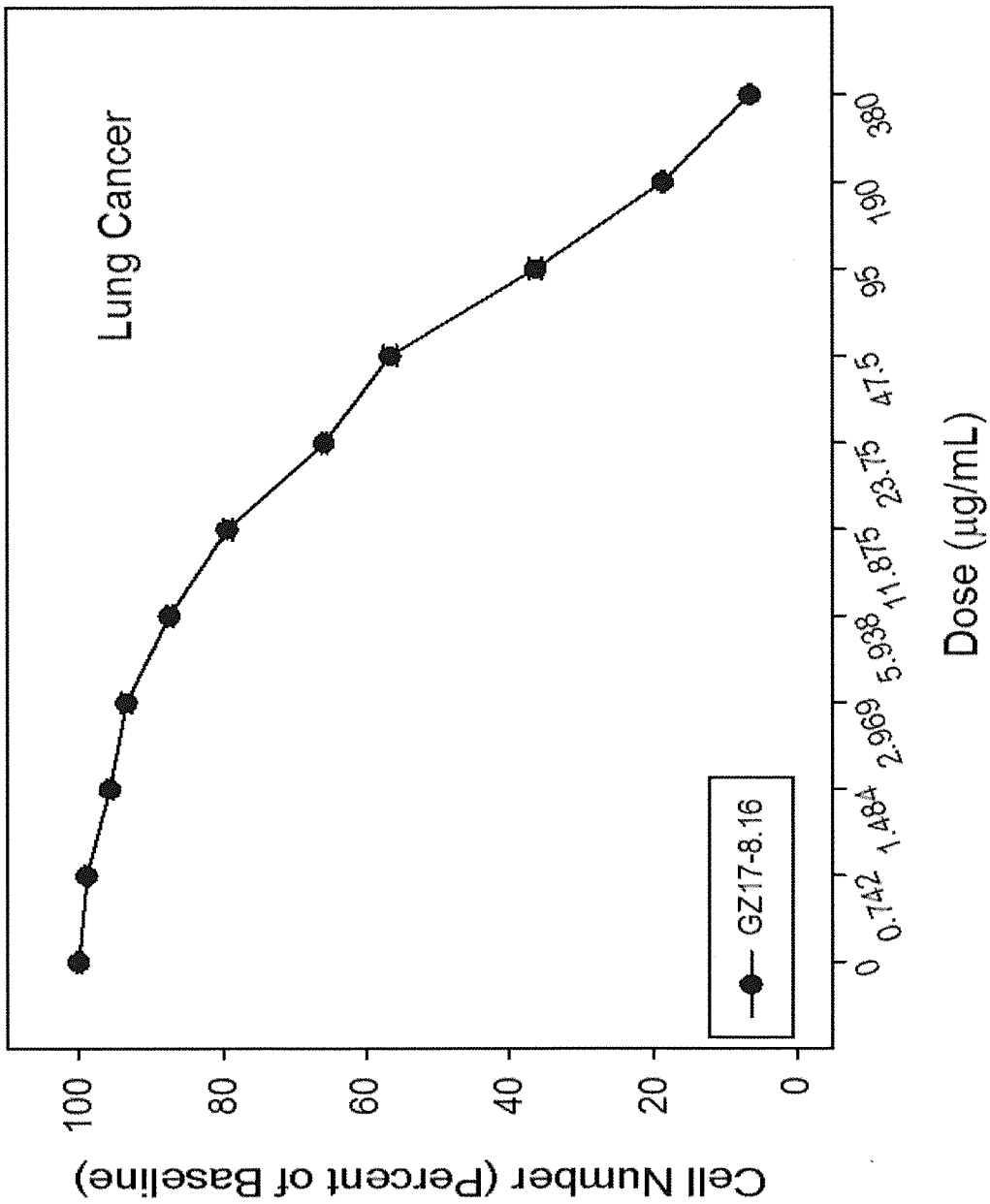

Lung Cancer
GZ17-8.16
Cell Number (Percent of Baseline)
0
20
40
60
80
100
0
0.742
1.484
2.969
5.938
11.875
23.75
47.5
95
190
380
Dose (µg/mL)

Fig. 34B

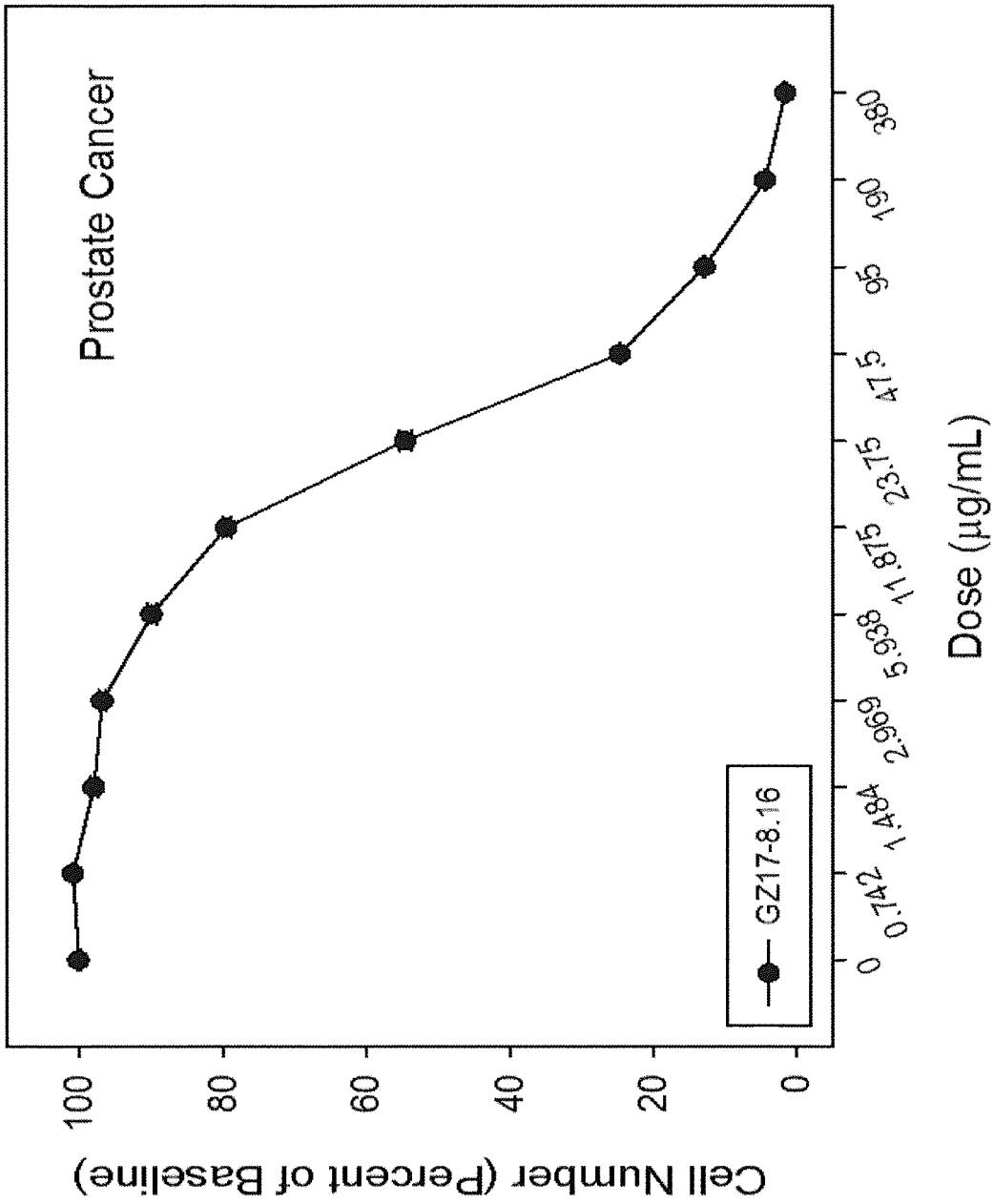

Prostate Cancer
Cell Number (Percent of Baseline)
0
20
40
60
80
100
GZ17-8.16
0
0.742
1.484
2.969
5.938
11.875
23.75
47.5
95
190
380
Dose (µg/mL)

Fig. 34C

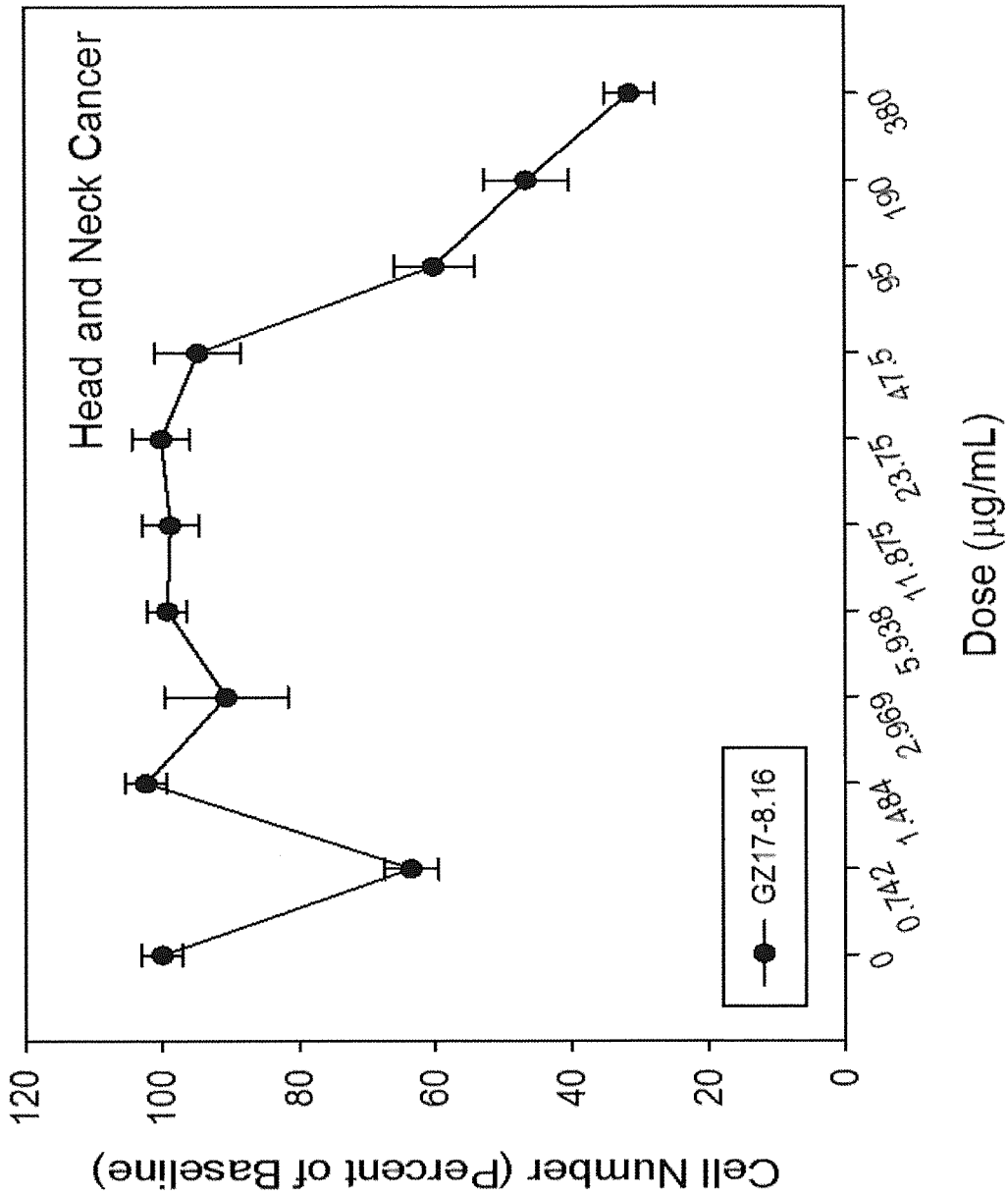

Head and Neck Cancer
Cell Number (Percent of Baseline)
120
100
80
60
40
20
0
GZ17-8.16
0
0.742
1.484
2.969
5.938
11.875
23.75
47.5
95
190
380
Dose (µg/mL)

Fig. 34D

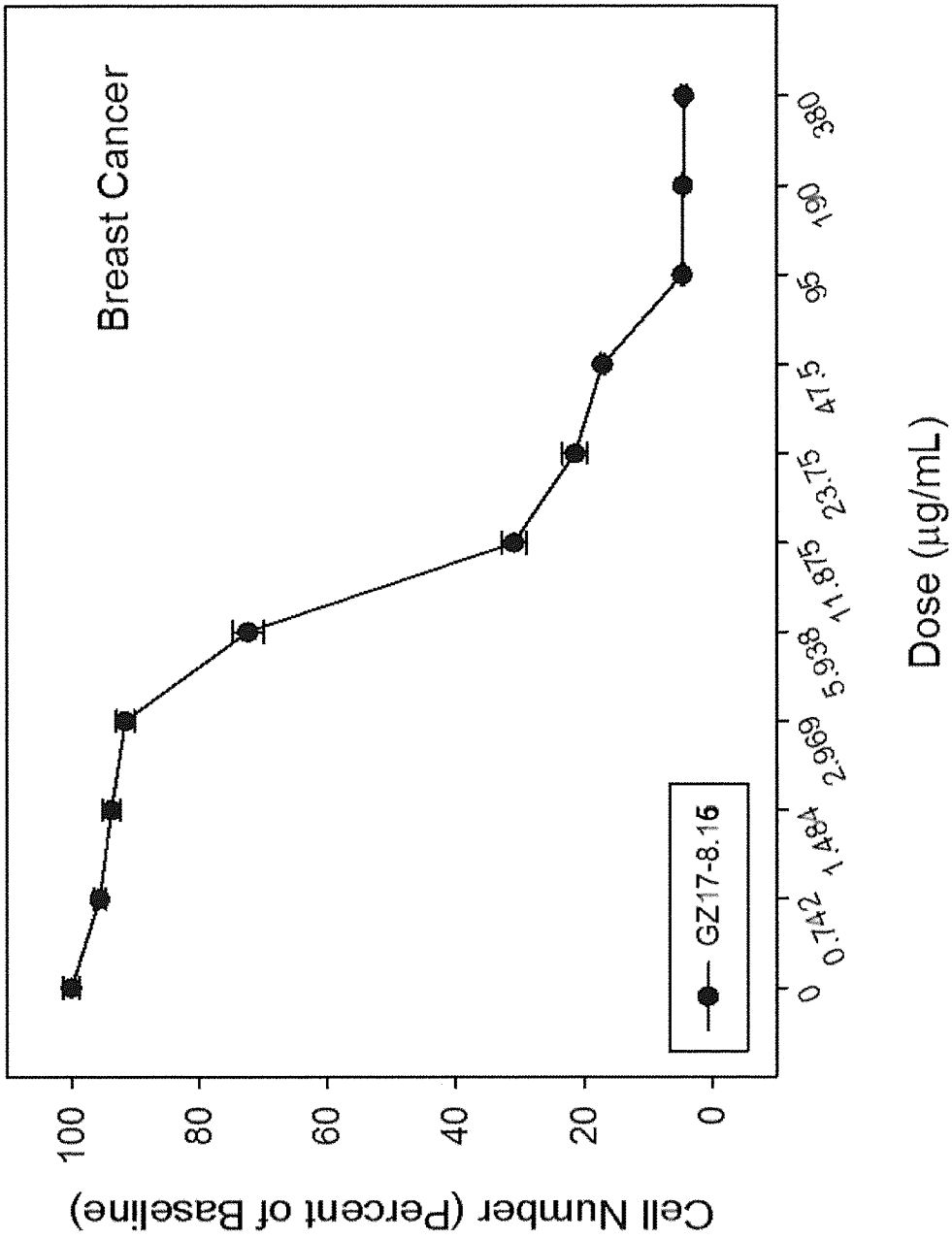

Breast Cancer
Cell Number (Percent of Baseline)
0
20
40
60
80
100
GZ17-8.16
0
0.742
1.484
2.969
5.938
11.875
23.75
47.5
95
190
380
Dose (µg/mL)

Fig. 34E

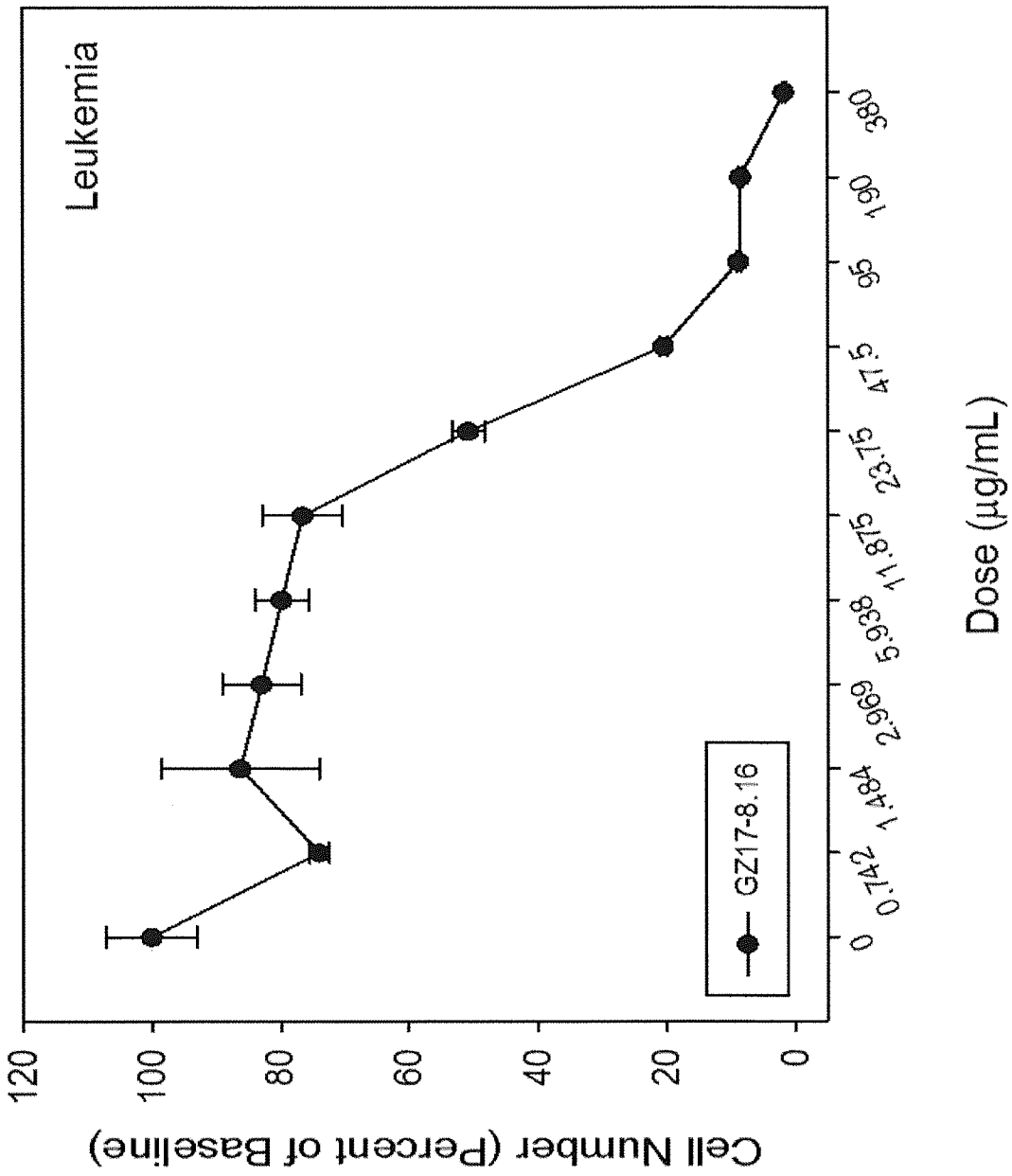

Leukemia
Cell Number (Percent of Baseline)
120
100
80
60
40
20
0
GZ17-8.16
0
0.742
1.484
2.969
5.938
11.875
23.75
47.5
95
190
380
Dose (µg/mL)

Fig. 34F

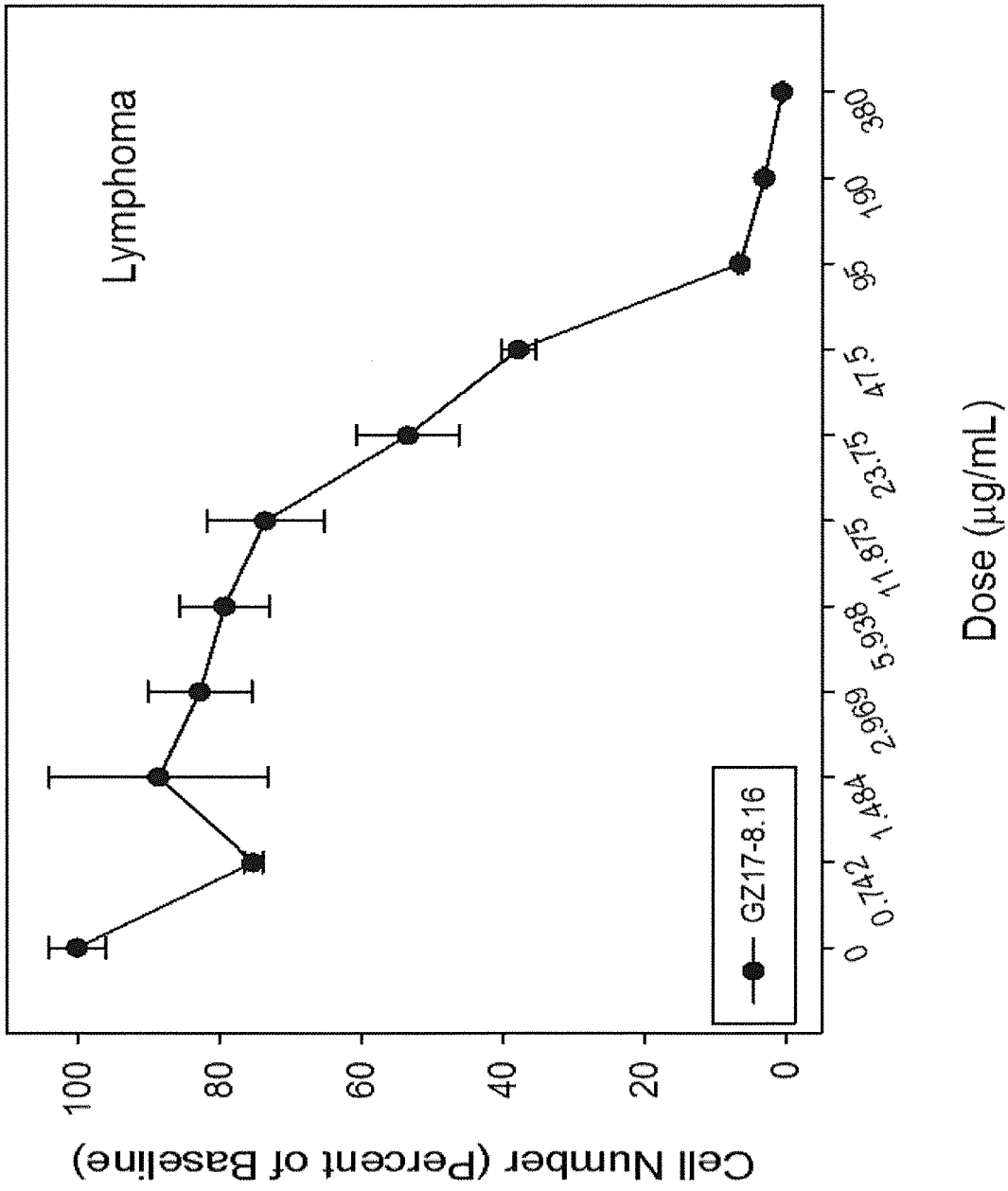

Lymphoma
Cell Number (Percent of Baseline)
100
80
60
40
20
0
GZ17-8.16
0
0.742
1.484
2.969
5.938
11.875
23.75
47.5
95
190
380
Dose (µg/mL)

Fig. 34G

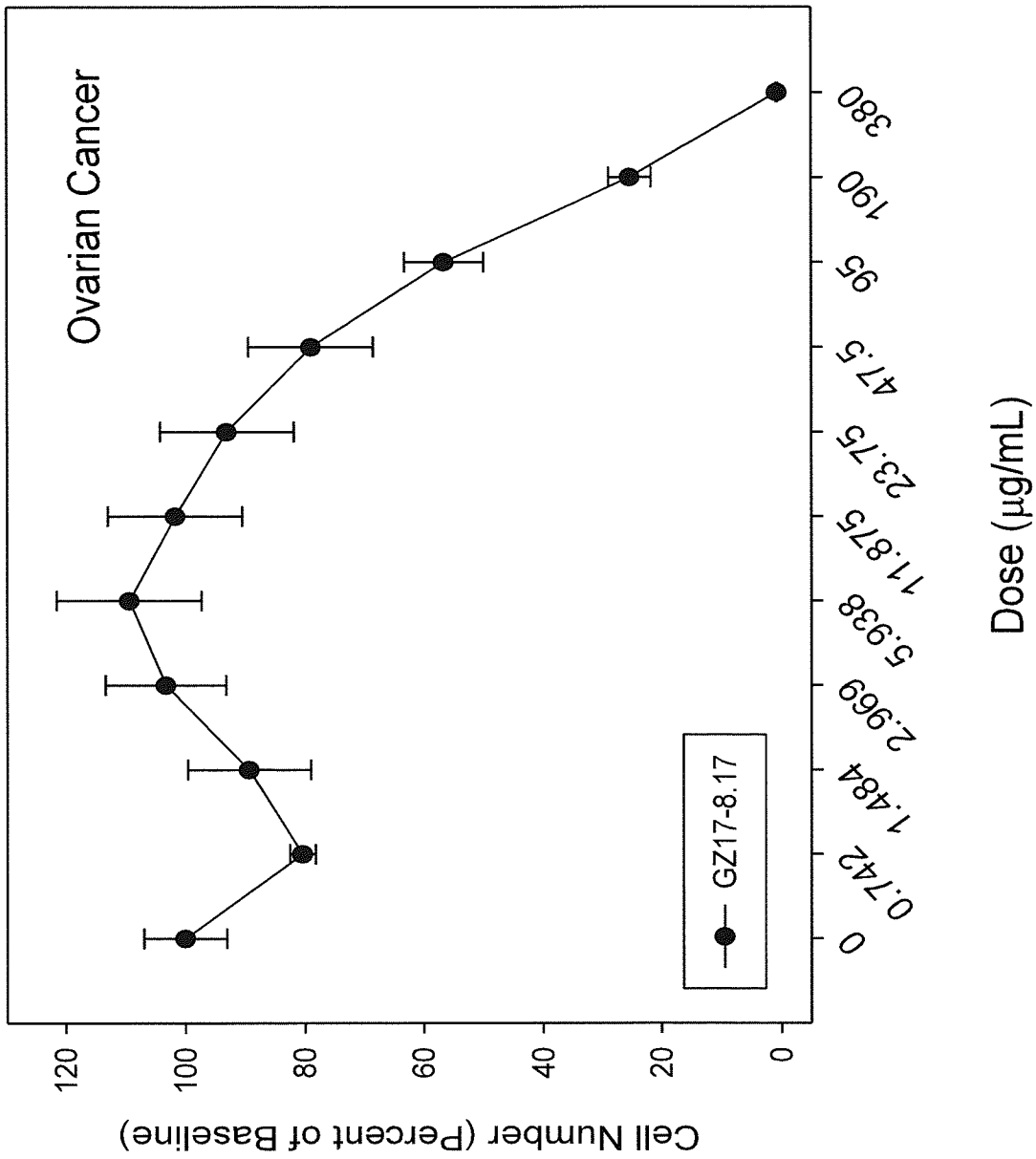

Ovarian Cancer
Cell Number (Percent of Baseline)
0
20
40
60
80
100
120
GZ17-8.17
0
0.742
1.484
2.969
5.938
11.875
23.75
47.5
95
190
380
Dose (µg/mL)

Fig. 35A

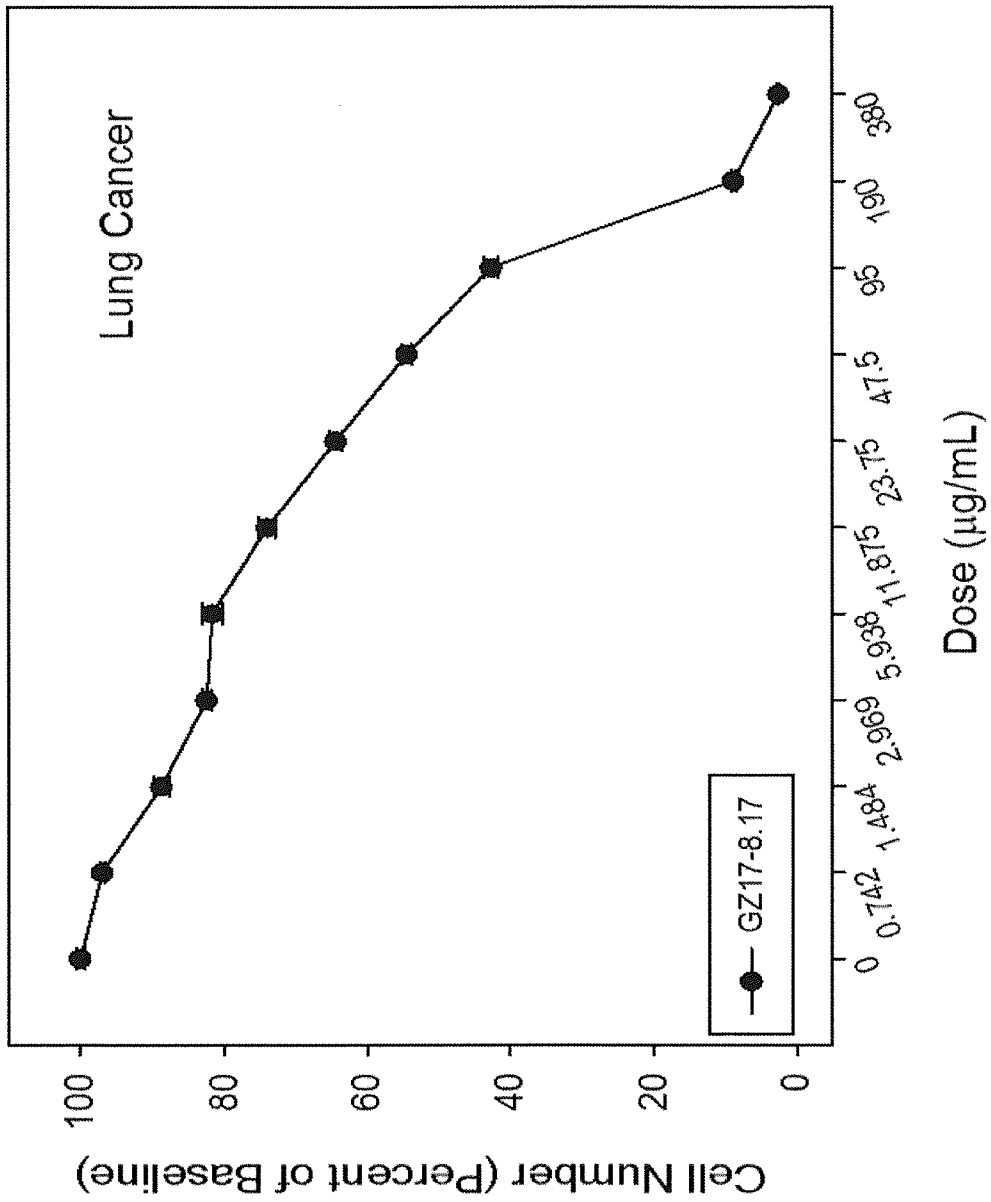

Lung Cancer
Cell Number (Percent of Baseline)
0
20
40
60
80
100
GZ17-8.17
0
0.742
1.484
2.969
5.938
11.875
23.75
47.5
95
190
380
Dose (µg/mL)

Fig. 35B

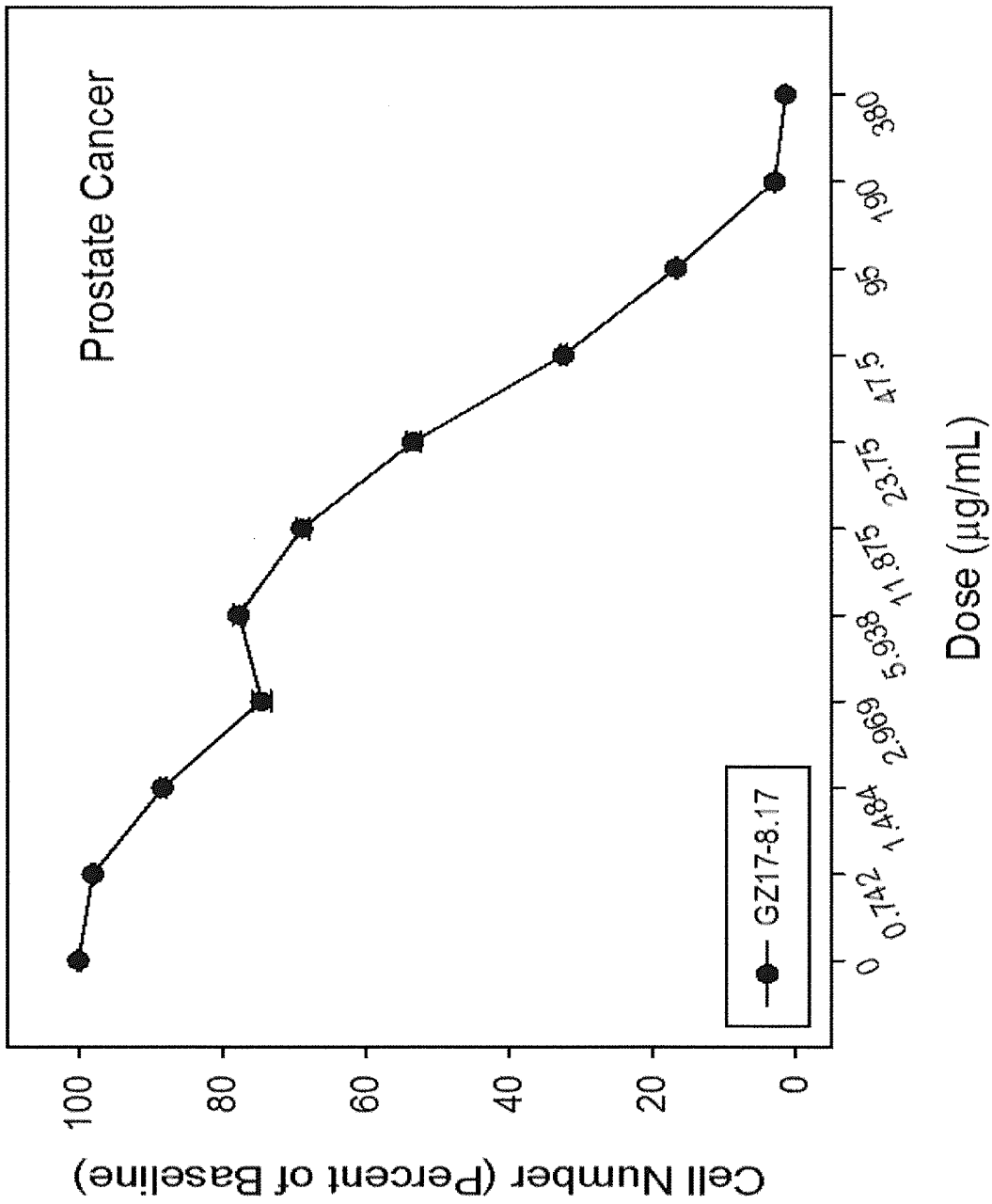

Prostate Cancer
Cell Number (Percent of Baseline)
0
20
40
60
80
100
GZ17-8.17
0
0.742
1.484
2.969
5.938
11.875
23.75
47.5
95
190
380
Dose (µg/mL)

Fig. 35C

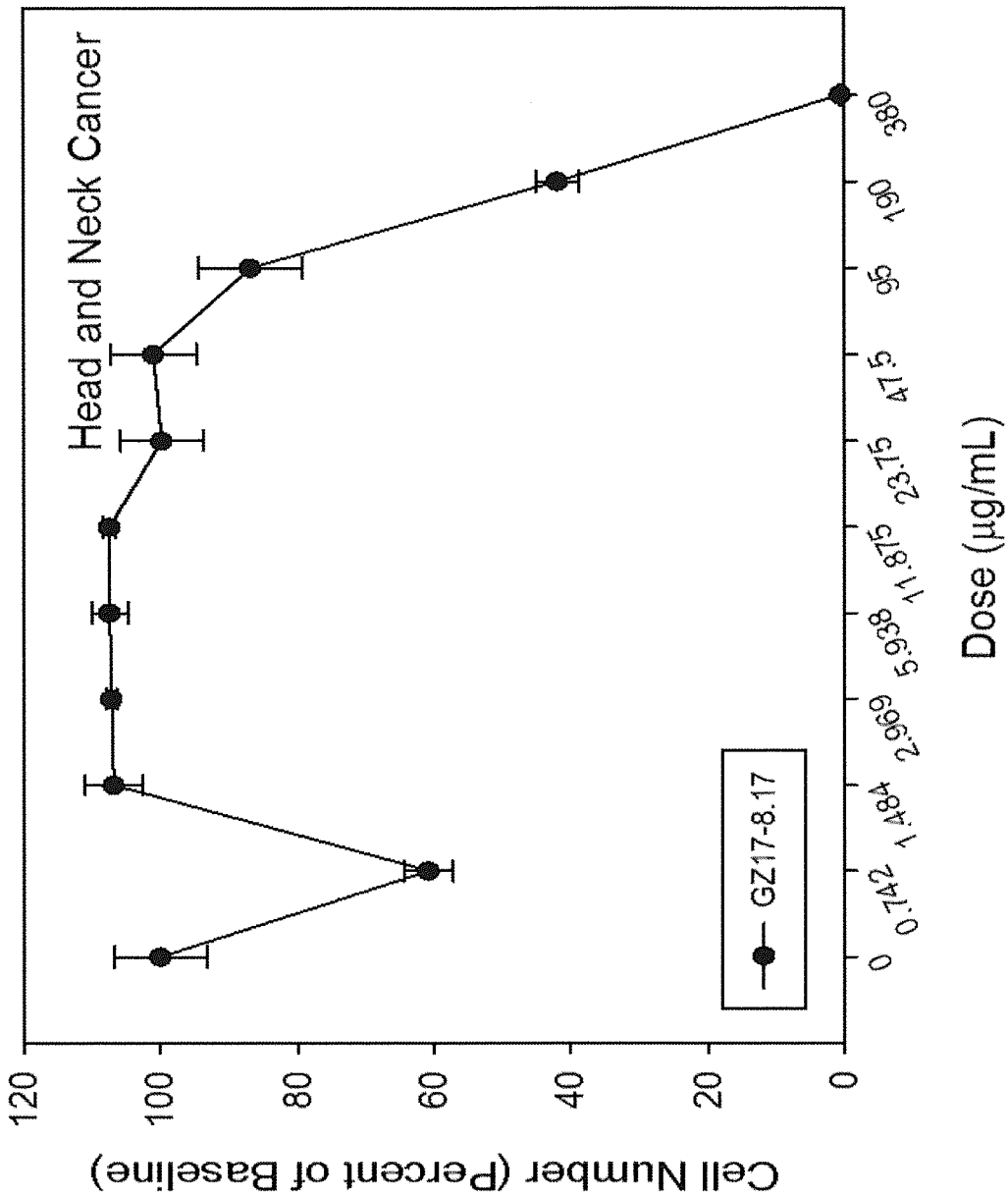

Head and Neck Cancer
Cell Number (Percent of Baseline)
120
100
80
60
40
20
0
GZ17-8.17
0
0.742
1.484
2.969
5.938
11.875
23.75
47.5
95
190
380
Dose (µg/mL)

Fig. 35D

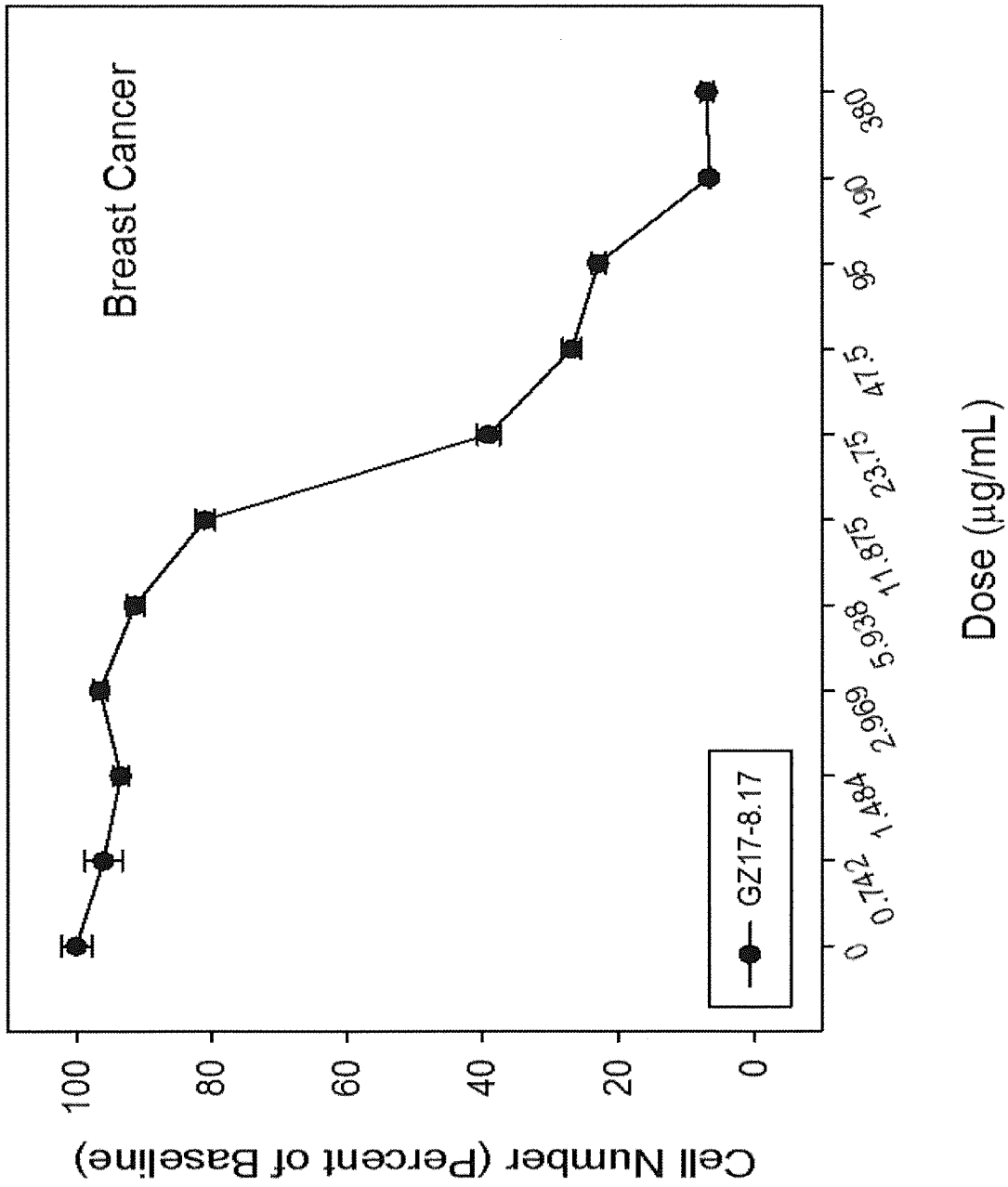

Breast Cancer
Cell Number (Percent of Baseline)
0
20
40
60
80
100
GZ17-8.17
0
0.742
1.484
2.969
5.938
11.875
23.75
47.5
95
190
380
Dose (µg/mL)

Fig. 35E

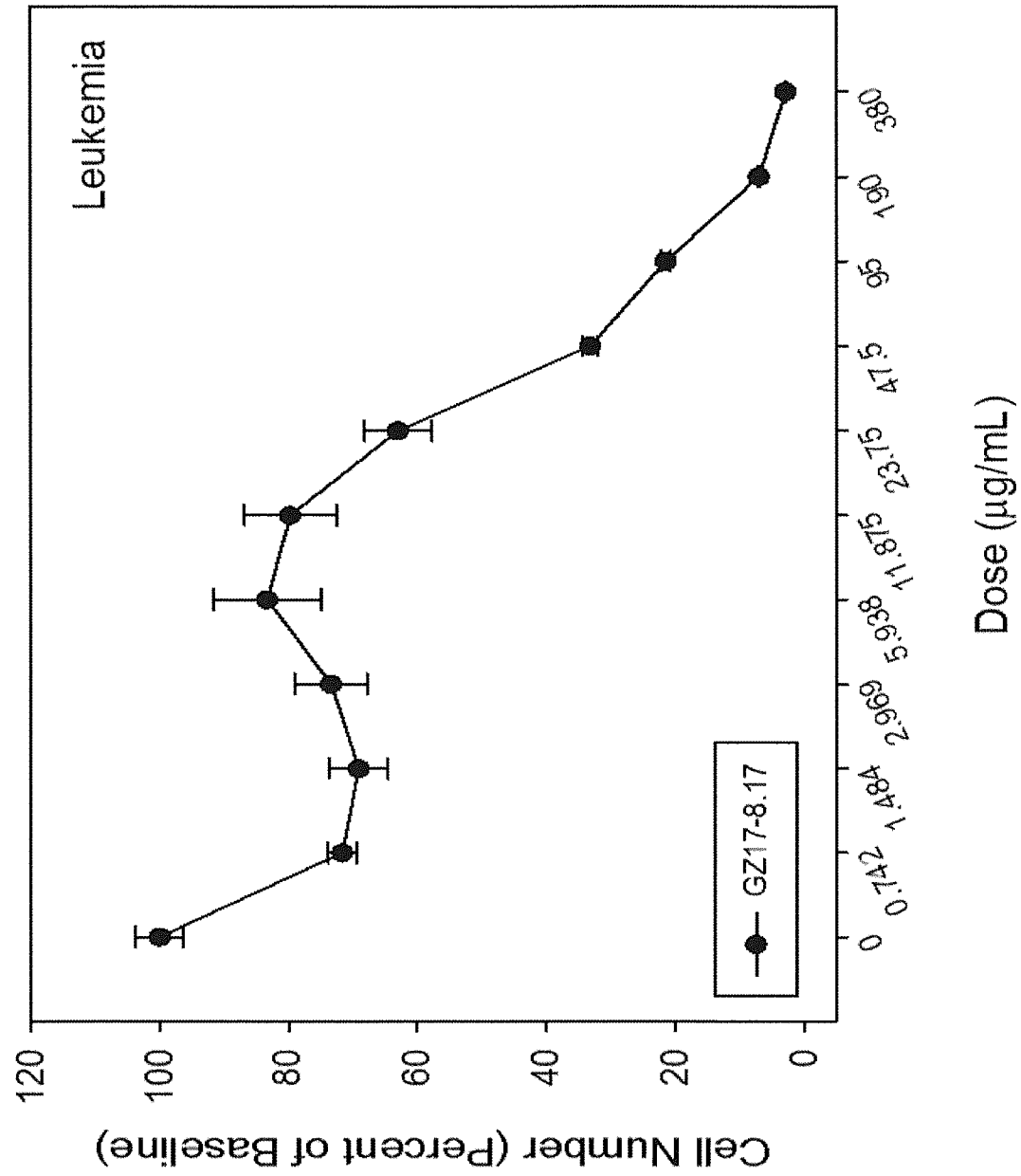

Leukemia
Cell Number (Percent of Baseline)
120
100
80
60
40
20
0
GZ17-8.17
0
0.742
1.484
2.969
5.938
11.875
23.75
47.5
95
190
380
Dose (µg/mL)

Fig. 35F

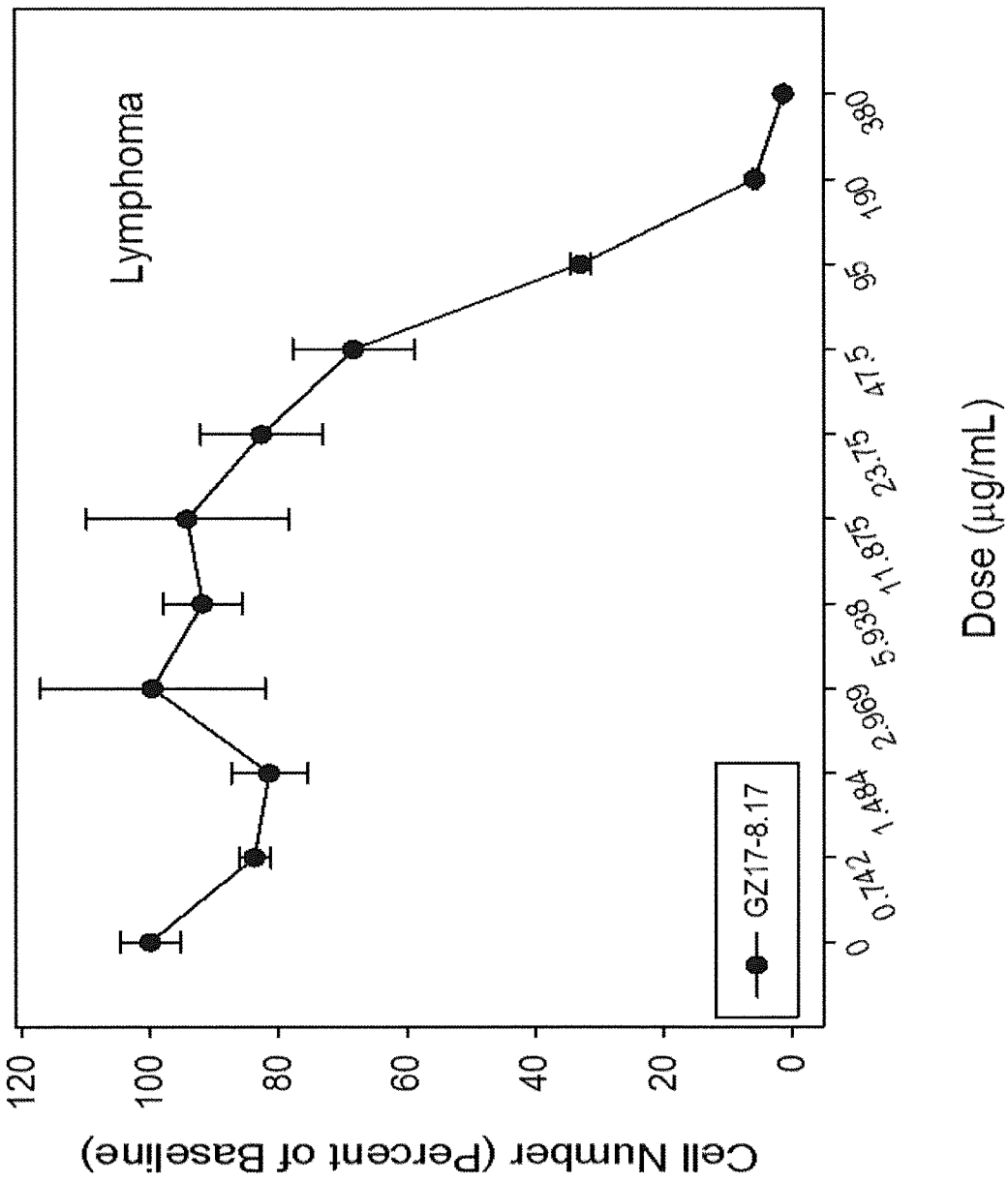

Lymphoma
Cell Number (Percent of Baseline)
0
20
40
60
80
100
120
GZ17-8.17
0
0.742
1.484
2.969
5.938
11.875
23.75
47.5
95
190
380
Dose (μg/mL)

Fig. 35G

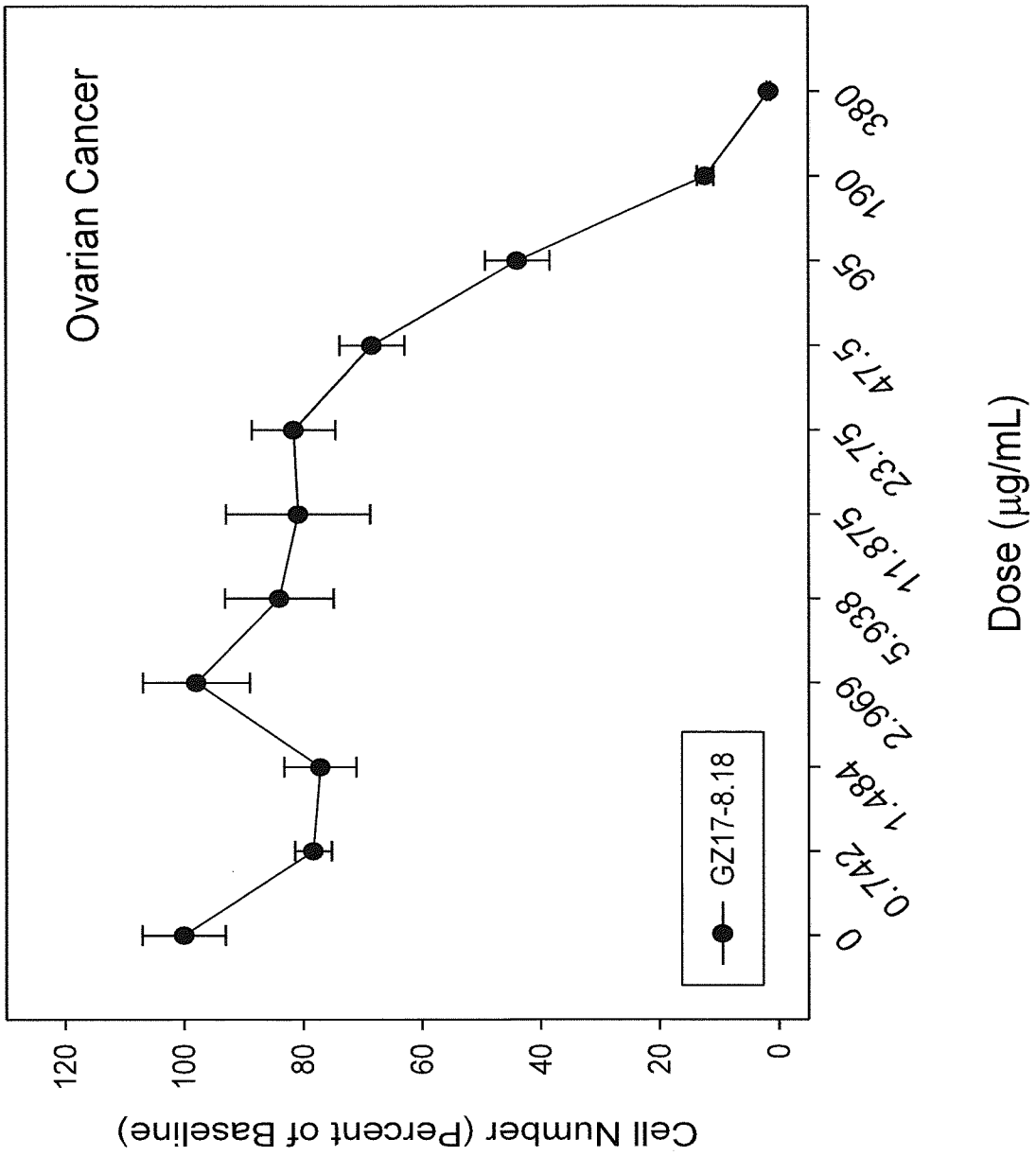

Ovarian Cancer
GZ17-8.18
Cell Number (Percent of Baseline)
0
20
40
60
80
100
120
0
0.742
1.484
2.969
5.938
11.875
23.75
47.5
95
190
380
Dose (µg/mL)

Fig. 36A

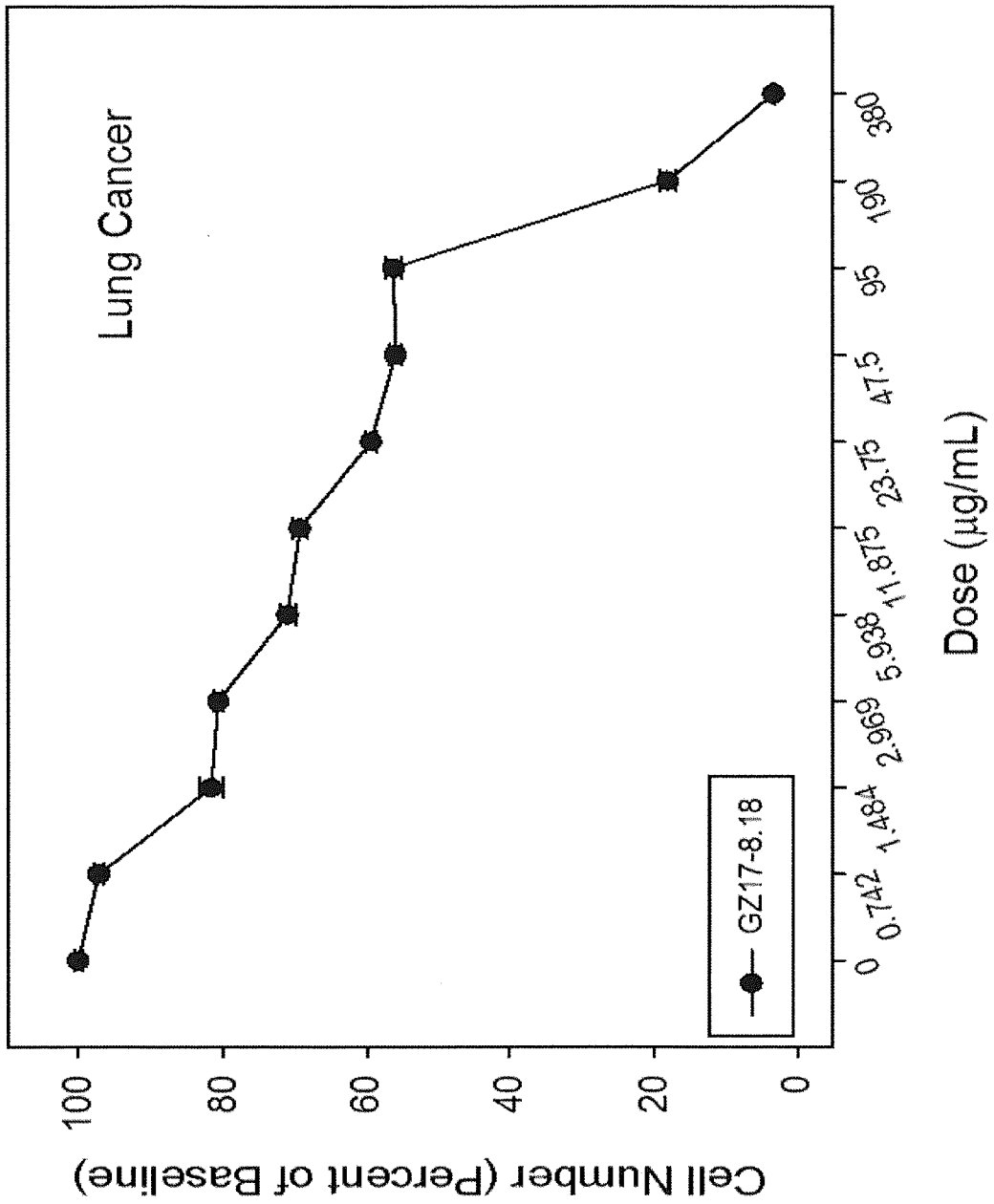

Lung Cancer
Cell Number (Percent of Baseline)
100
80
60
40
20
0
GZ17-8.18
0
0.742
1.484
2.969
5.938
11.875
23.75
47.5
95
190
380
Dose (µg/mL)

Fig. 36B

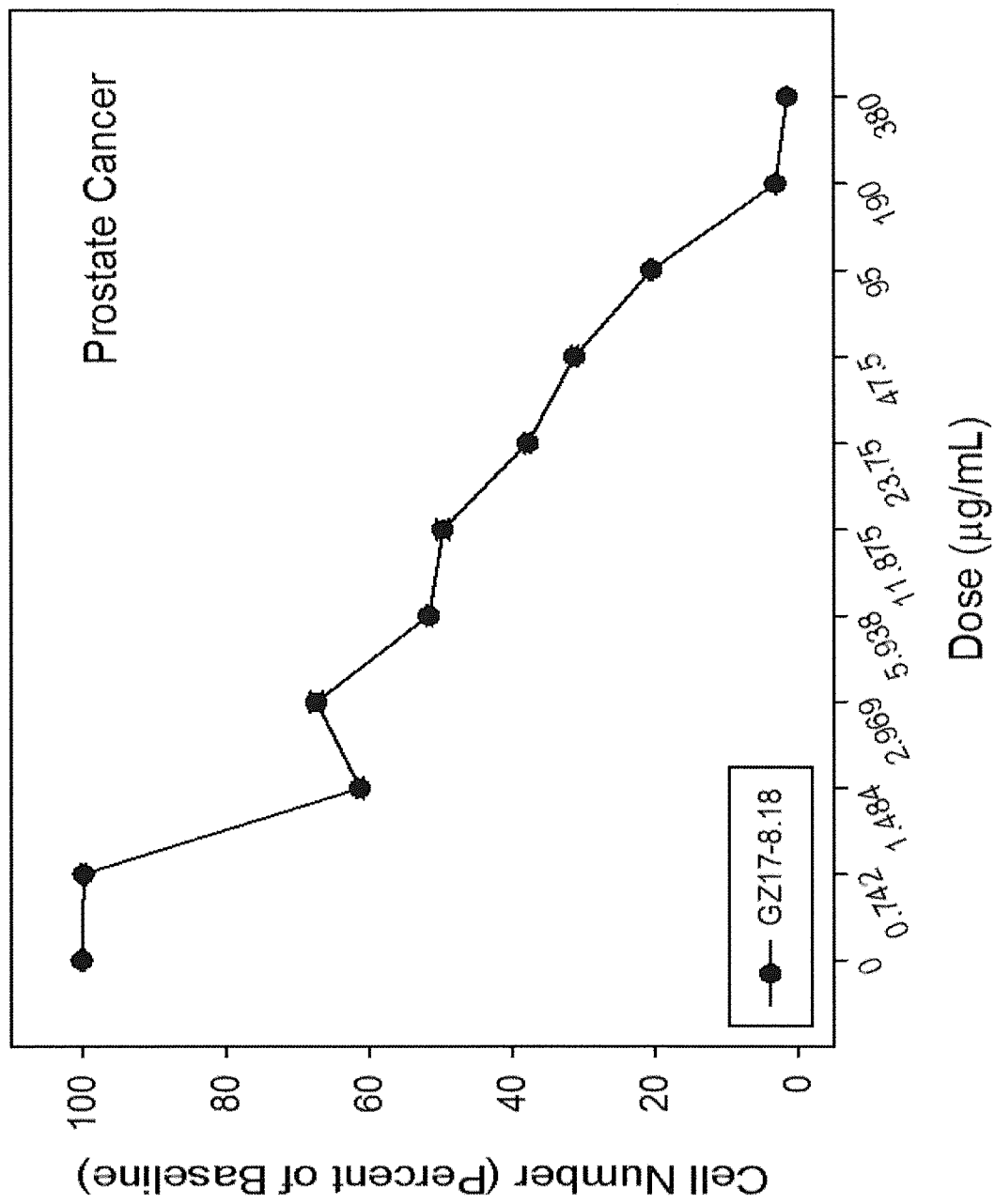

Prostate Cancer
Cell Number (Percent of Baseline)
0
20
40
60
80
100
GZ17-8.18
0
0.142
1.484
2.969
5.938
11.875
23.75
47.5
95
190
380
Dose (µg/mL)

Fig. 36C

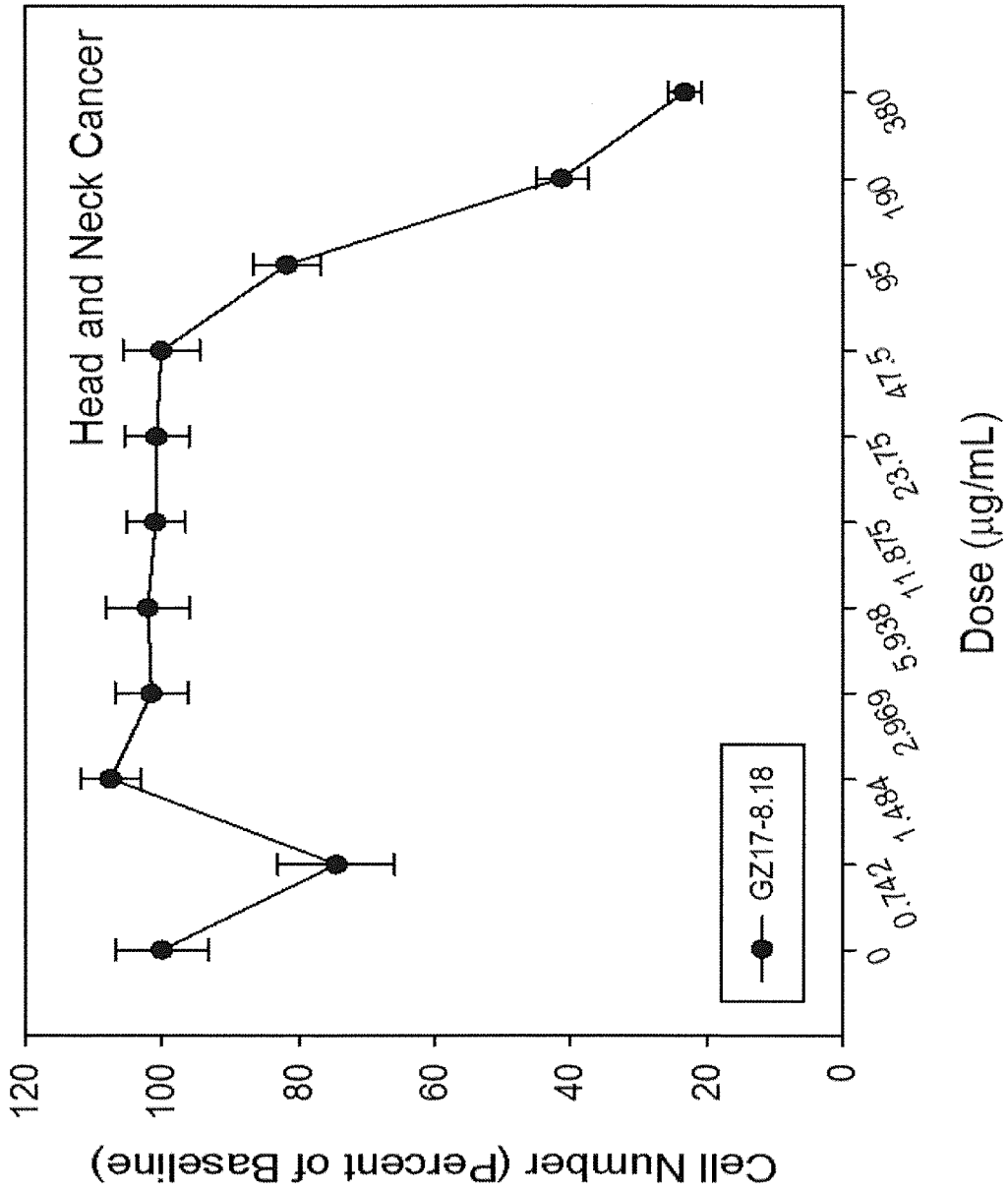

Head and Neck Cancer
Cell Number (Percent of Baseline)
120
100
80
60
40
20
0
GZ17-8.18
0
0.742
1.484
2.969
5.938
11.875
23.75
47.5
95
190
380
Dose (µg/mL)

Fig. 36D

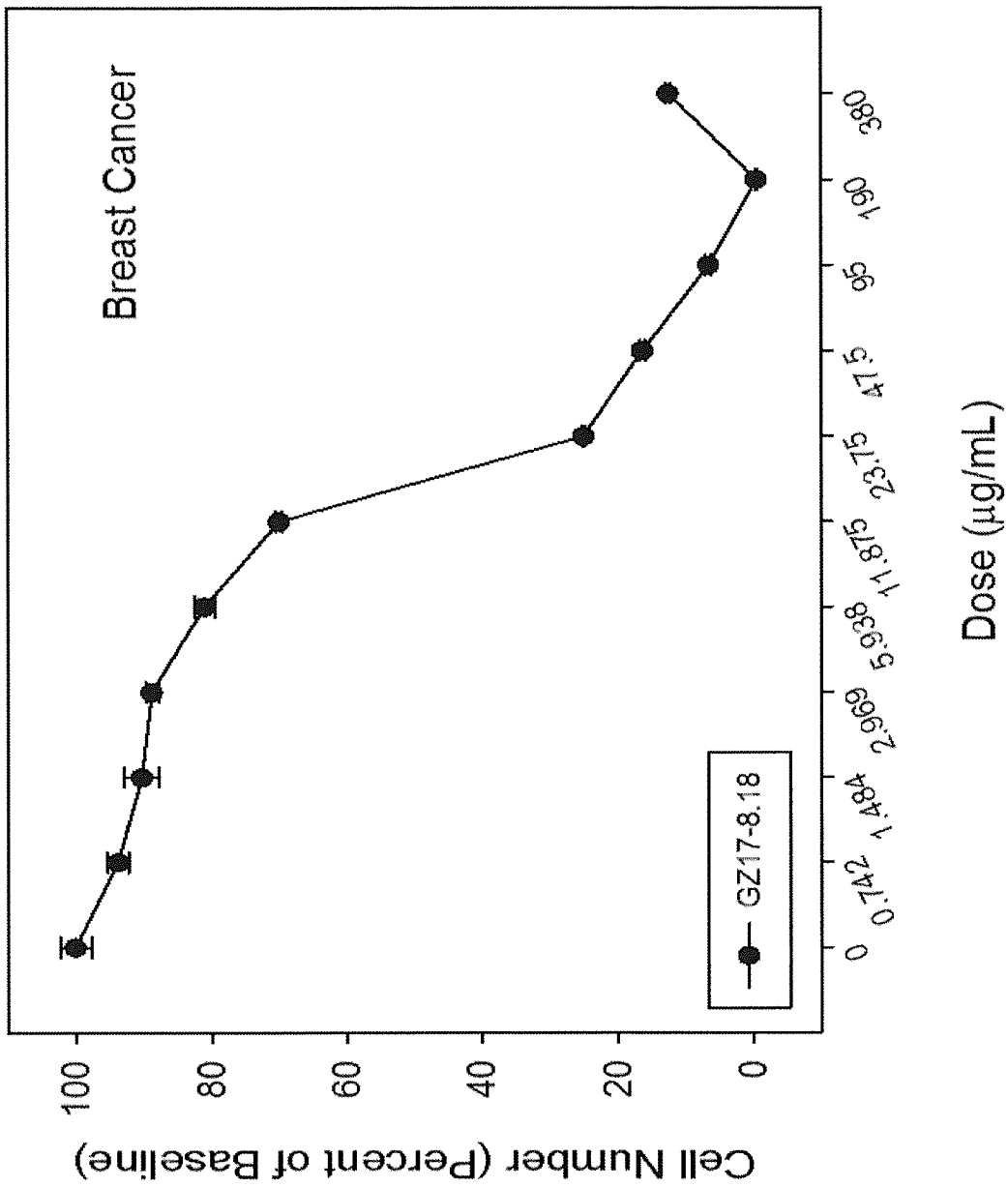

Breast Cancer
Cell Number (Percent of Baseline)
100
80
60
40
20
0
GZ17-8.18
0
0.142
1.484
2.969
5.938
11.875
23.75
47.5
95
190
380
Dose (µg/mL)

Fig. 36E

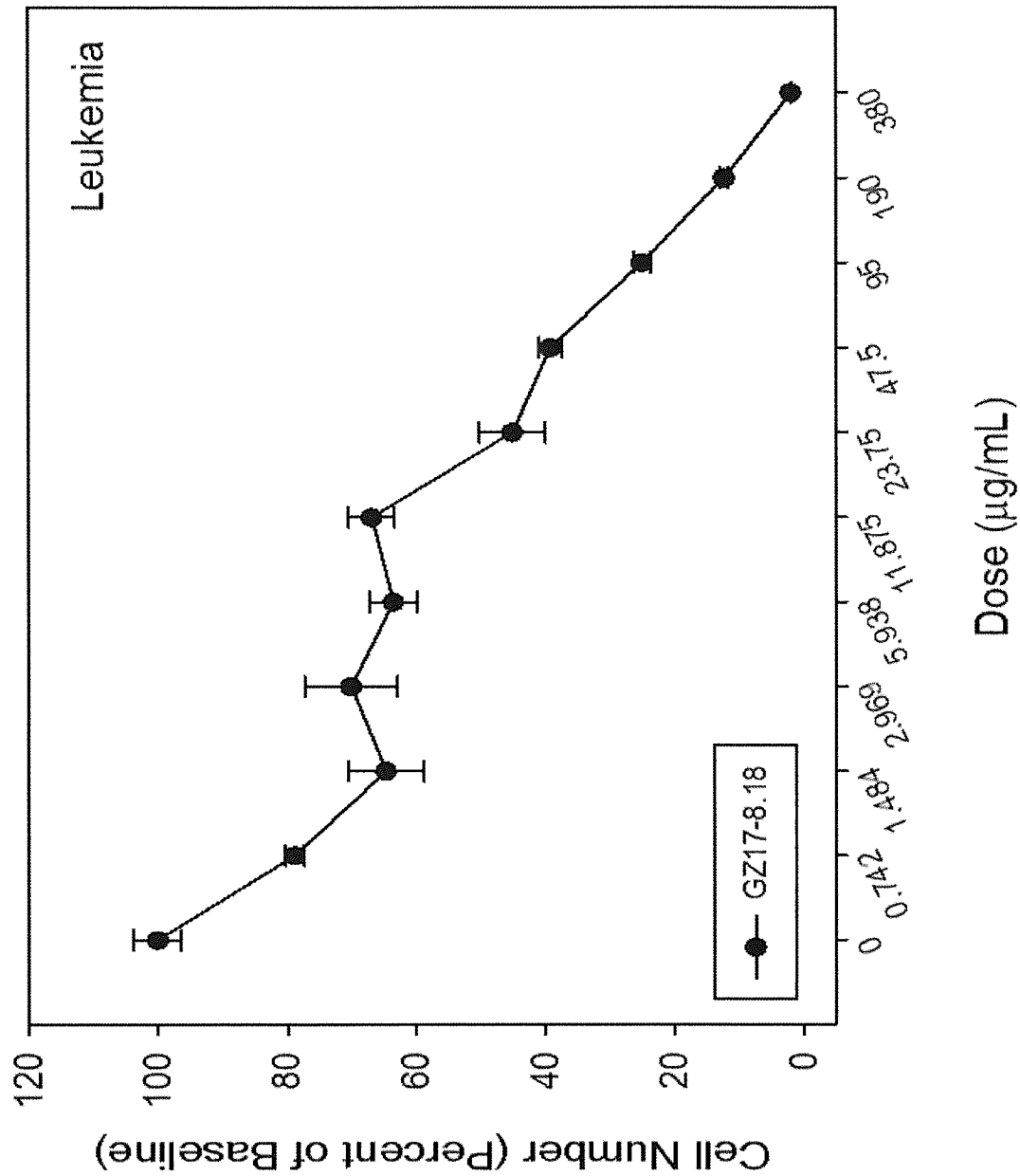

Leukemia
Cell Number (Percent of Baseline)
120
100
80
60
40
20
0
GZ17-8.18
0
0.742
1.484
2.969
5.938
11.875
23.75
47.5
95
190
380
Dose (µg/mL)

Fig. 36F

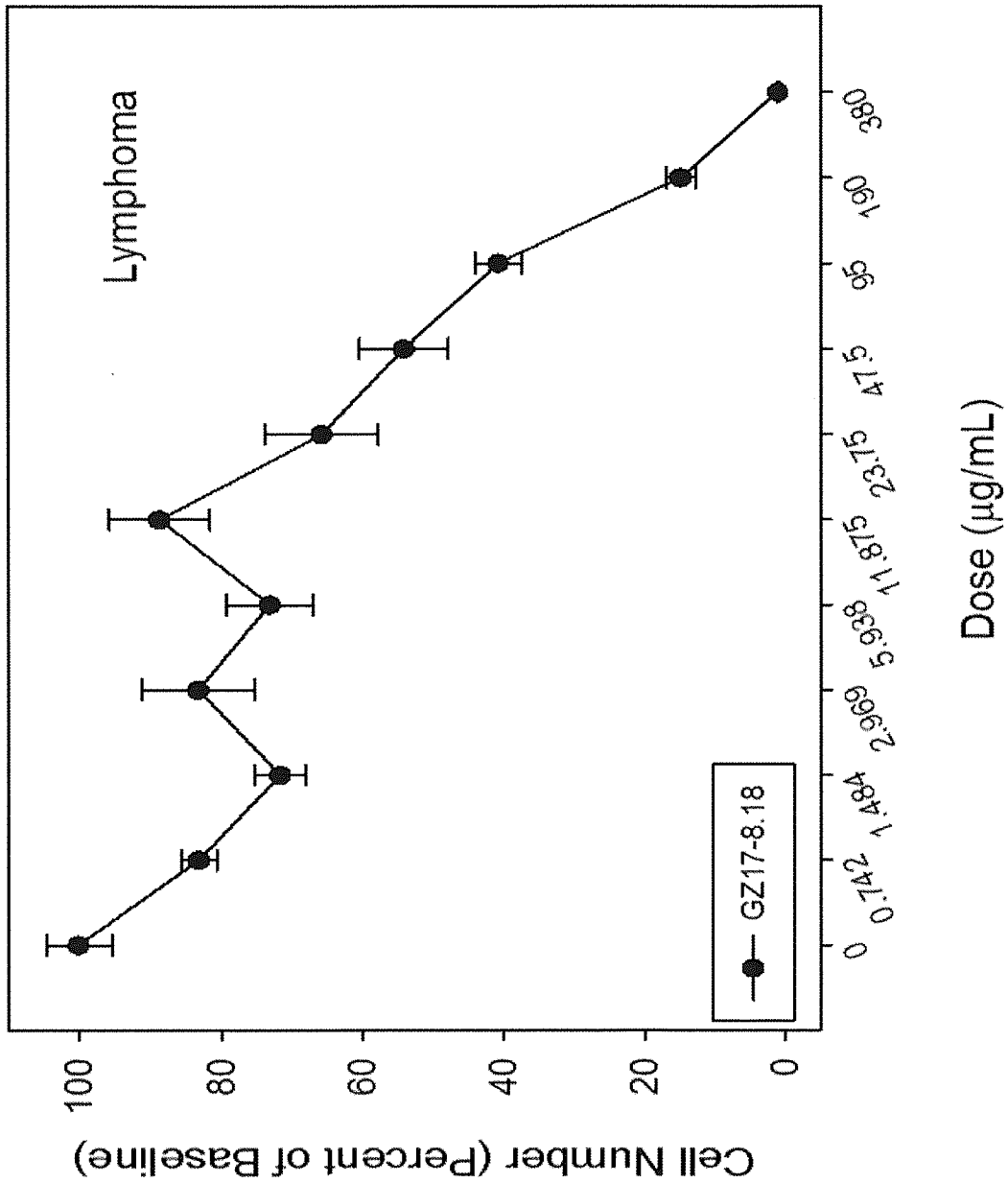

Lymphoma
GZ17-8.18
Cell Number (Percent of Baseline)
0
20
40
60
80
100
0
0.742
1.484
2.969
5.938
11.875
23.75
47.5
95
190
380
Dose (µg/mL)

Fig. 36G

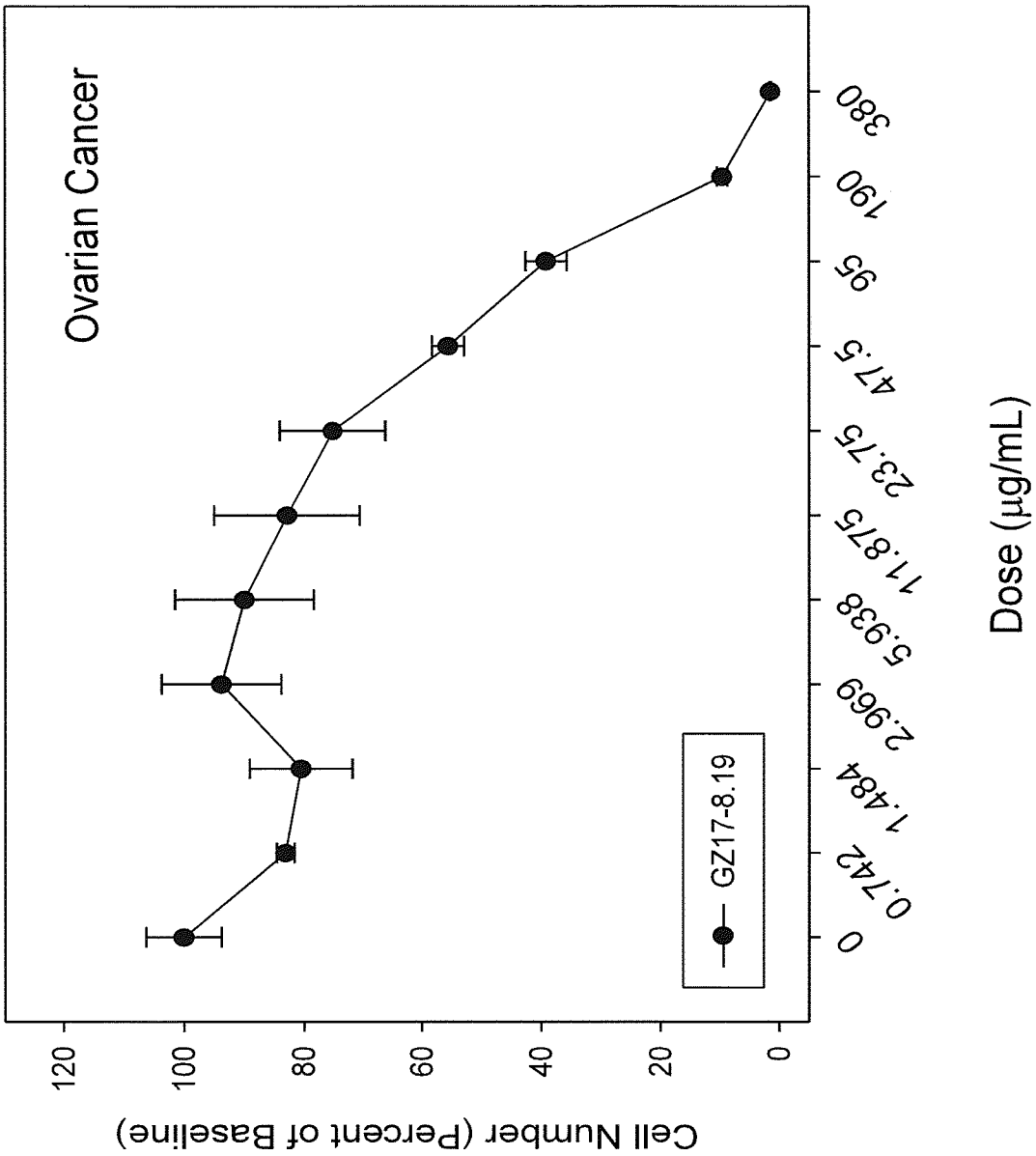

Ovarian Cancer
Cell Number (Percent of Baseline)
120
100
80
60
40
20
0
GZ17-8.19
0
0.742
1.484
2.969
5.938
11.875
23.75
47.5
95
190
380
Dose (µg/mL)

Fig. 37A

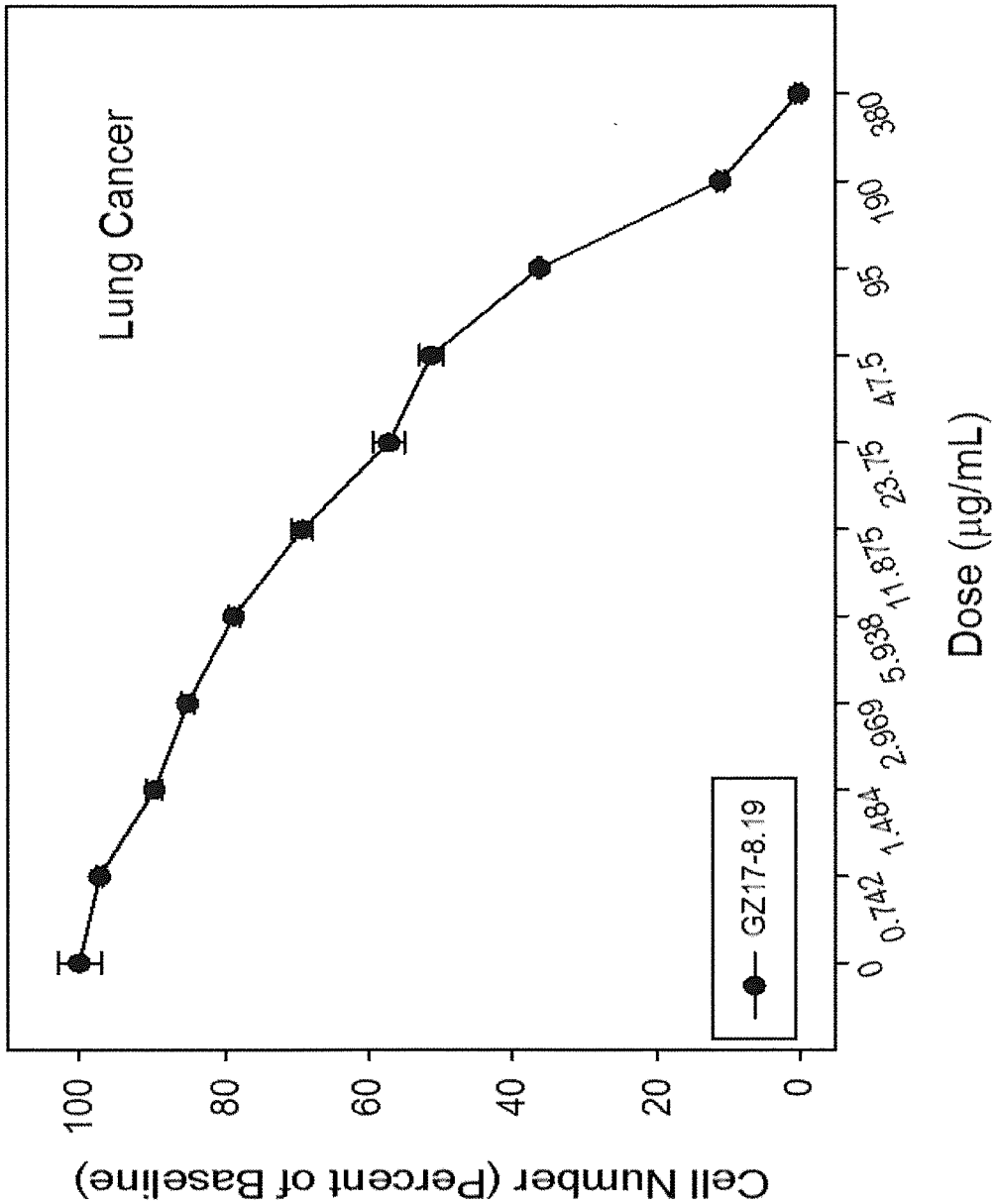

Lung Cancer
Cell Number (Percent of Baseline)
0
20
40
60
80
100
GZ17-8.19
0
0.742
1.484
2.969
5.938
11.875
23.75
47.5
95
190
380
Dose (µg/mL)

Fig. 37B

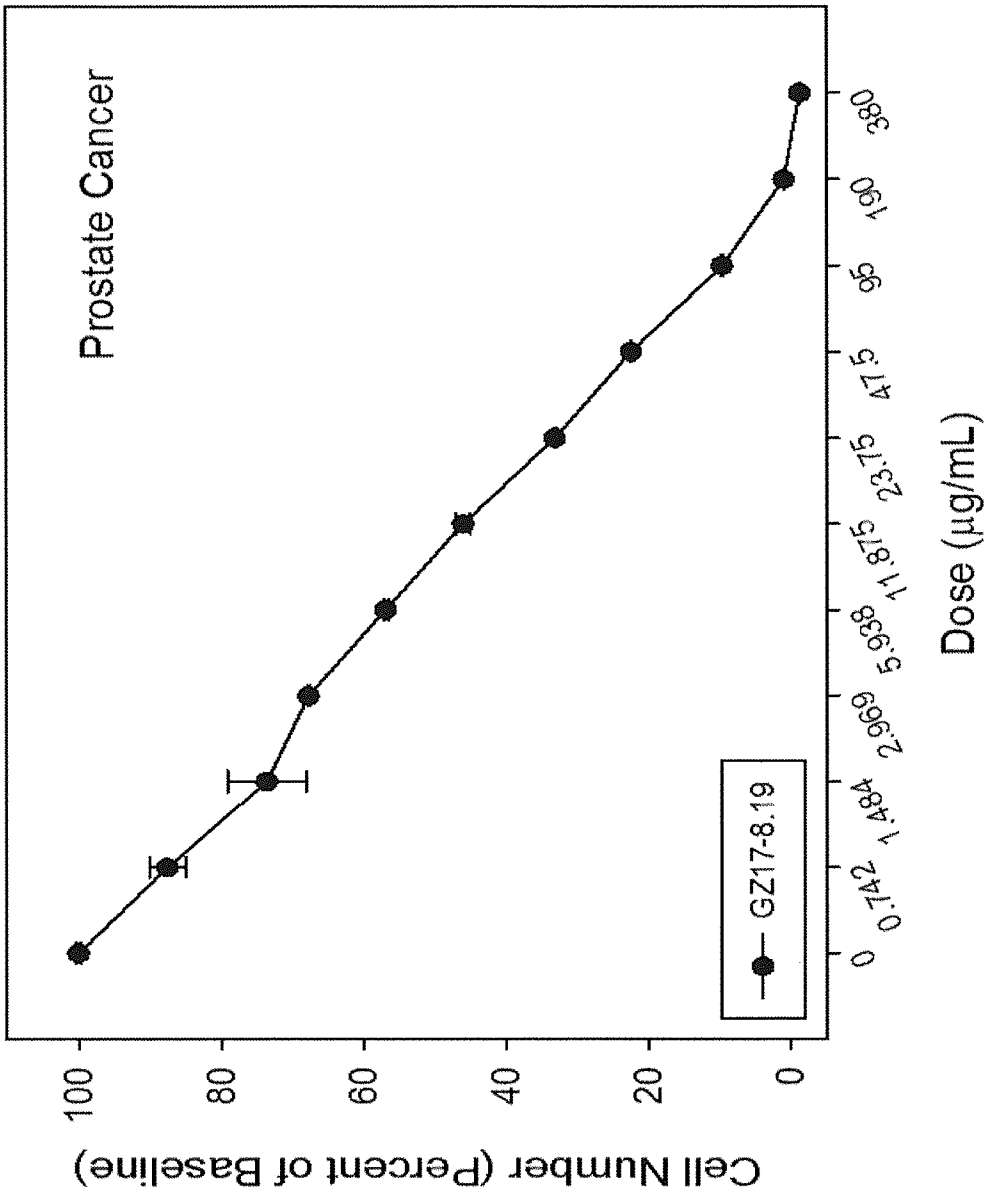

Prostate Cancer
Cell Number (Percent of Baseline)
0
20
40
60
80
100
GZ17-8.19
0
0.742
1.484
2.969
5.938
11.875
23.75
47.5
95
190
380
Dose (µg/mL)

Fig. 37C

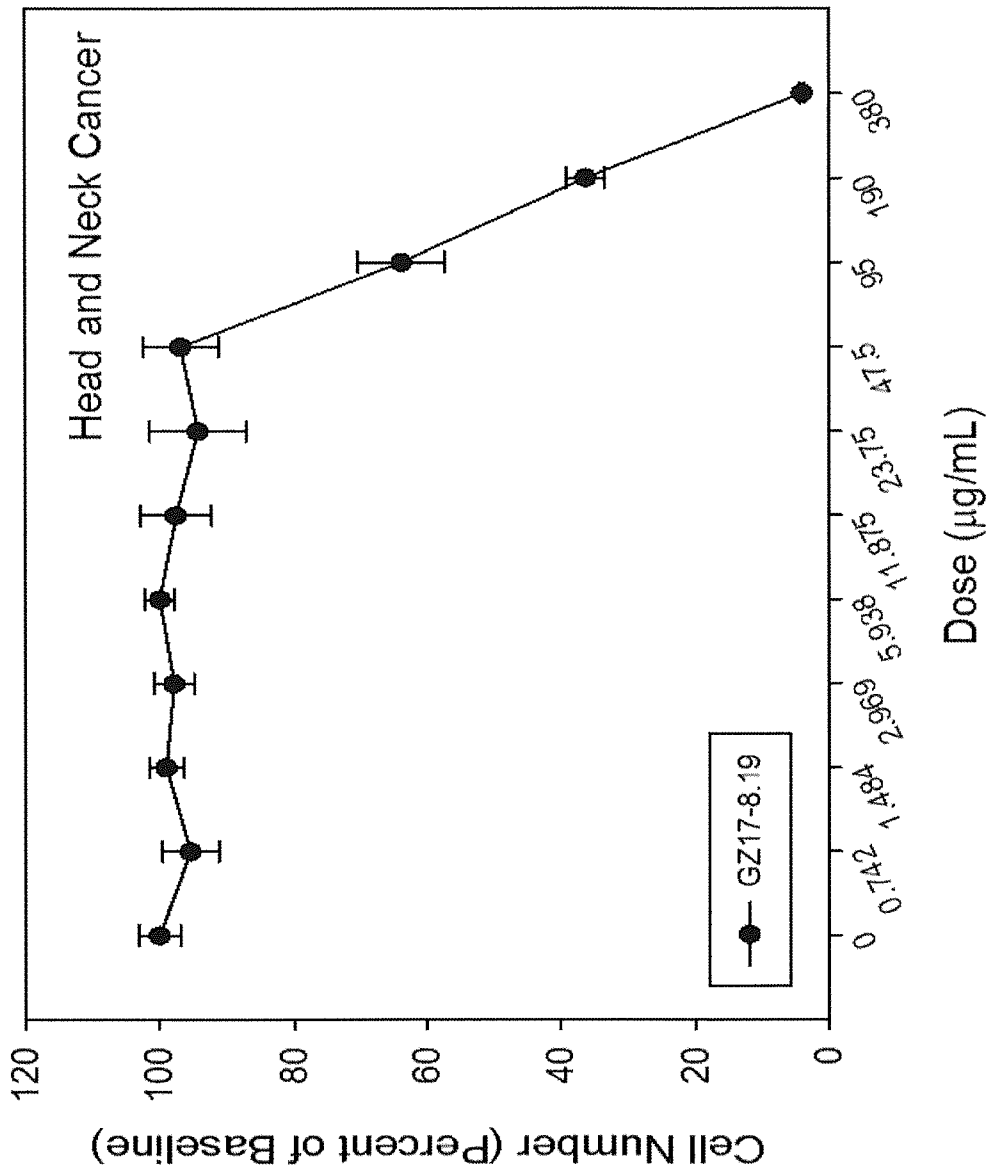

Head and Neck Cancer
Cell Number (Percent of Baseline)
120
100
80
60
40
20
0
GZ17-8.19
0
0.7142
1.484
2.969
5.938
11.875
23.75
47.5
95
190
380
Dose (µg/mL)

Fig. 37D

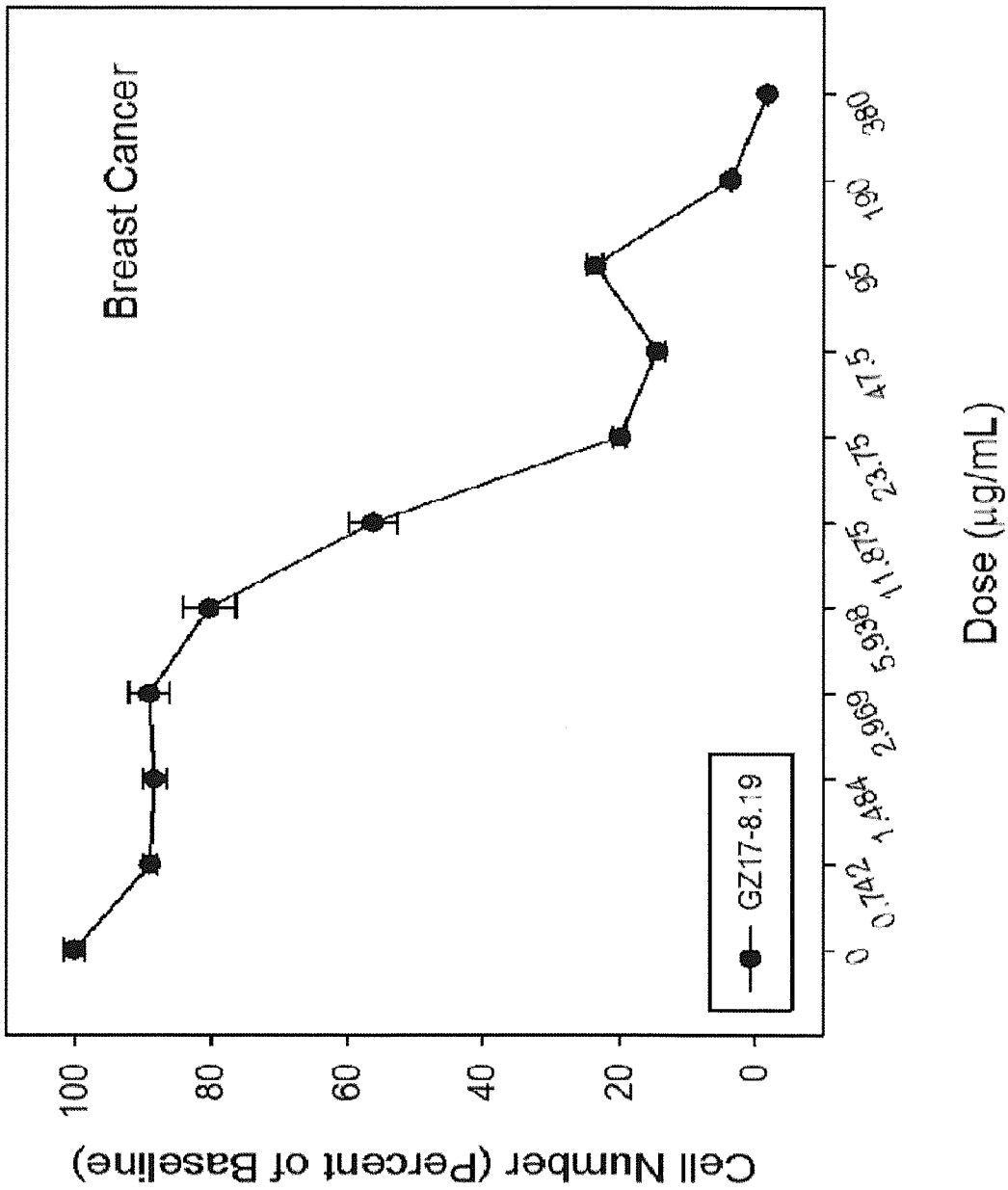

Breast Cancer
GZ17-8.19
Cell Number (Percent of Baseline)
0
20
40
60
80
100
0
0.742
1.484
2.969
5.938
11.875
23.75
47.5
95
190
380
Dose (µg/mL)

Fig. 37E

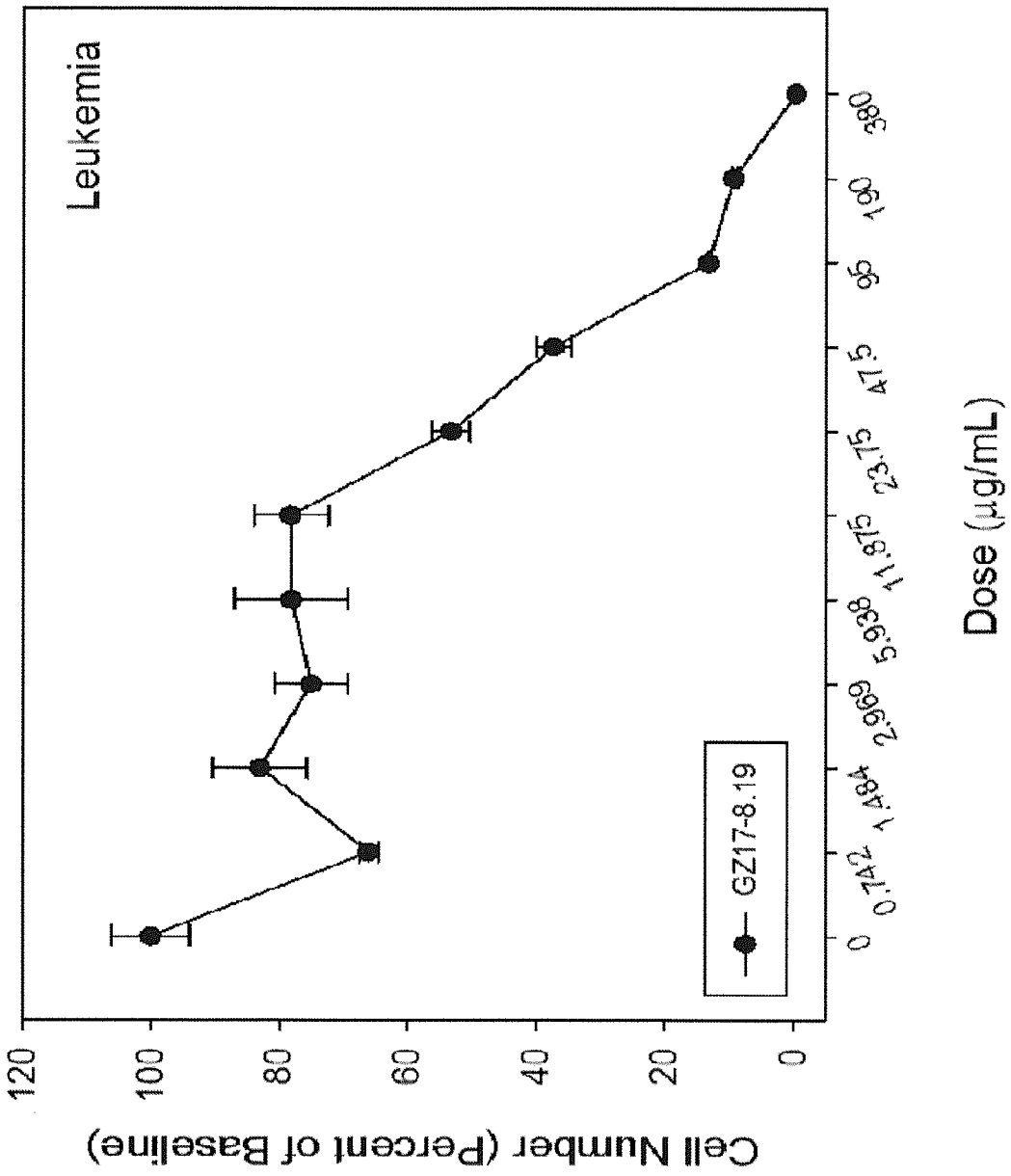

Leukemia
Cell Number (Percent of Baseline)
120
100
80
60
40
20
0
GZ17-8.19
0
0.742
1.484
2.969
5.938
11.875
23.75
47.5
95
190
380
Dose (µg/mL)

Fig. 37F

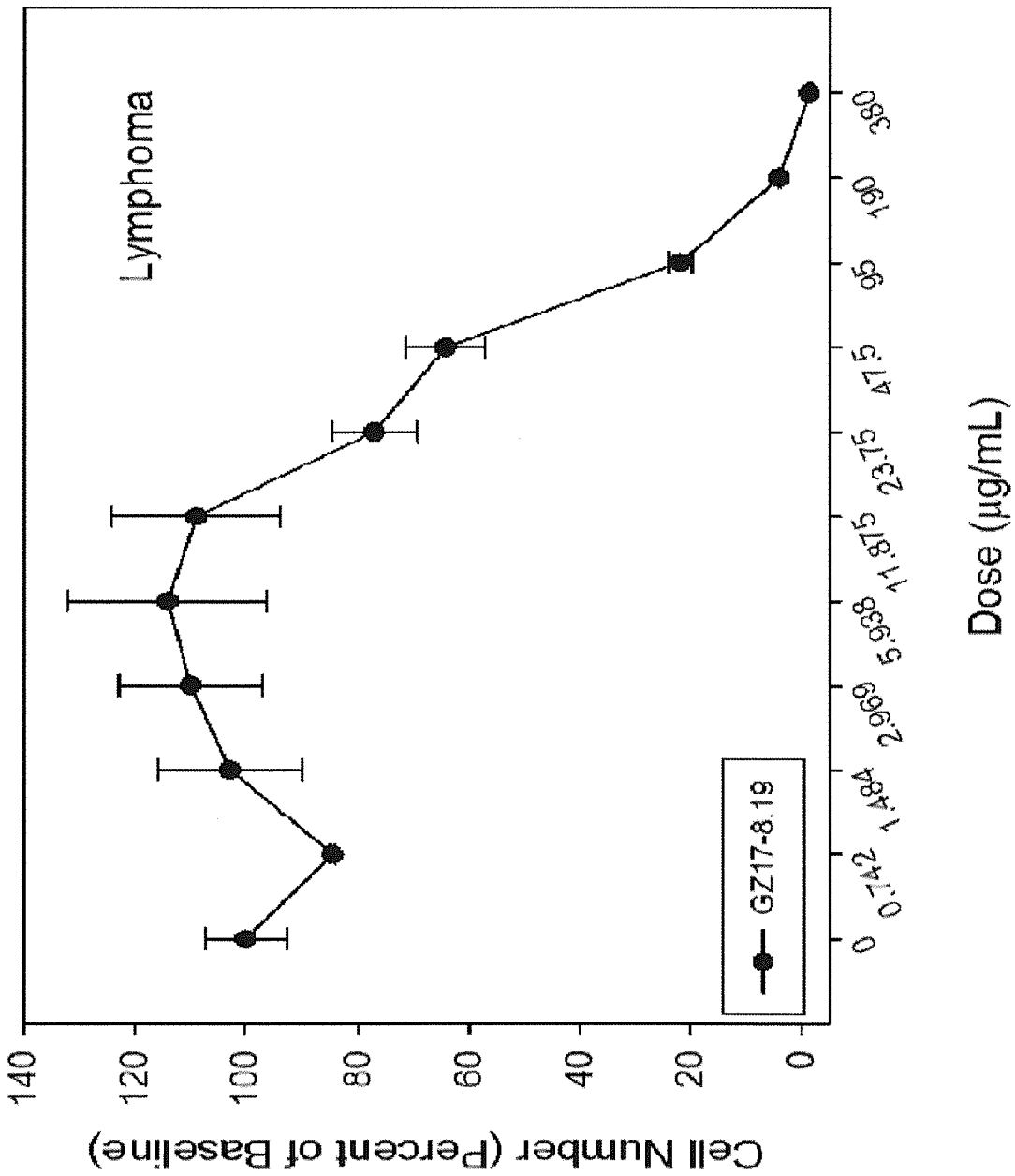

Lymphoma
Cell Number (Percent of Baseline)
0
20
40
60
80
100
120
140
GZ17-8.19
0
0.742
1.484
2.969
5.938
11.875
23.75
47.5
95
190
380
Dose (µg/mL)

Fig. 37G

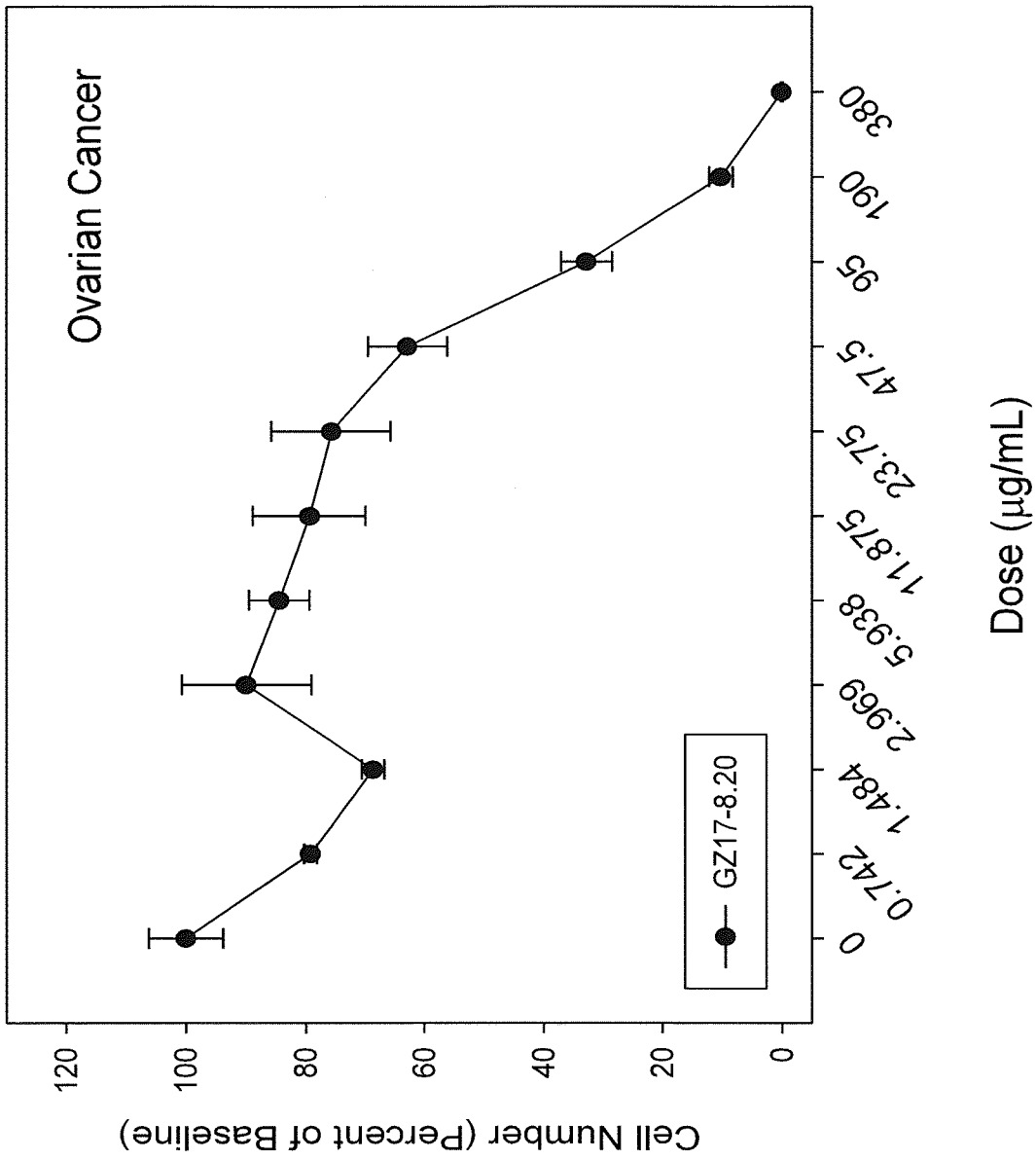

Ovarian Cancer
Cell Number (Percent of Baseline)
0
20
40
60
80
100
120
GZ17-8.20
0
0.742
1.484
2.969
5.938
11.875
23.75
47.5
95
190
380
Dose (µg/mL)

Fig. 38A

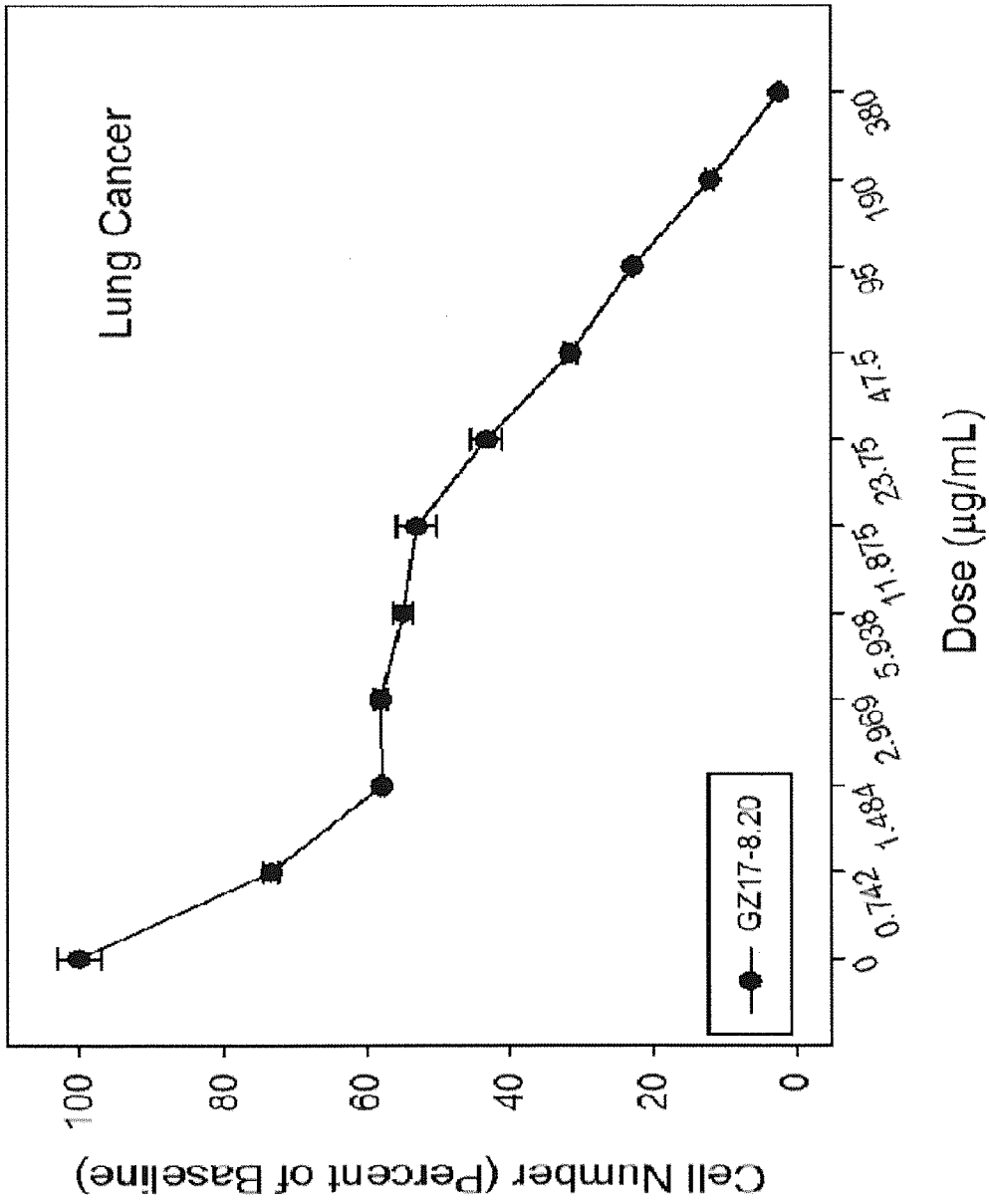

Lung Cancer
Cell Number (Percent of Baseline)
100
80
60
40
20
0
GZ17-8.20
0
0.742
1.484
2.969
5.938
11.875
23.75
47.5
95
190
380
Dose (µg/mL)

Fig. 38B

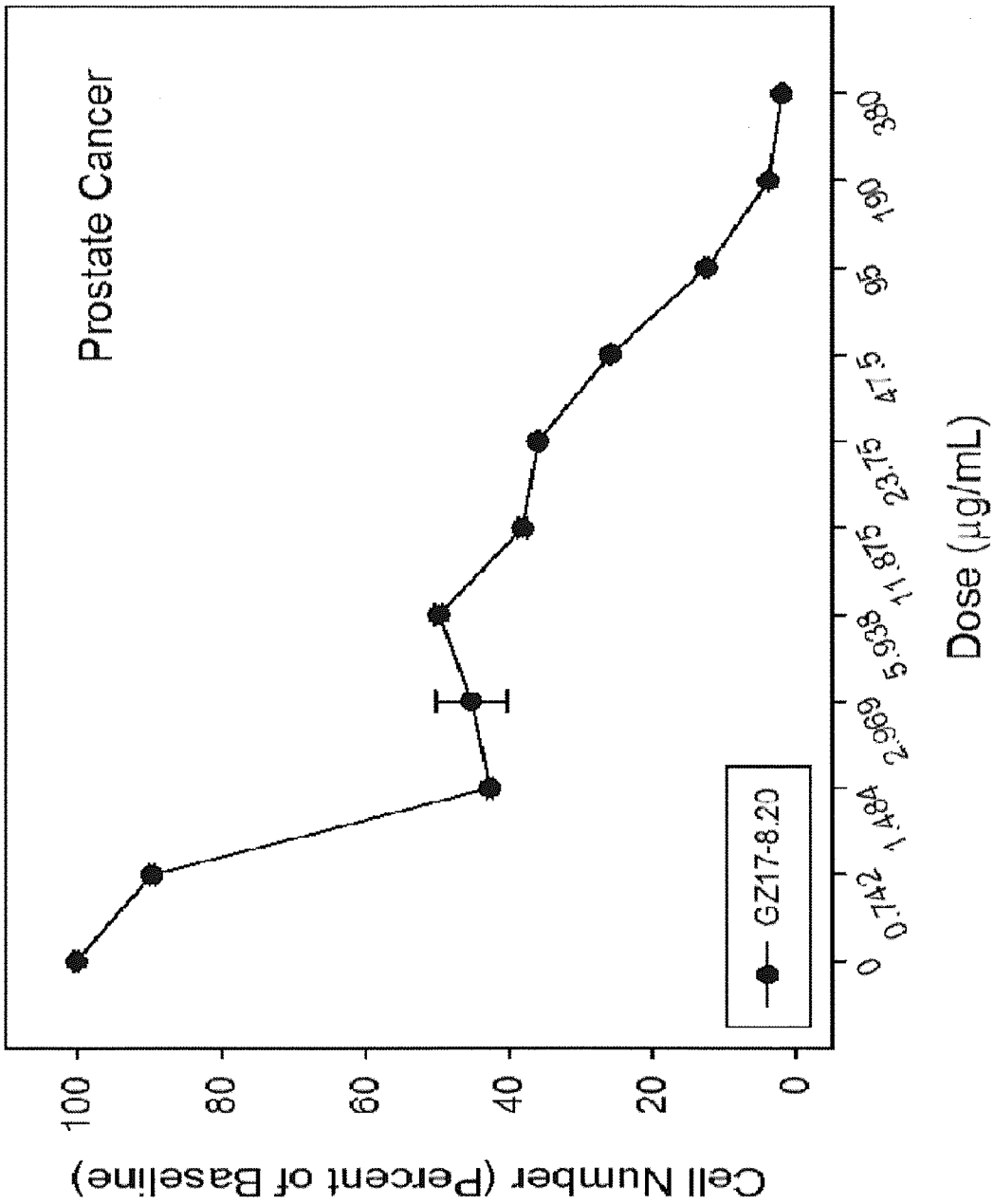

Prostate Cancer
Cell Number (Percent of Baseline)
0
20
40
60
80
100
GZ17-8.20
0
0.742
1.484
2.969
5.938
11.875
23.75
47.5
95
190
380
Dose (µg/mL)

Fig. 38C

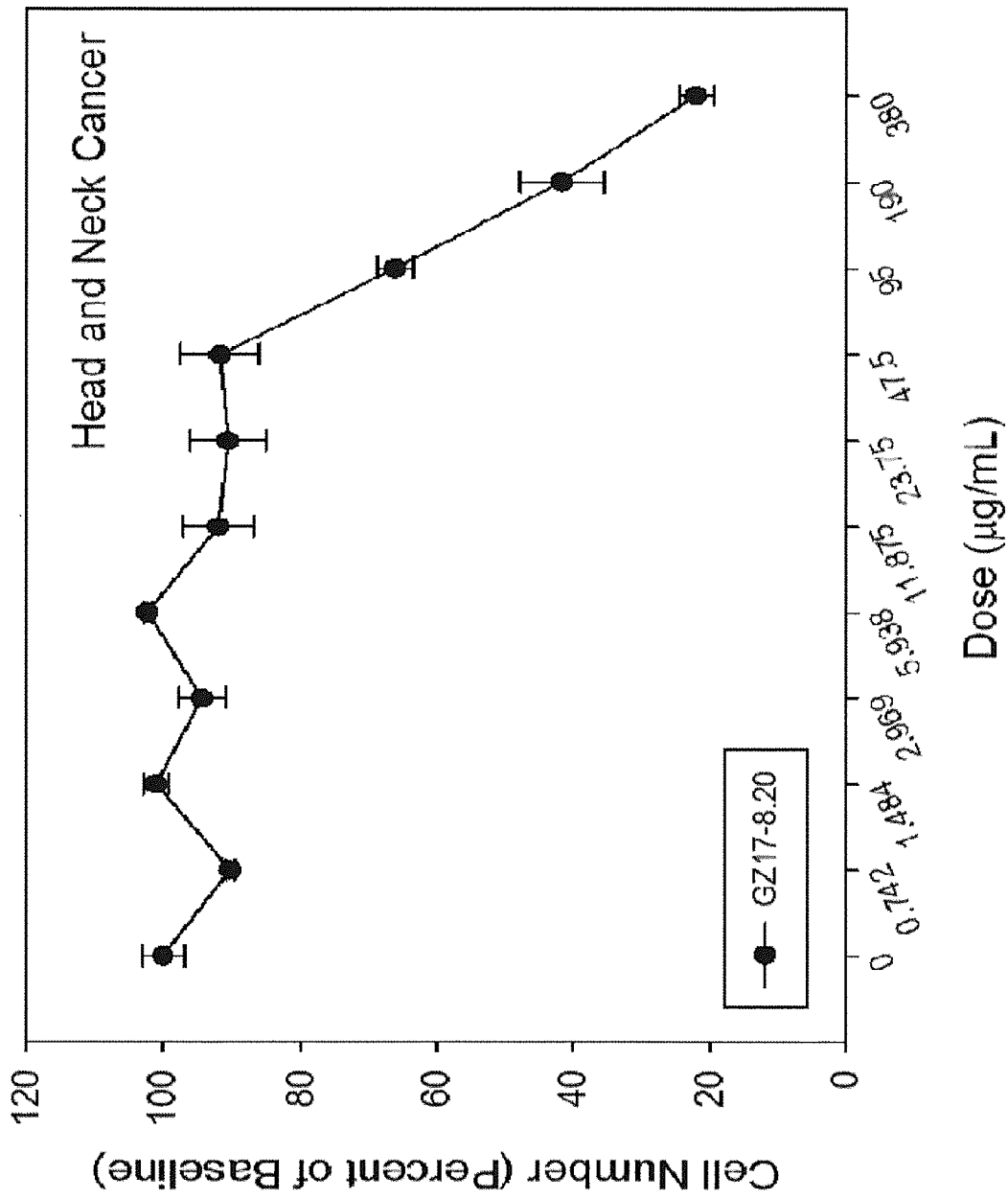

Head and Neck Cancer
Cell Number (Percent of Baseline)
120
100
80
60
40
20
0
GZ17-8.20
0
0.742
1.484
2.969
5.938
11.875
23.75
47.5
95
190
380
Dose (µg/mL)

Fig. 38D

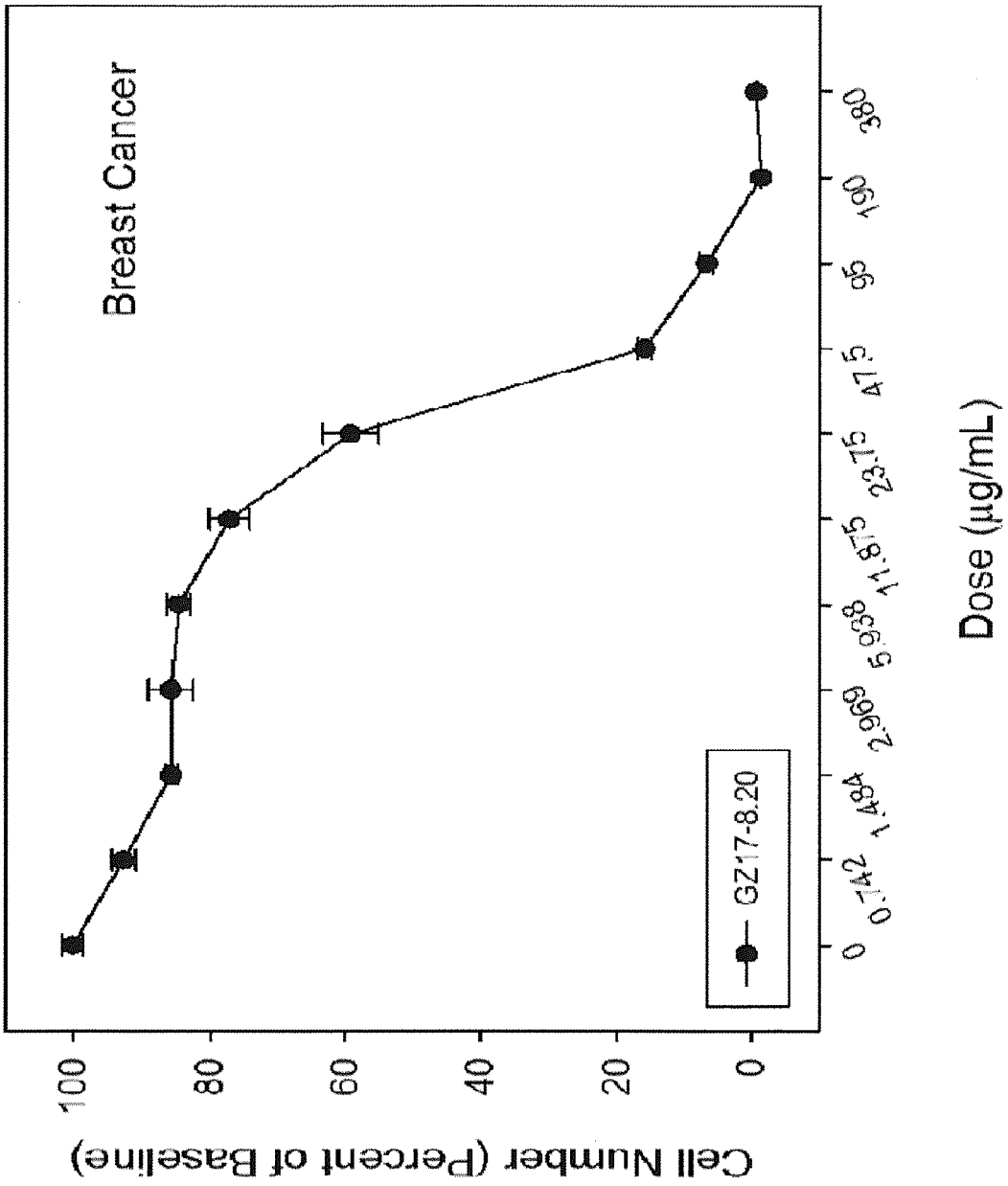

Breast Cancer
GZ17-8.20
Cell Number (Percent of Baseline)
0
20
40
60
80
100
0
0.742
1.484
2.969
5.938
11.875
23.75
47.5
95
190
380
Dose (µg/mL)

Fig. 38E

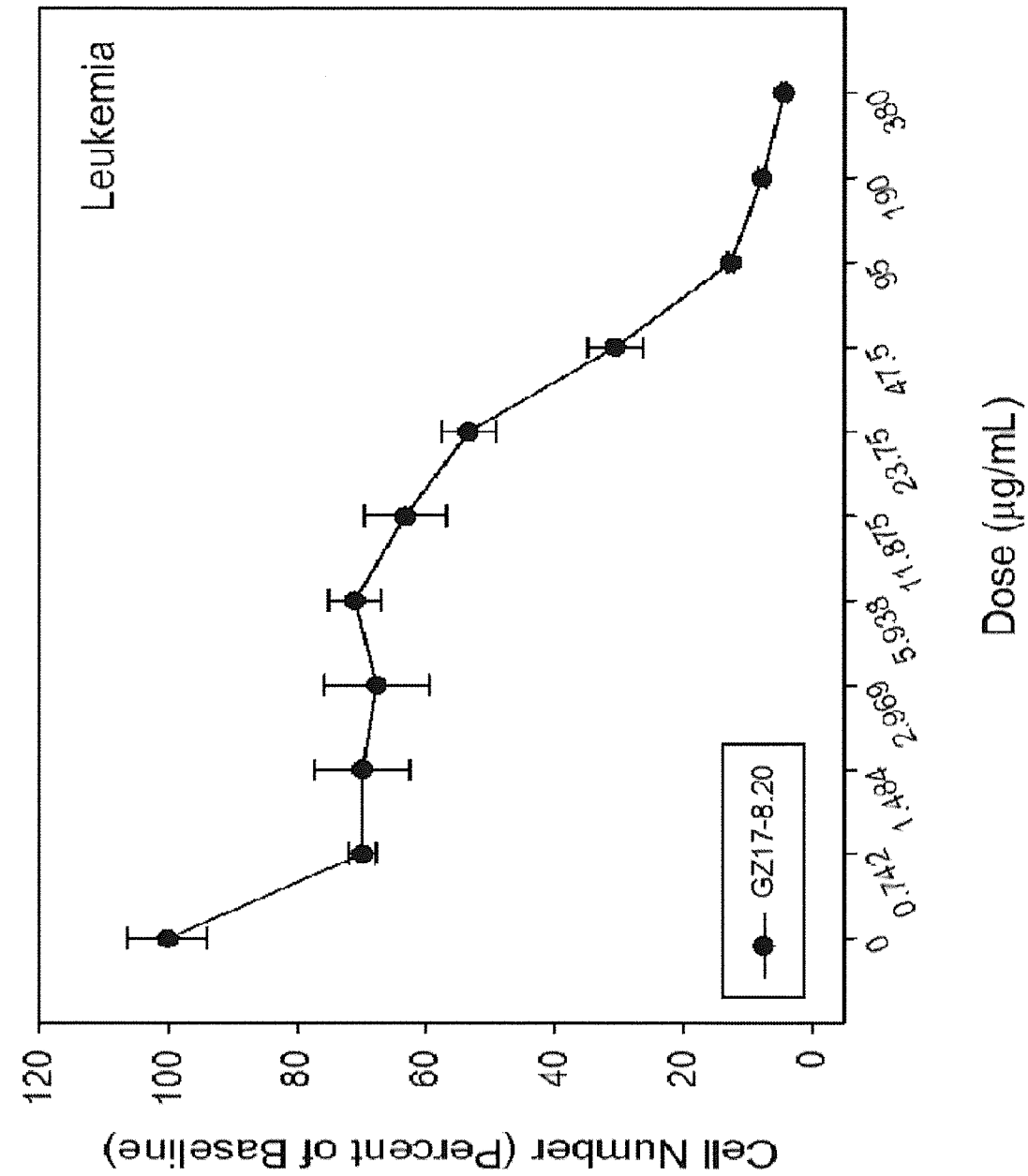

Leukemia
Cell Number (Percent of Baseline)
120
100
80
60
40
20
0
GZ17-8.20
0
0.742
1.484
2.969
5.938
11.875
23.75
47.5
95
190
380
Dose (µg/mL)

Fig. 38F

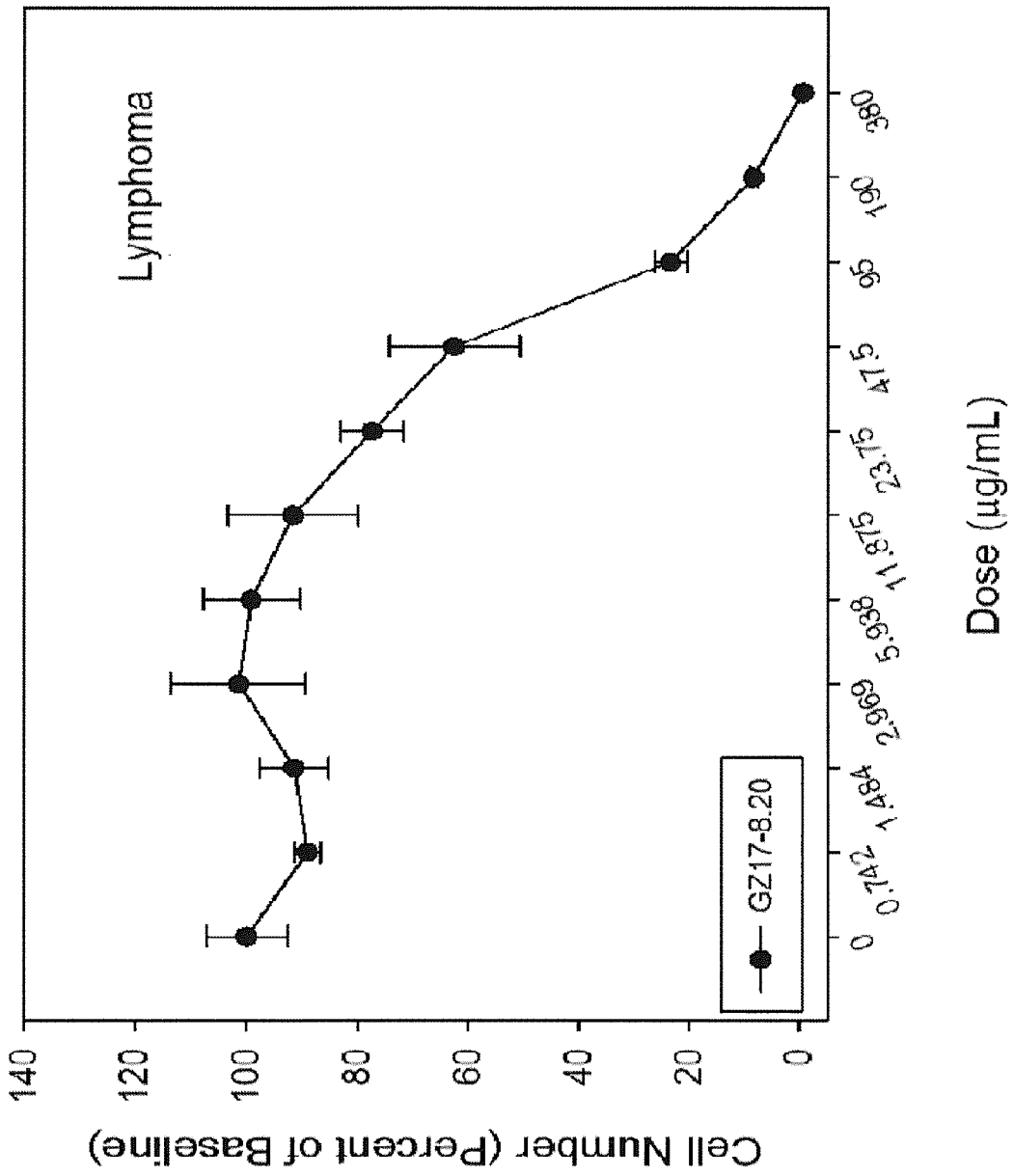

Lymphoma
Cell Number (Percent of Baseline)
0
20
40
60
80
100
120
140
GZ17-8.20
0
0.742
1.484
2.969
5.938
11.875
23.75
47.5
95
190
380
Dose (µg/mL)

Fig. 38G

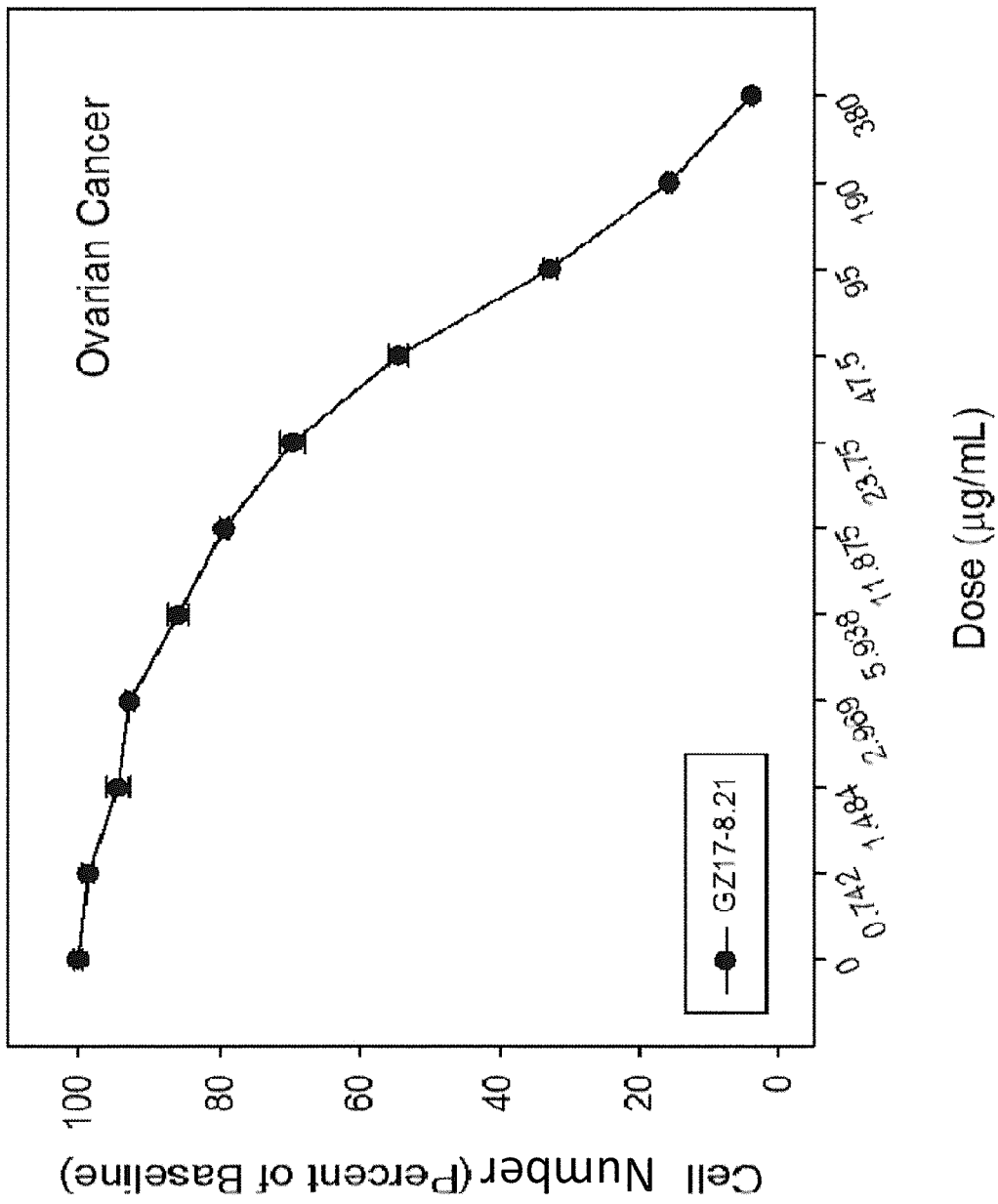

Ovarian Cancer
Cell Number (Percent of Baseline)
100
80
60
40
20
0
GZ17-8.21
0
0.142
1.484
2.969
5.938
11.875
23.75
47.5
95
190
380
Dose (µg/mL)

Fig. 39A

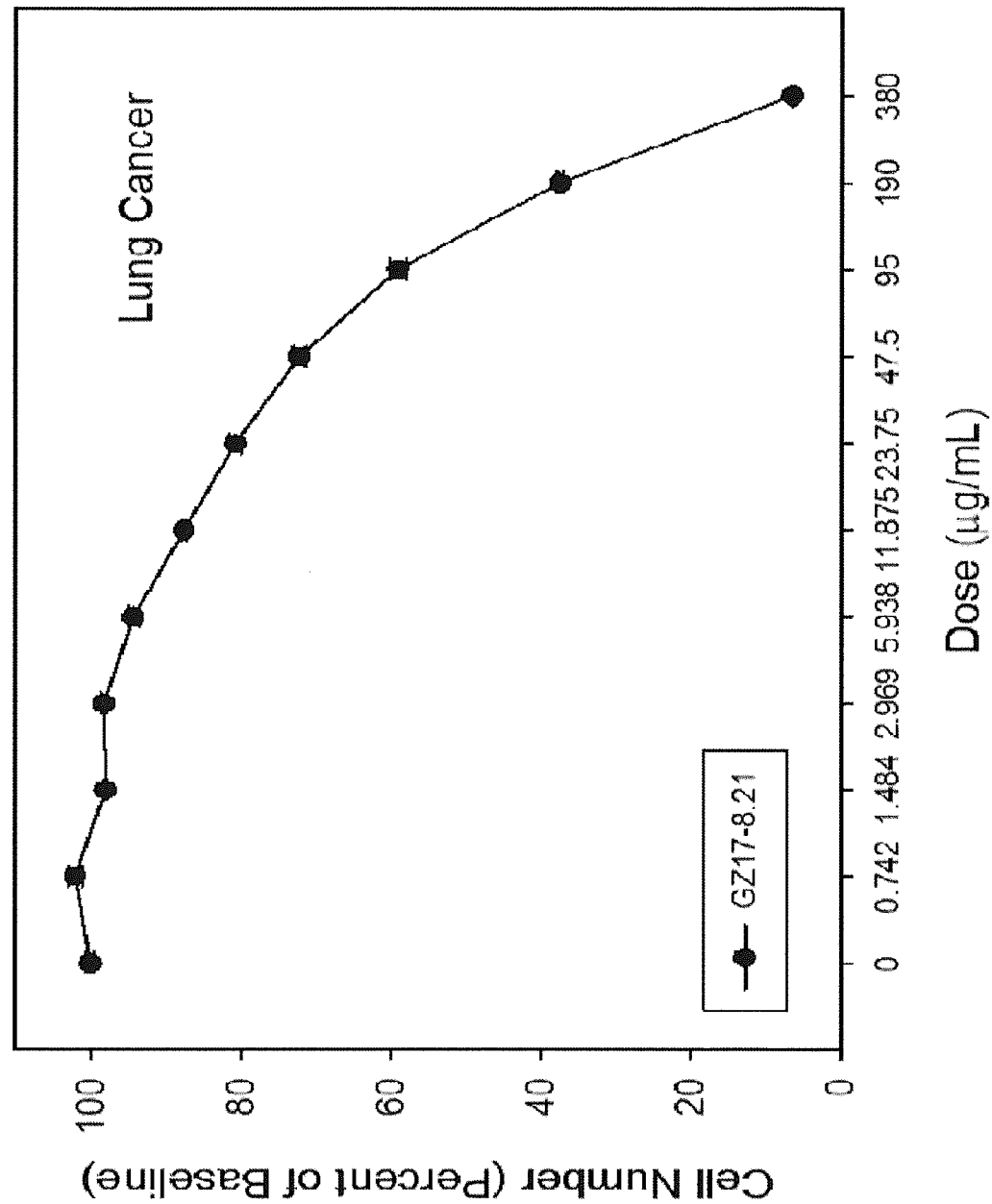

Lung Cancer
Cell Number (Percent of Baseline)
0
20
40
60
80
100
GZ17-8.21
0
0.742
1.484
2.969
5.938
11.875
23.75
47.5
95
190
380
Dose (μg/mL)

Fig. 39B

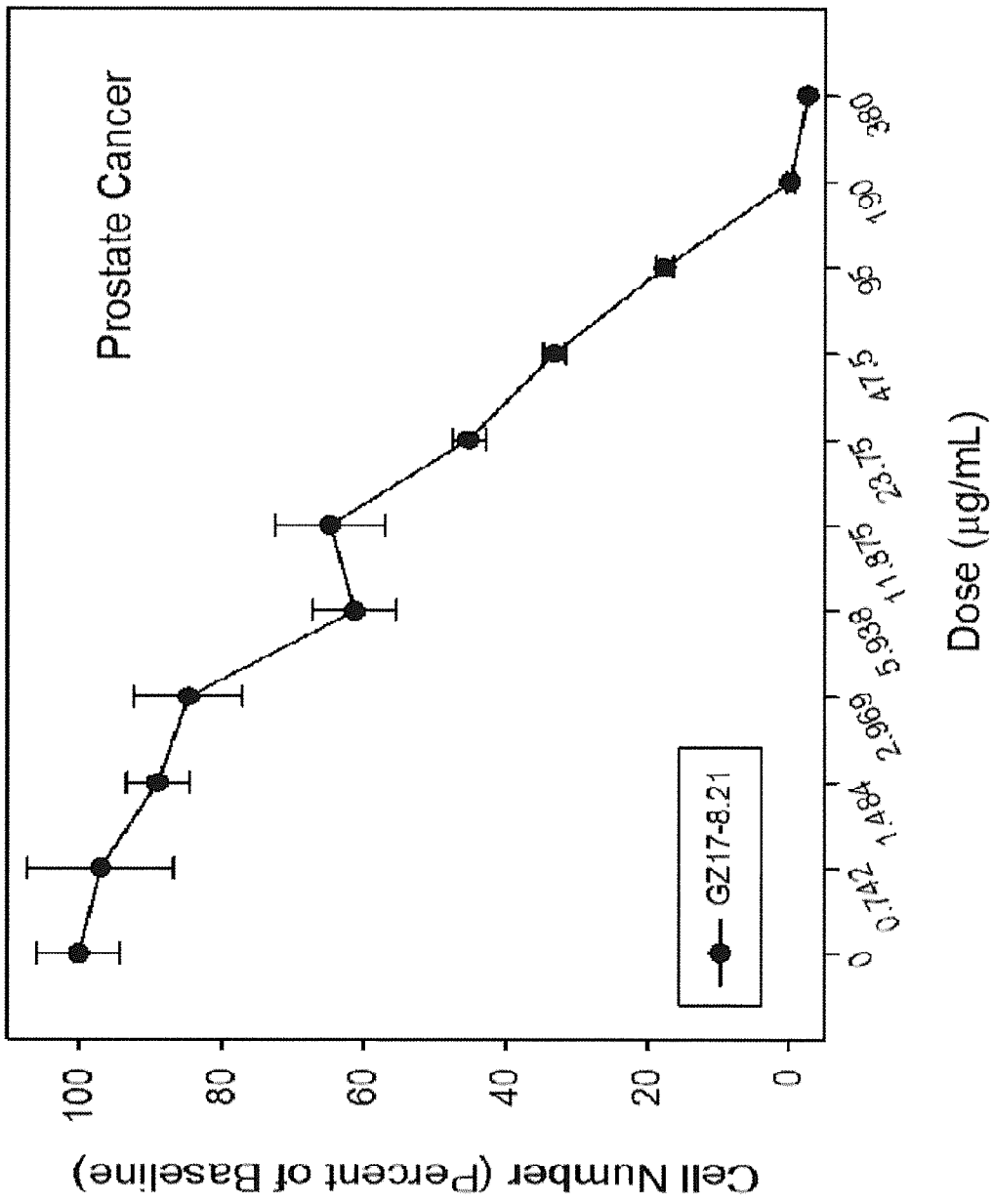

Prostate Cancer
GZ17-8.21
Cell Number (Percent of Baseline)
0
20
40
60
80
100
0
0.742
1.484
2.969
5.938
11.875
23.75
47.5
95
190
380
Dose (µg/mL)

Fig. 39C

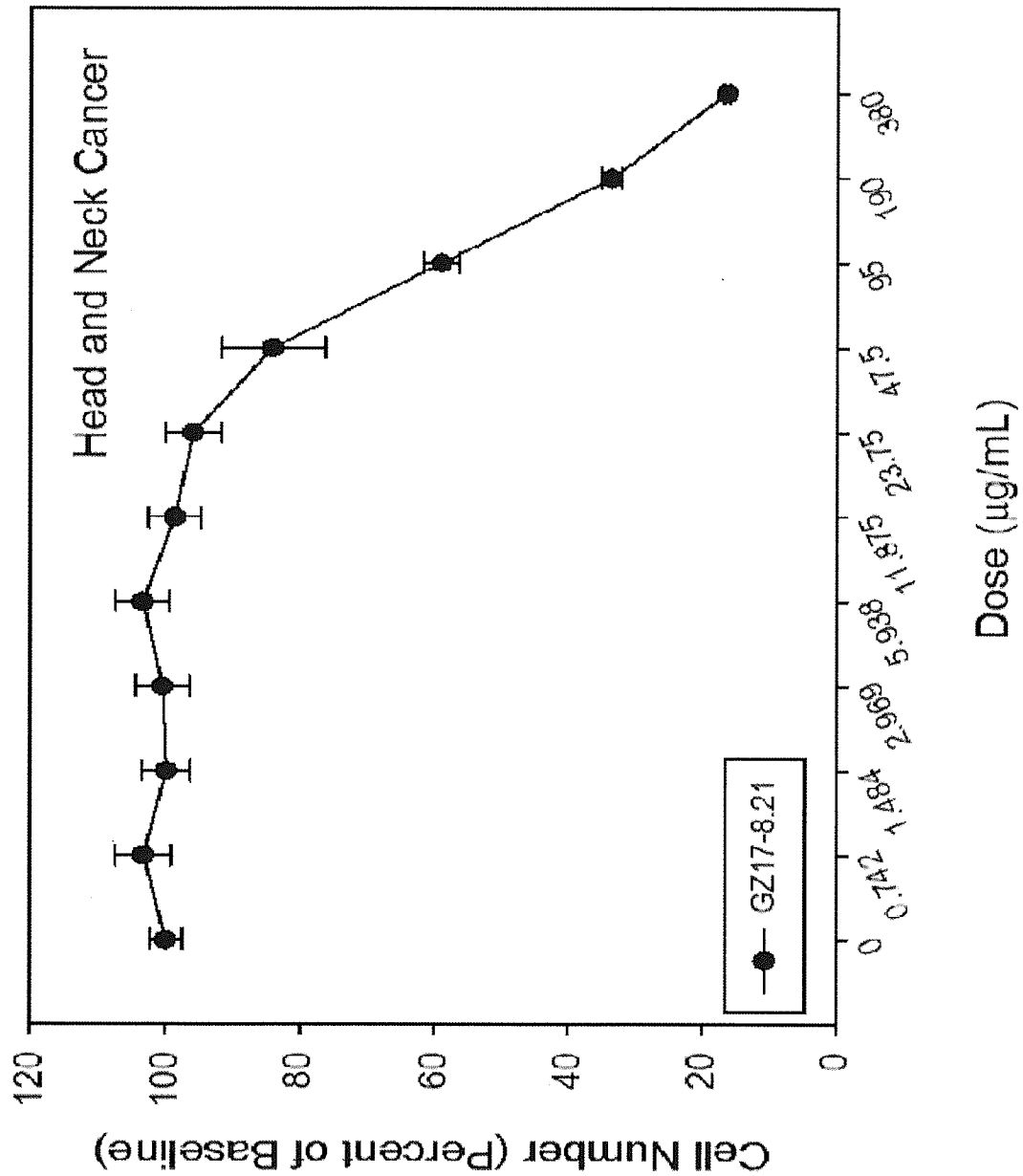

Head and Neck Cancer
Cell Number (Percent of Baseline)
120
100
80
60
40
20
0
GZ17-8.21
0
0.742
1.484
2.969
5.938
11.875
23.75
47.5
95
190
380
Dose (µg/mL)

Fig. 39D

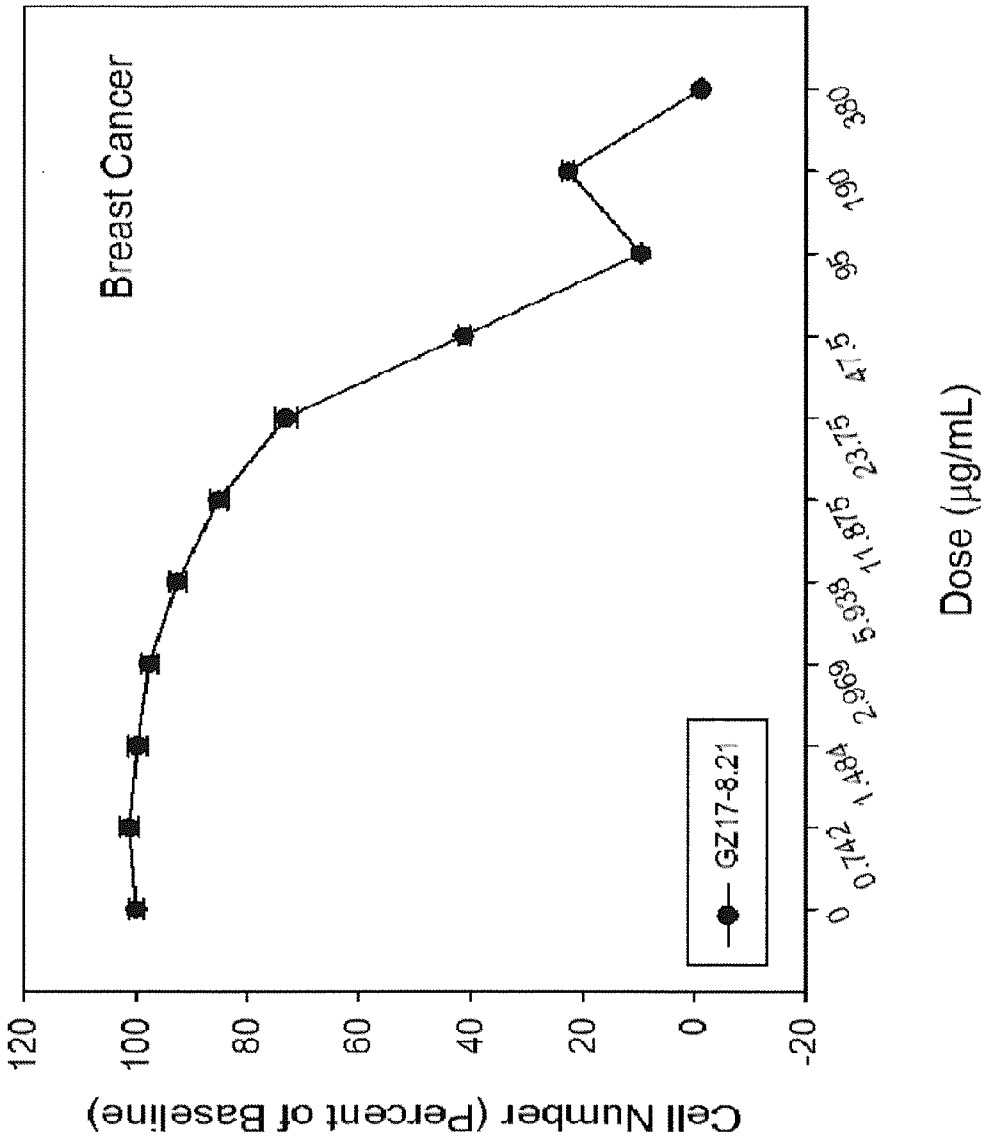

Breast Cancer
GZ17-8.21
Cell Number (Percent of Baseline)
120
100
80
60
40
20
0
-20
0
0.742
1.484
2.969
5.938
11.875
23.75
47.5
95
190
380
Dose (µg/mL)

Fig. 39E

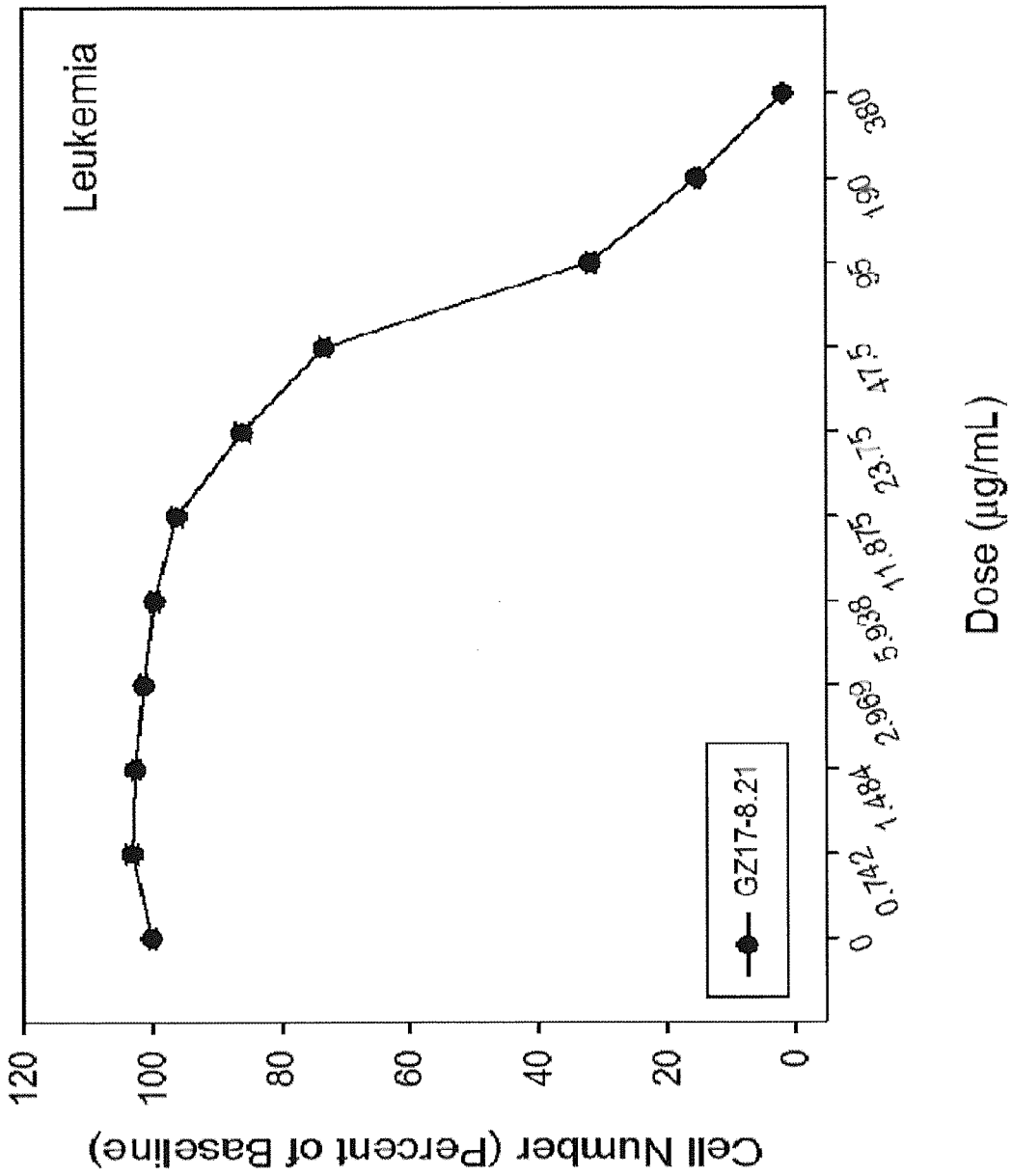

Leukemia
GZ17-8.21
Cell Number (Percent of Baseline)
120
100
80
60
40
20
0
0
0.742
1.484
2.969
5.938
11.875
23.75
47.5
95
190
380
Dose (µg/mL)

Fig. 39F

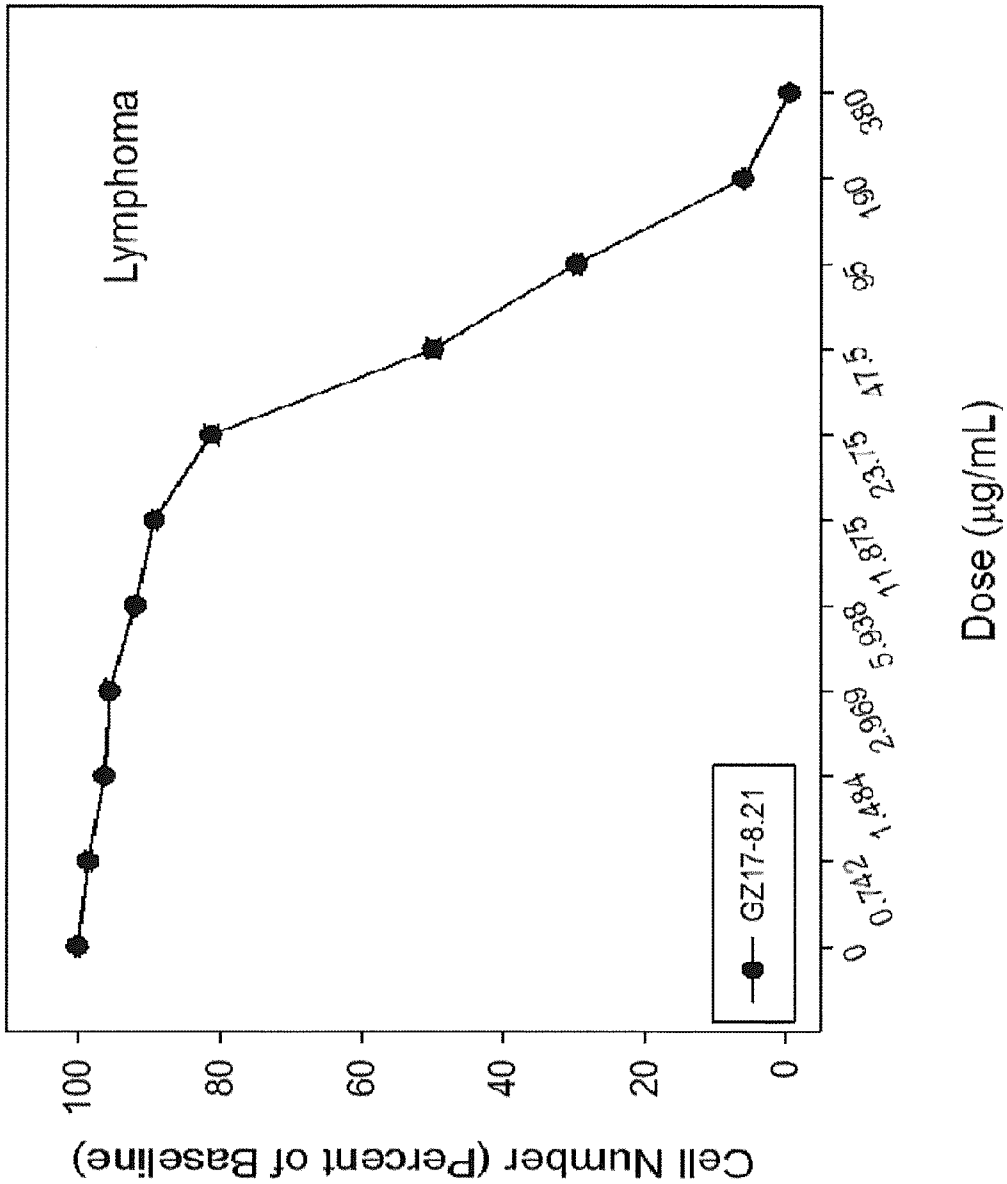

Lymphoma
Cell Number (Percent of Baseline)
0
20
40
60
80
100
GZ17-8.21
0
0.742
1.484
2.969
5.938
11.875
23.75
47.5
95
190
380
Dose (µg/mL)

Fig. 39G

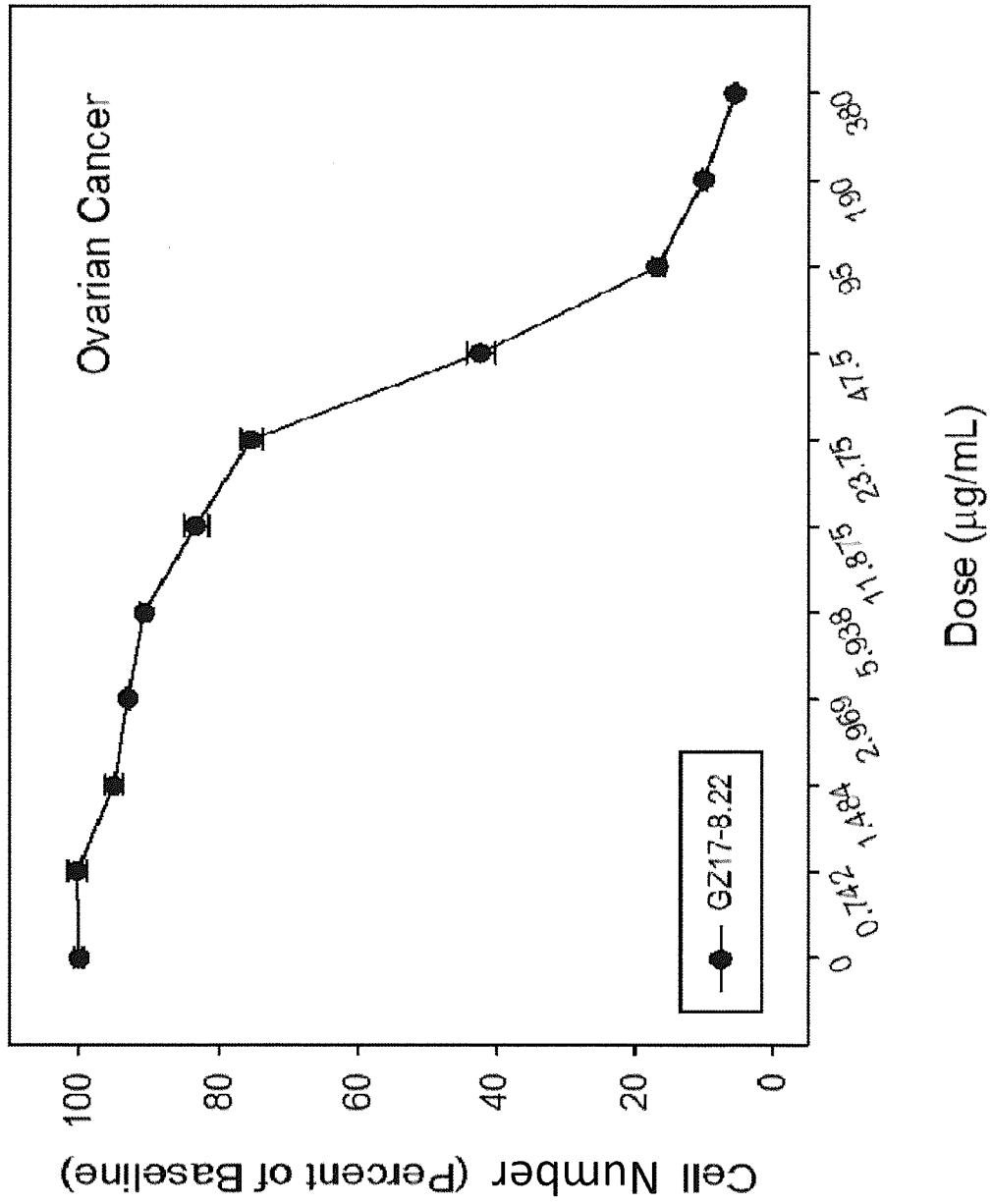

Ovarian Cancer
Cell Number (Percent of Baseline)
0
20
40
60
80
100
GZ17-8.22
0
0.742
1.484
2.969
5.938
11.875
23.75
47.5
95
190
380
Dose (µg/mL)

Fig. 40A

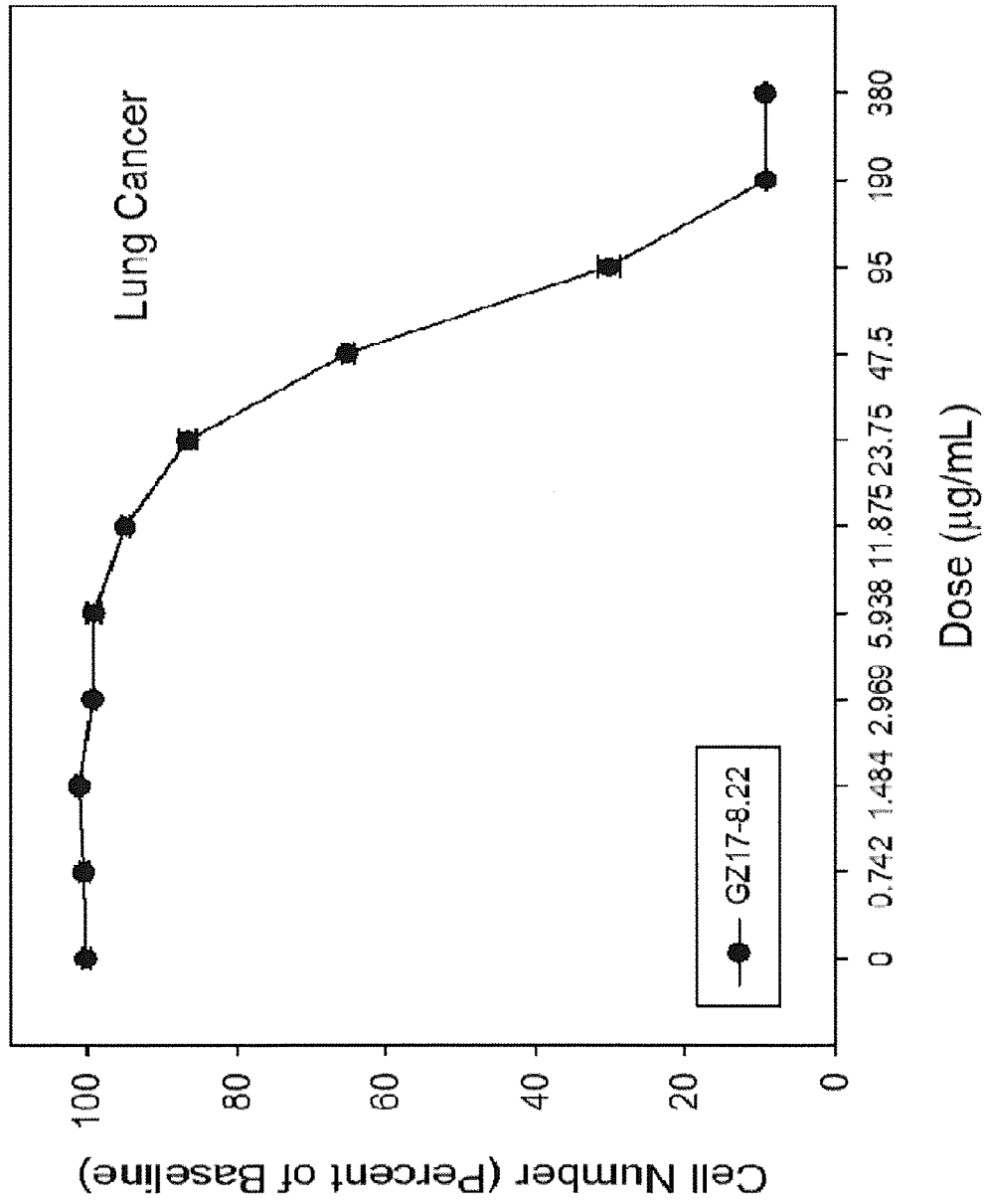

Lung Cancer
Cell Number (Percent of Baseline)
0
20
40
60
80
100
GZ17-8.22
0
0.742
1.484
2.969
5.938
11.875
23.75
47.5
95
190
380
Dose (µg/mL)

Fig. 40B

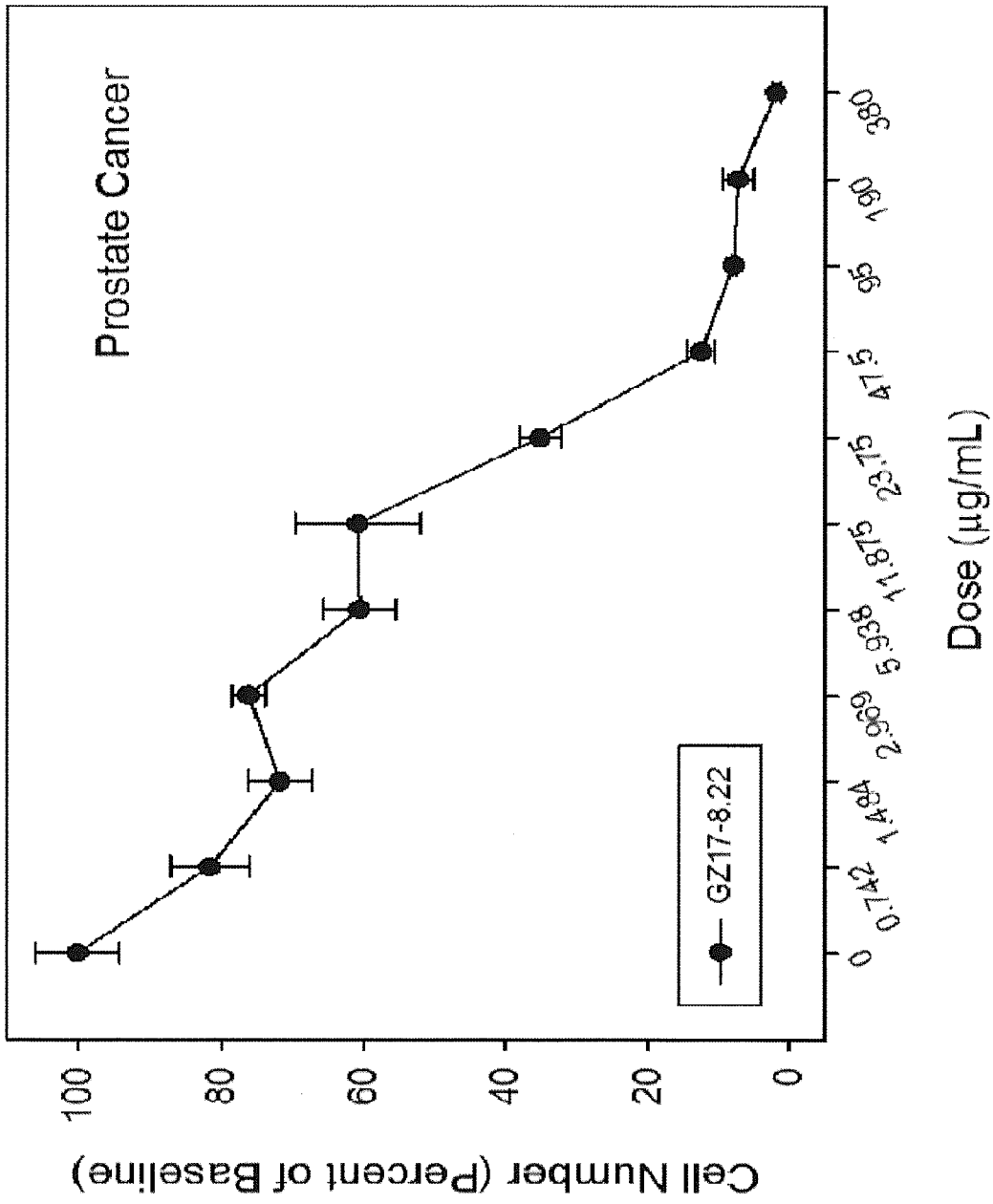

Prostate Cancer
GZ17-8.22
Cell Number (Percent of Baseline)
0
20
40
60
80
100
0
0.7812
1.484
2.969
5.938
11.875
23.75
47.5
95
190
380
Dose (µg/mL)

Fig. 40C

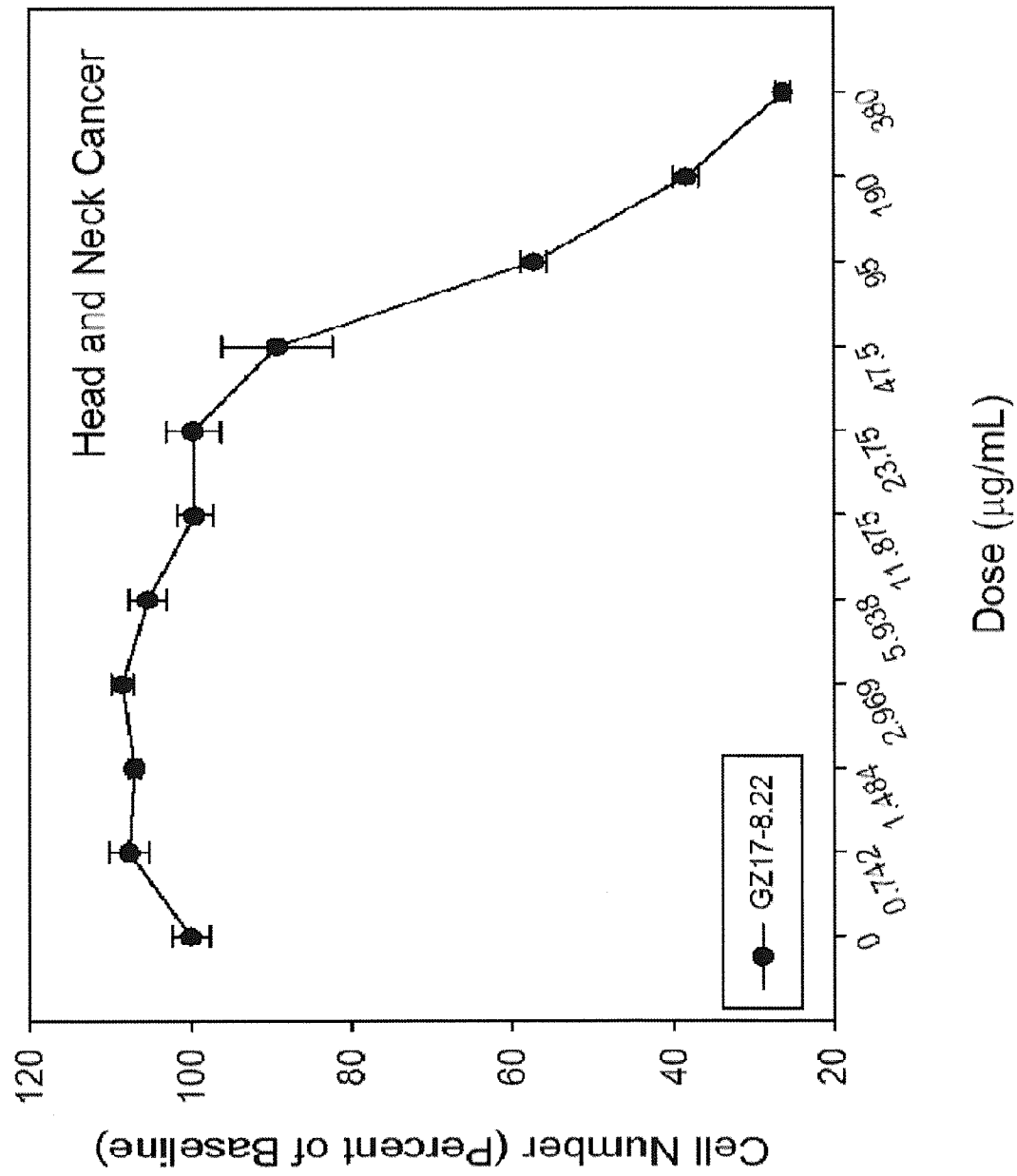

Head and Neck Cancer
Cell Number (Percent of Baseline)
120
100
80
60
40
20
GZ17-8.22
0
0.712
1.424
2.969
5.938
11.875
23.75
47.5
95
190
380
Dose (µg/mL)

Fig. 40D

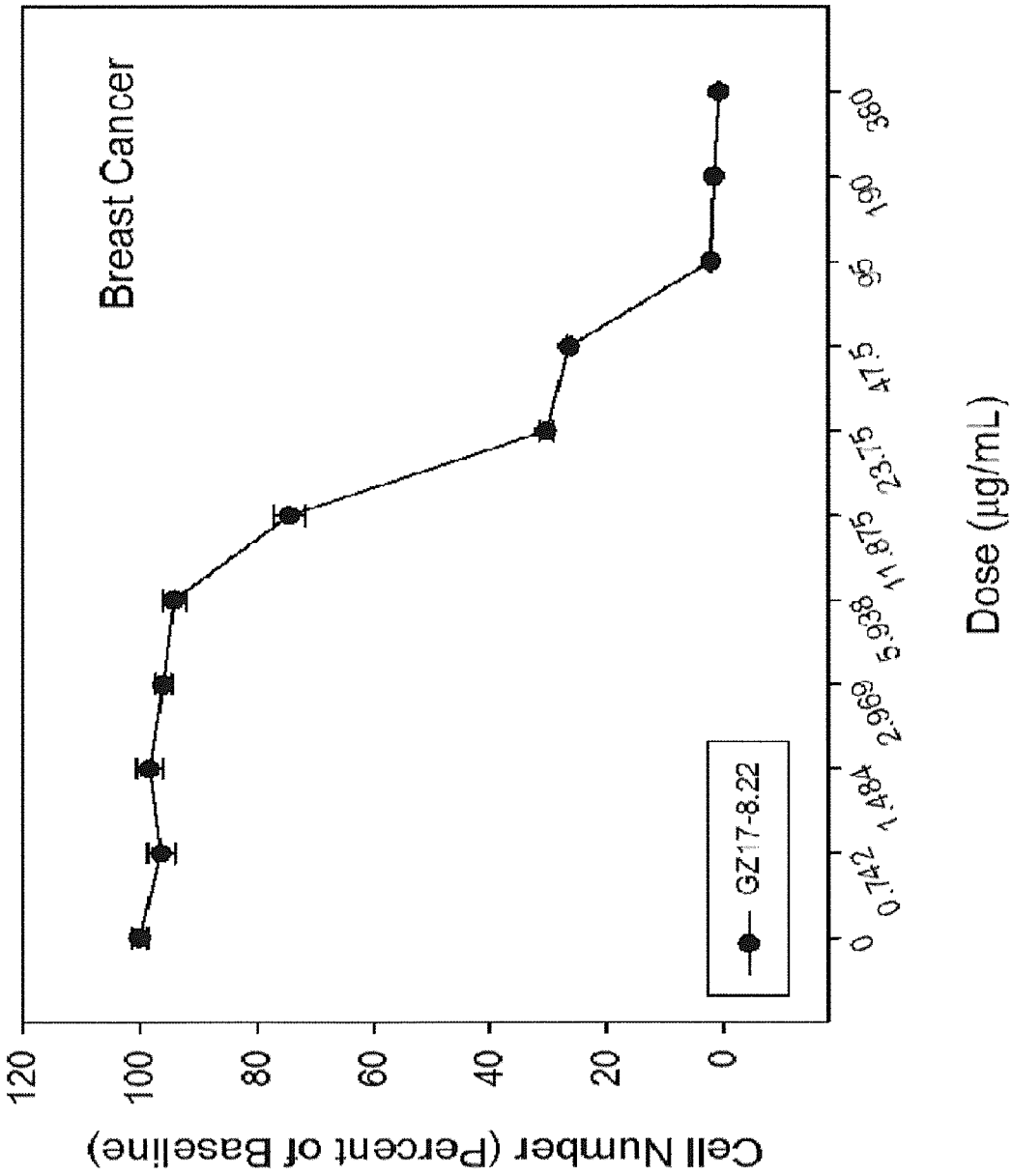

Breast Cancer
Cell Number (Percent of Baseline)
120
100
80
60
40
20
0
GZ17-8.22
0
0.742
1.484
2.969
5.938
11.875
23.75
47.5
95
190
380
Dose (µg/mL)

Fig. 40E

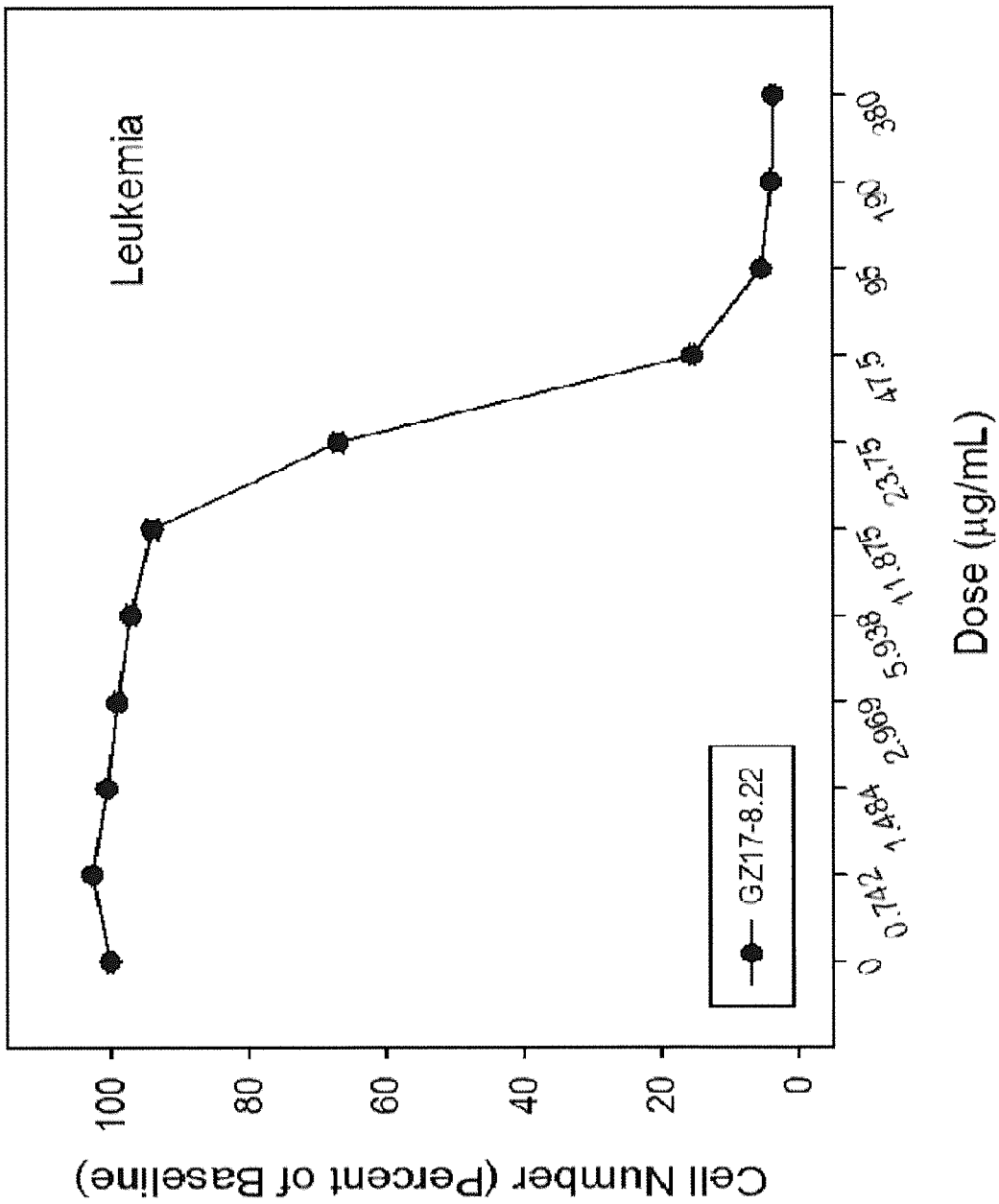

Leukemia
GZ17-8.22
Cell Number (Percent of Baseline)
0
20
40
60
80
100
0
0.742
1.484
2.969
5.938
11.875
23.75
47.5
95
190
380
Dose (µg/mL)

Fig. 40F

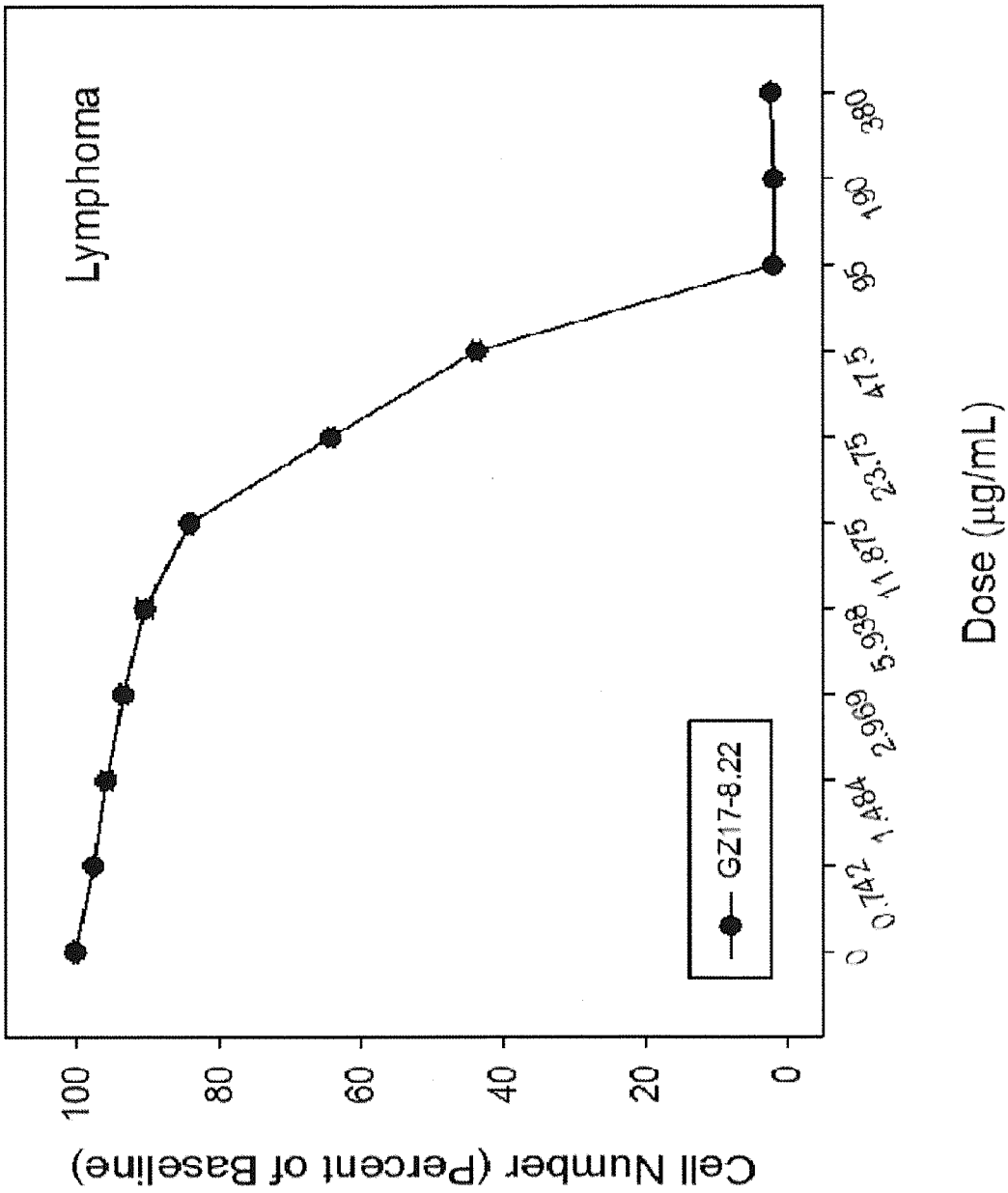

Lymphoma
Cell Number (Percent of Baseline)
100
80
60
40
20
0
GZ17-8.22
0
0.742
1.484
2.969
5.938
11.875
23.75
47.5
95
190
380
Dose (µg/mL)

Fig. 40G

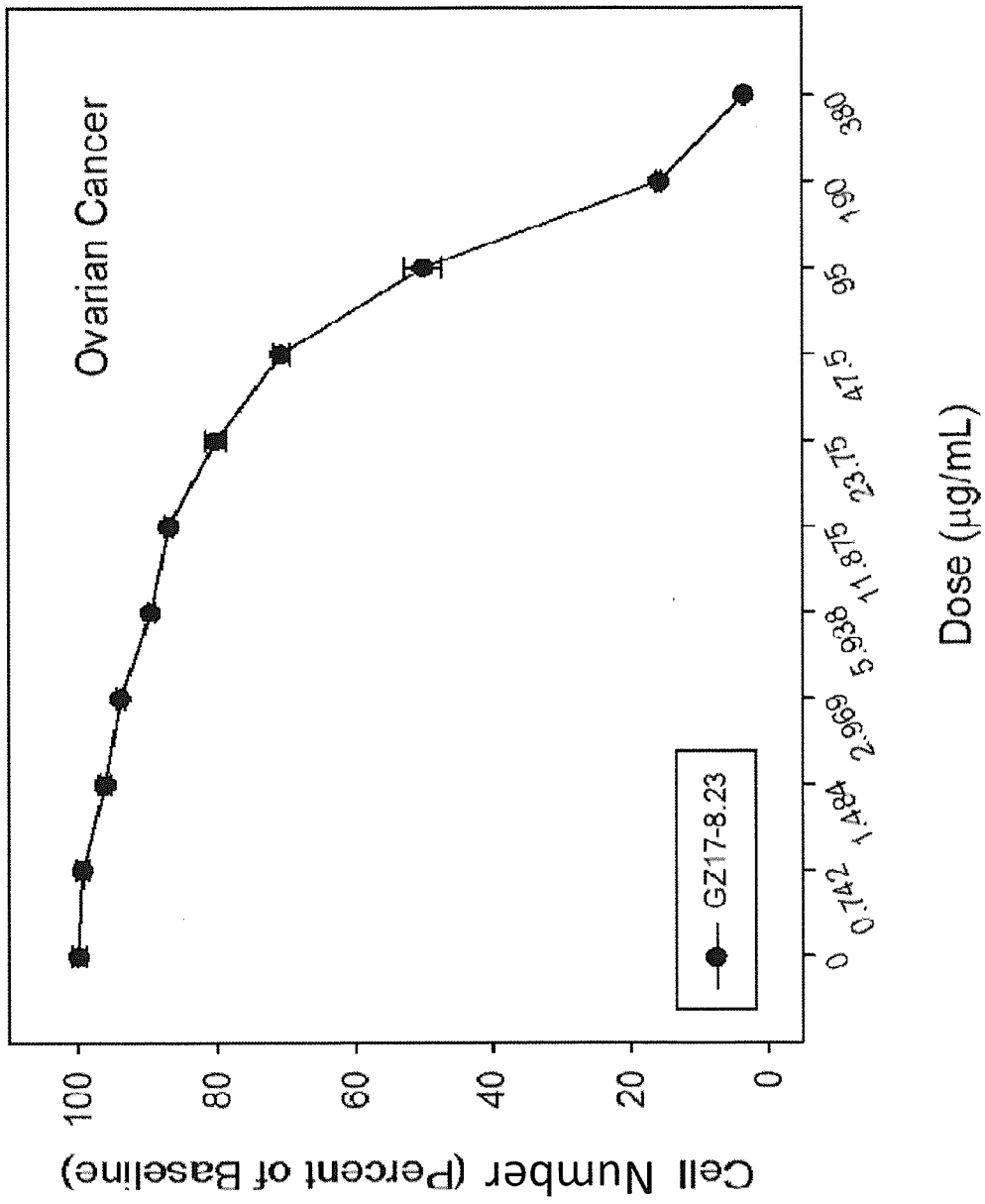

Ovarian Cancer
Cell Number (Percent of Baseline)
0
20
40
60
80
100
GZ17-8.23
0
0.142
1.424
2.969
5.938
11.875
23.75
47.5
95
190
380
Dose (µg/mL)

Fig. 41A

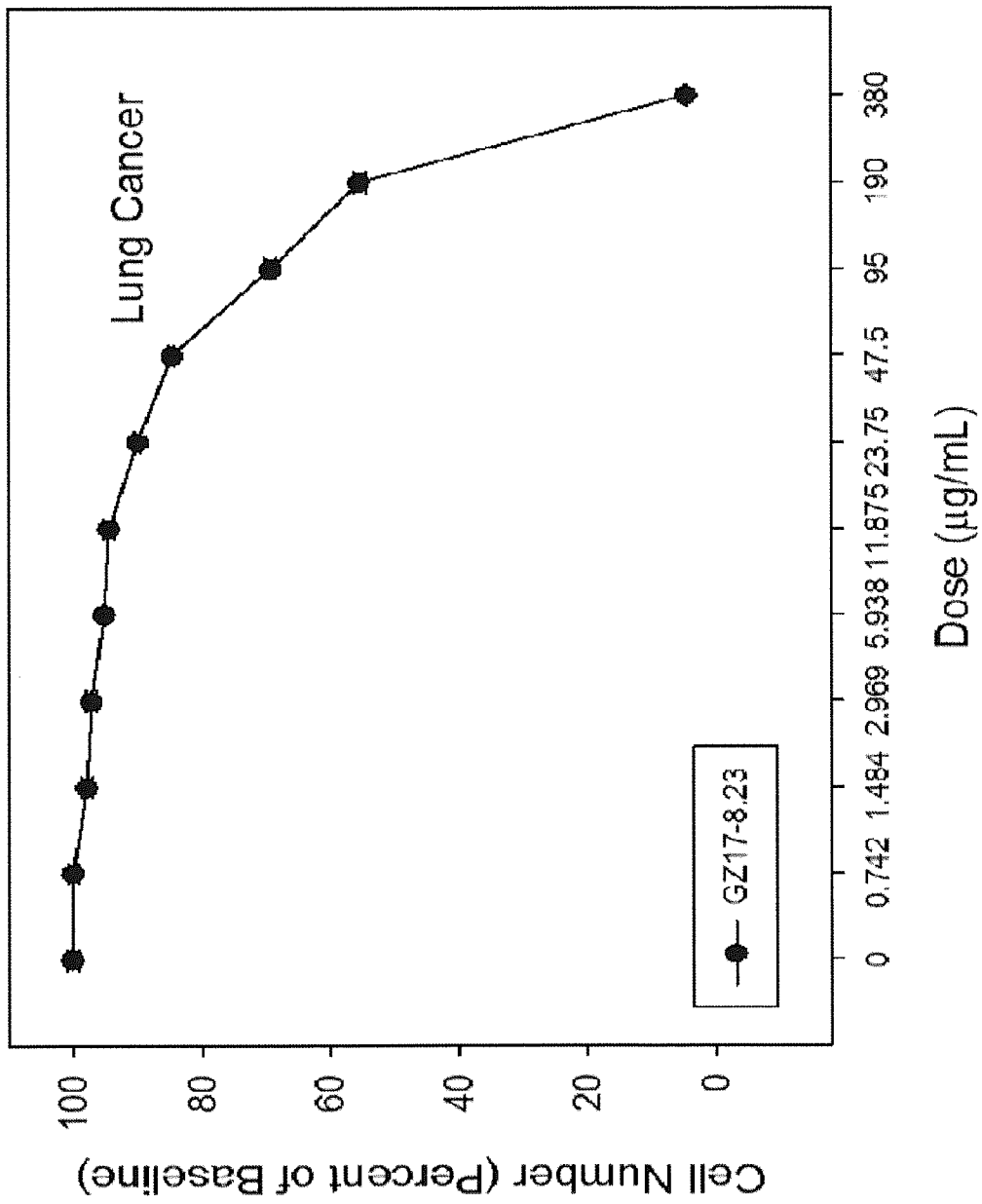

Lung Cancer
Cell Number (Percent of Baseline)
100
80
60
40
20
0
GZ17-8.23
0
0.742
1.484
2.969
5.938
11.875
23.75
47.5
95
190
380
Dose (µg/mL)

Fig. 41B

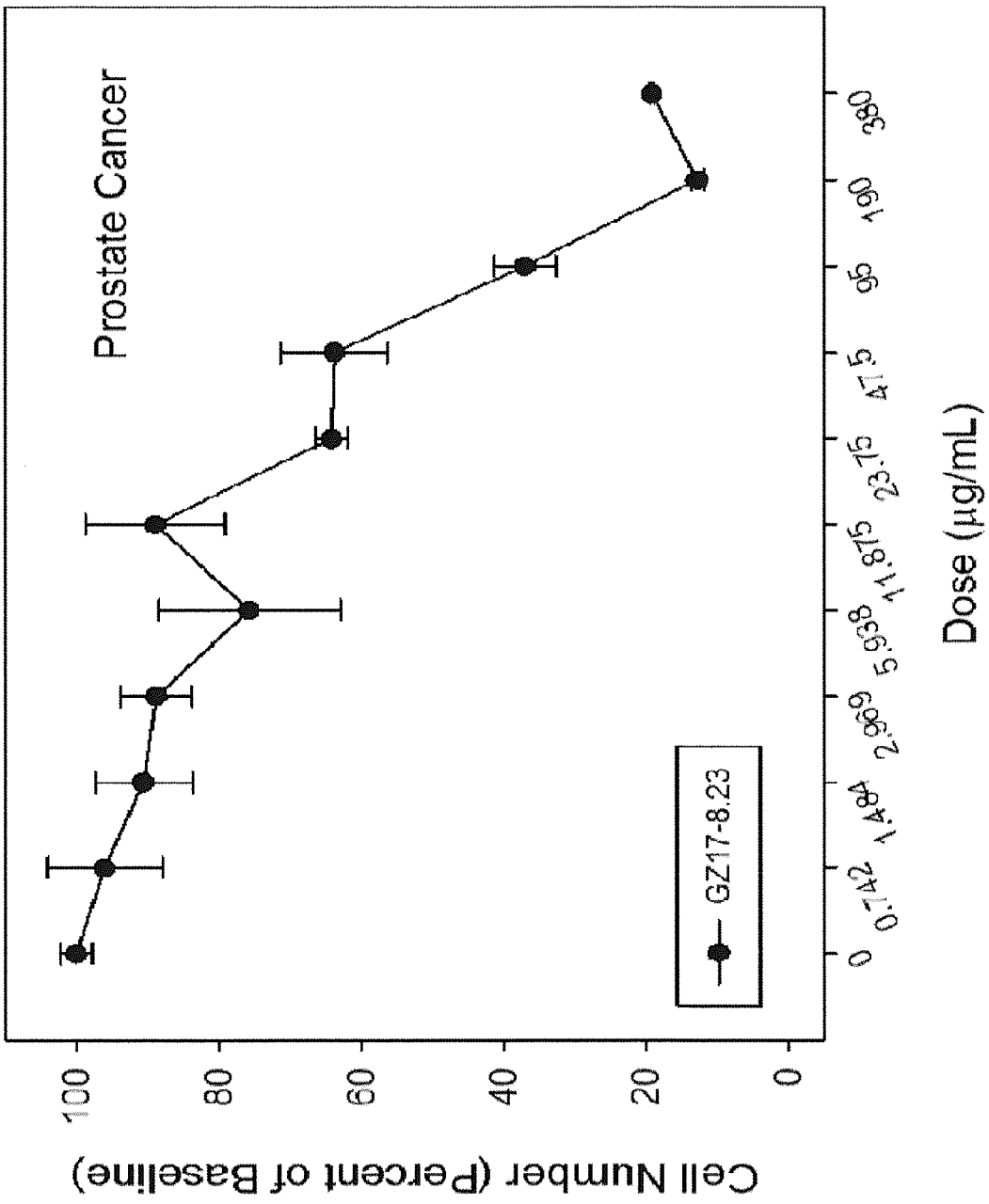

Prostate Cancer
Cell Number (Percent of Baseline)
0
20
40
60
80
100
GZ17-8.23
0
0.742
1.484
2.969
5.938
11.875
23.75
47.5
95
190
380
Dose (µg/mL)

Fig. 41C

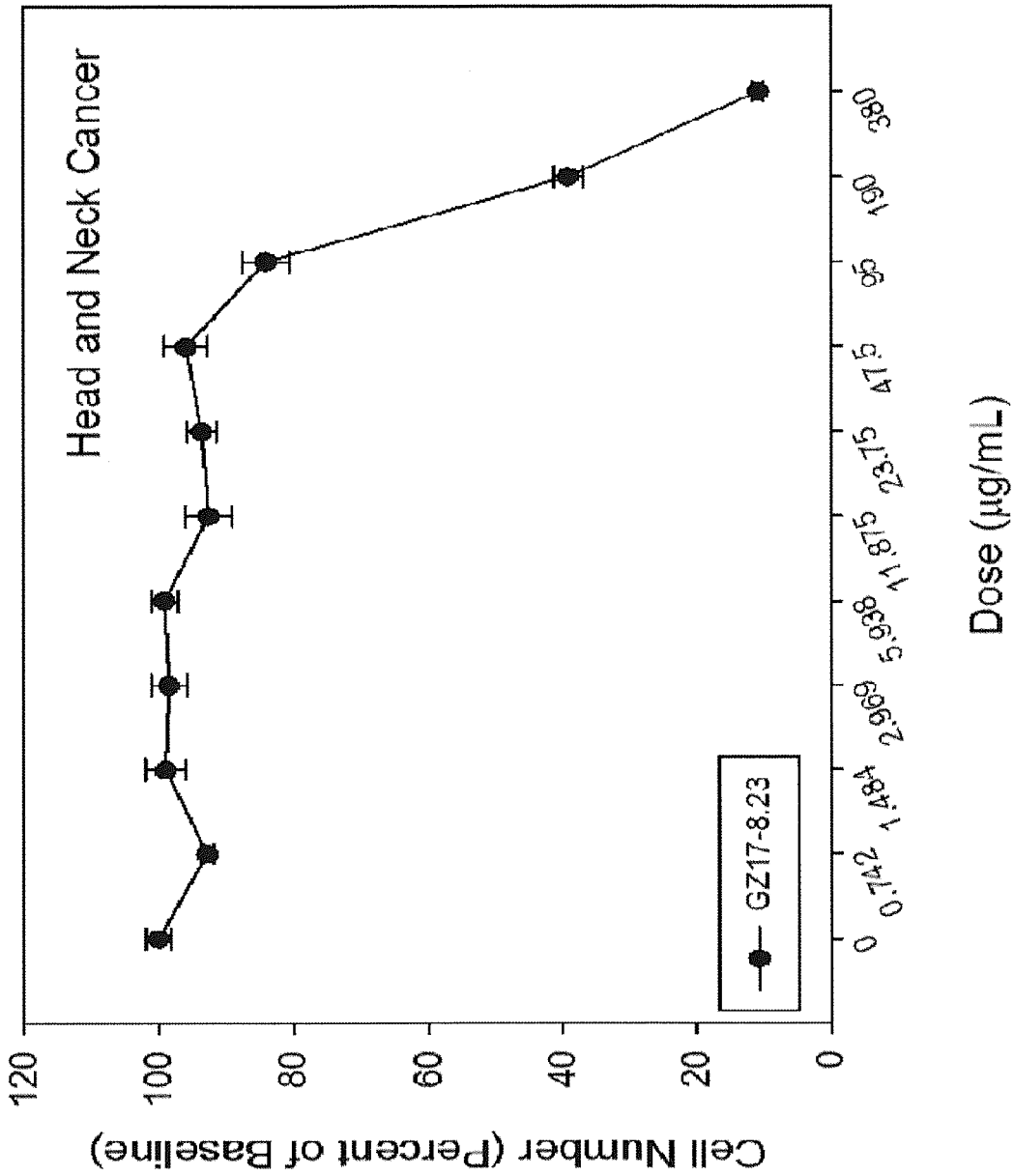

Head and Neck Cancer
Cell Number (Percent of Baseline)
120
100
80
60
40
20
0
GZ17-8.23
0
0.742
1.484
2.969
5.938
11.875
23.75
47.5
95
190
380
Dose (µg/mL)

Fig. 41D

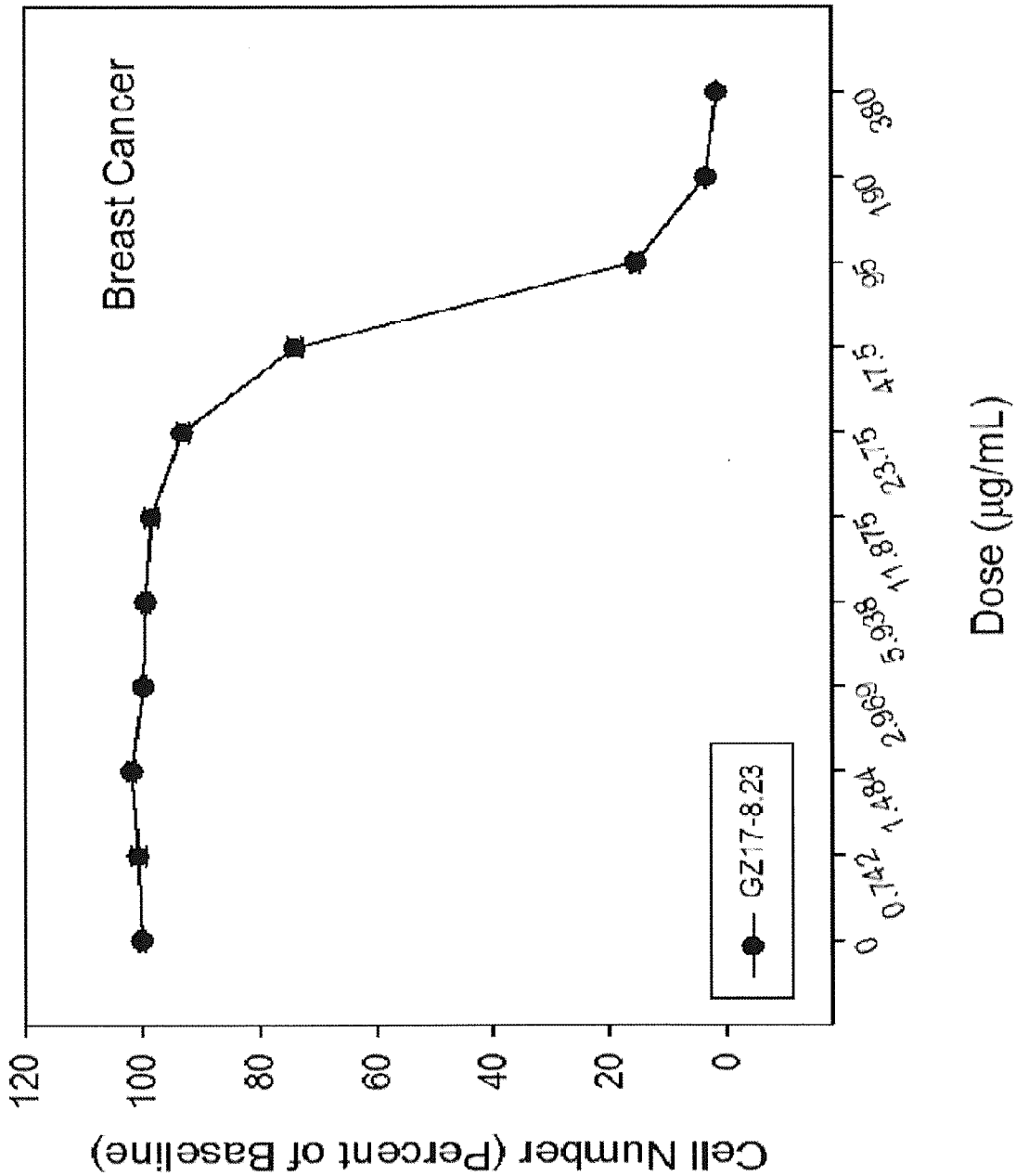

Breast Cancer
GZ17-8.23
Cell Number (Percent of Baseline)
120
100
80
60
40
20
0
0
0.742
1.484
2.969
5.938
11.875
23.75
47.5
95
190
380
Dose (µg/mL)

Fig. 41E

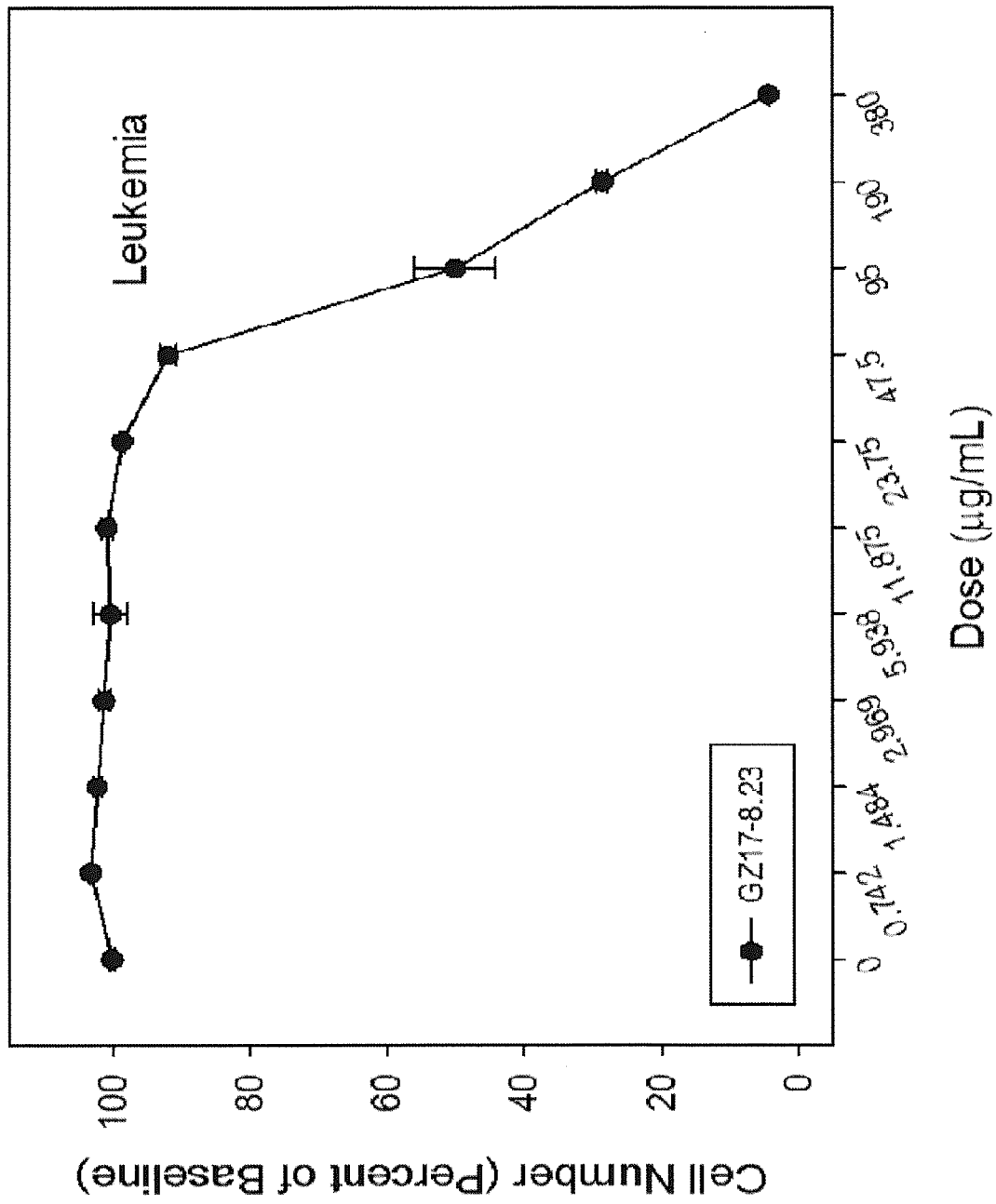

Leukemia
Cell Number (Percent of Baseline)
0
20
40
60
80
100
GZ17-8.23
0
0.742
1.484
2.969
5.938
11.875
23.75
47.5
95
190
380
Dose (μg/mL)

Fig. 41F

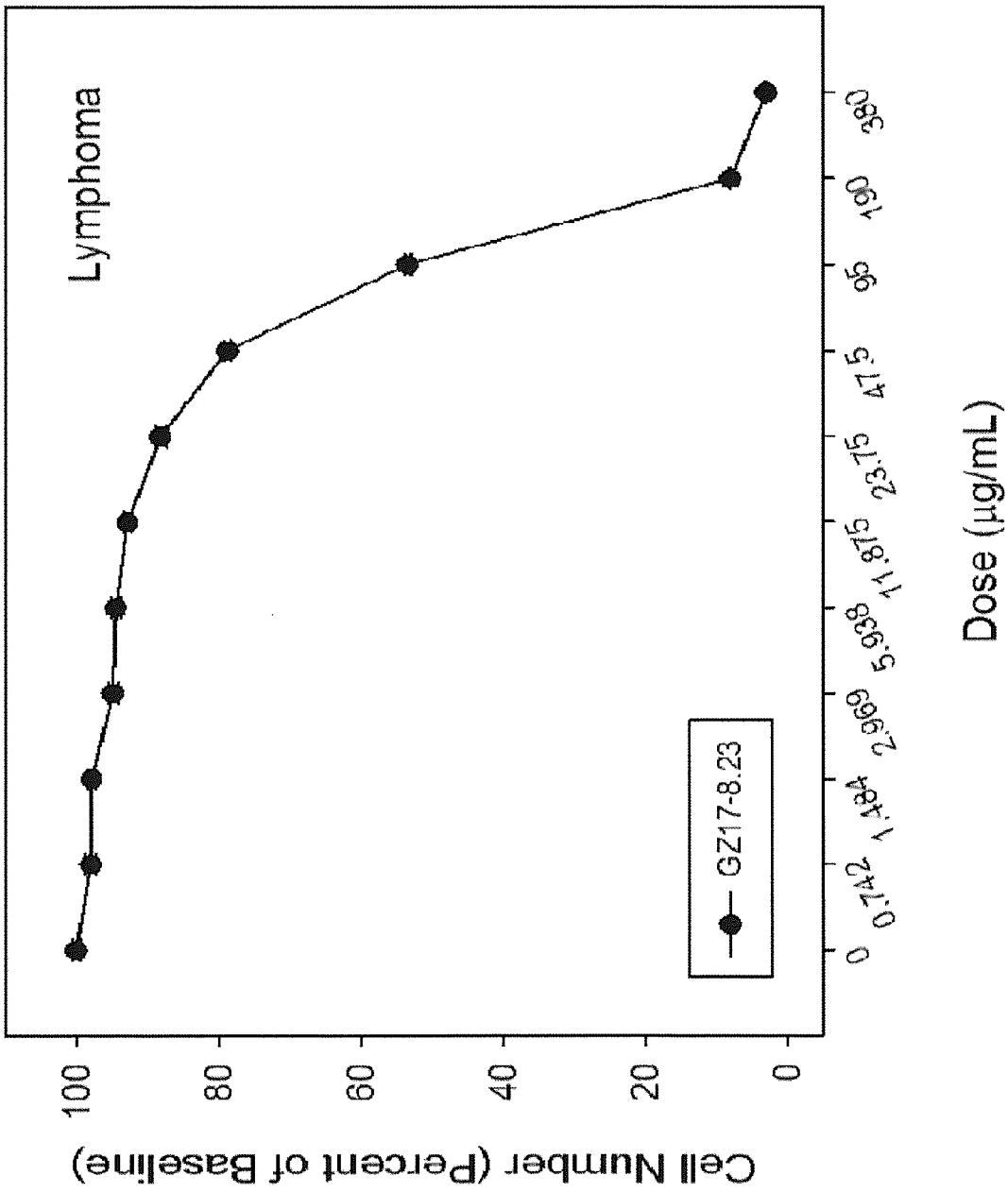

Lymphoma
GZ17-8.23
Cell Number (Percent of Baseline)
0
20
40
60
80
100
0
0.142
1.424
2.969
5.938
11.875
23.75
47.5
95
190
380
Dose (µg/mL)

Fig. 41G

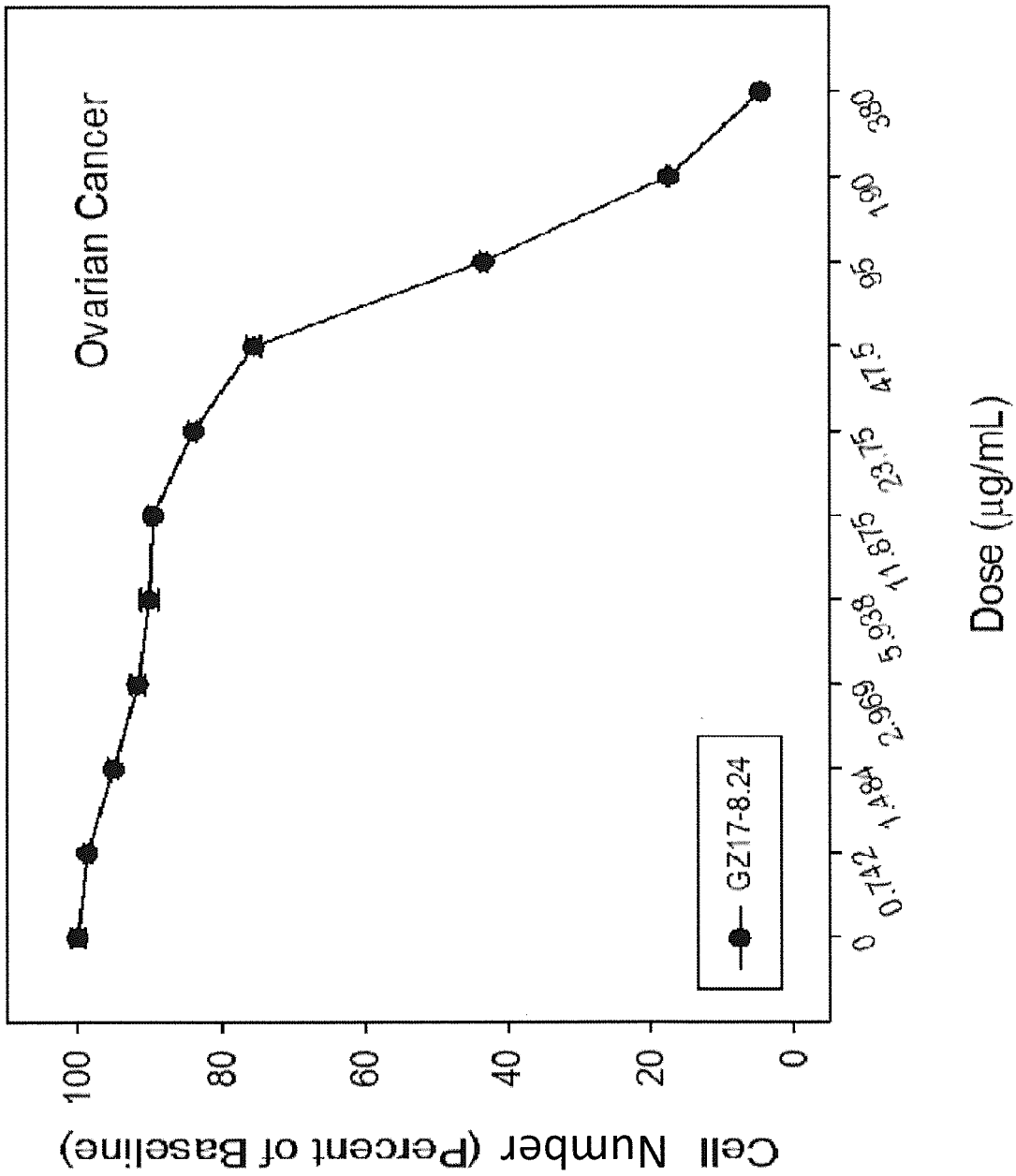

Ovarian Cancer
GZ17-8.24
Cell Number (Percent of Baseline)
0
20
40
60
80
100
0
0.742
1.484
2.969
5.938
11.875
23.75
47.5
95
190
380
Dose (µg/mL)

Fig. 42A

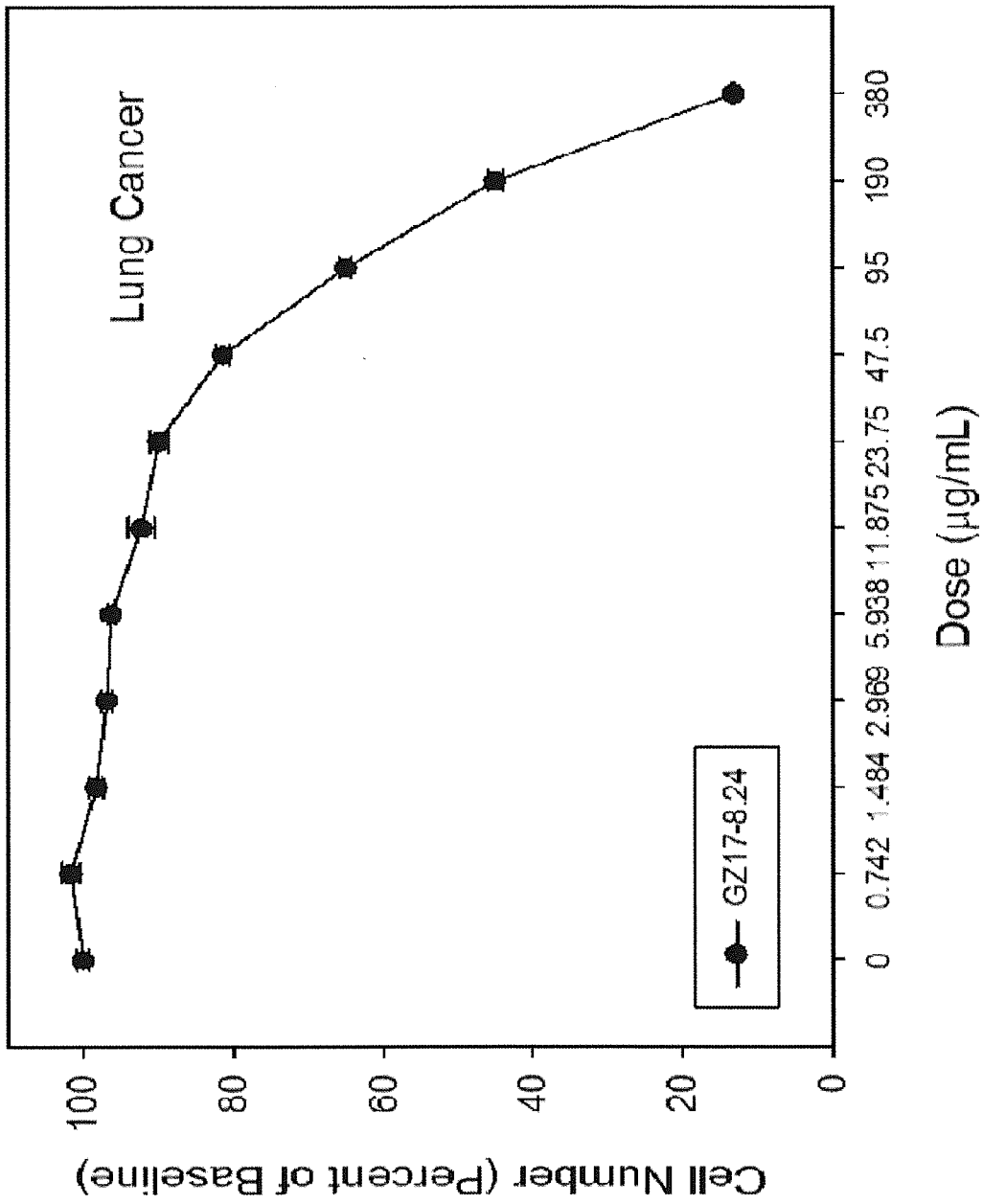

Lung Cancer
GZ17-8.24
Cell Number (Percent of Baseline)
0
20
40
60
80
100
0
0.742
1.484
2.969
5.938
11.875
23.75
47.5
95
190
380
Dose (µg/mL)

Fig. 42B

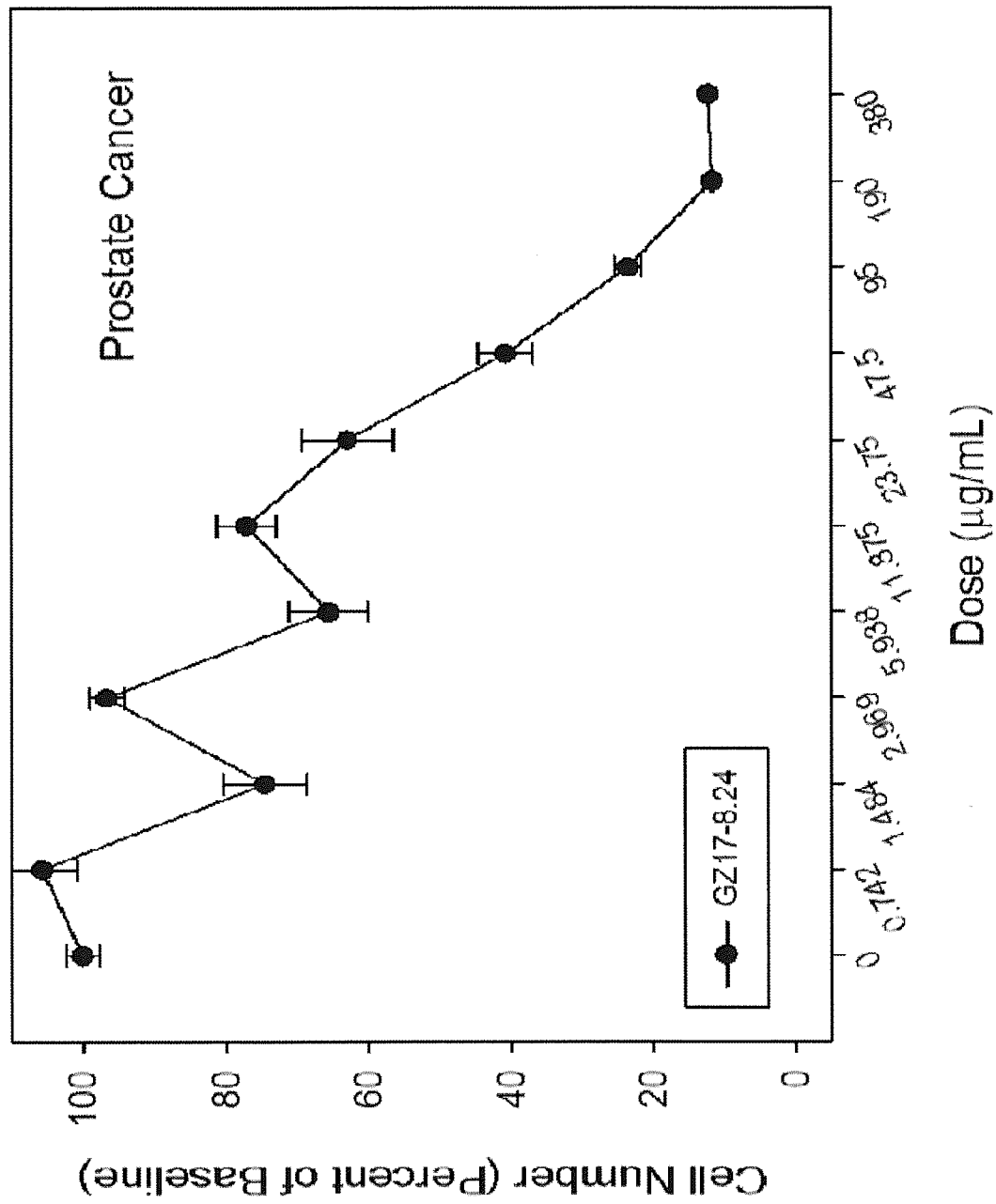

Prostate Cancer
Cell Number (Percent of Baseline)
0
20
40
60
80
100
GZ17-8.24
0
0.142
1.484
2.969
5.938
11.875
23.75
47.5
95
190
380
Dose (µg/mL)

Fig. 42C

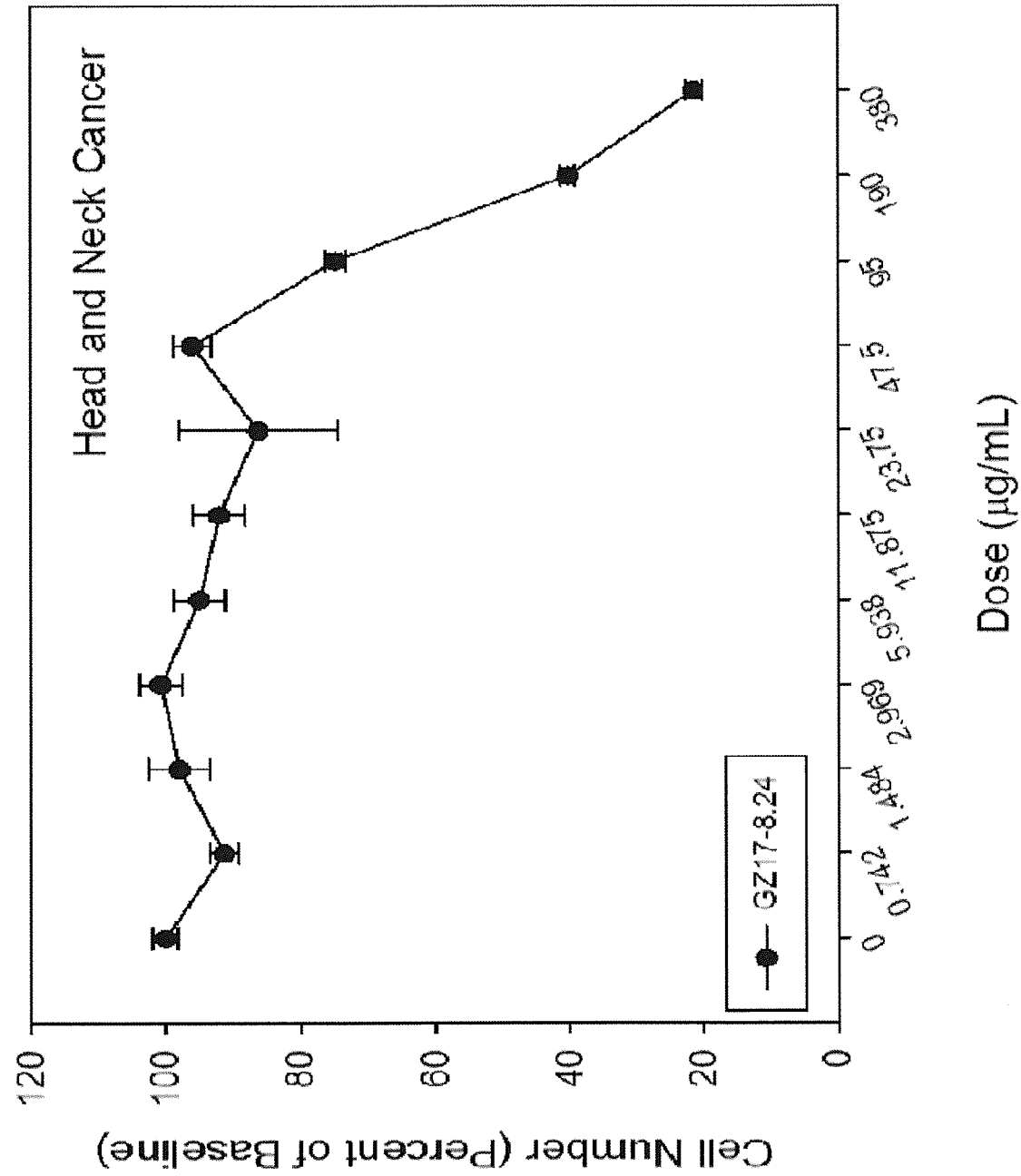

Head and Neck Cancer
Cell Number (Percent of Baseline)
120
100
80
60
40
20
0
GZ17-8.24
0
0.742
1.484
2.969
5.938
11.875
23.75
47.5
95
190
380
Dose (μg/mL)

Fig. 42D

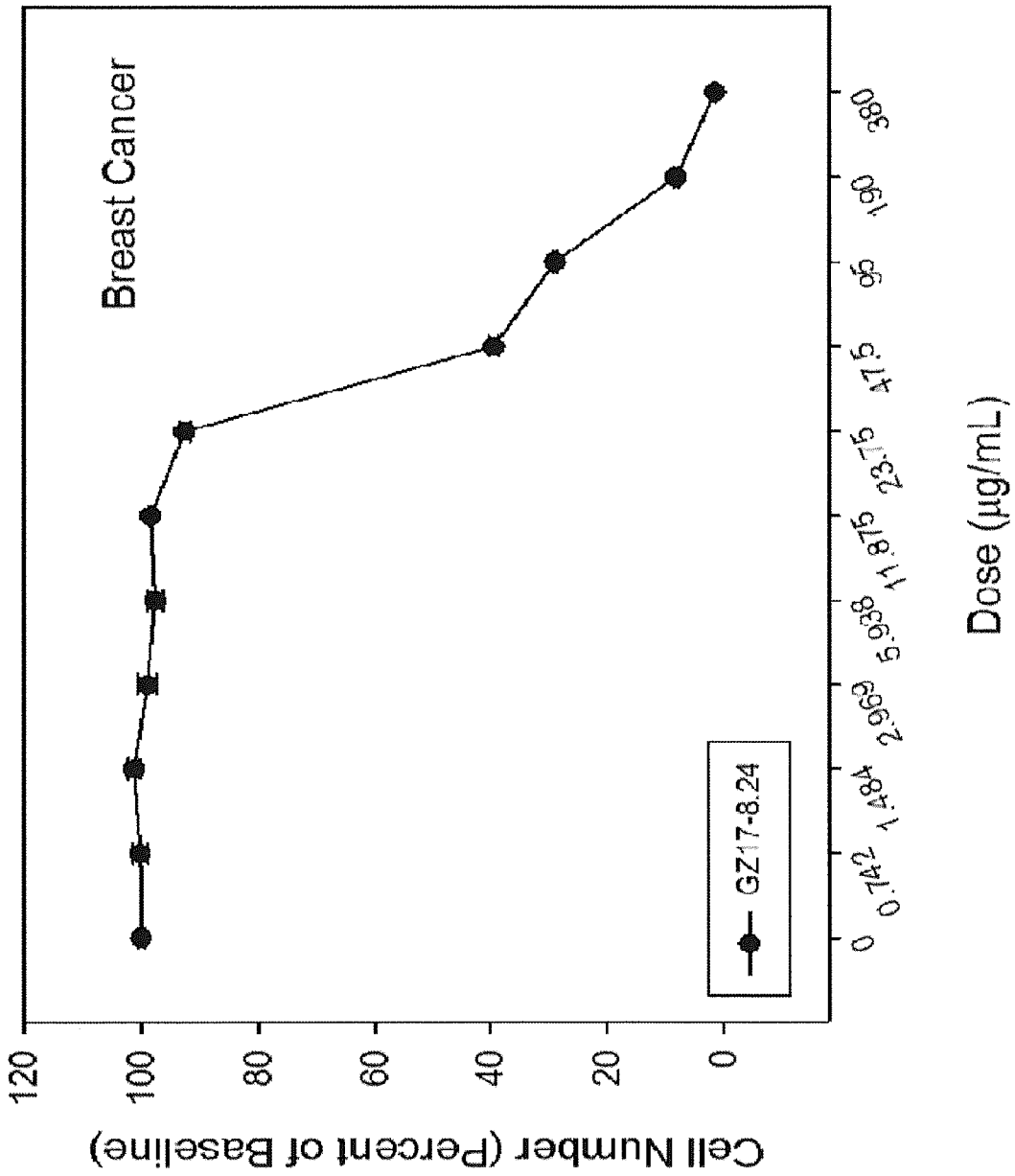

Breast Cancer
Cell Number (Percent of Baseline)
120
100
80
60
40
20
0
GZ17-8.24
0
0.742
1.484
2.969
5.938
11.875
23.75
47.5
95
190
380
Dose (µg/mL)

Fig. 42E

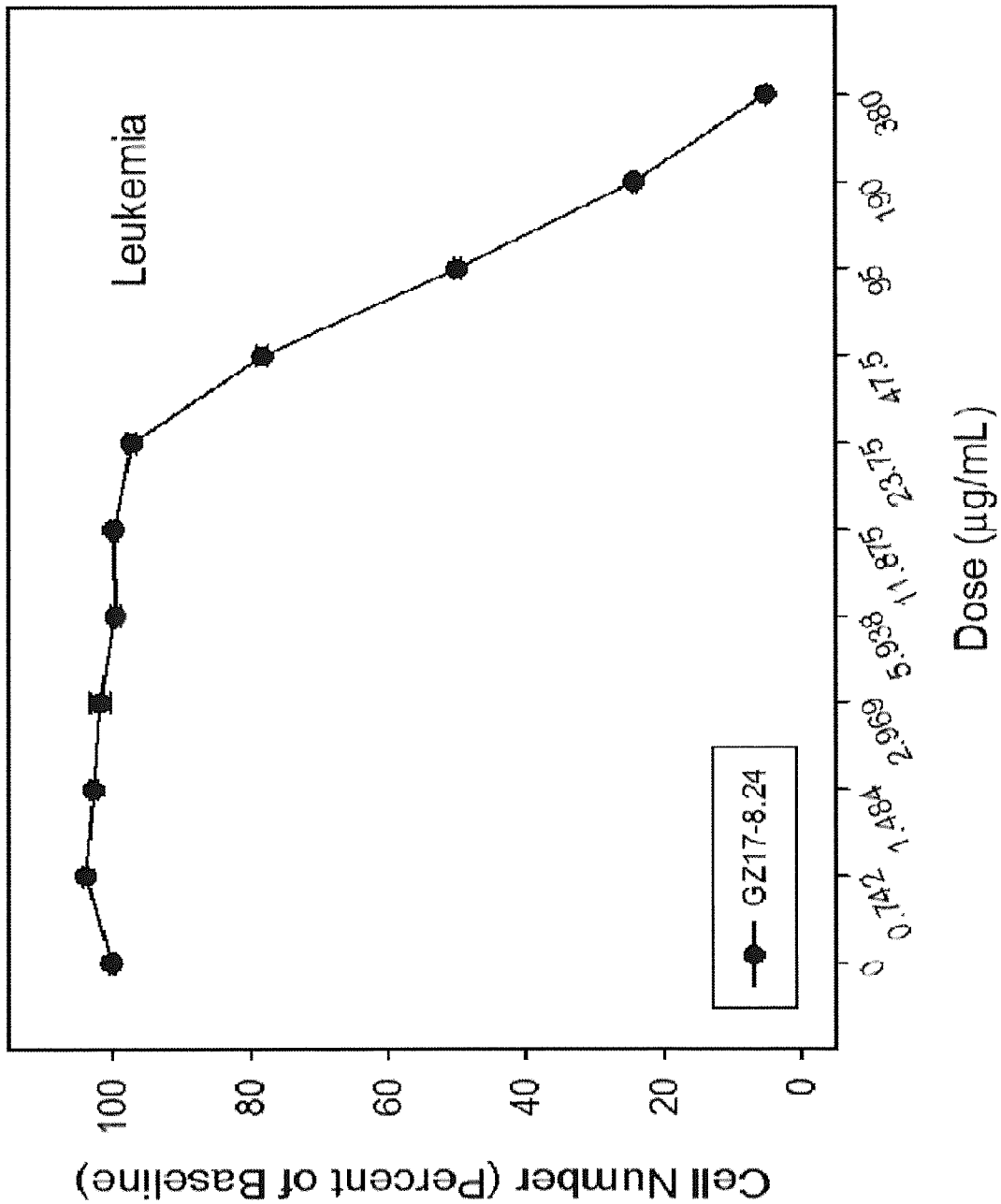

Leukemia
Cell Number (Percent of Baseline)
0
20
40
60
80
100
GZ17-8.24
0
0.742
1.484
2.969
5.938
11.875
23.75
47.5
95
190
380
Dose (µg/mL)

Fig. 42F

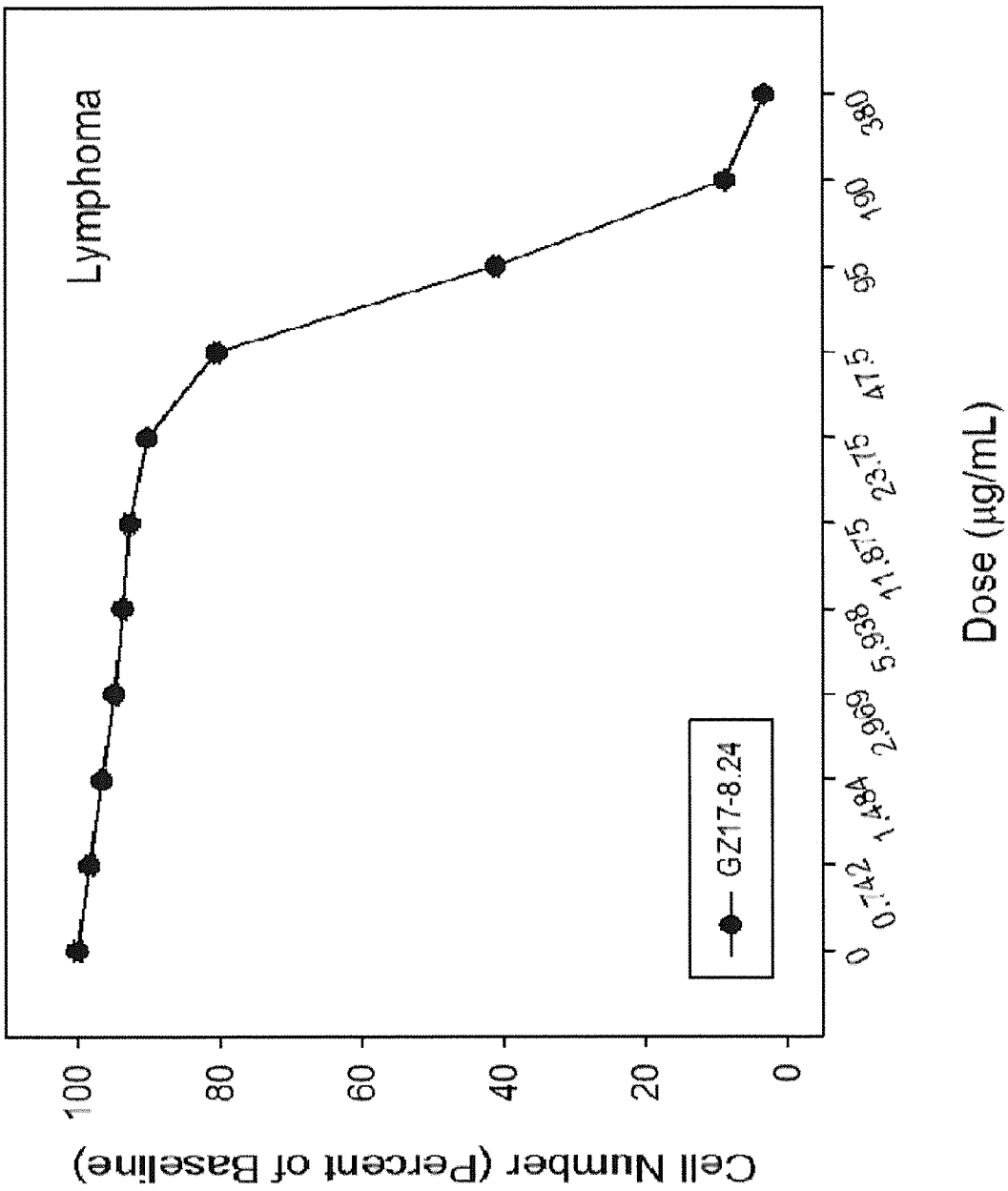

Lymphoma
Cell Number (Percent of Baseline)
0
20
40
60
80
100
GZ17-8.24
0
0.742
1.484
2.969
5.938
11.875
23.75
47.5
95
190
380
Dose (µg/mL)

Fig. 42G

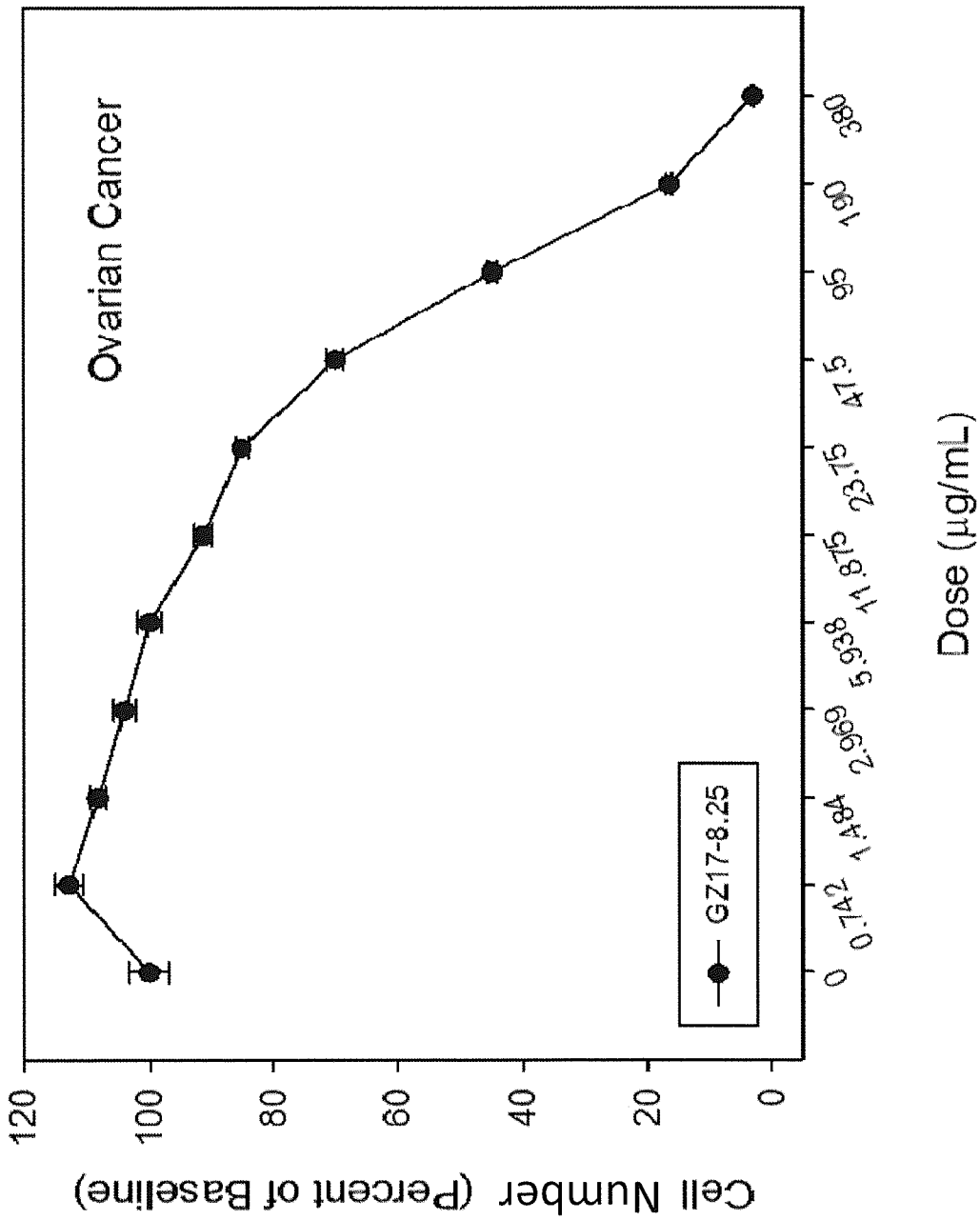

Ovarian Cancer
GZ17-8.25
Cell Number (Percent of Baseline)
0
20
40
60
80
100
120
0
0.742
1.484
2.969
5.938
11.875
23.75
47.5
95
190
380
Dose (µg/mL)

Fig. 43A

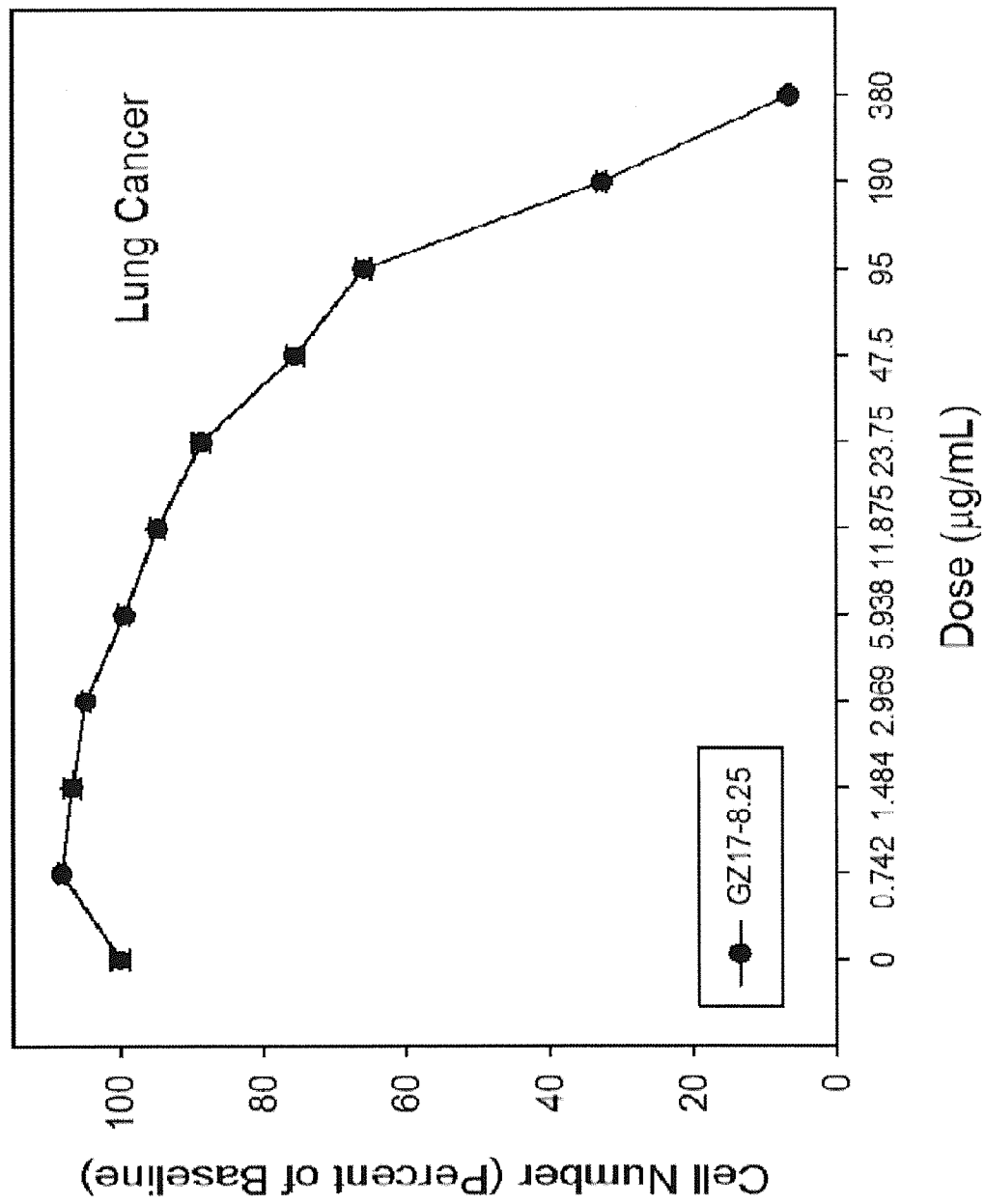

Lung Cancer
Cell Number (Percent of Baseline)
0
20
40
60
80
100
GZ17-8.25
0
0.742
1.484
2.969
5.938
11.875
23.75
47.5
95
190
380
Dose (µg/mL)

Fig. 43B

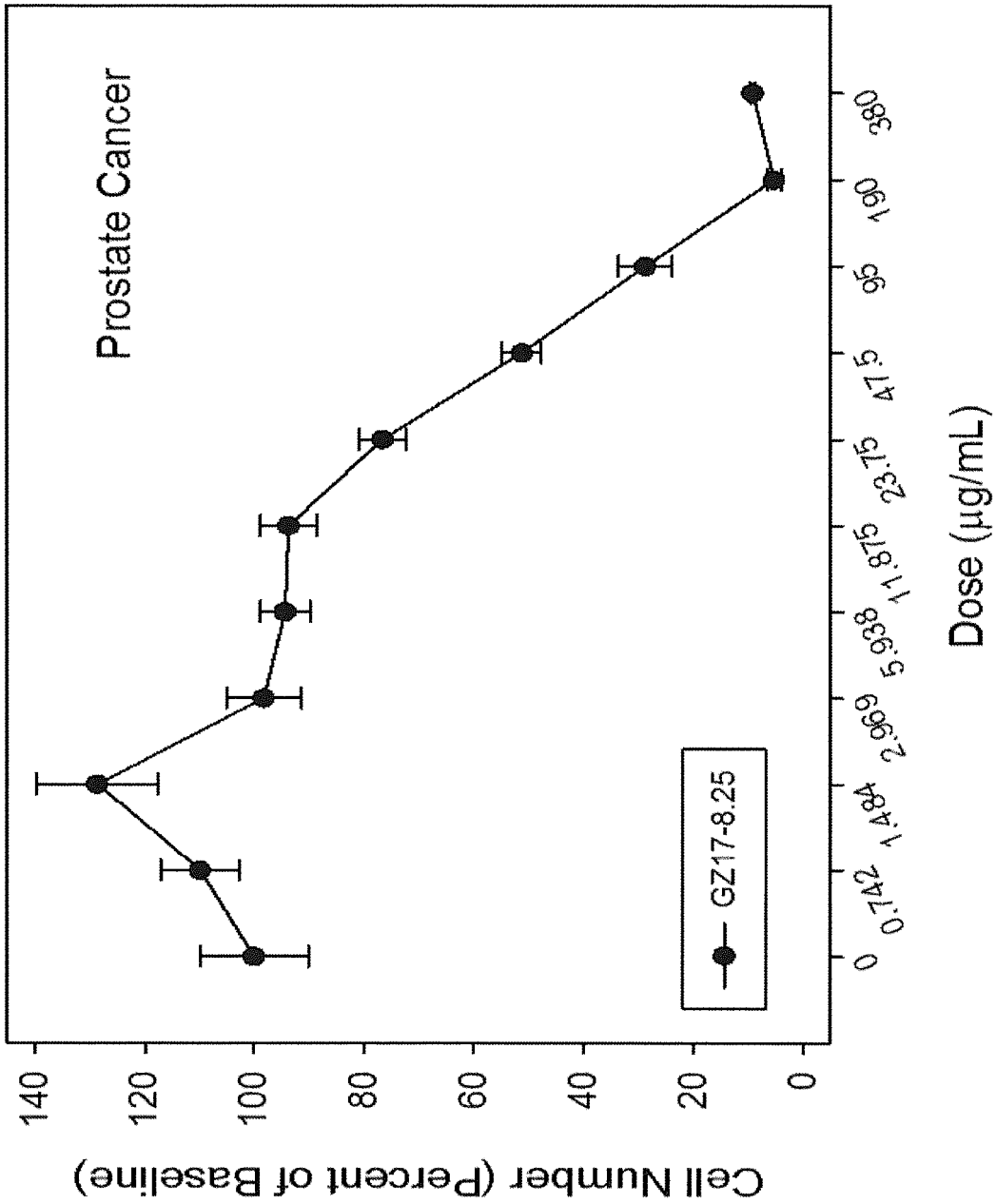

Prostate Cancer
Cell Number (Percent of Baseline)
0
20
40
60
80
100
120
140
GZ17-8.25
0
0.742
1.484
2.969
5.938
11.875
23.75
47.5
95
190
380
Dose (µg/mL)

Fig. 43C

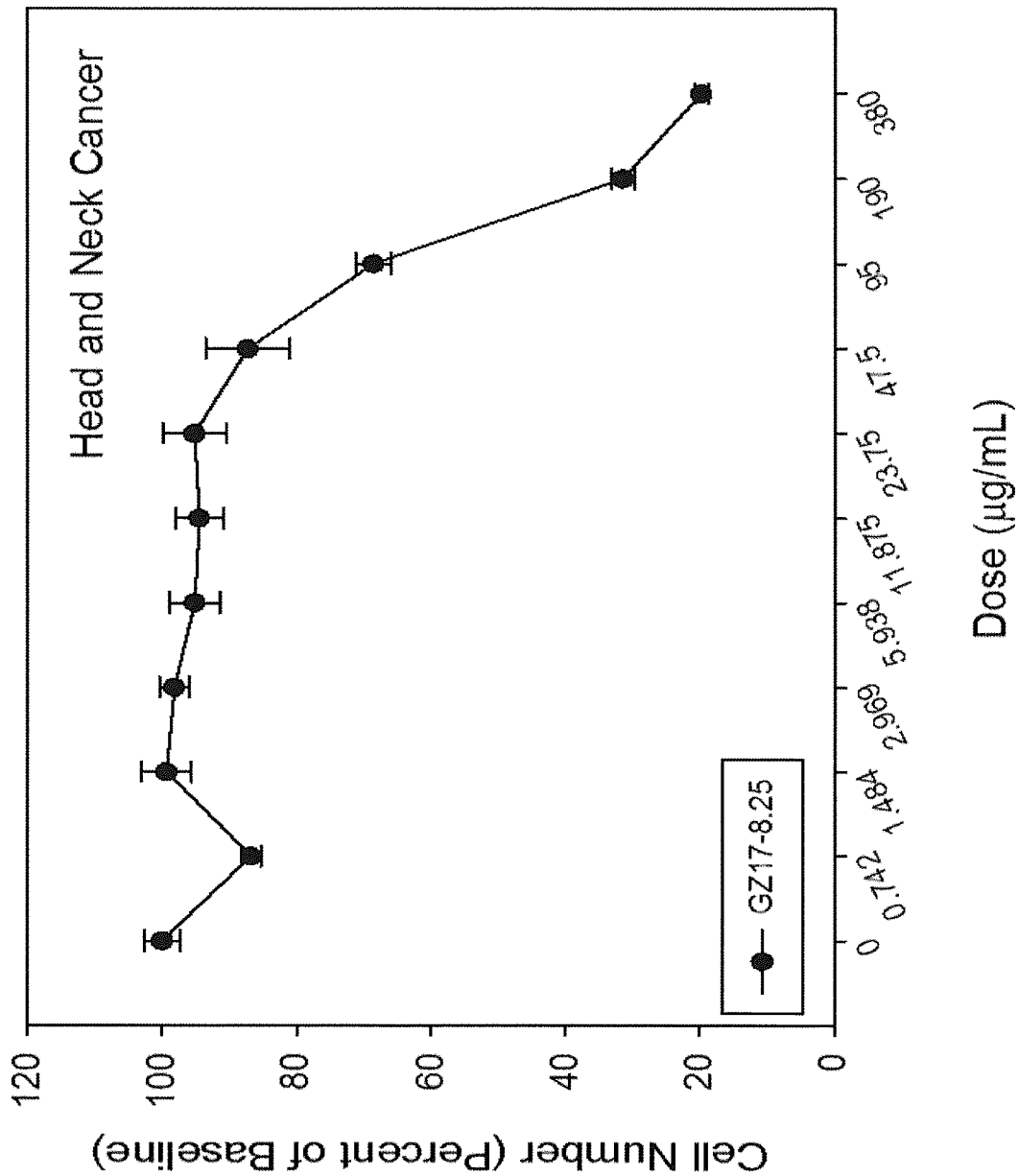

Head and Neck Cancer
Cell Number (Percent of Baseline)
120
100
80
60
40
20
0
GZ17-8.25
0
0.742
1.484
2.969
5.938
11.875
23.75
47.5
95
190
380
Dose (µg/mL)

Fig. 43D

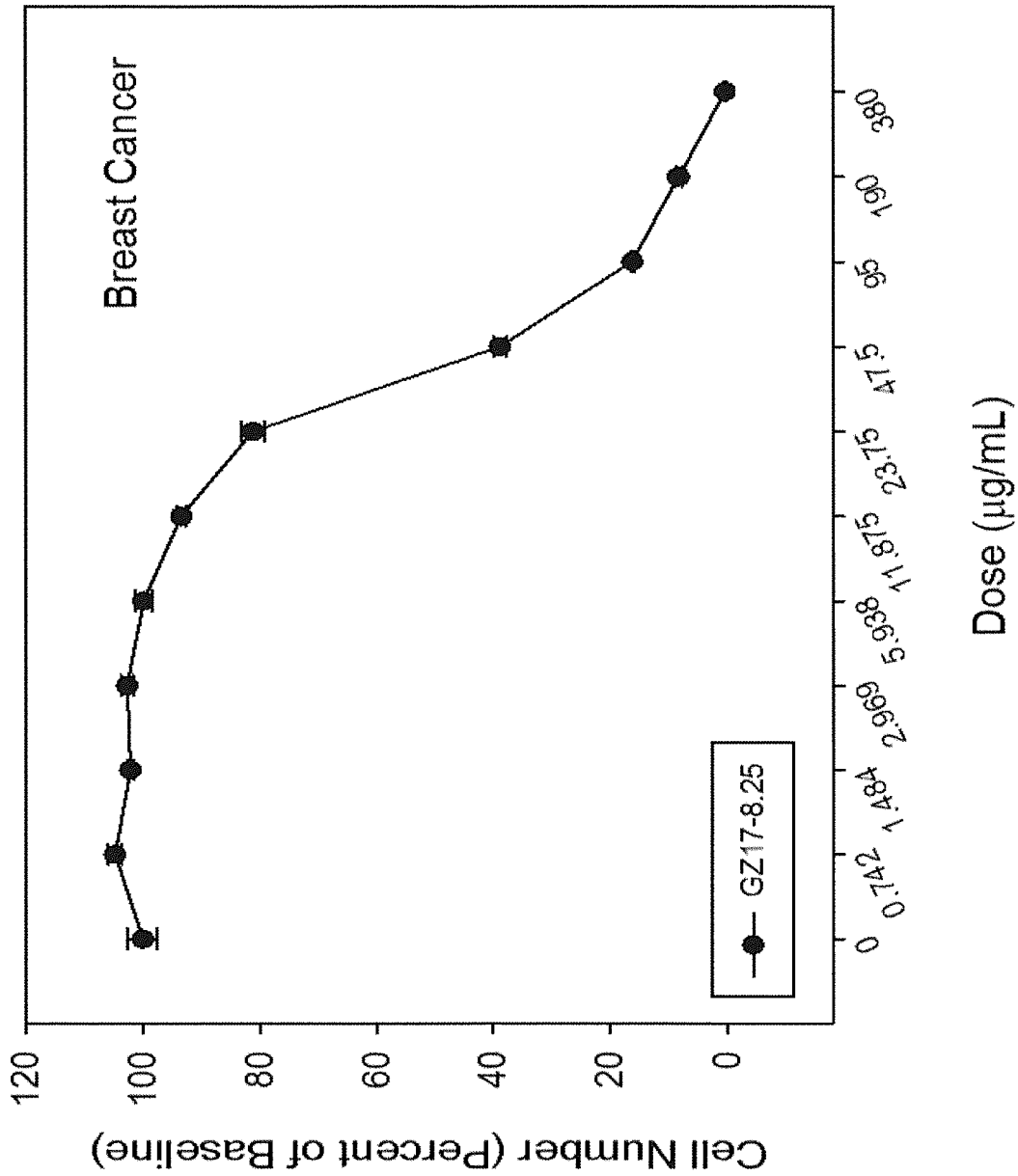

Breast Cancer
Cell Number (Percent of Baseline)
120
100
80
60
40
20
0
GZ17-8.25
0
0.742
1.484
2.969
5.938
11.875
23.75
47.5
95
190
380
Dose (µg/mL)

Fig. 43E

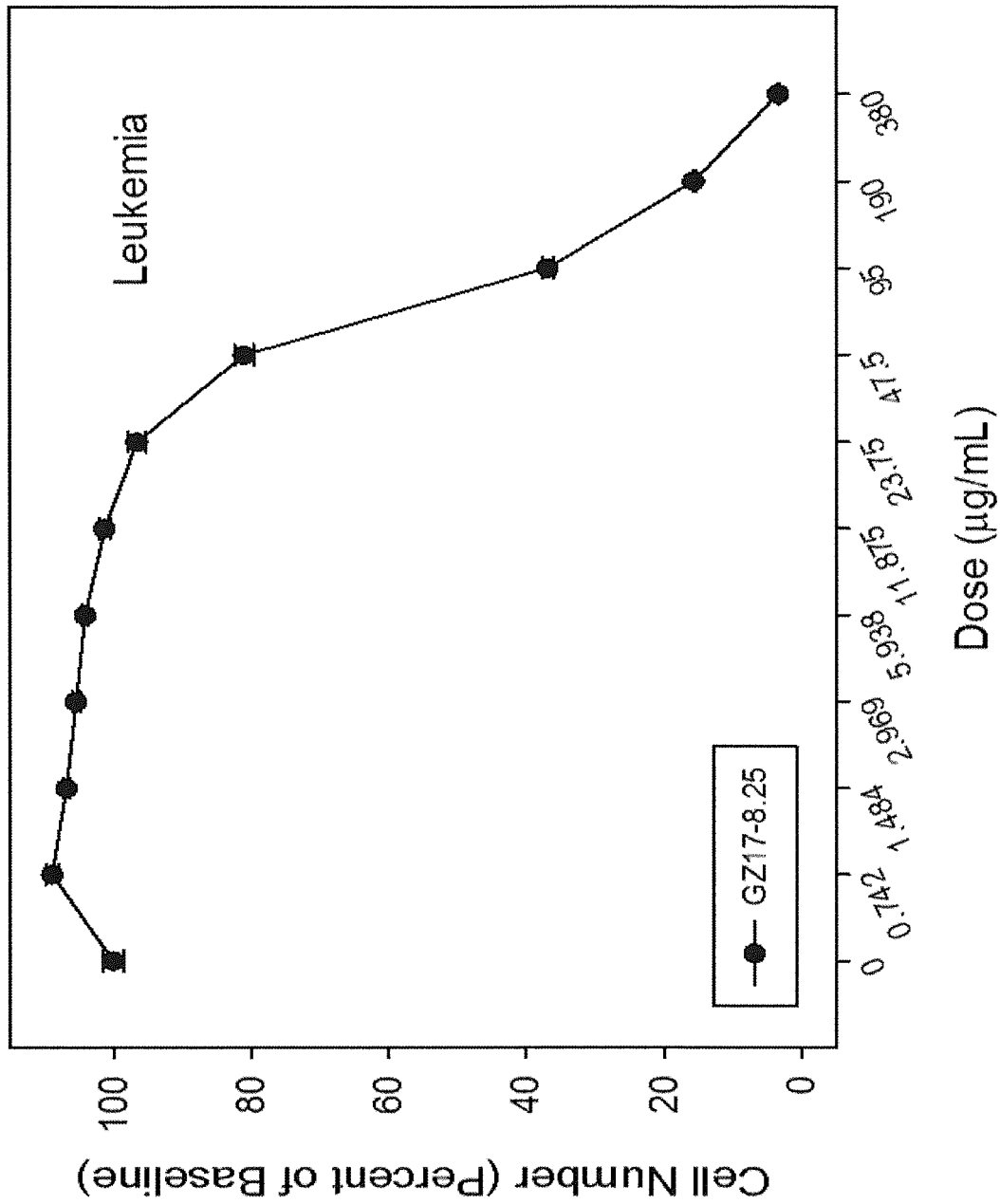

Leukemia
GZ17-8.25
Cell Number (Percent of Baseline)
0
20
40
60
80
100
0
0.742
1.484
2.969
5.938
11.875
23.75
47.5
95
190
380
Dose (µg/mL)

Fig. 43F

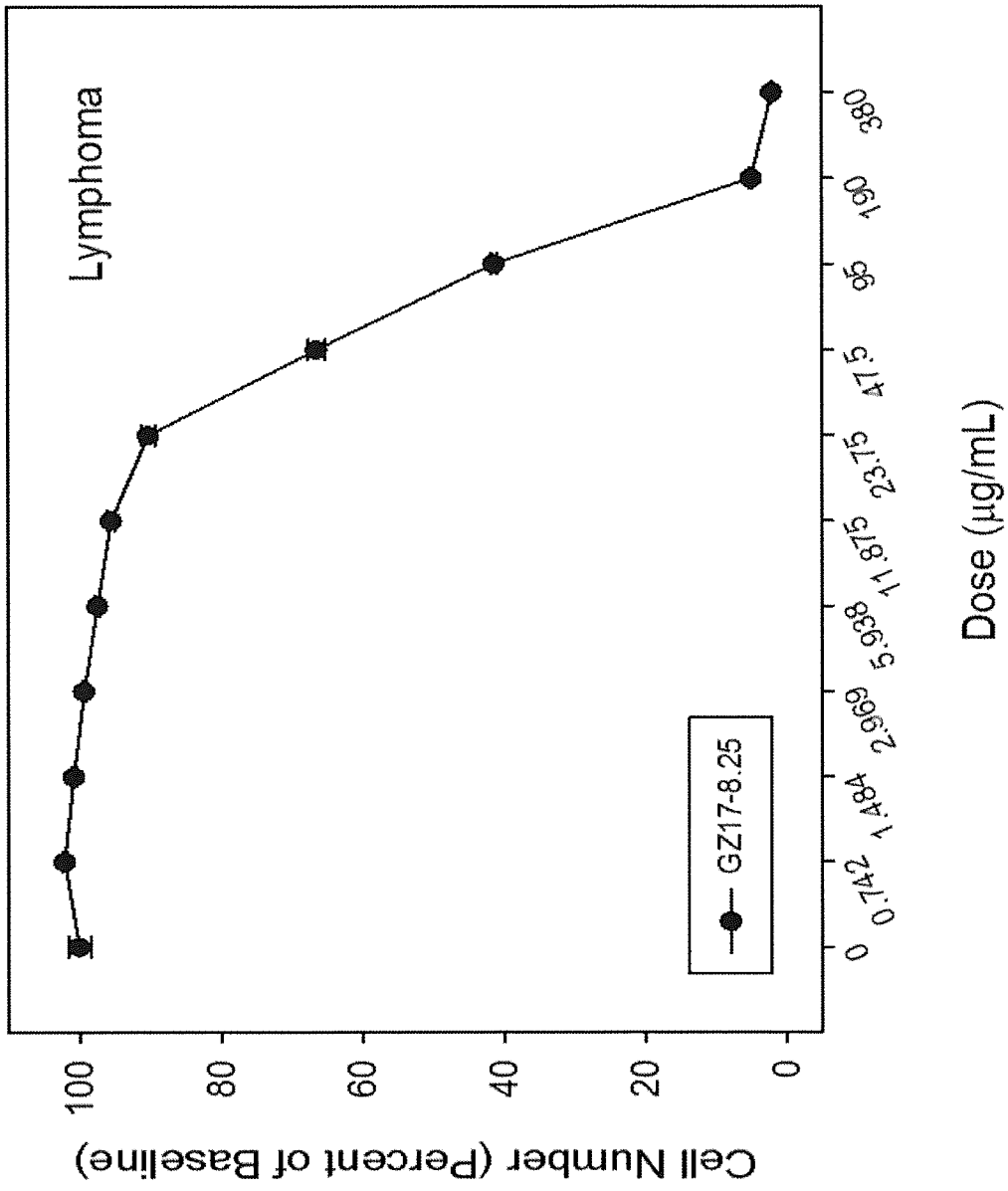

Lymphoma
Cell Number (Percent of Baseline)
0
20
40
60
80
100
GZ17-8.25
0
0.742
1.484
2.969
5.938
11.875
23.75
47.5
95
190
380
Dose (µg/mL)

Fig. 43G

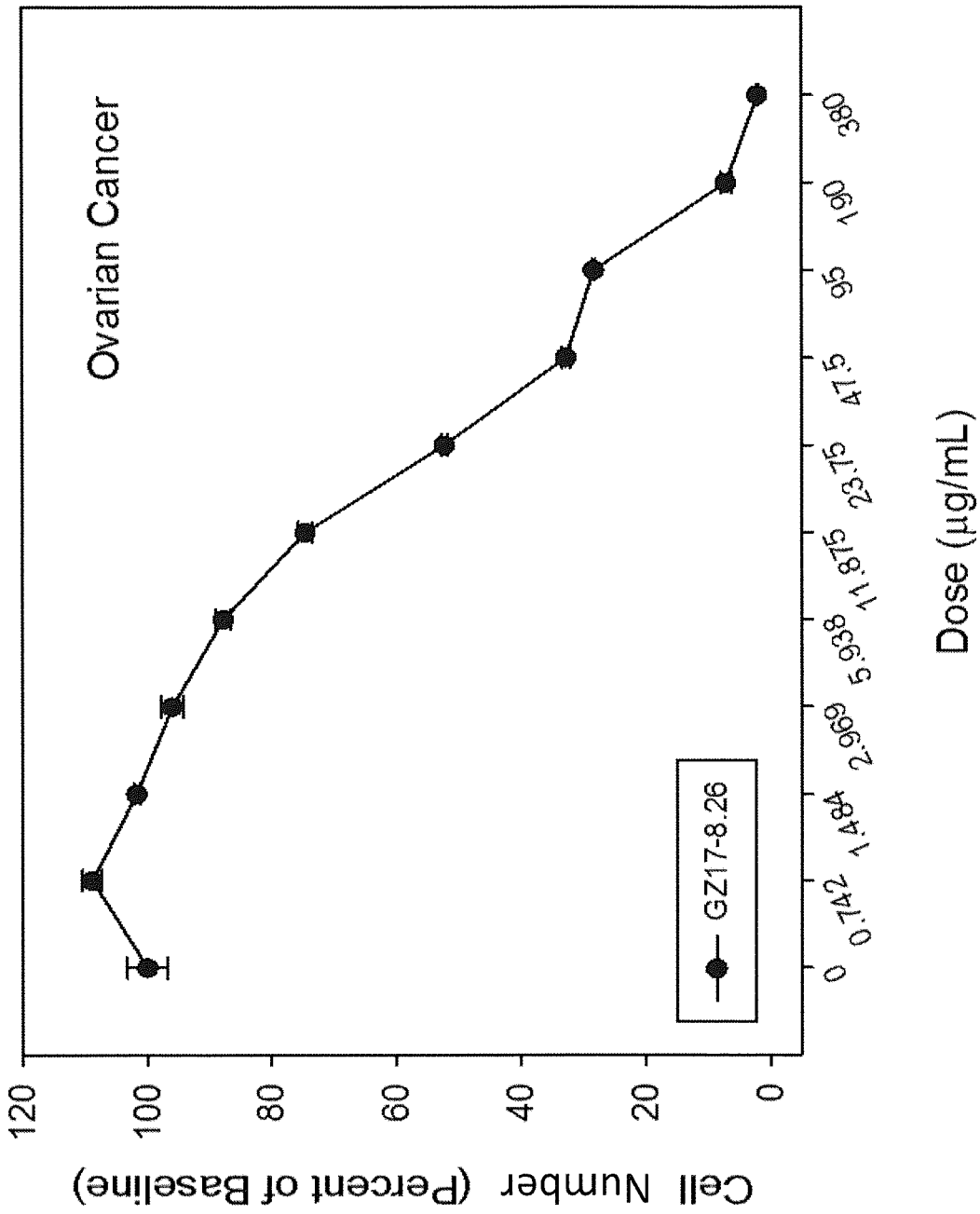

Ovarian Cancer
GZ17-8.26
Cell Number (Percent of Baseline)
Dose (µg/mL)
0
20
40
60
80
100
120
0
0.742
1.484
2.969
5.938
11.875
23.75
47.5
95
190
380

Fig. 44A

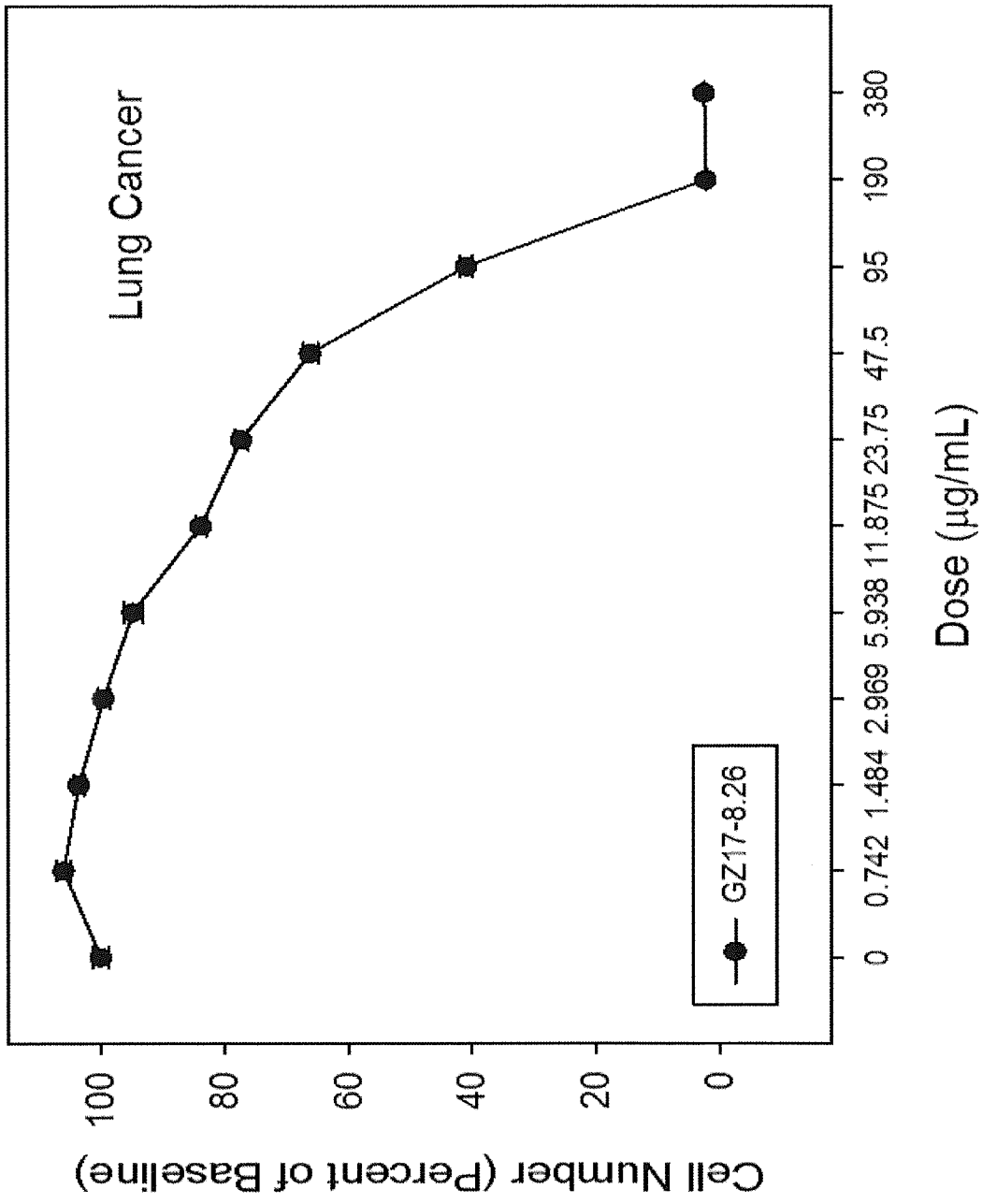

Lung Cancer
Cell Number (Percent of Baseline)
0
20
40
60
80
100
GZ17-8.26
0
0.742
1.484
2.969
5.938
11.875
23.75
47.5
95
190
380
Dose (µg/mL)

Fig. 44B

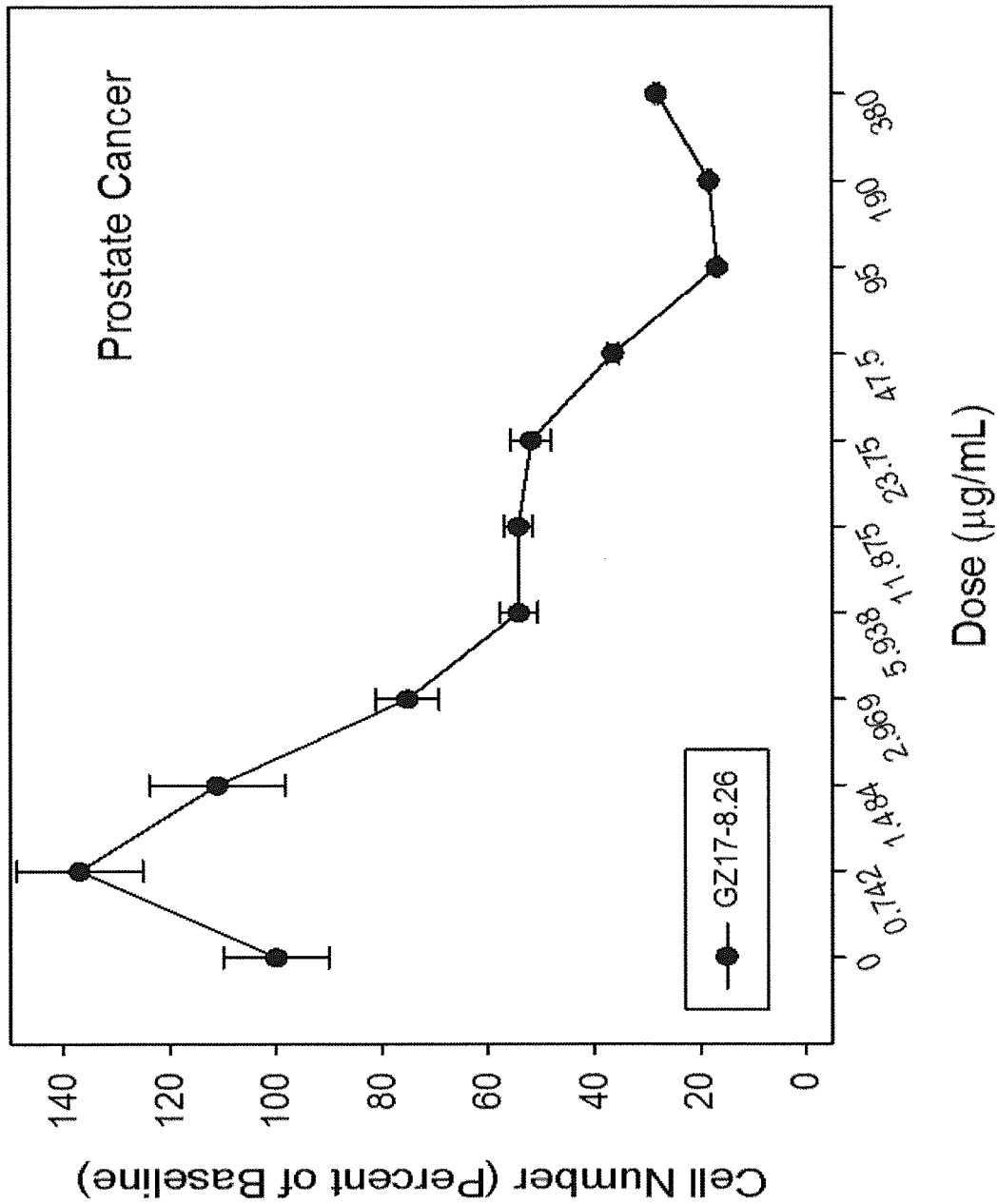

Prostate Cancer
Cell Number (Percent of Baseline)
0
20
40
60
80
100
120
140
GZ17-8.26
0
0.742
1.484
2.969
5.938
11.875
23.75
47.5
95
190
380
Dose (µg/mL)

Fig. 44C

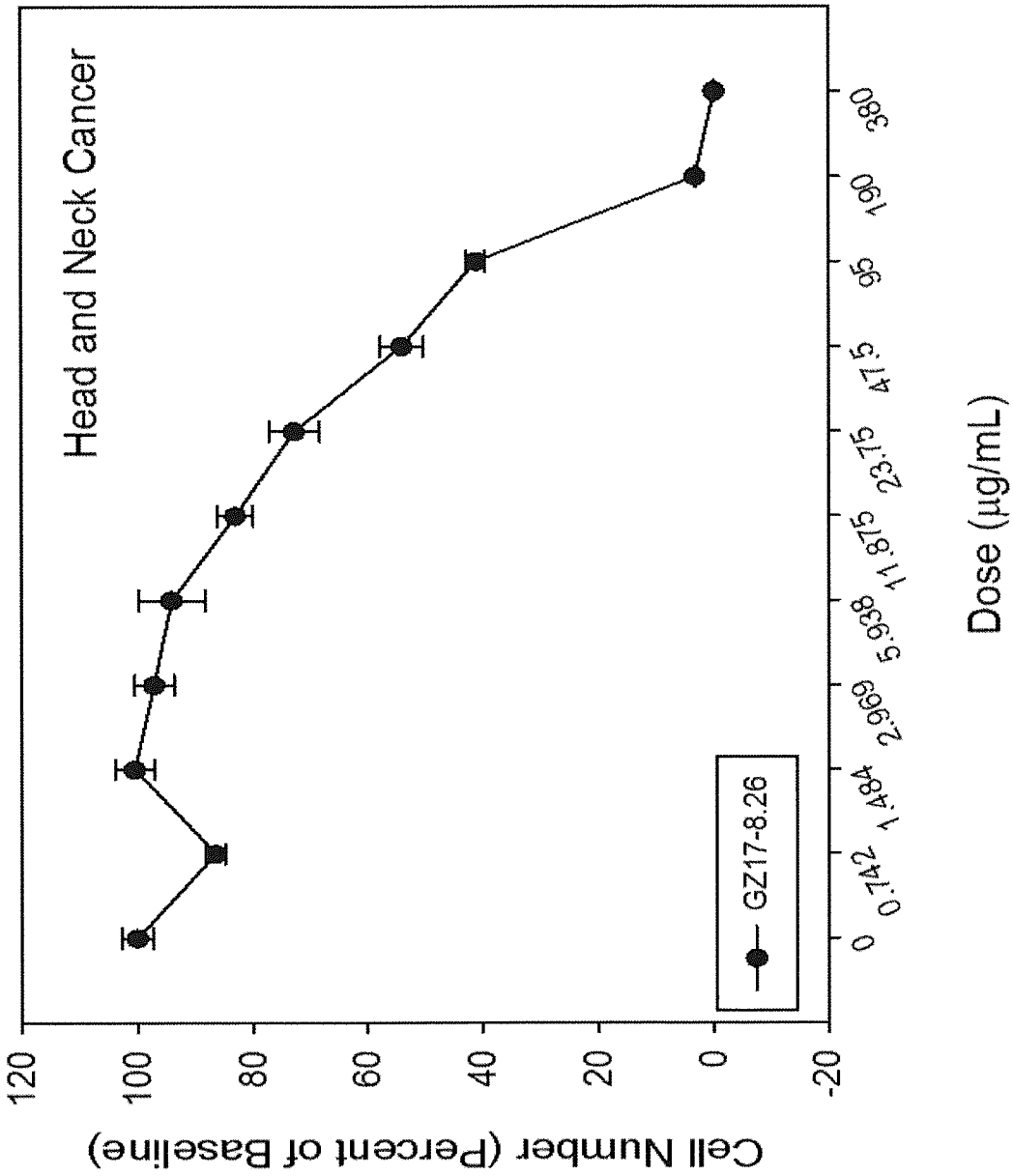

Head and Neck Cancer
Cell Number (Percent of Baseline)
120
100
80
60
40
20
0
-20
GZ17-8.26
0
0.142
1.484
2.969
5.938
11.875
23.75
47.5
95
190
380
Dose (µg/mL)

Fig. 44D

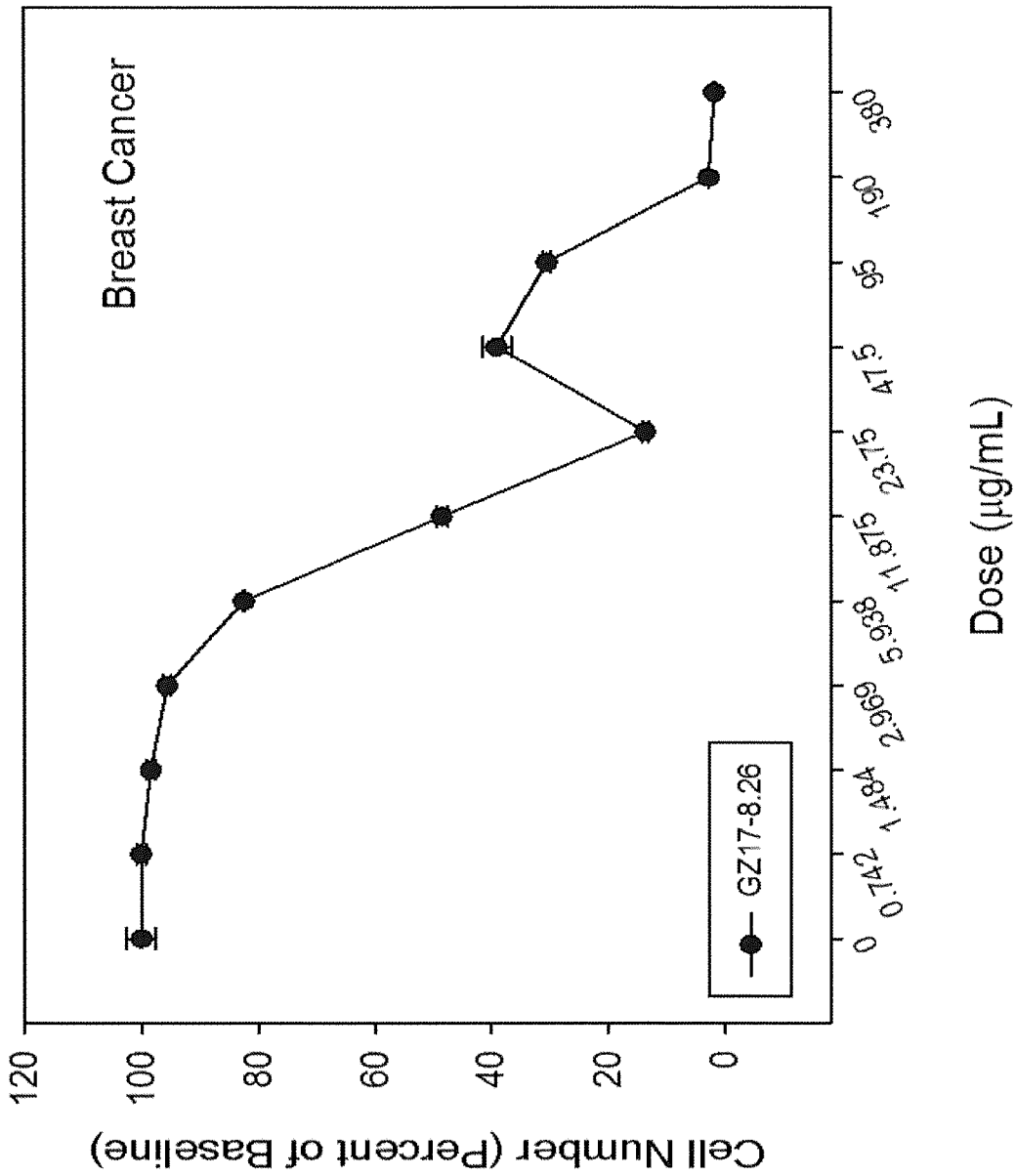

Breast Cancer
Cell Number (Percent of Baseline)
120
100
80
60
40
20
0
GZ17-8.26
0
0.742
1.484
2.969
5.938
11.875
23.75
47.5
95
190
380
Dose (µg/mL)

Fig. 44E

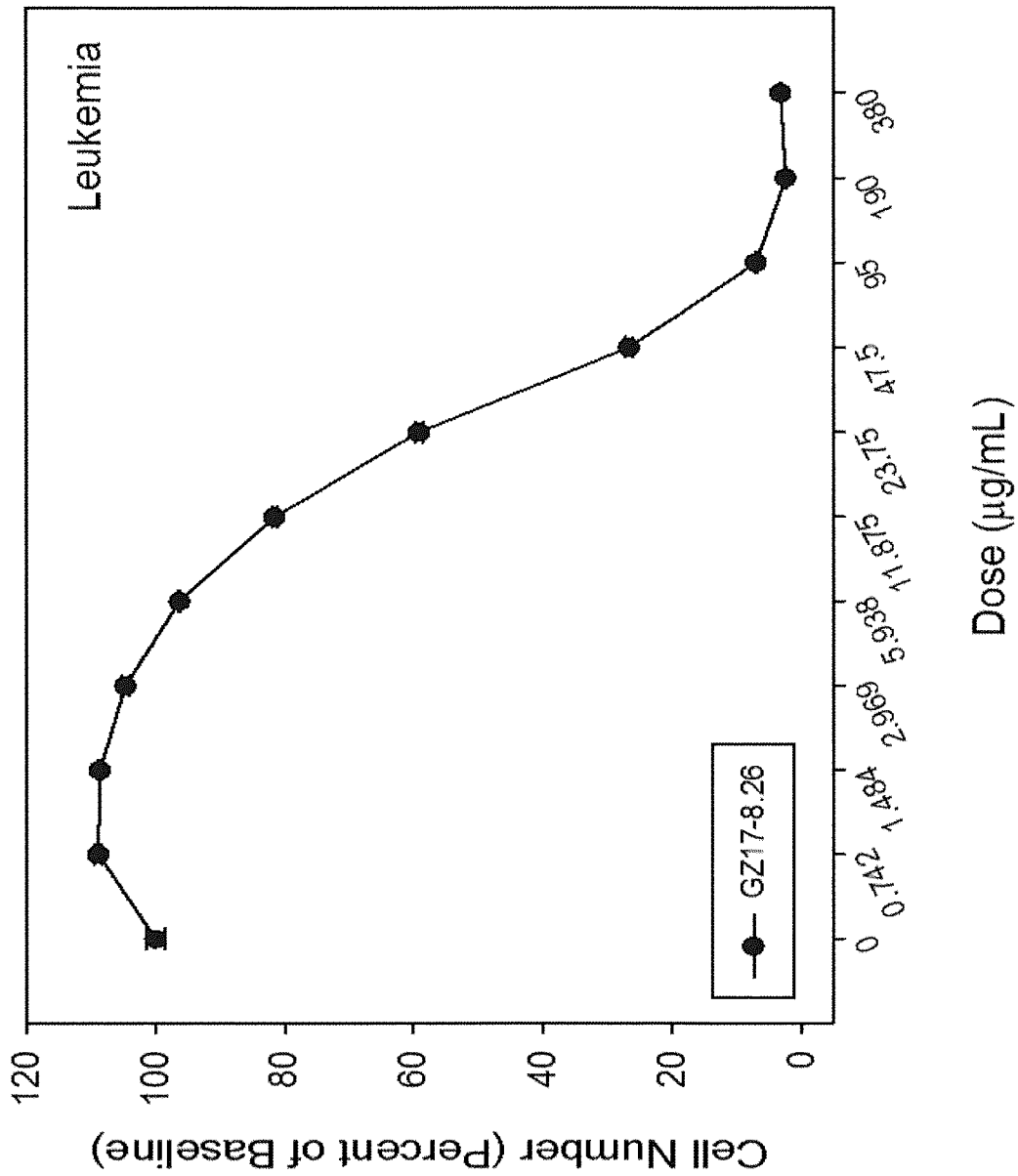

Leukemia
Cell Number (Percent of Baseline)
120
100
80
60
40
20
0
GZ17-8.26
0
0.742
1.484
2.969
5.938
11.875
23.75
47.5
95
190
380
Dose (µg/mL)

Fig. 44F

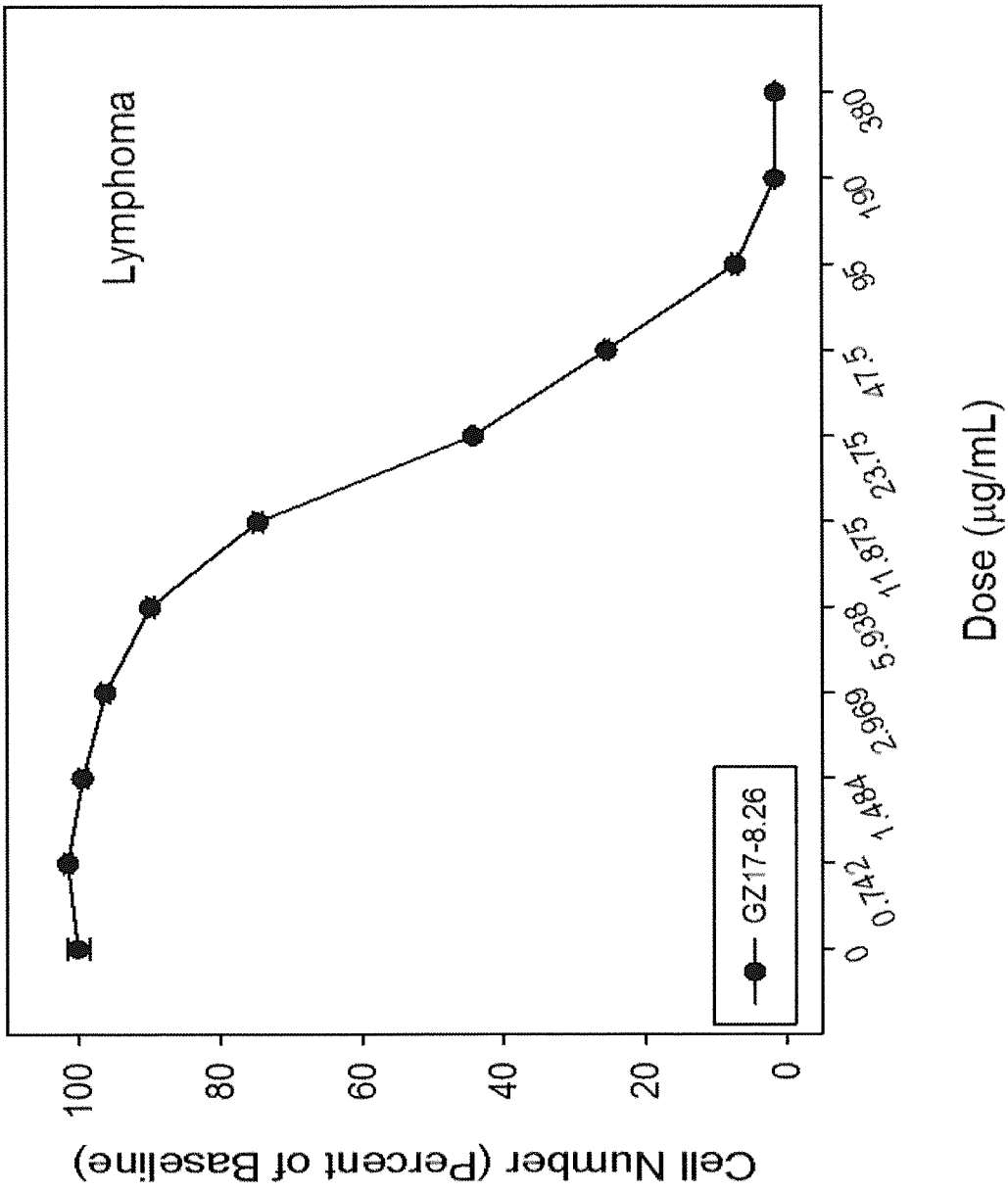

Lymphoma
Cell Number (Percent of Baseline)
0
20
40
60
80
100
GZ17-8.26
0
0.742
1.484
2.969
5.938
11.875
23.75
47.5
95
190
380
Dose (µg/mL)

Fig. 44G

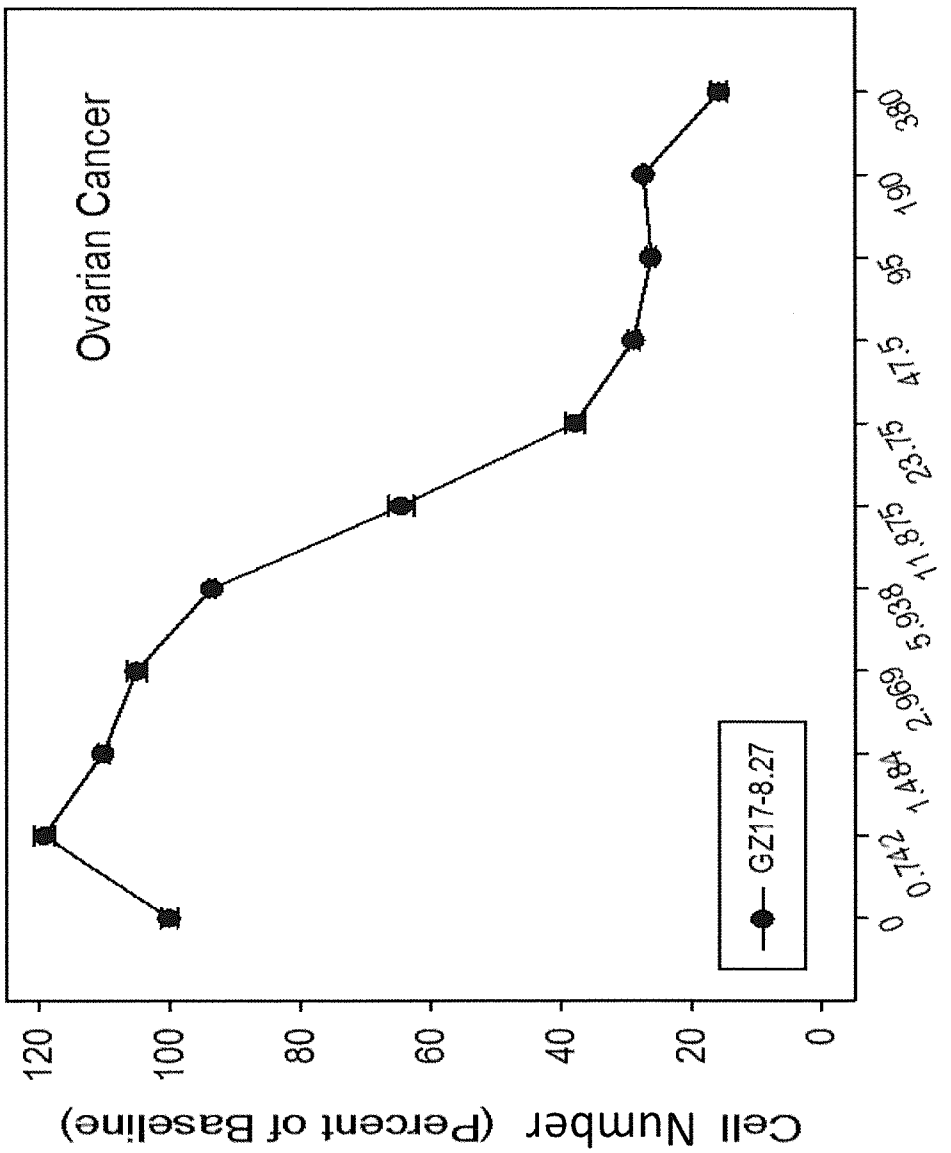

Ovarian Cancer
Cell Number (Percent of Baseline)
120
100
80
60
40
20
0
GZ17-8.27
0
0.742
1.484
2.969
5.938
11.875
23.75
47.5
95
190
380
Dose (µg/mL)

Fig. 45A

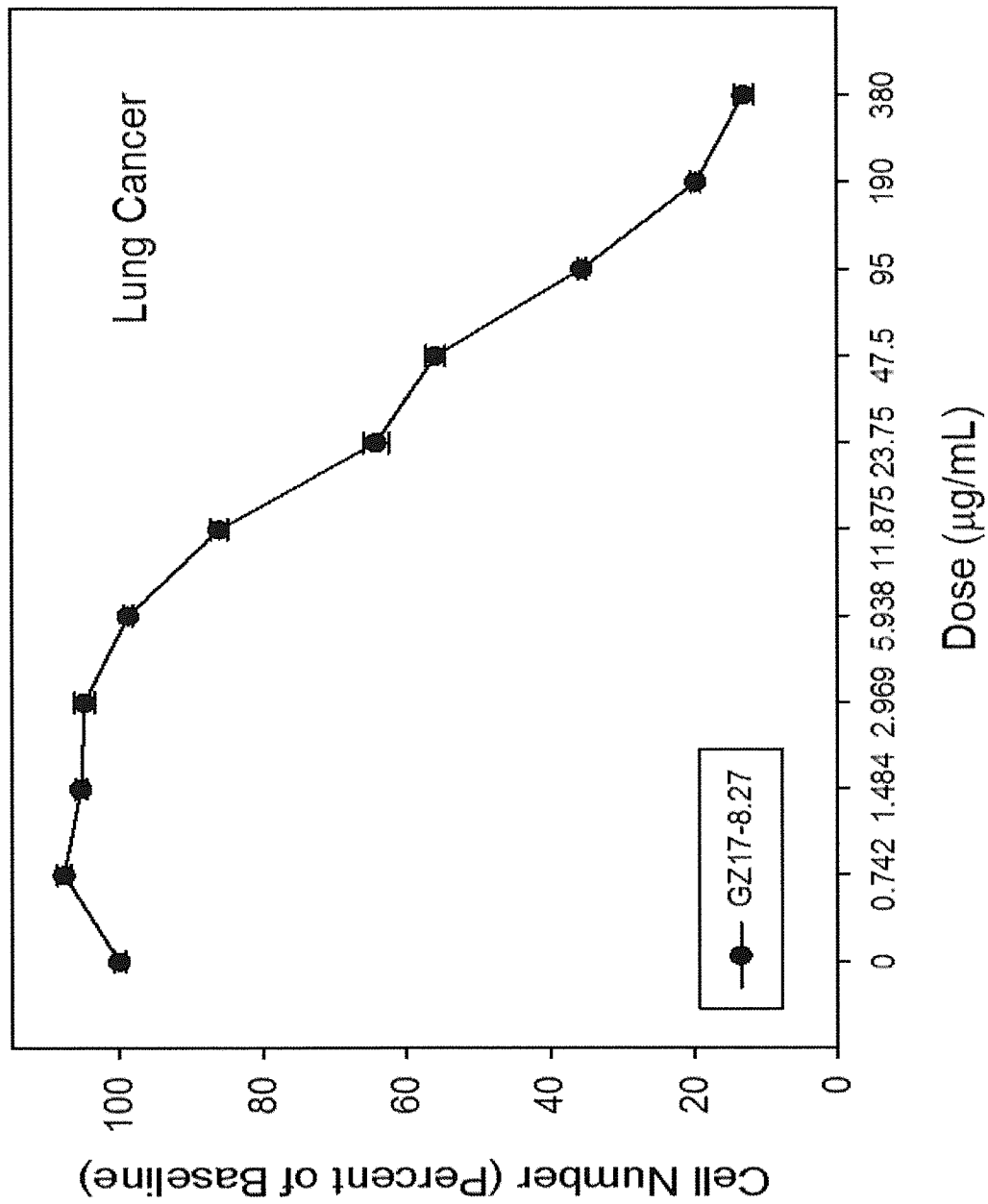

Lung Cancer
Cell Number (Percent of Baseline)
0
20
40
60
80
100
GZ17-8.27
0
0.742
1.484
2.969
5.938
11.875
23.75
47.5
95
190
380
Dose (µg/mL)

Fig. 45B

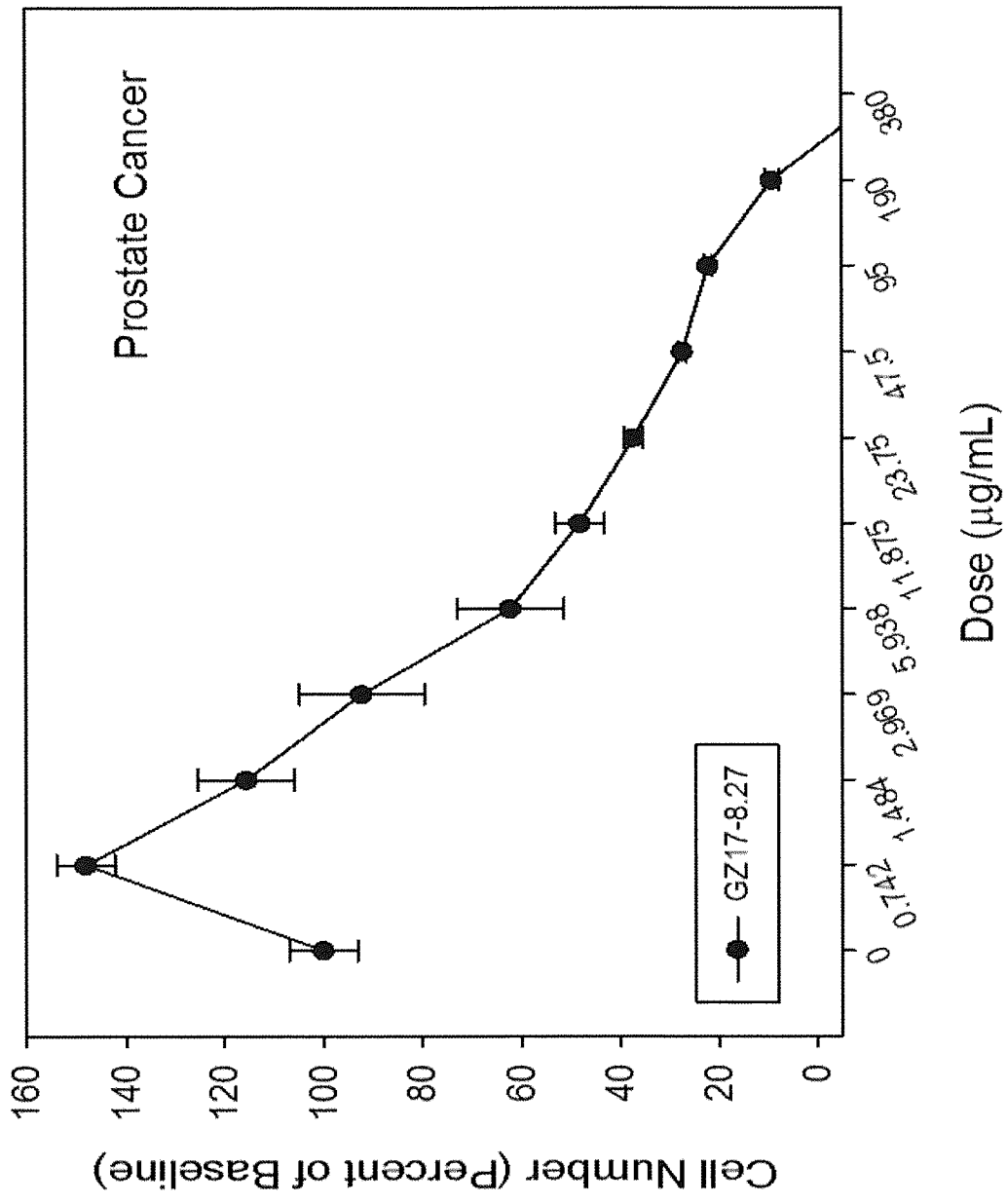

Prostate Cancer
Cell Number (Percent of Baseline)
0
20
40
60
80
100
120
140
160
GZ17-8.27
0
0.742
1.484
2.969
5.938
11.875
23.75
47.5
95
190
380
Dose (µg/mL)

Fig. 45C

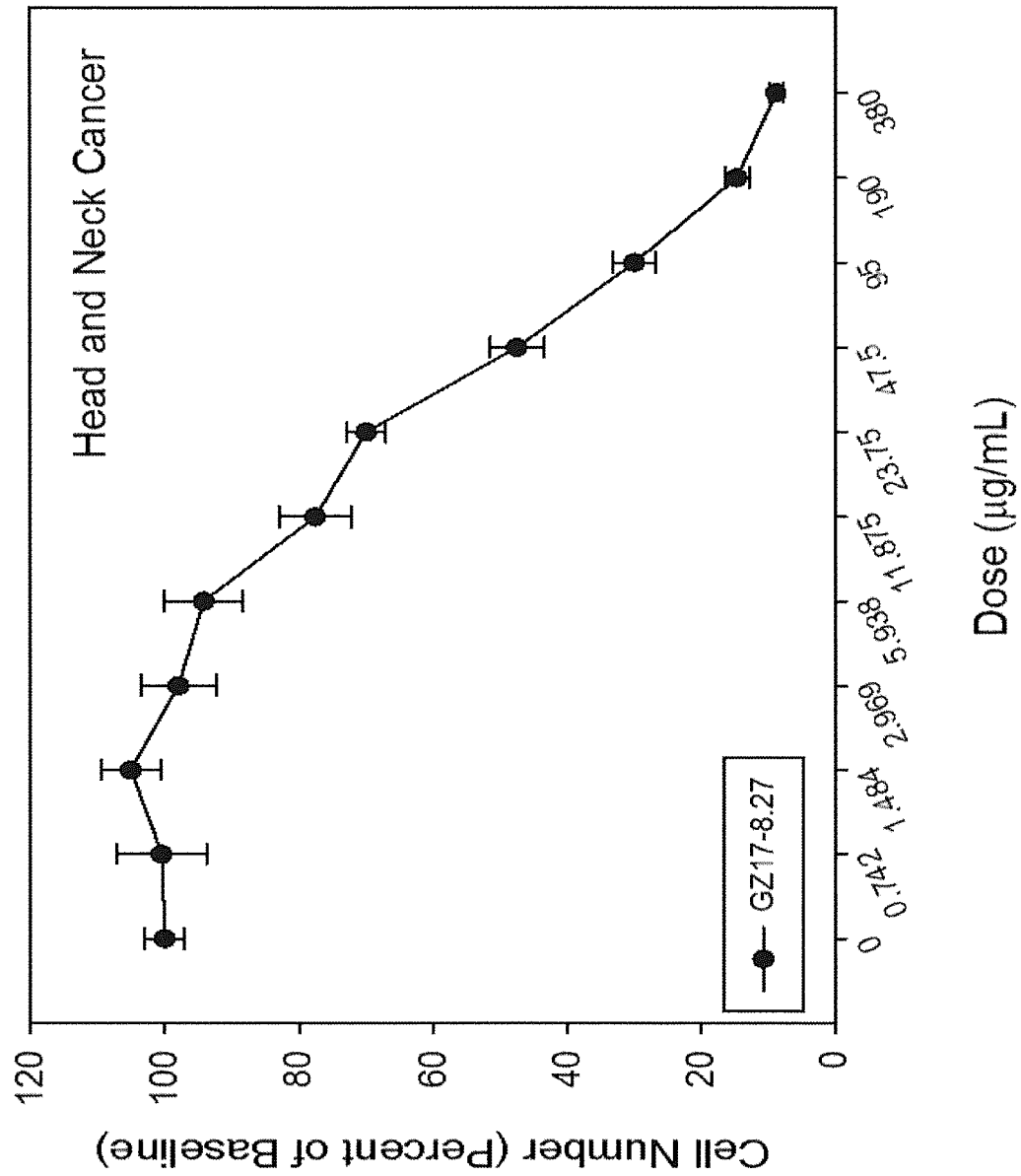

Head and Neck Cancer
Cell Number (Percent of Baseline)
120
100
80
60
40
20
0
GZ17-8.27
0
0.742
1.484
2.969
5.938
11.875
23.75
47.5
95
190
380
Dose (µg/mL)

Fig. 45D

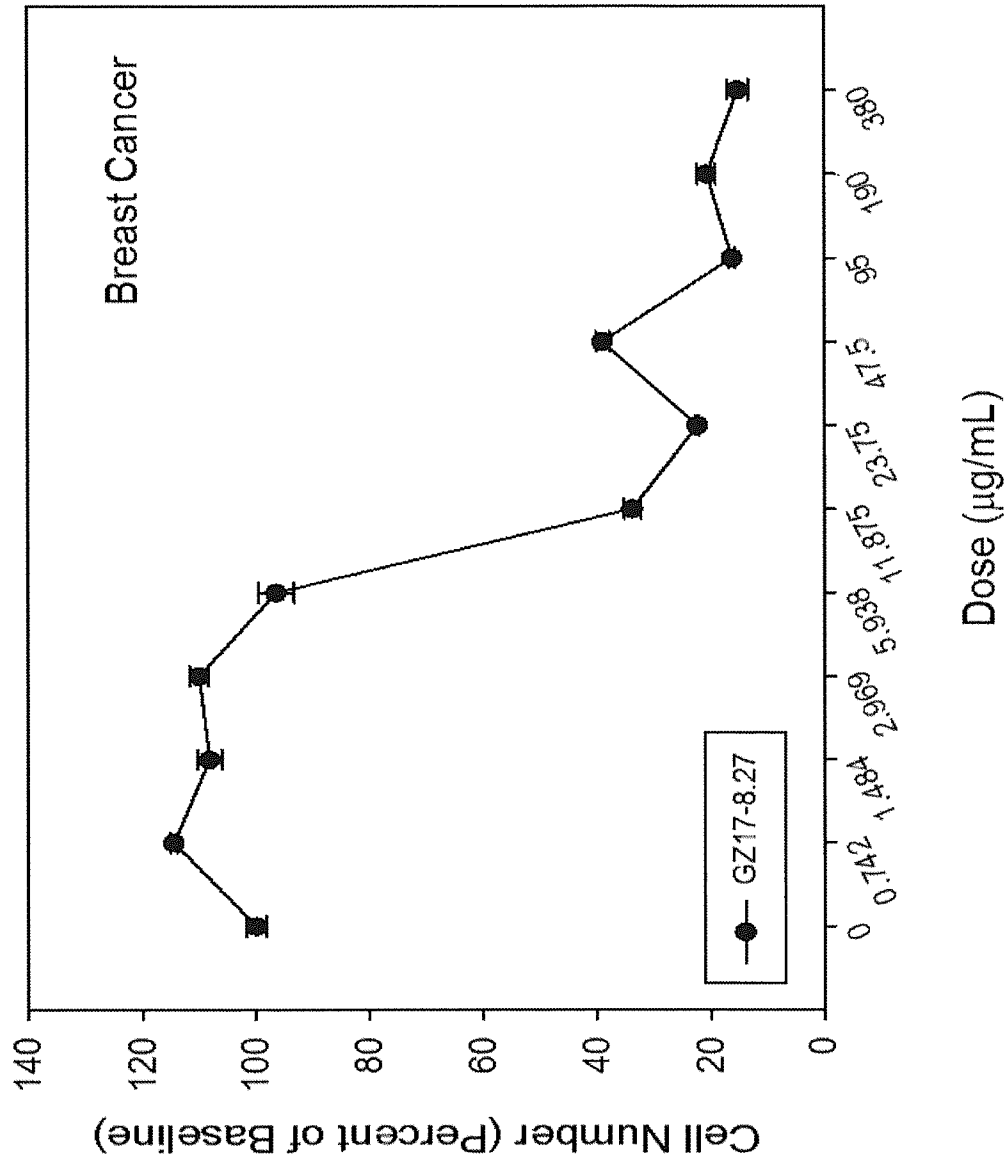

Breast Cancer
Cell Number (Percent of Baseline)
0
20
40
60
80
100
120
140
GZ17-8.27
0
0.742
1.484
2.969
5.938
11.875
23.75
47.5
95
190
380
Dose (µg/mL)

Fig. 45E

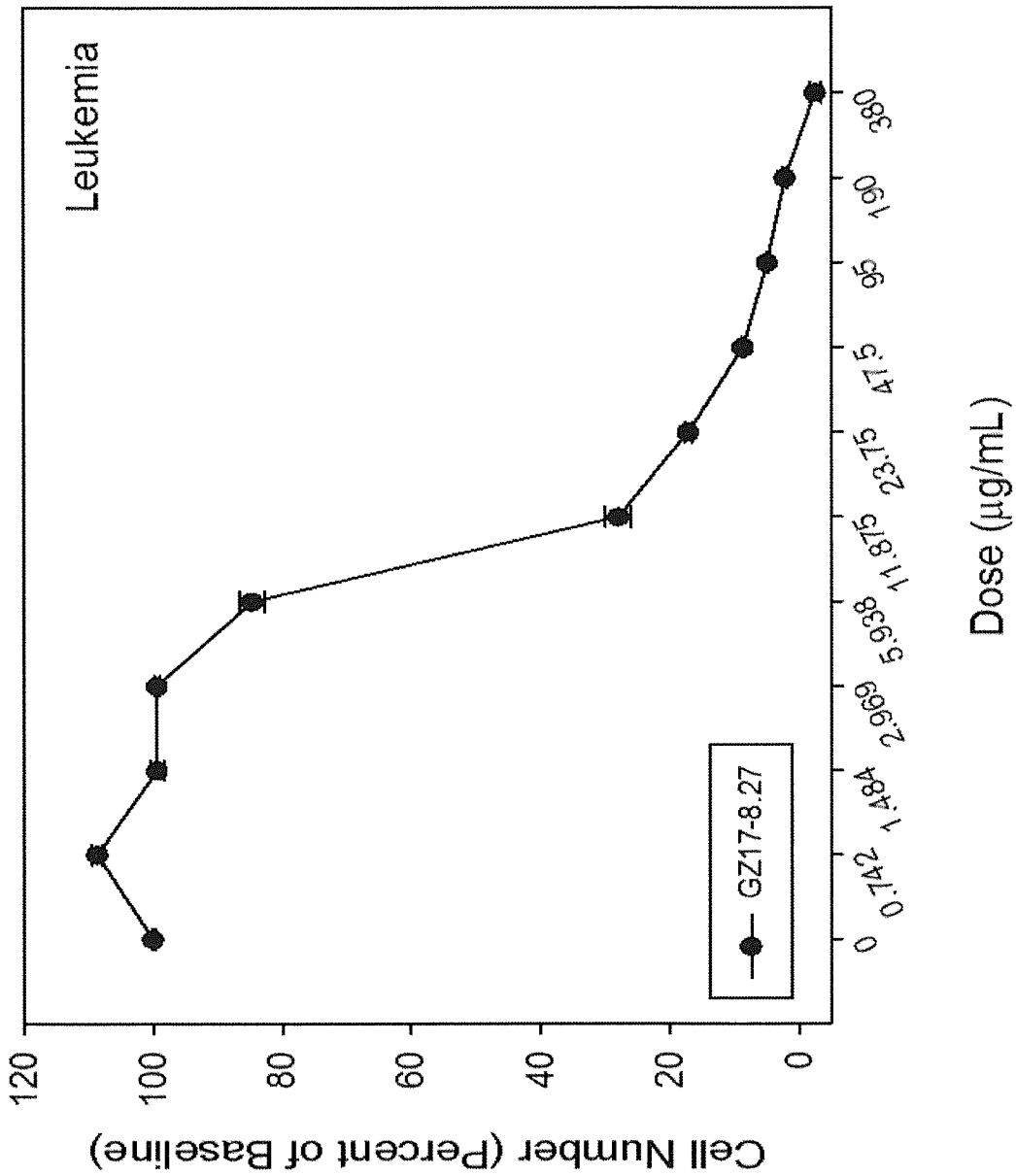

Leukemia
Cell Number (Percent of Baseline)
120
100
80
60
40
20
0
GZ17-8.27
0
0.742
1.484
2.969
5.938
11.875
23.75
47.5
95
190
380
Dose (µg/mL)

Fig. 45F

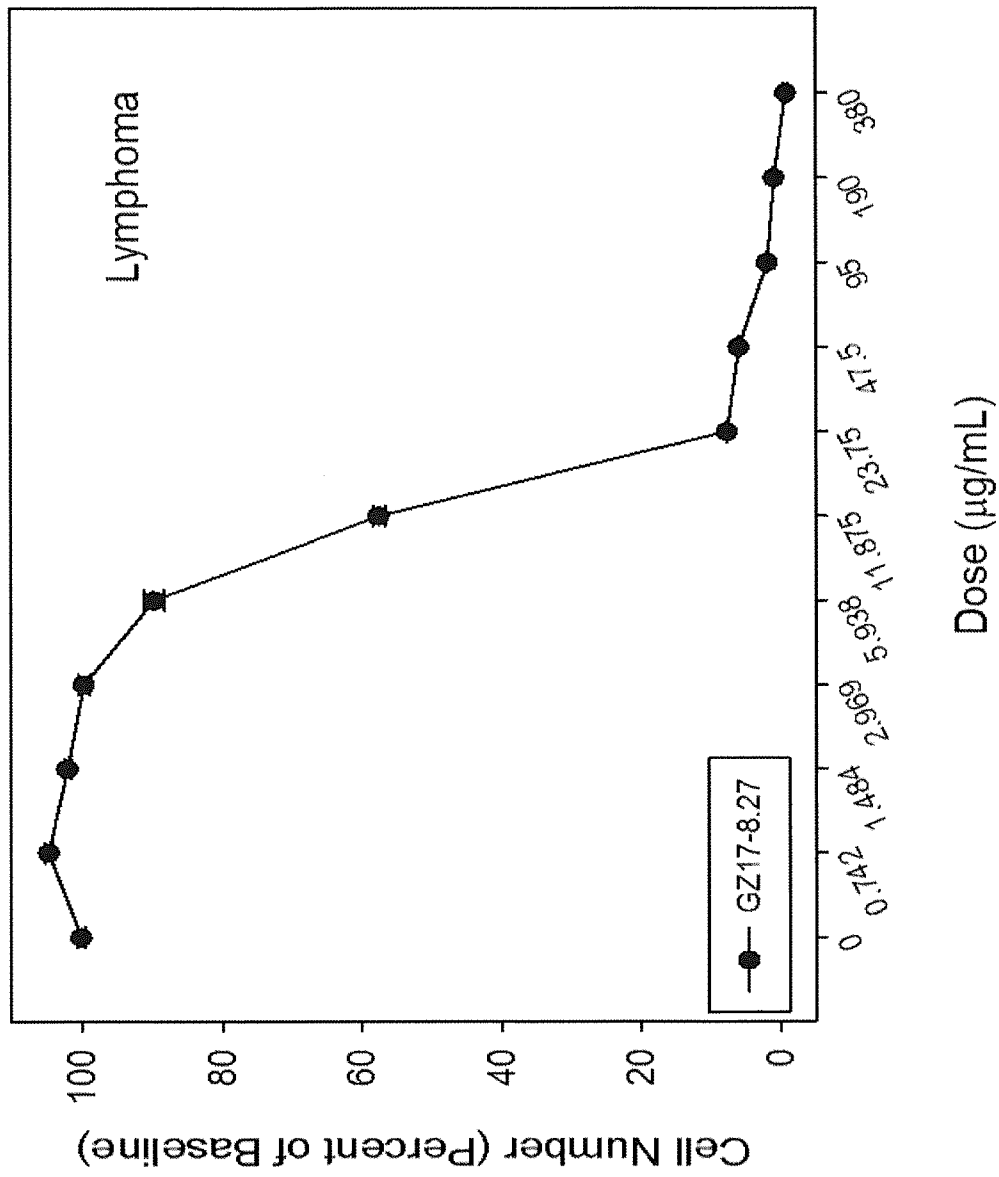

Lymphoma
GZ17-8.27
Cell Number (Percent of Baseline)
0
20
40
60
80
100
0
0.742
1.484
2.969
5.938
11.875
23.75
47.5
95
190
380
Dose (µg/mL)

Fig. 45G

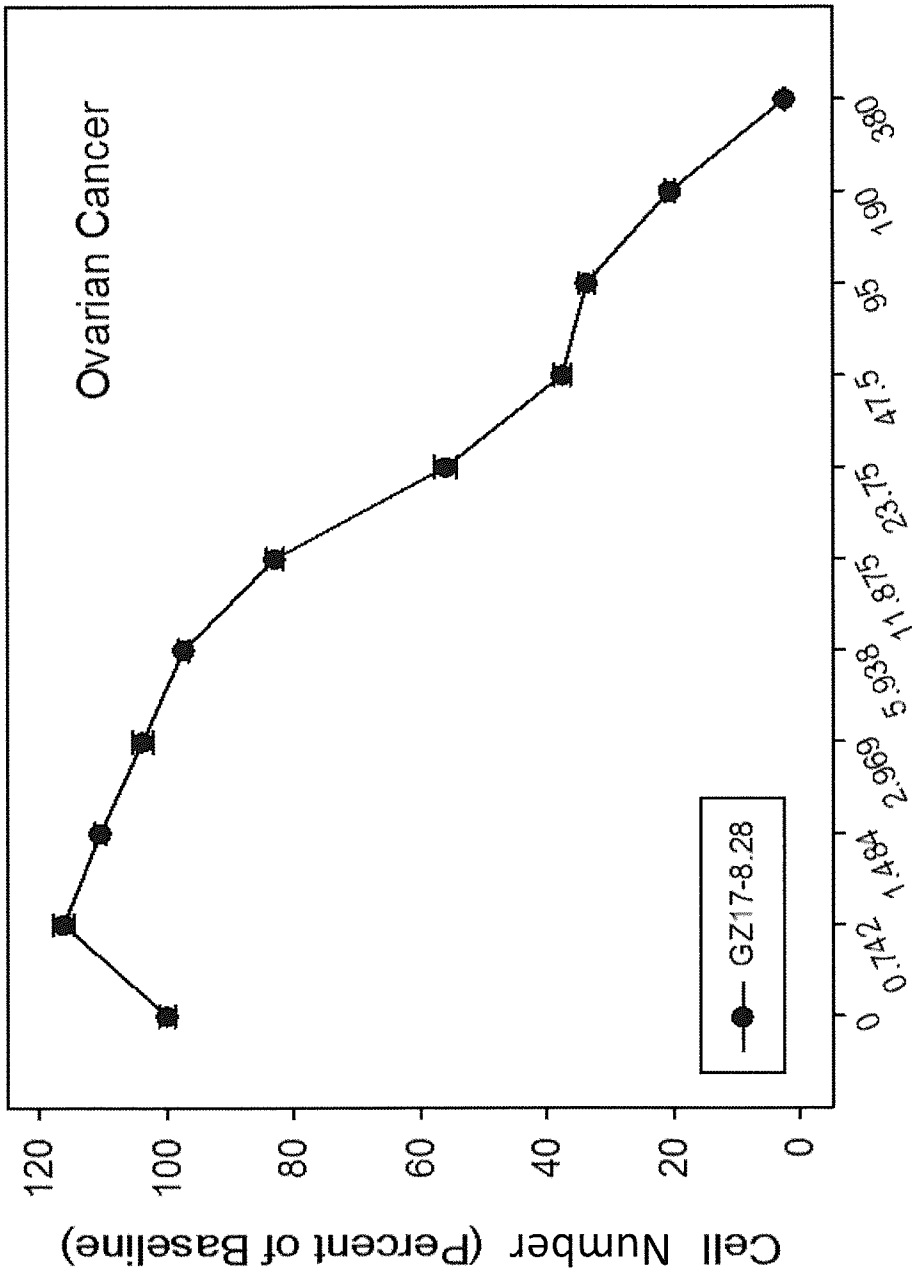

Ovarian Cancer
GZ17-8.28
Cell Number (Percent of Baseline)
0
20
40
60
80
100
120
0
0.742
1.484
2.969
5.938
11.875
23.75
47.5
95
190
380
Dose (µg/mL)

Fig. 46A

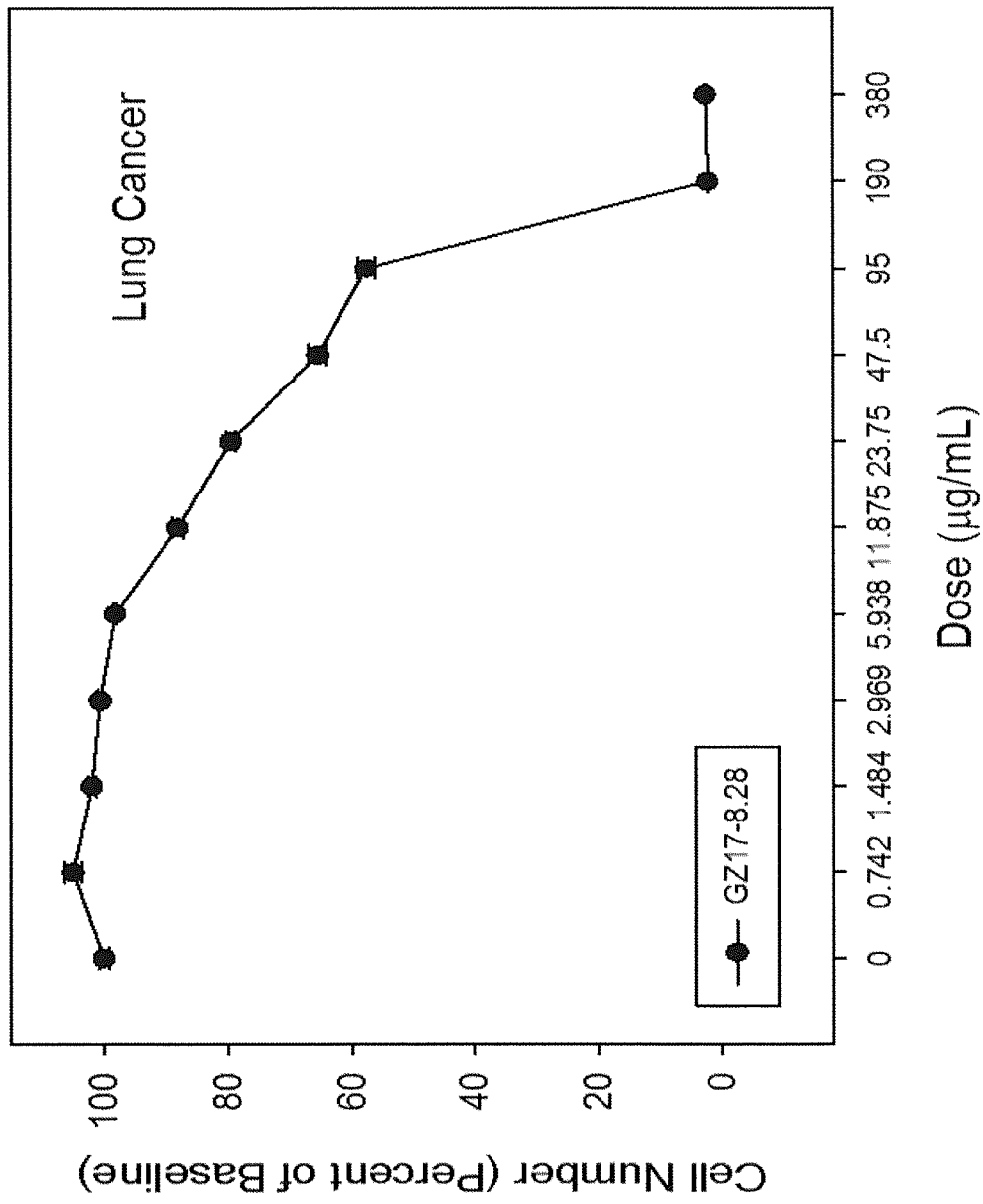

Lung Cancer
Cell Number (Percent of Baseline)
0
20
40
60
80
100
GZ17-8.28
0
0.742
1.484
2.969
5.938
11.875
23.75
47.5
95
190
380
Dose (µg/mL)

Fig. 46B

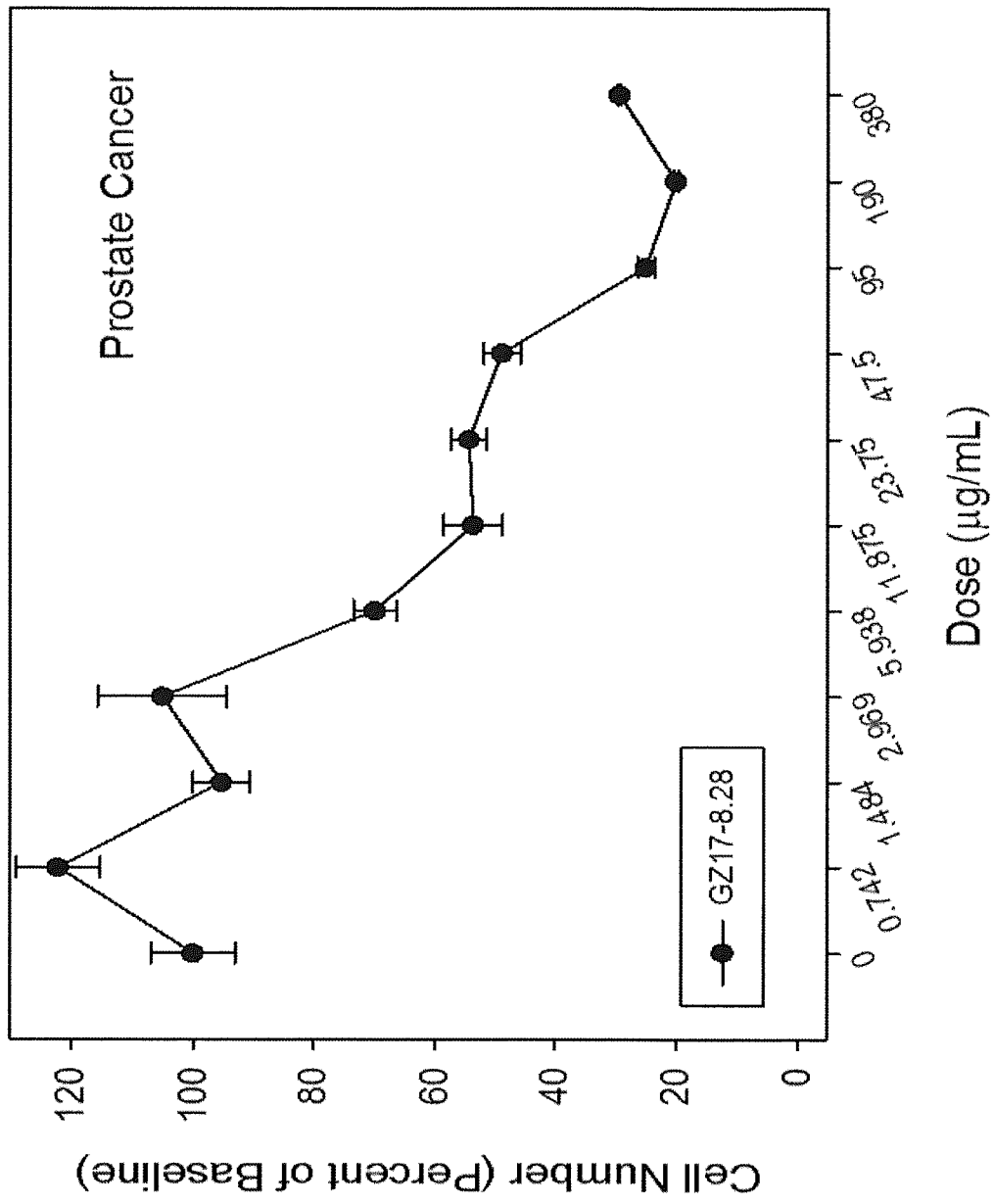

Prostate Cancer
Cell Number (Percent of Baseline)
0
20
40
60
80
100
120
GZ17-8.28
0
0.742
1.484
2.969
5.938
11.875
23.75
47.5
95
190
380
Dose (µg/mL)

Fig. 46C

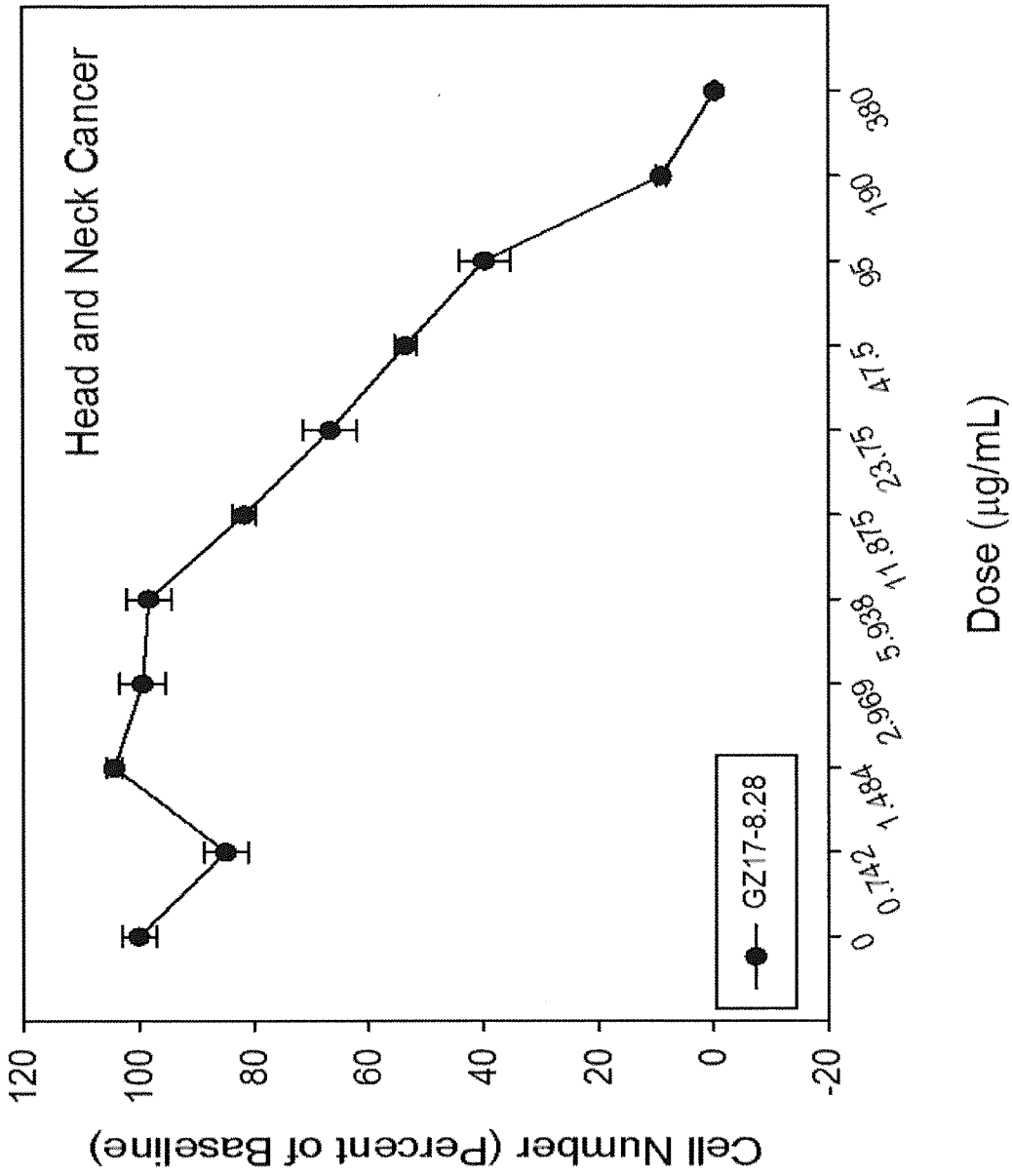

Head and Neck Cancer
Cell Number (Percent of Baseline)
120
100
80
60
40
20
0
-20
GZ17-8.28
0
0.742
1.484
2.969
5.938
11.875
23.75
47.5
95
190
380
Dose (µg/mL)

Fig. 46D

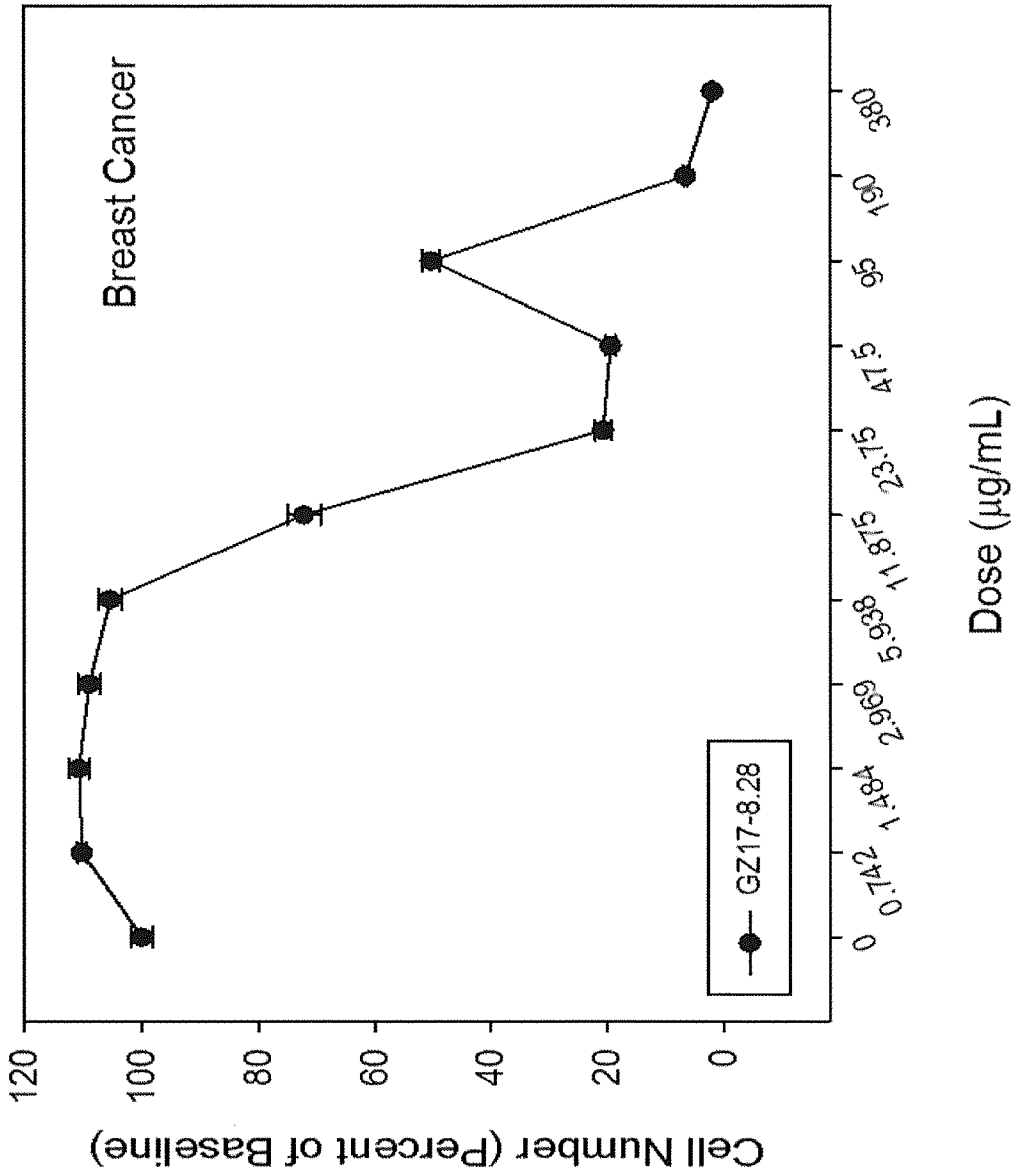

Breast Cancer
GZ17-8.28
Cell Number (Percent of Baseline)
0
20
40
60
80
100
120
0
0.742
1.484
2.969
5.938
11.875
23.75
47.5
95
190
380
Dose (µg/mL)

Fig. 46E

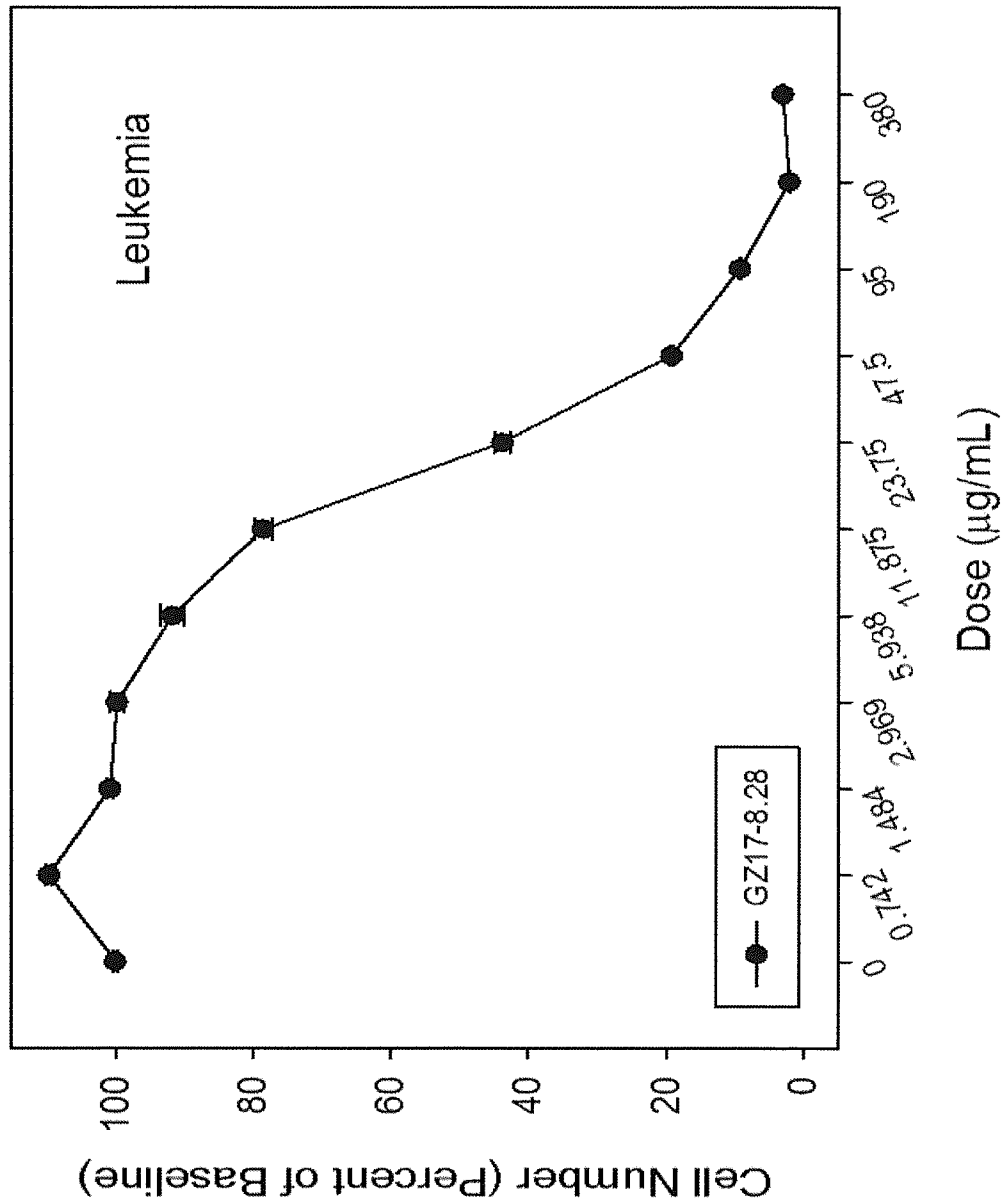

Leukemia
GZ17-8.28
Cell Number (Percent of Baseline)
0
20
40
60
80
100
0
0.742
1.484
2.969
5.938
11.875
23.75
47.5
95
190
380
Dose (µg/mL)

Fig. 46F

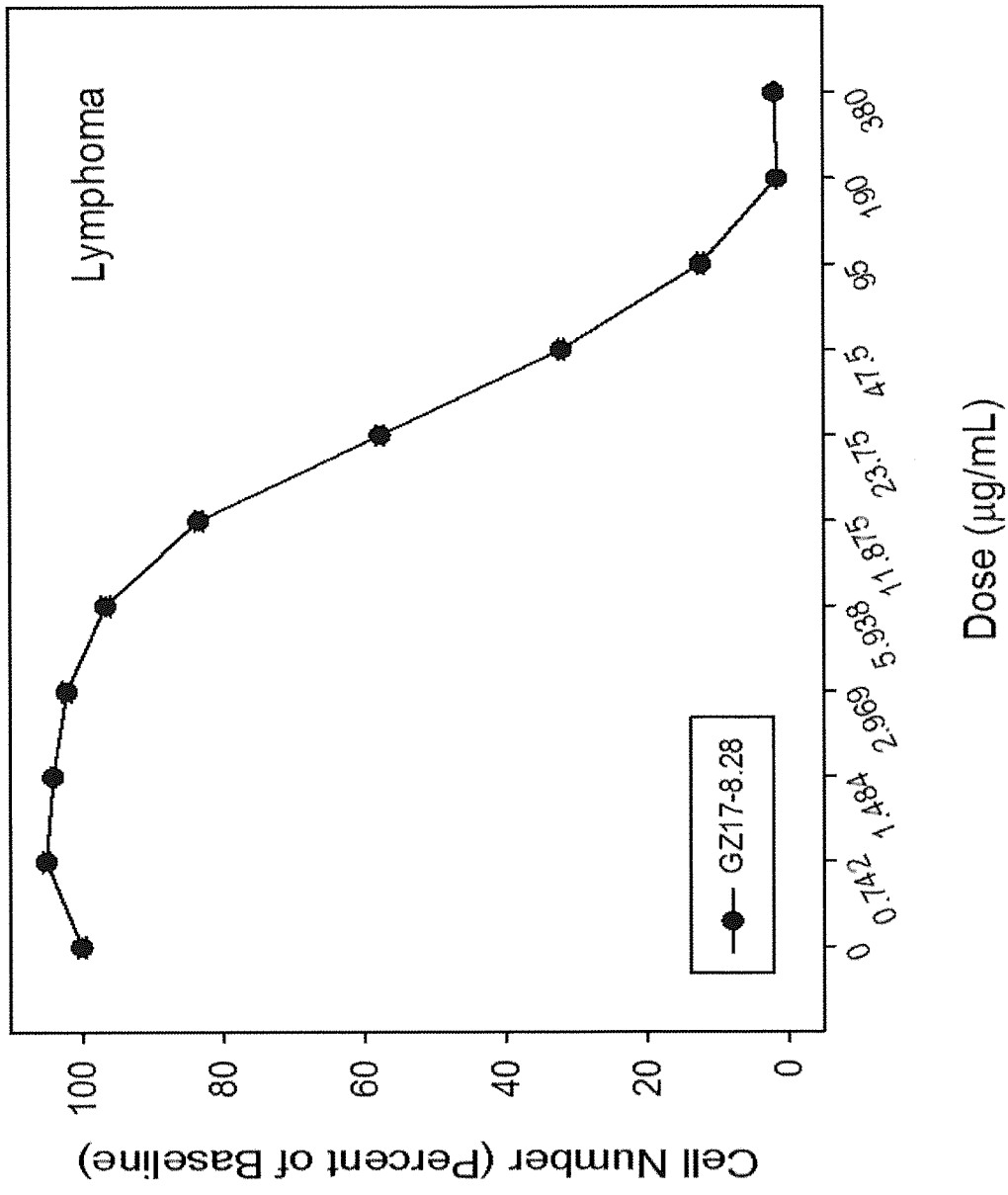

Lymphoma
Cell Number (Percent of Baseline)
0
20
40
60
80
100
GZ17-8.28
0
0.742
1.484
2.969
5.938
11.875
23.75
47.5
95
190
380
Dose (µg/mL)

Fig. 46G

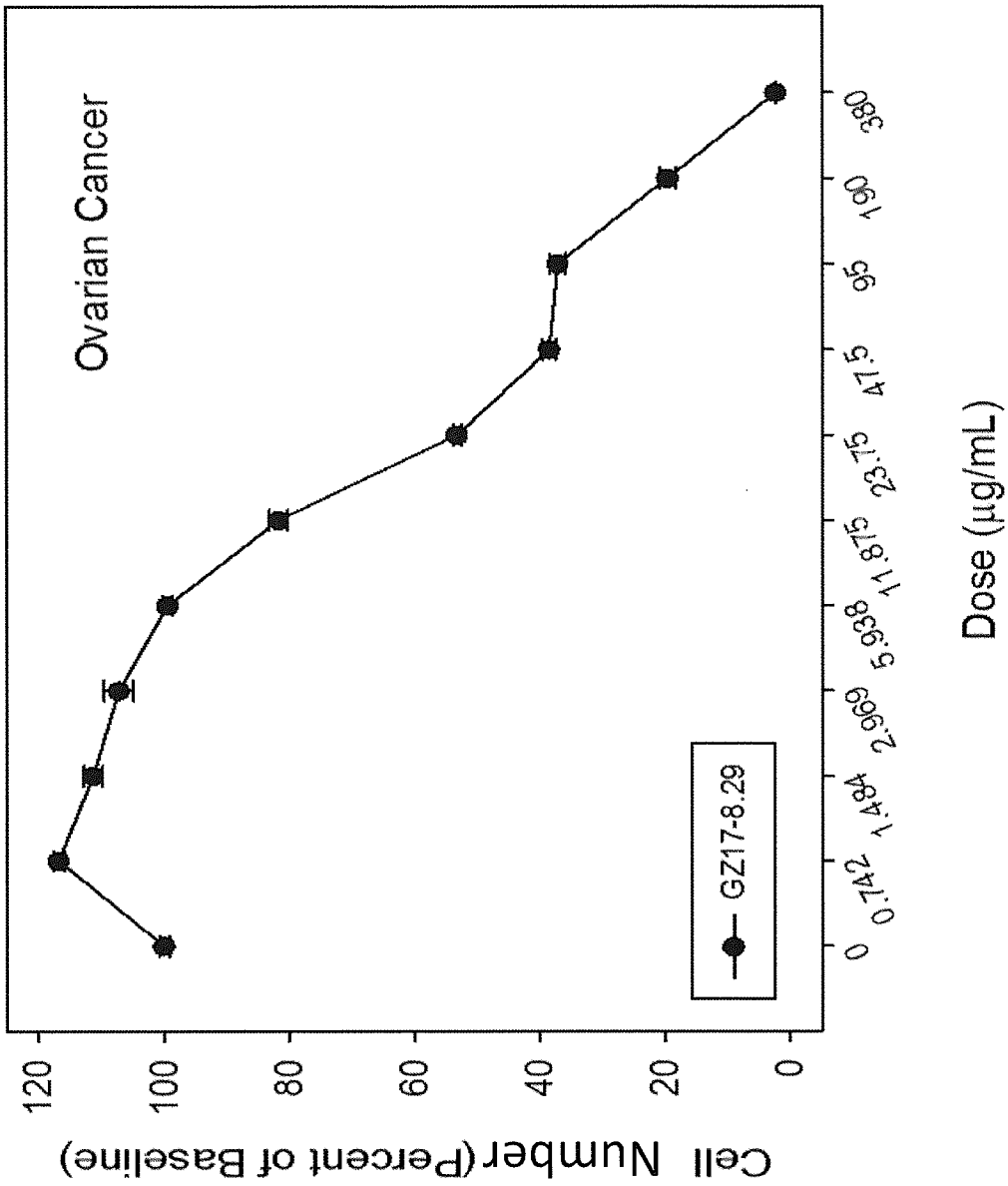

Ovarian Cancer
Cell Number (Percent of Baseline)
120
100
80
60
40
20
0
GZ17-8.29
0
0.742
1.484
2.969
5.938
11.875
23.75
47.5
95
190
380
Dose (µg/mL)

Fig. 47A

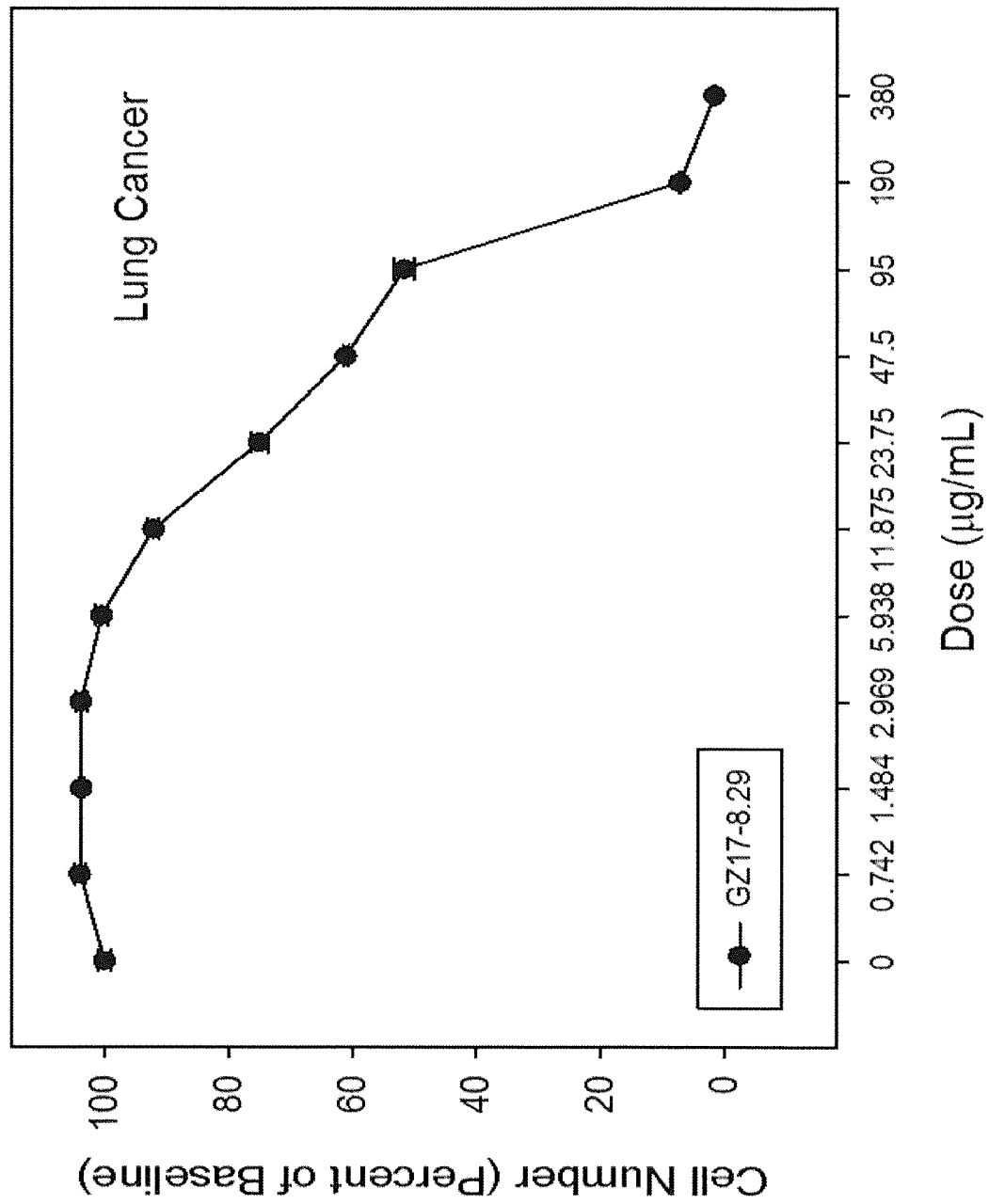

Lung Cancer
Cell Number (Percent of Baseline)
0
20
40
60
80
100
0
0.742
1.484
2.969
5.938
11.875
23.75
47.5
95
190
380
Dose (µg/mL)
GZ17-8.29

Fig. 47B

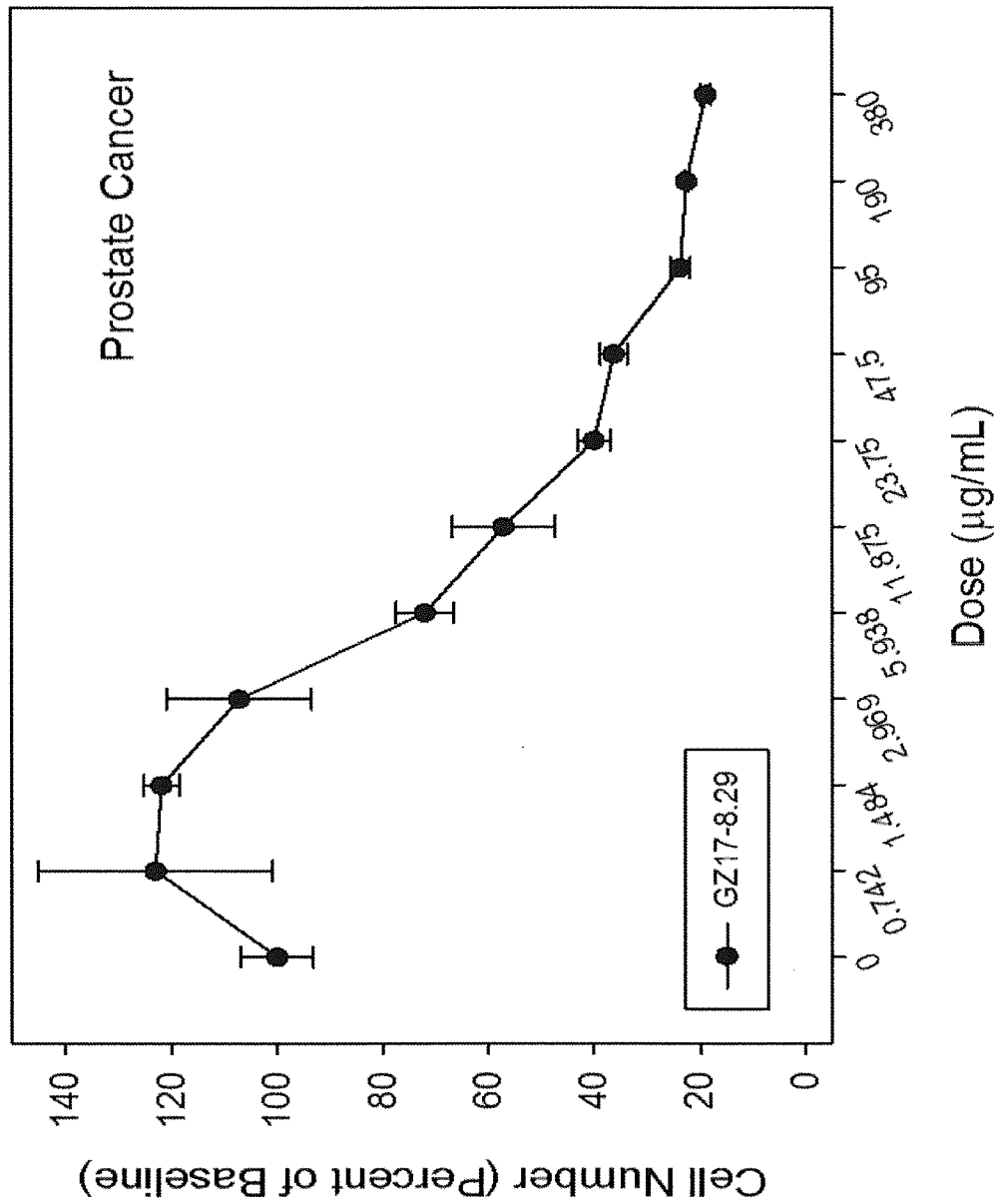

Prostate Cancer
Cell Number (Percent of Baseline)
0
20
40
60
80
100
120
140
GZ17-8.29
0
0.742
1.484
2.969
5.938
11.875
23.75
47.5
95
190
380
Dose (µg/mL)

Fig. 47C

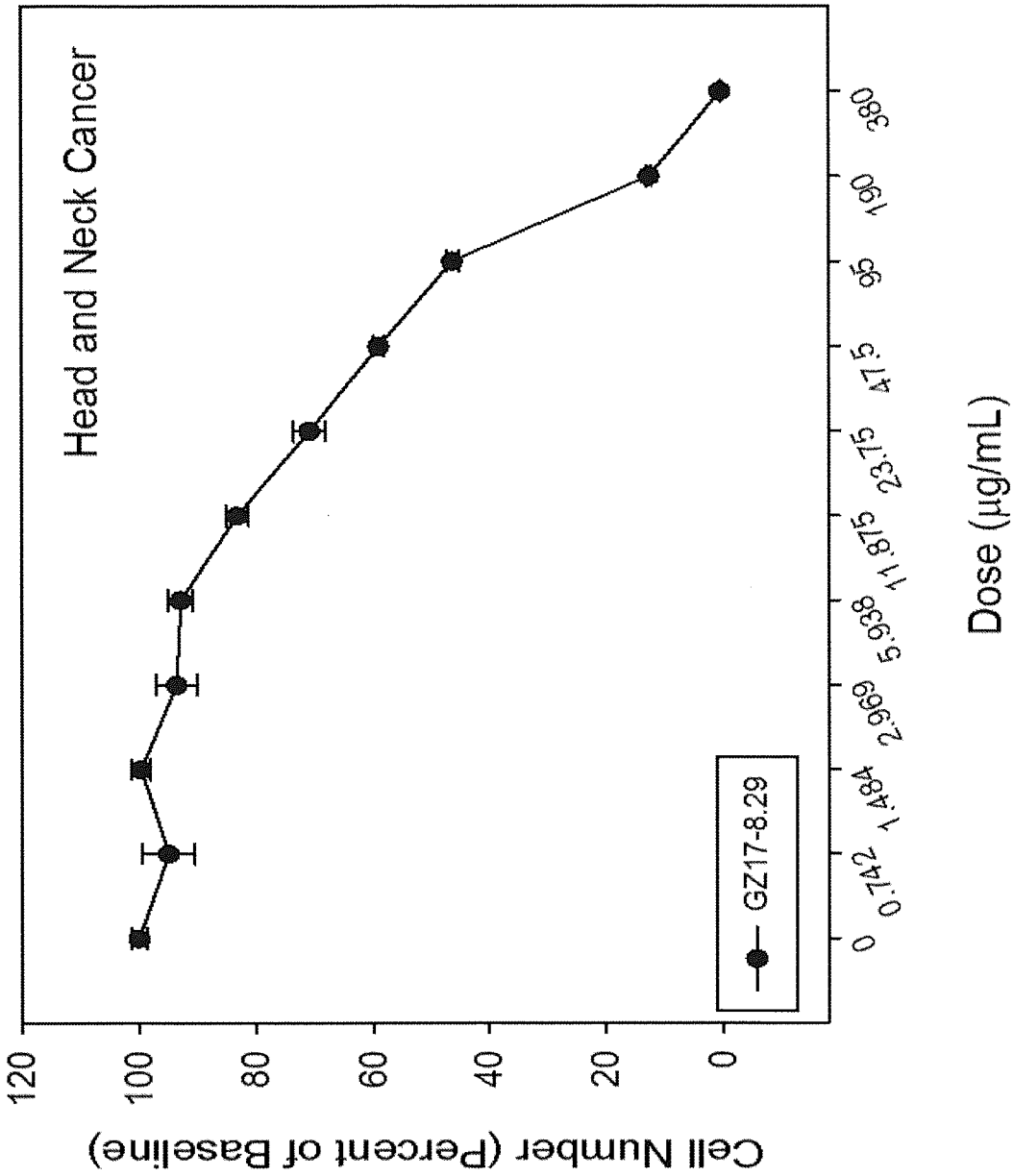

Head and Neck Cancer
Cell Number (Percent of Baseline)
120
100
80
60
40
20
0
GZ17-8.29
0
0.742
1.484
2.969
5.938
11.875
23.75
47.5
95
190
380
Dose (µg/mL)

Fig. 47D

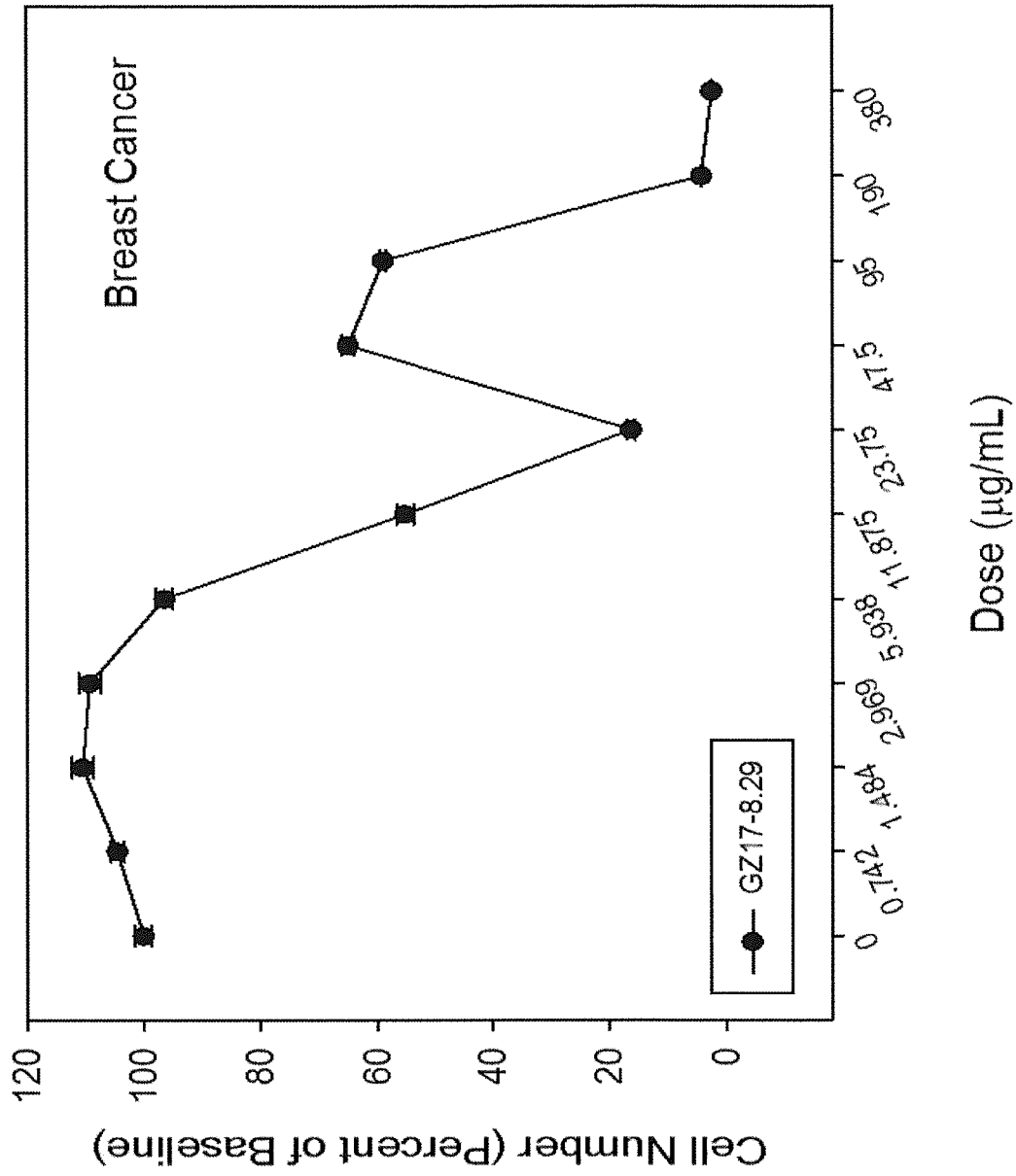

Breast Cancer
Cell Number (Percent of Baseline)
120
100
80
60
40
20
0
GZ17-8.29
0
0.742
1.484
2.969
5.938
11.875
23.75
47.5
95
190
380
Dose (µg/mL)

Fig. 47E

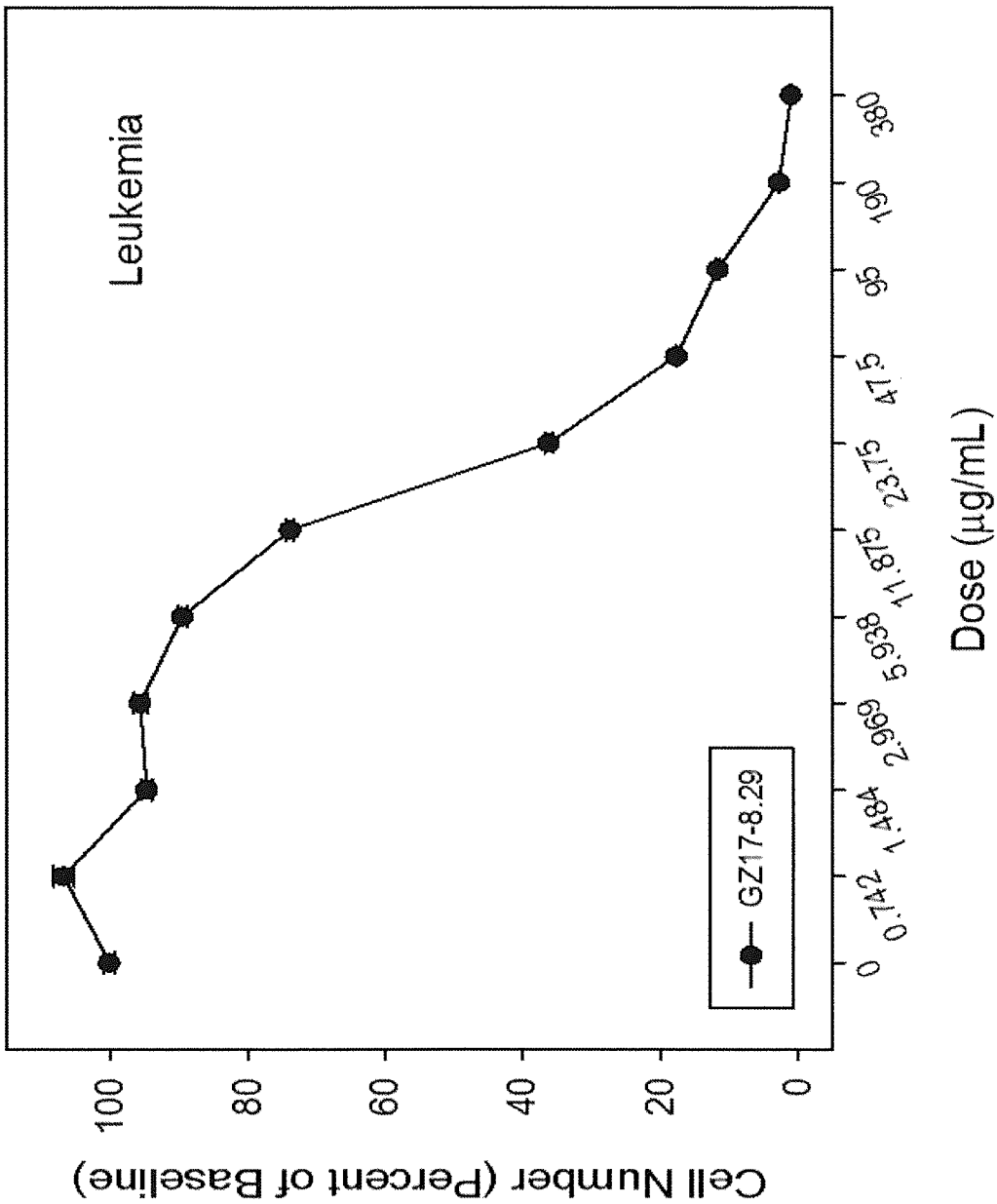

Leukemia
Cell Number (Percent of Baseline)
0
20
40
60
80
100
GZ17-8.29
0
0.742
1.484
2.969
5.938
11.875
23.75
47.5
95
190
380
Dose (µg/mL)

Fig. 47F

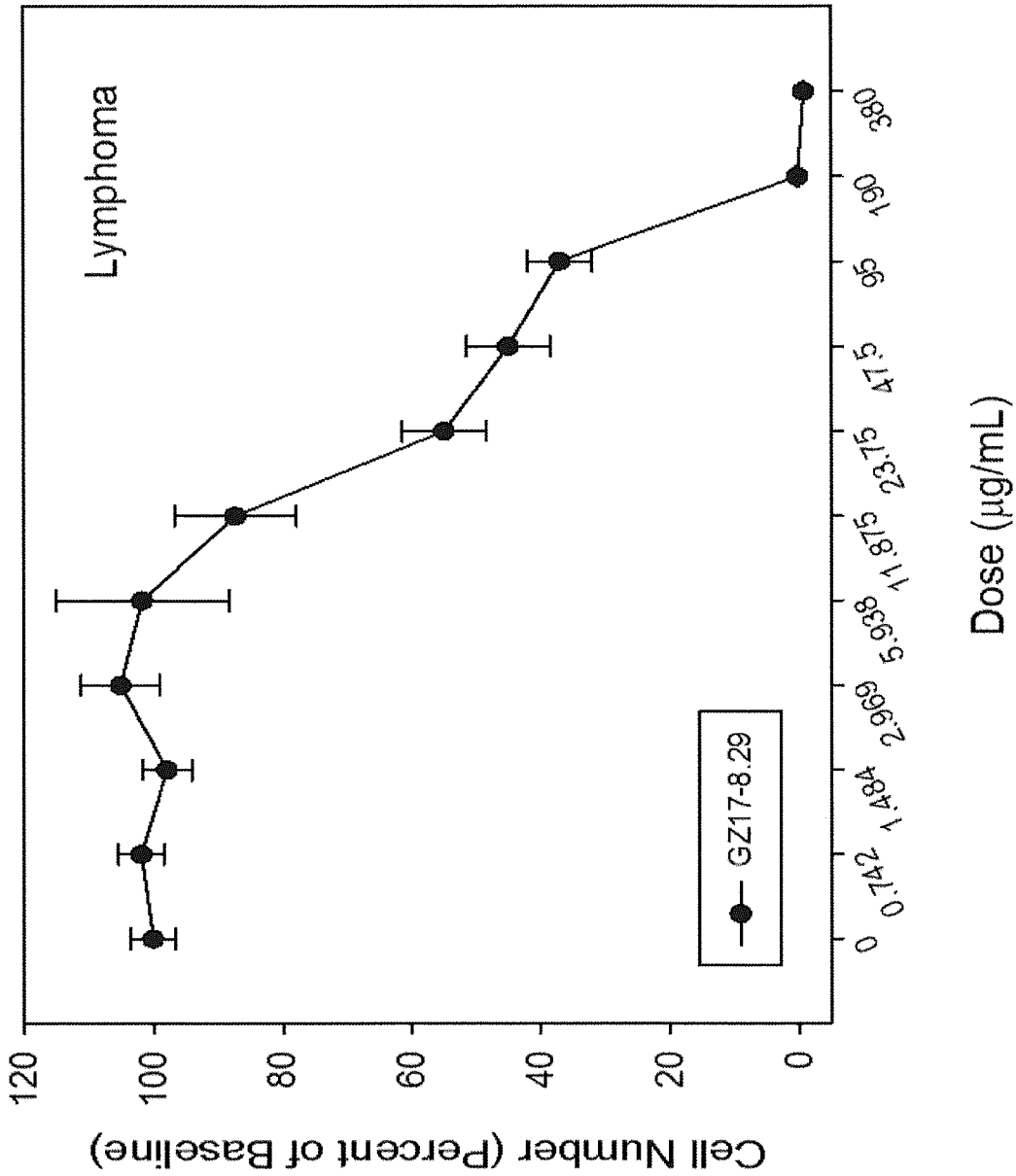

Lymphoma
GZ17-8.29
Cell Number (Percent of Baseline)
0
20
40
60
80
100
120
0
0.742
1.484
2.969
5.938
11.875
23.75
47.5
95
190
380
Dose (µg/mL)

Fig. 47G

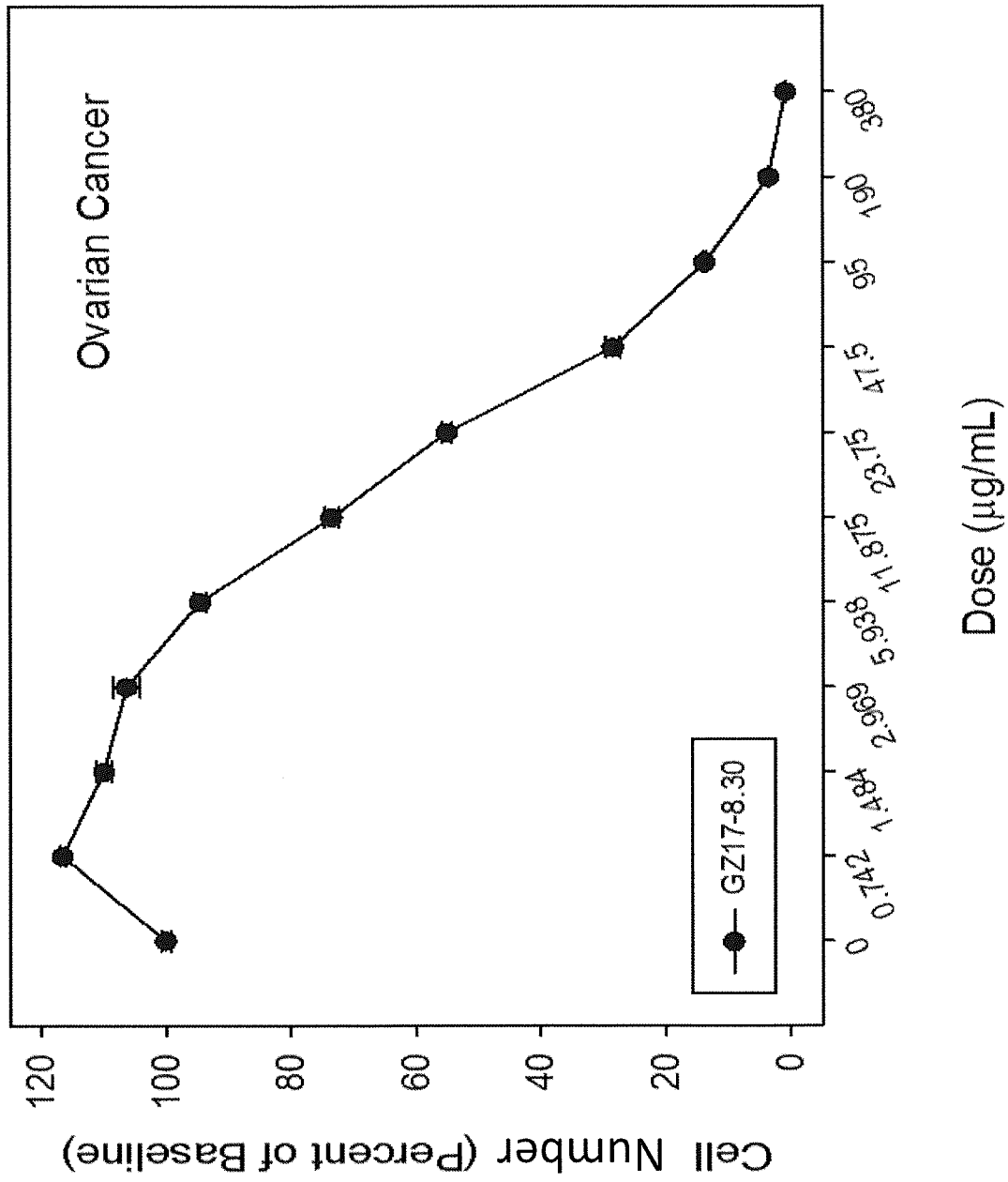

Ovarian Cancer
Cell Number (Percent of Baseline)
120
100
80
60
40
20
0
GZ17-8.30
0
0.742
1.484
2.969
5.938
11.875
23.75
47.5
95
190
380
Dose (µg/mL)

Fig. 48A

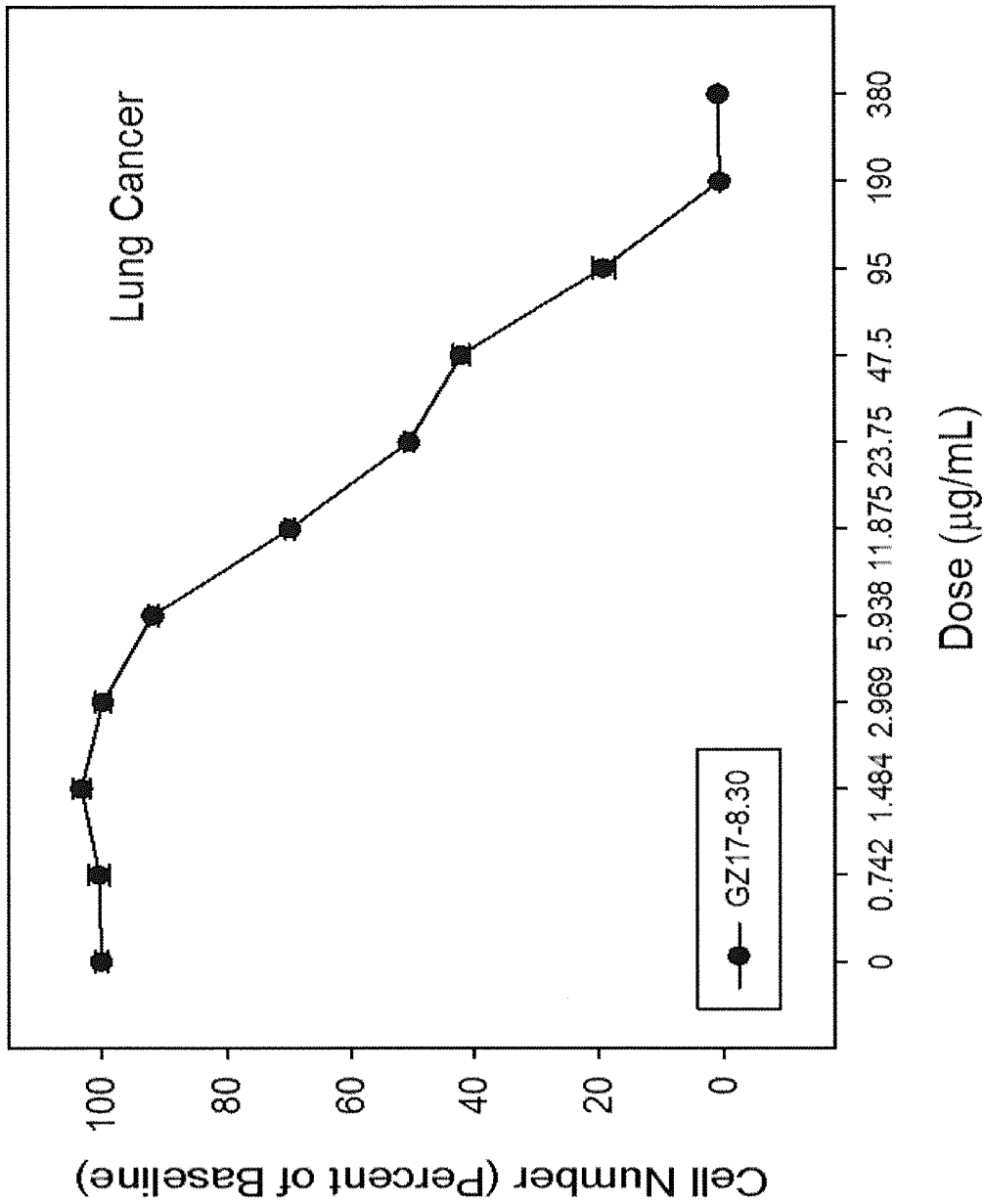

Lung Cancer
Cell Number (Percent of Baseline)
0
20
40
60
80
100
GZ17-8.30
0
0.742
1.484
2.969
5.938
11.875
23.75
47.5
95
190
380
Dose (µg/mL)

Fig. 48B

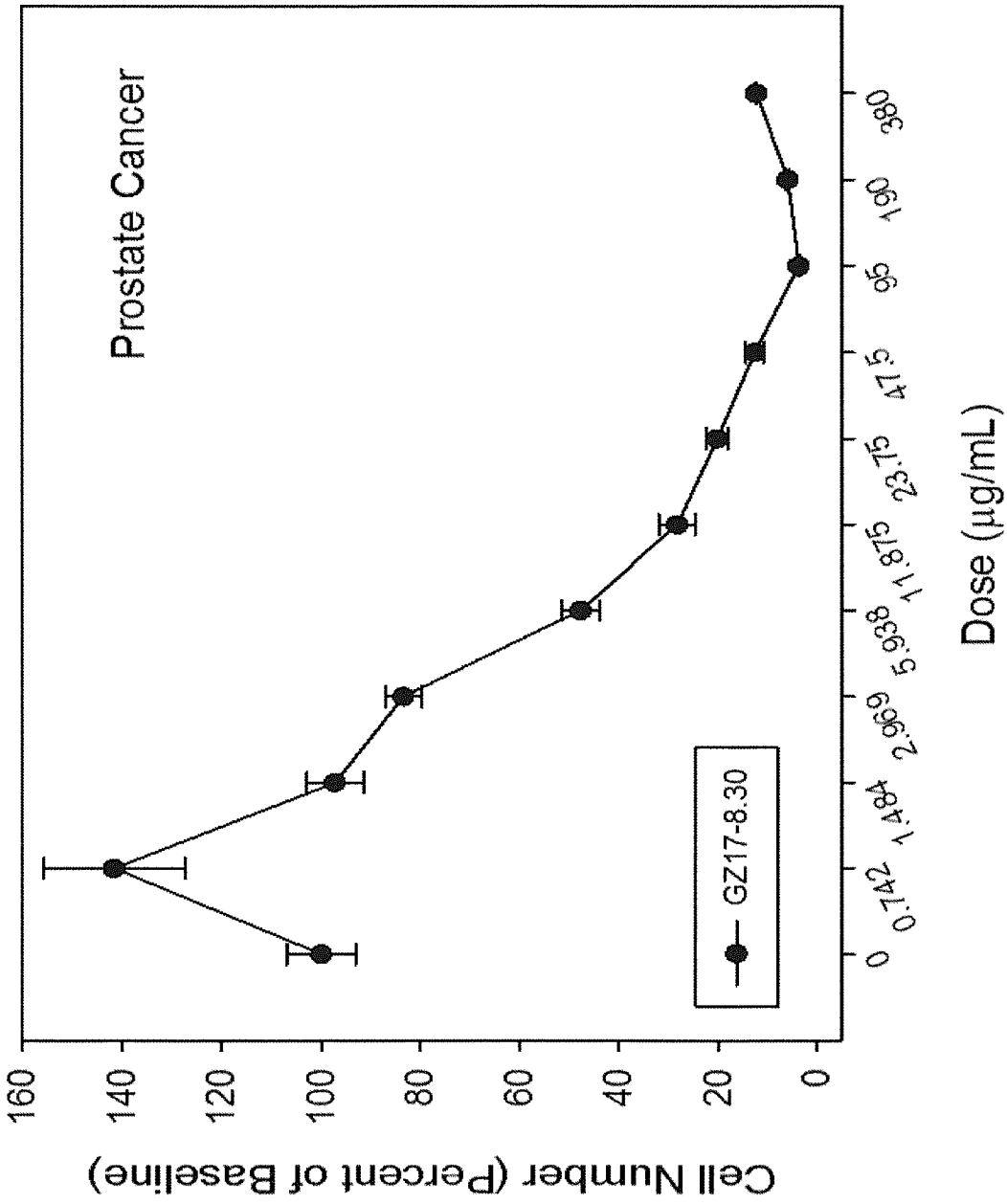

Prostate Cancer
GZ17-8.30
Cell Number (Percent of Baseline)
0
20
40
60
80
100
120
140
160
0
0.742
1.484
2.969
5.938
11.875
23.75
47.5
95
190
380
Dose (µg/mL)

Fig. 48C

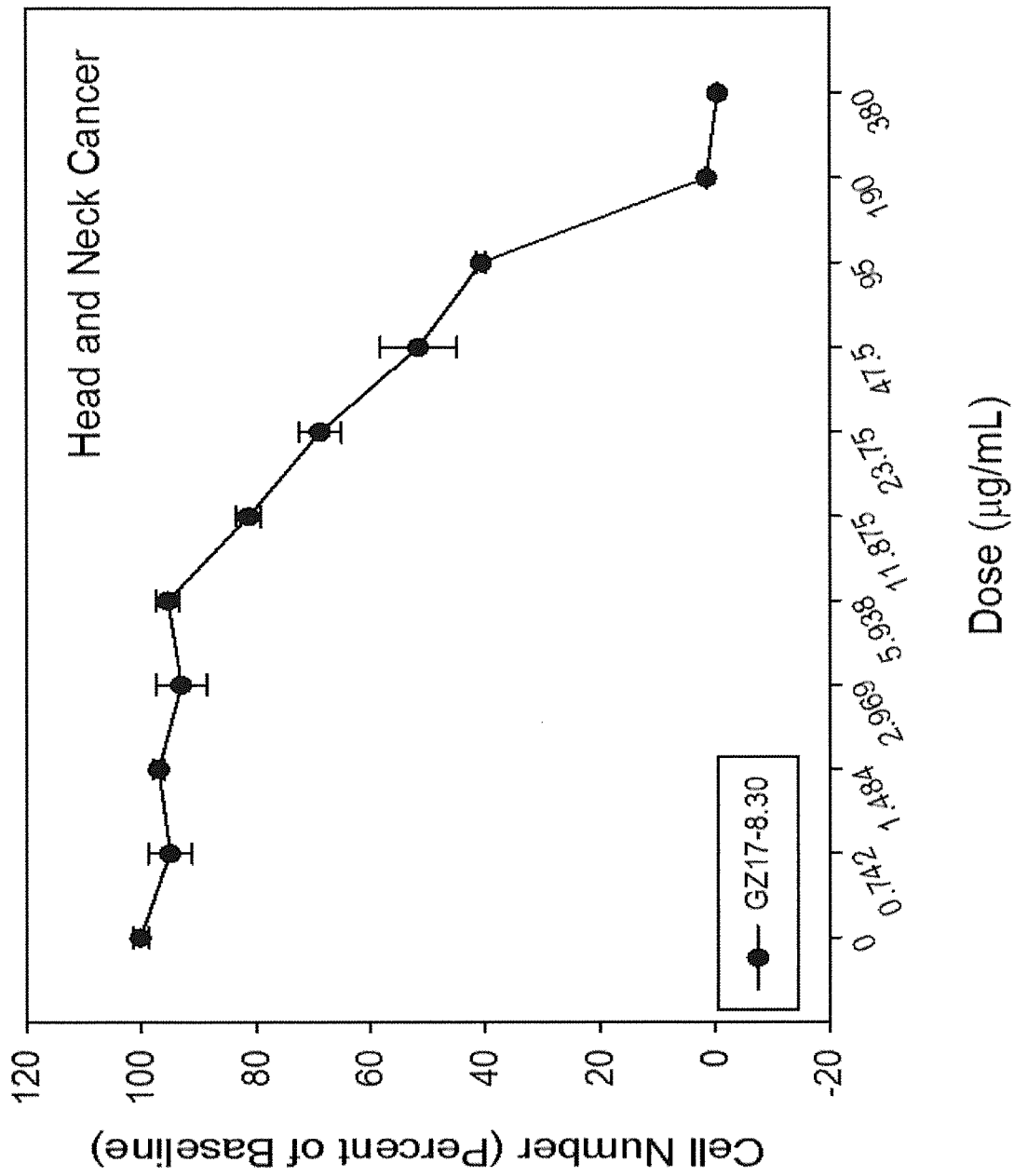

Head and Neck Cancer
Cell Number (Percent of Baseline)
120
100
80
60
40
20
0
-20
GZ17-8.30
0
0.142
1.484
2.969
5.938
11.875
23.75
47.5
95
190
380
Dose (µg/mL)

Fig. 48D

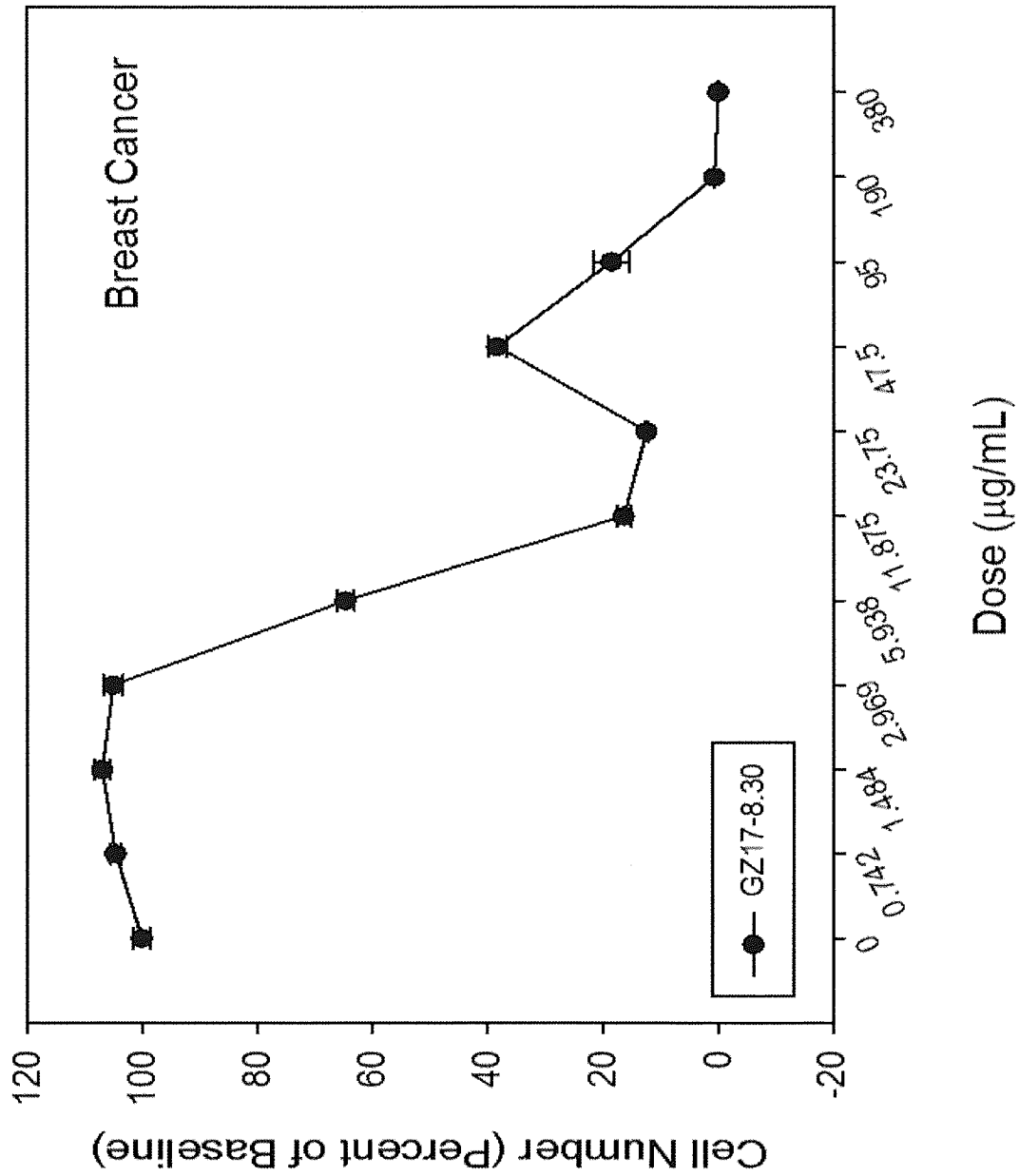

Breast Cancer
GZ17-8.30
Cell Number (Percent of Baseline)
120
100
80
60
40
20
0
-20
0
0.142
0.284
0.569
1.138
2.275
4.55
9.1
18.2
36.4
Dose (µg/mL)

Fig. 48E

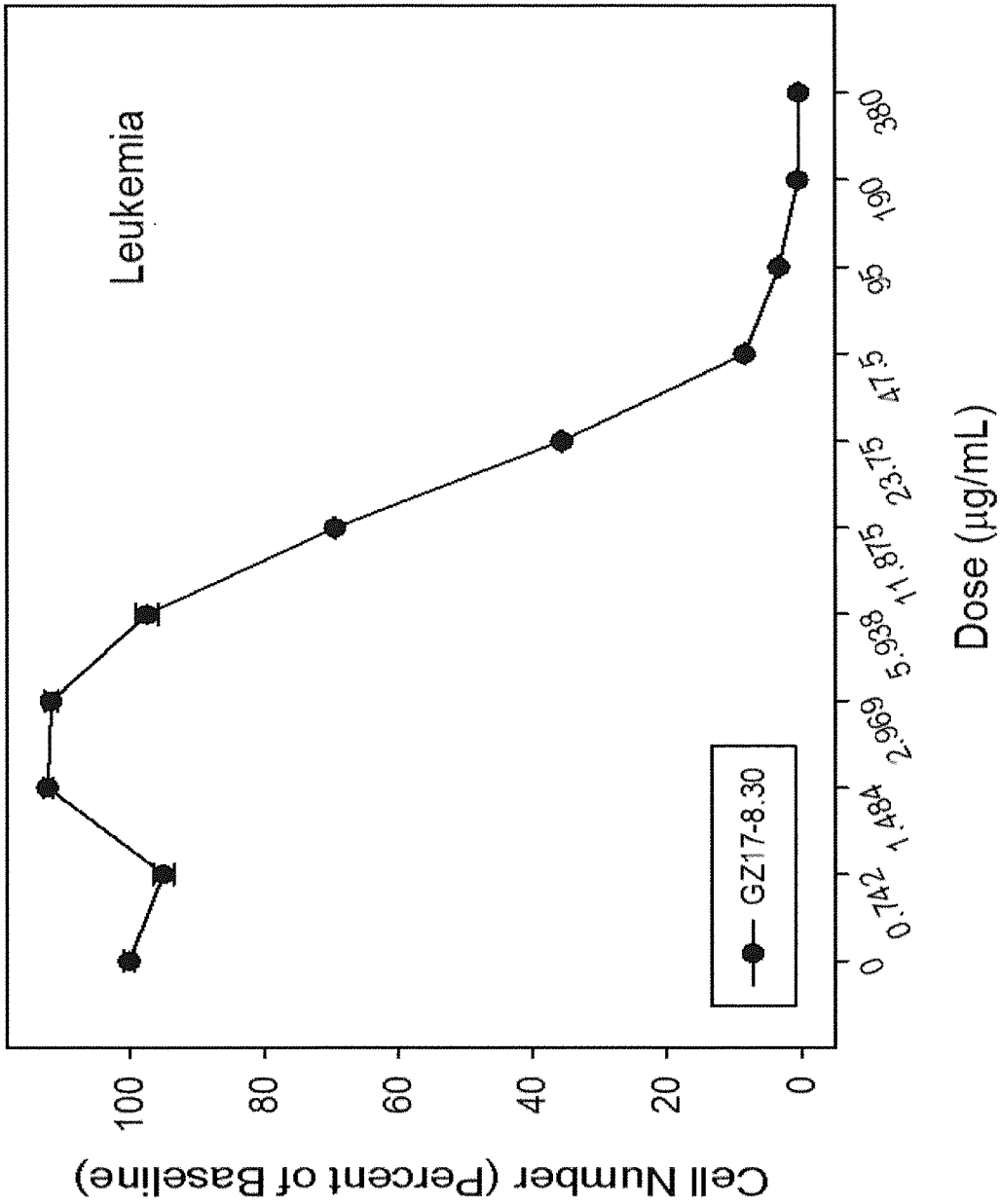

Leukemia
GZ17-8.30
Cell Number (Percent of Baseline)
0
20
40
60
80
100
0
0.742
1.484
2.969
5.938
11.875
23.75
47.5
95
190
380
Dose (µg/mL)

Fig. 48F

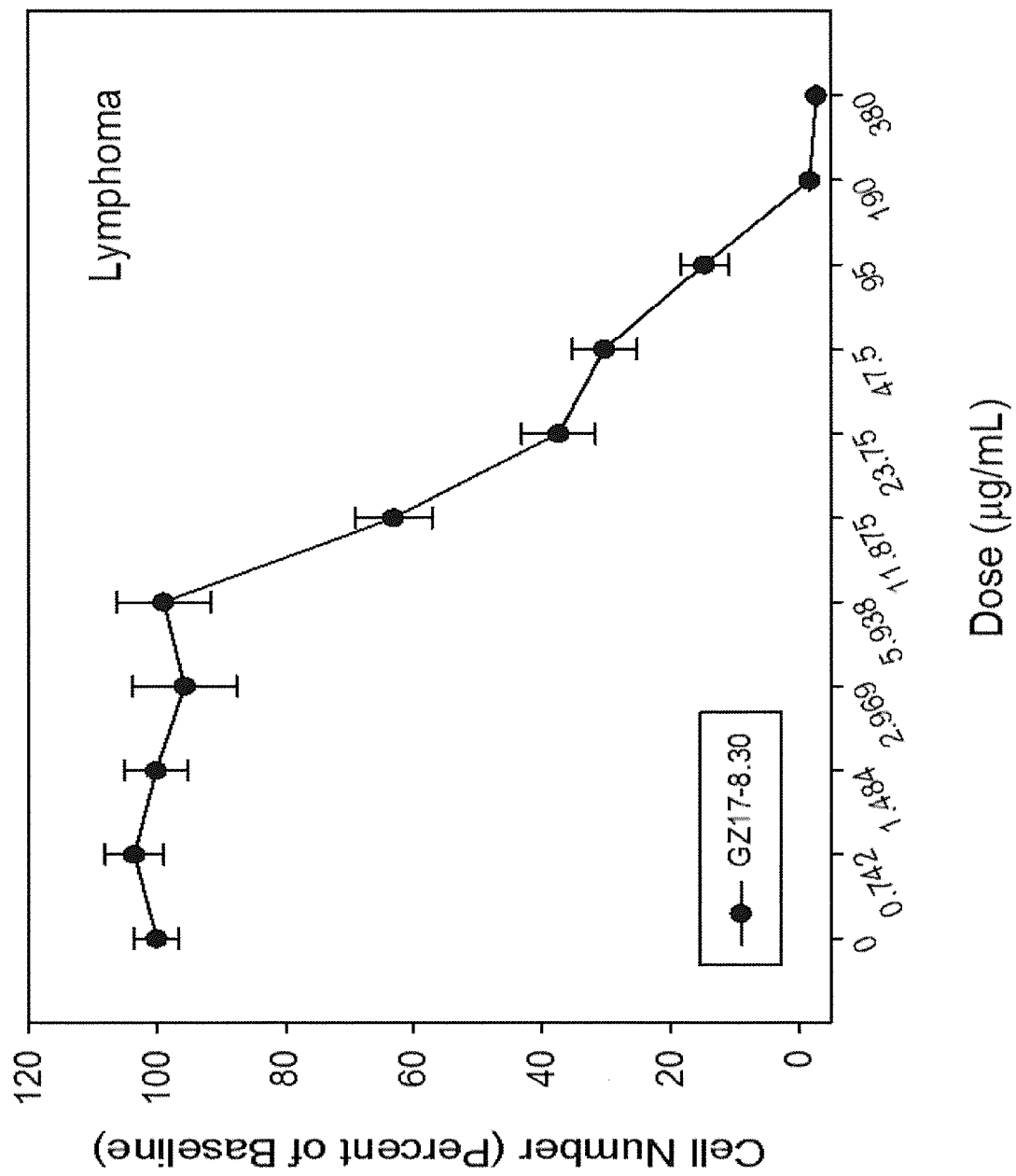

Lymphoma
Cell Number (Percent of Baseline)
120
100
80
60
40
20
0
GZ17-8.30
0
0.742
1.484
2.969
5.938
11.875
23.75
47.5
95
190
380
Dose (µg/mL)

Fig. 48G

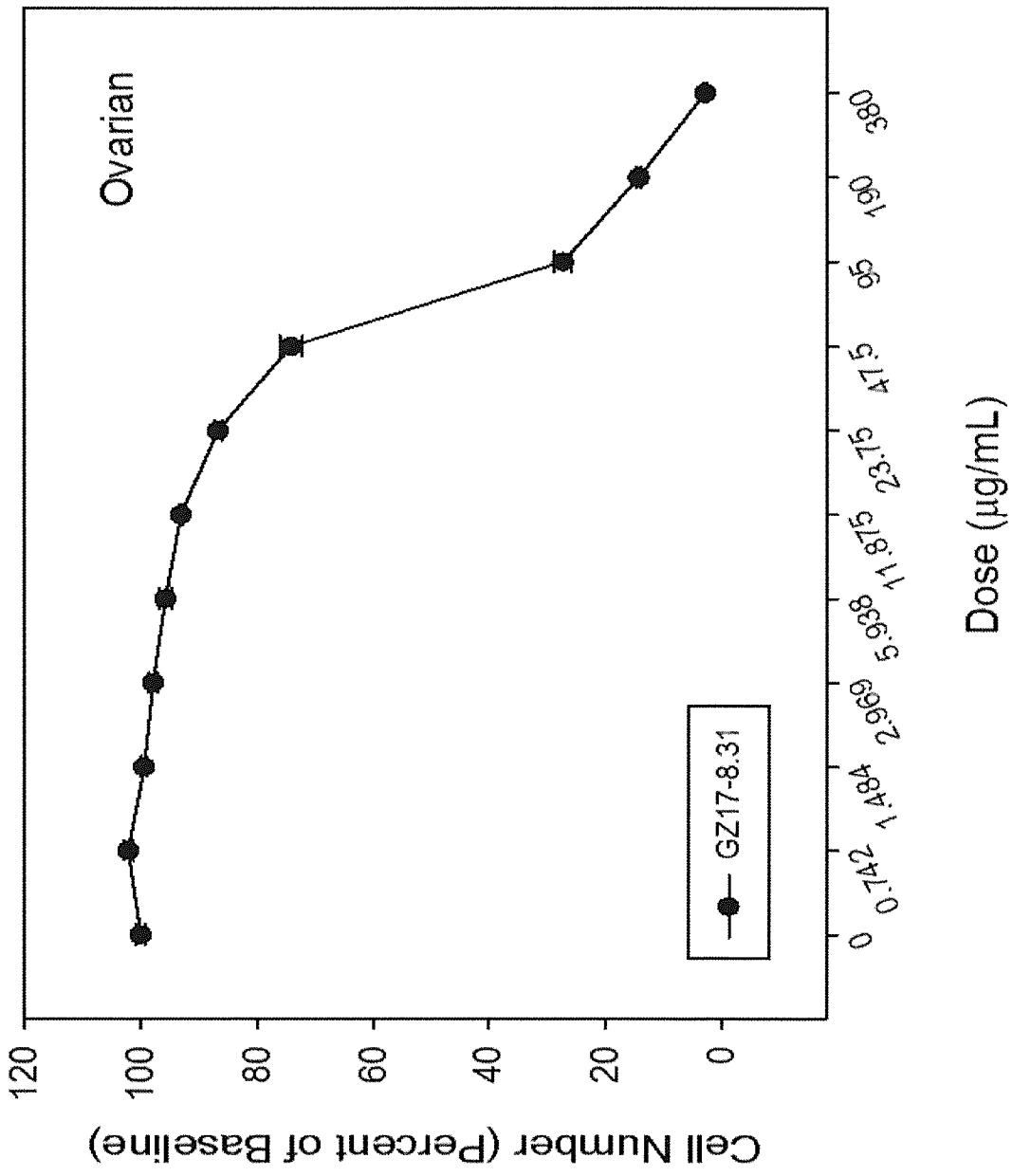

Ovarian
Cell Number (Percent of Baseline)
120
100
80
60
40
20
0
GZ17-8.31
0
0.142
1.484
2.969
5.938
11.875
23.75
47.5
95
190
380
Dose (µg/mL)

Fig. 49A

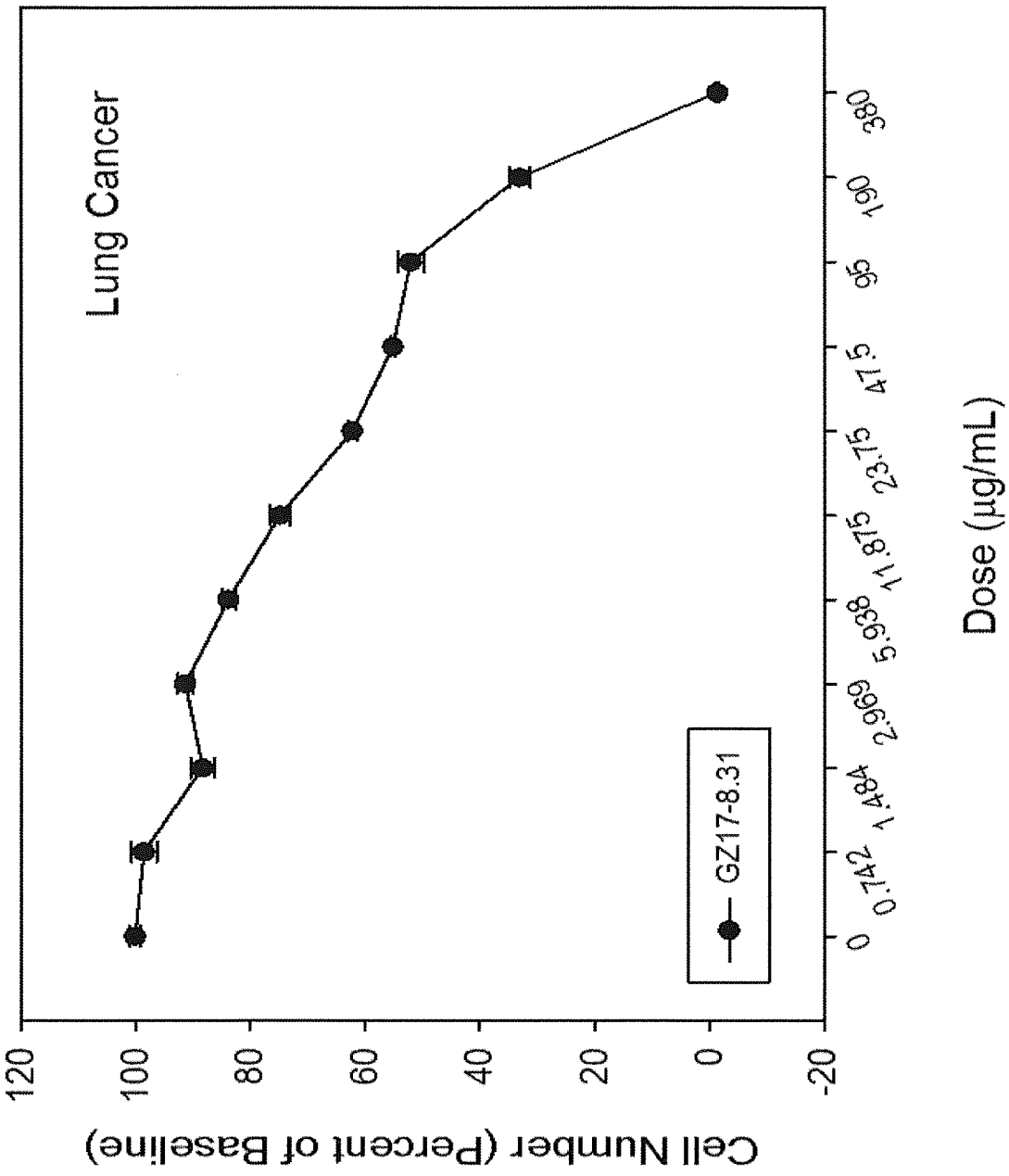

Lung Cancer
GZ17-8.31
Cell Number (Percent of Baseline)
120
100
80
60
40
20
0
-20
0
0.742
1.484
2.969
5.938
11.875
23.75
47.5
95
190
380
Dose (µg/mL)

Fig. 49B

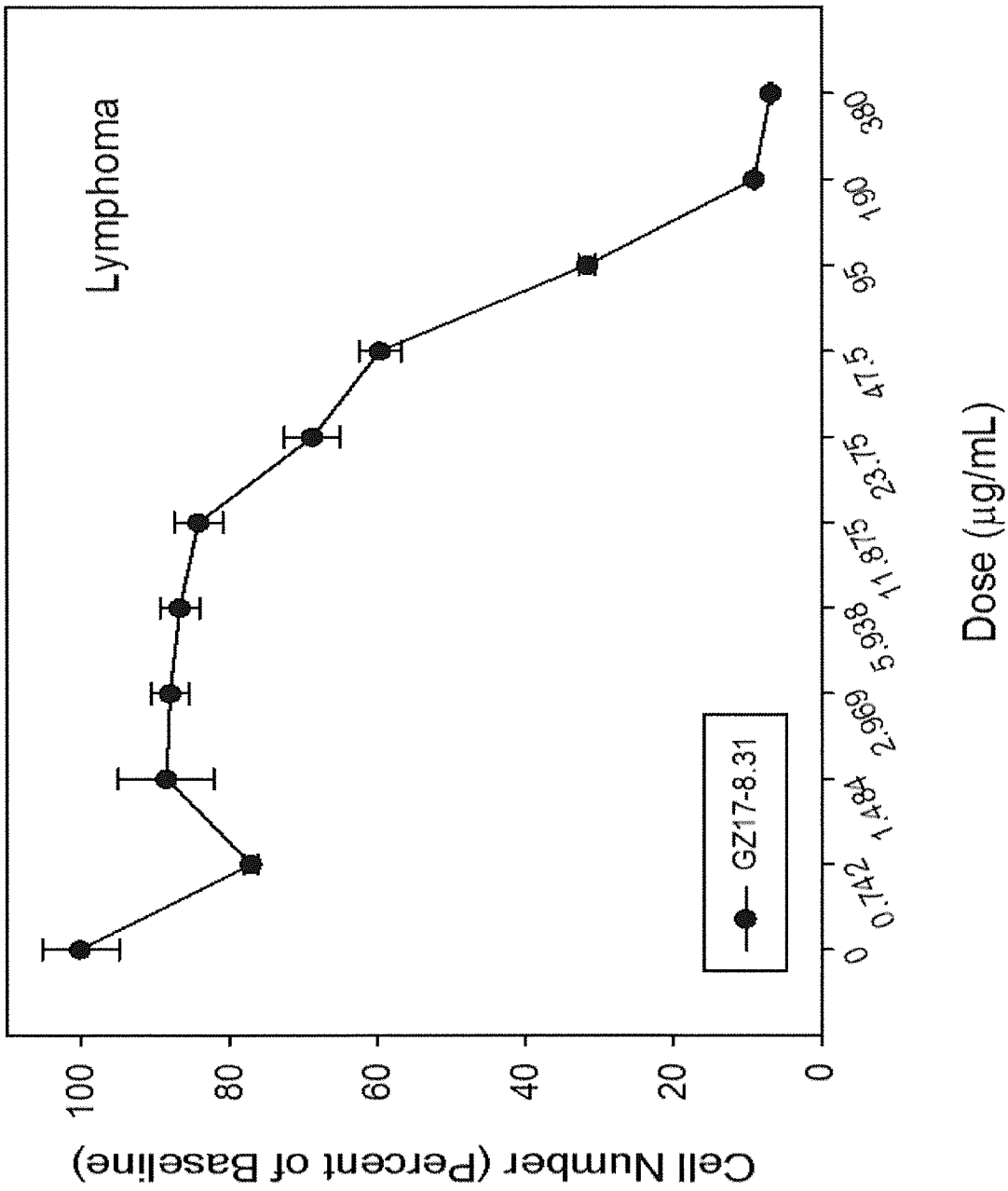

Lymphoma
GZ17-8.31
Cell Number (Percent of Baseline)
0
20
40
60
80
100
0
0.742
1.484
2.969
5.938
11.875
23.75
47.5
95
190
380
Dose (µg/mL)

Fig. 49C

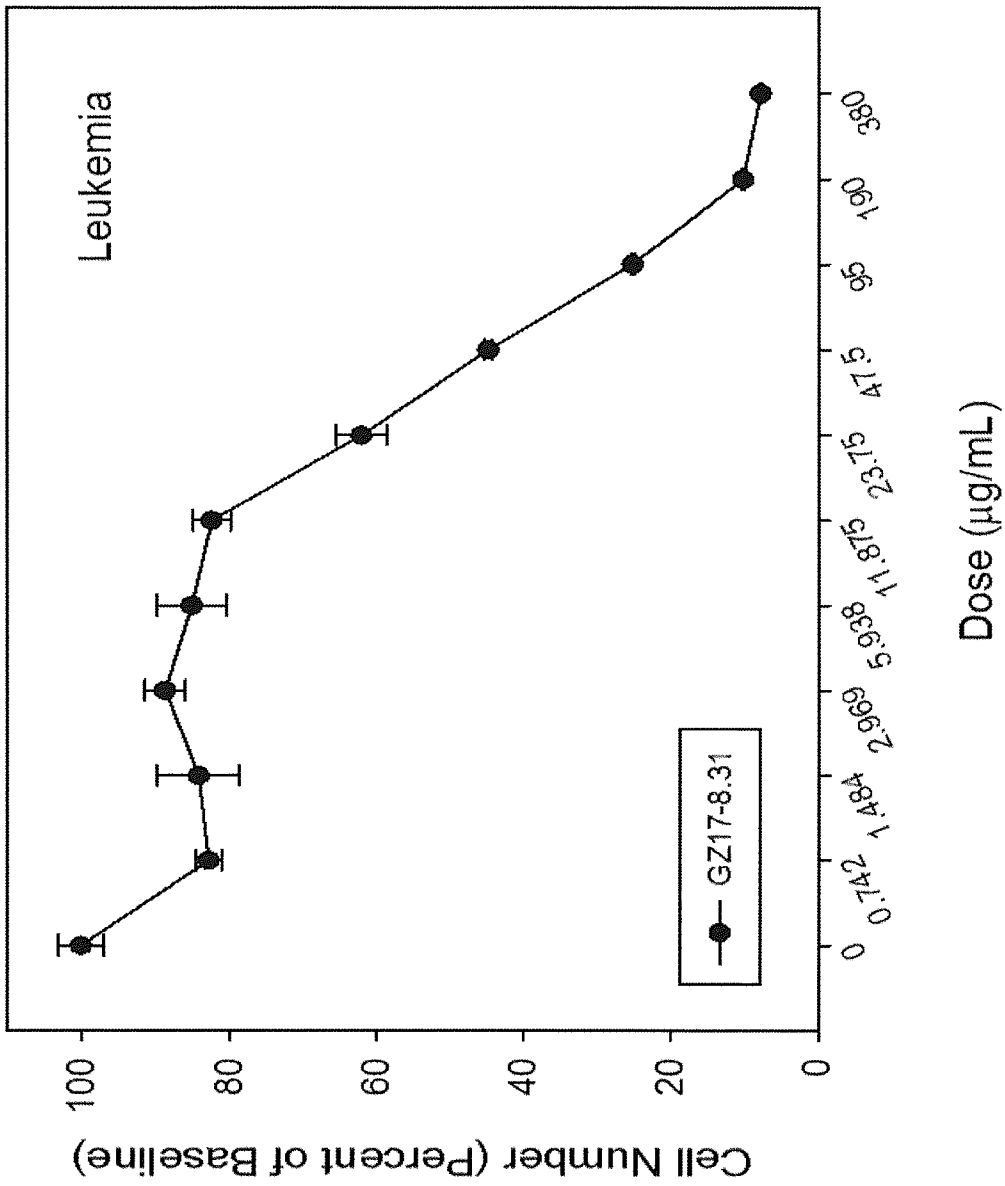

Leukemia
GZ17-8.31
Cell Number (Percent of Baseline)
0
20
40
60
80
100
0
0.742
1.484
2.969
5.938
11.875
23.75
47.5
95
190
380
Dose (µg/mL)

Fig. 49D

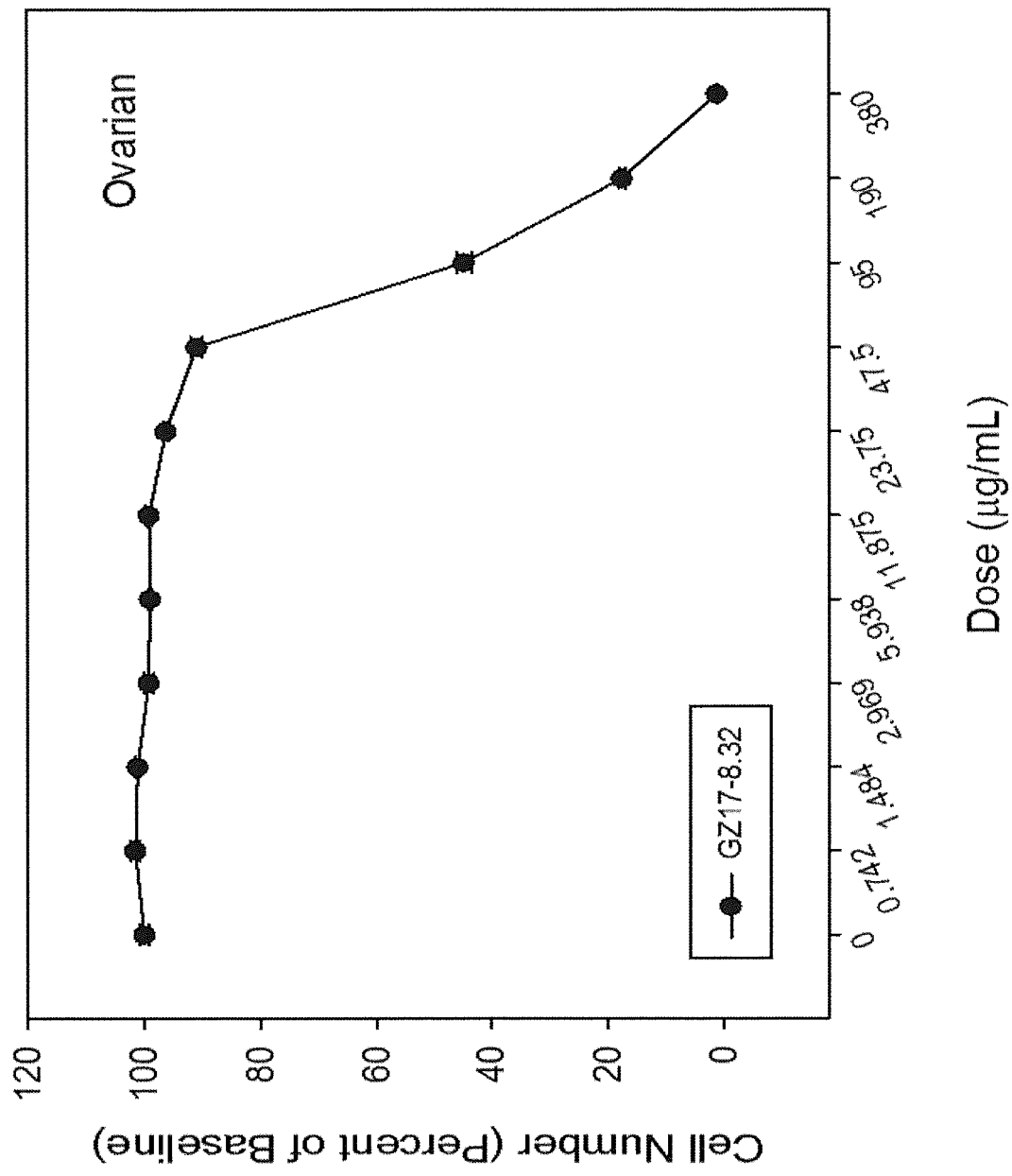

Ovarian
Cell Number (Percent of Baseline)
120
100
80
60
40
20
0
GZ17-8.32
0
0.742
1.484
2.969
5.938
11.875
23.75
47.5
95
190
380
Dose (µg/mL)

Fig. 50A

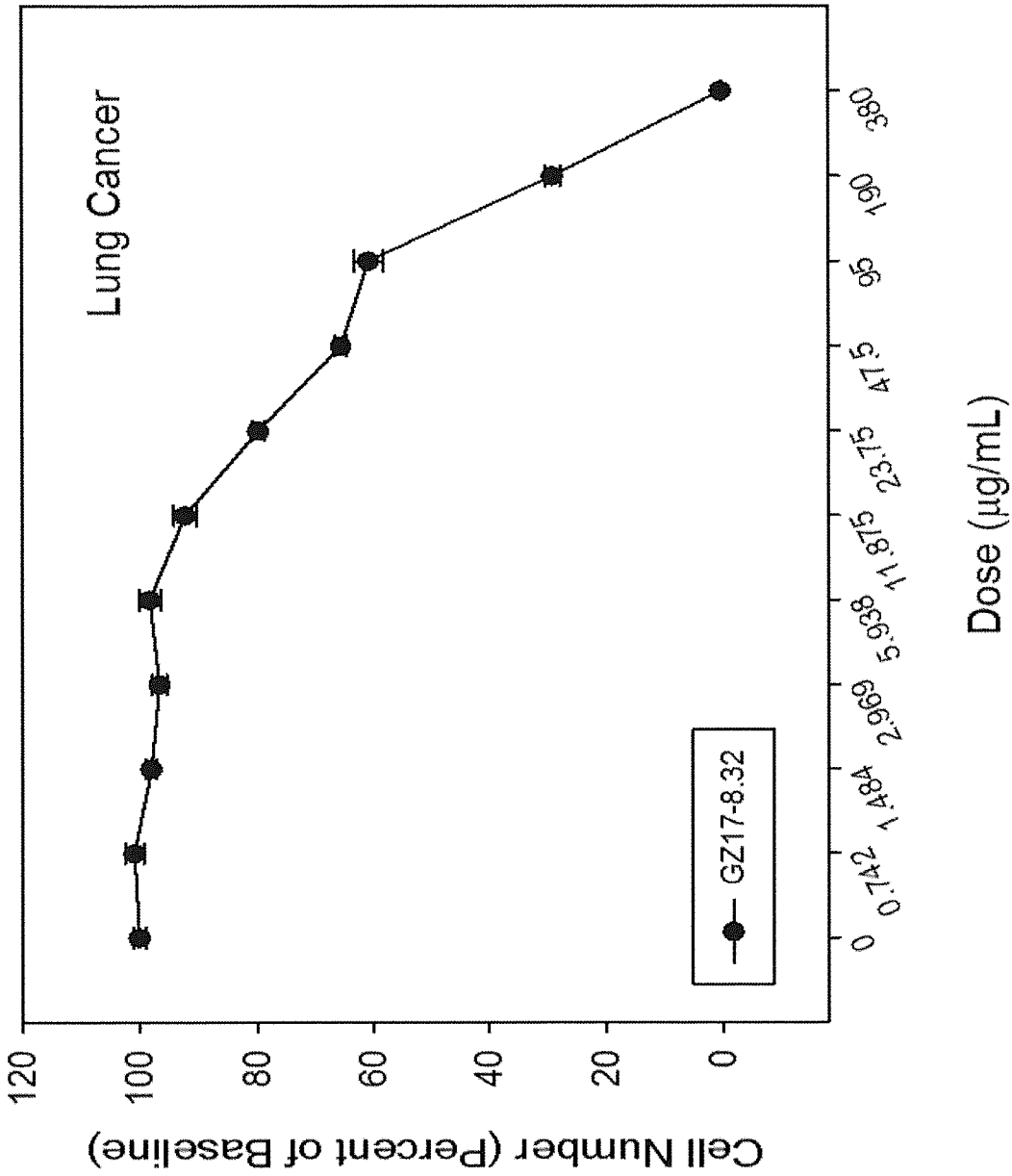

Lung Cancer
Cell Number (Percent of Baseline)
120
100
80
60
40
20
0
GZ17-8.32
0
0.742
1.484
2.969
5.938
11.875
23.75
47.5
95
190
380
Dose (µg/mL)

Fig. 50B

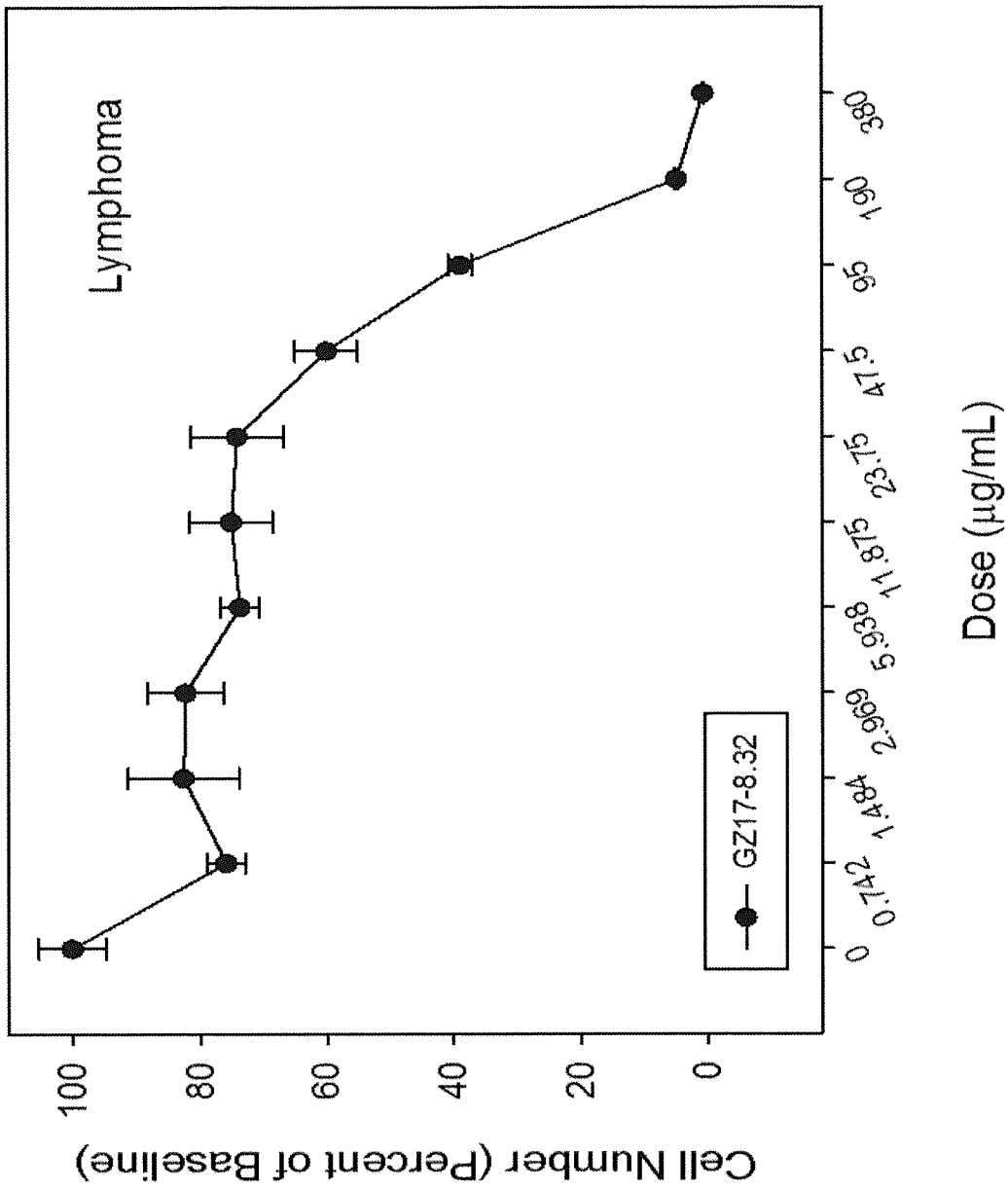

Lymphoma
Cell Number (Percent of Baseline)
100
80
60
40
20
0
GZ17-8.32
0
0.742
1.484
2.969
5.938
11.875
23.75
47.5
95
190
380
Dose (µg/mL)

Fig. 50C

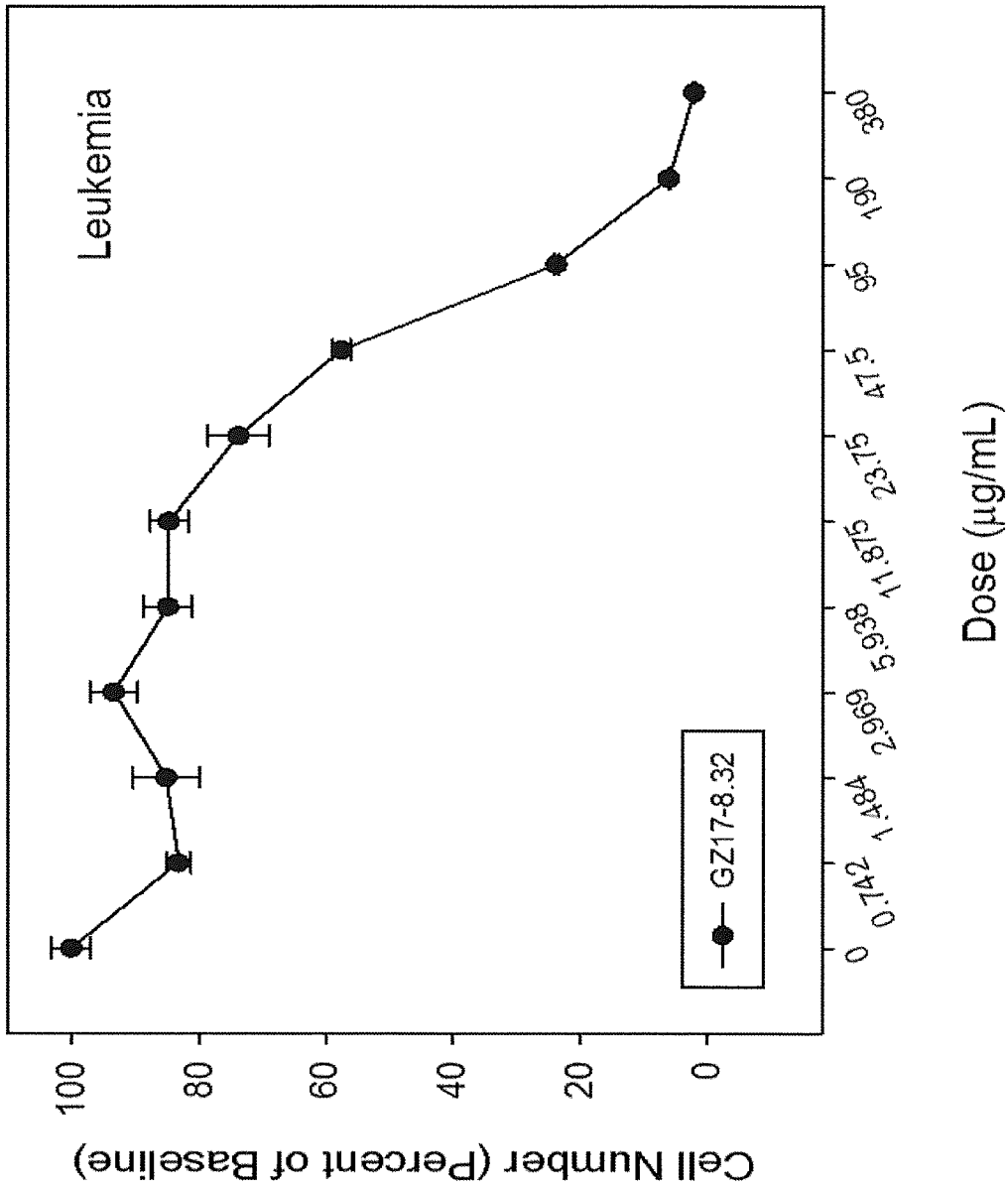

Leukemia
Cell Number (Percent of Baseline)
100
80
60
40
20
0
GZ17-8.32
0
0.142
1.484
2.969
5.938
11.875
23.75
47.5
95
190
380
Dose (µg/mL)

Fig. 50D

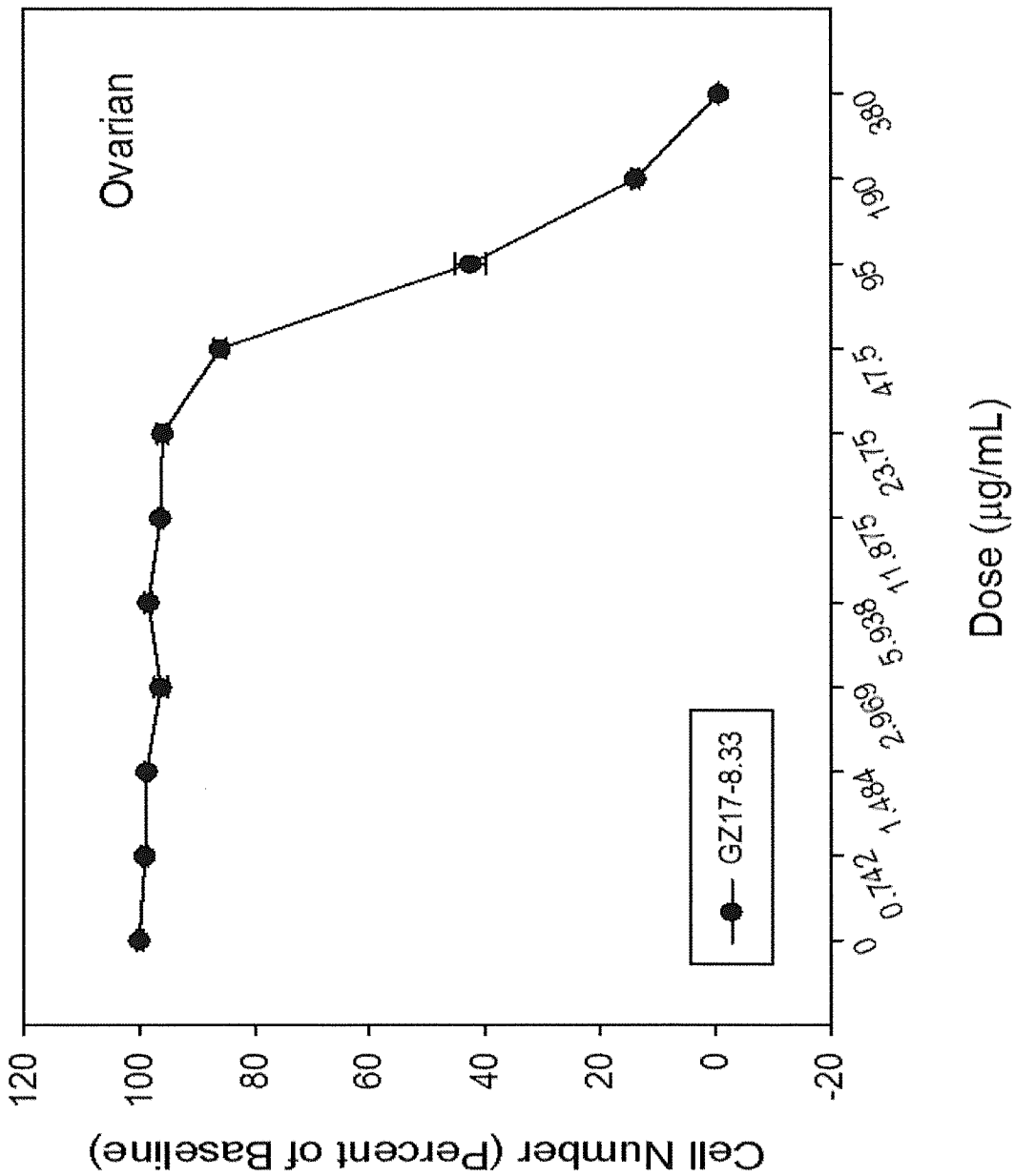

Ovarian
Cell Number (Percent of Baseline)
120
100
80
60
40
20
0
-20
GZ17-8.33
0
0.742
1.484
2.969
5.938
11.875
23.75
47.5
95
190
380
Dose (µg/mL)

Fig. 51A

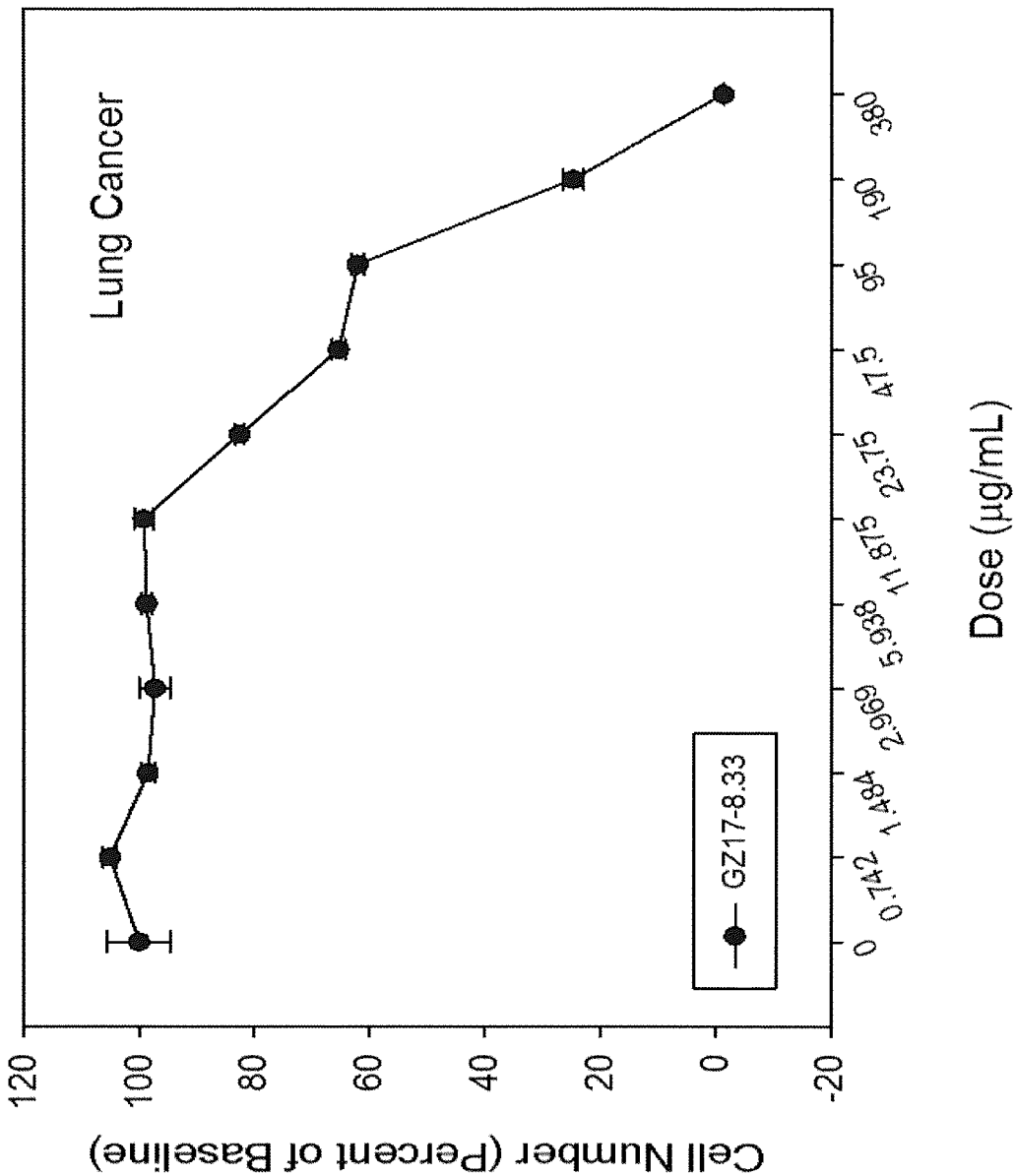

Lung Cancer
Cell Number (Percent of Baseline)
120
100
80
60
40
20
0
-20
GZ17-8.33
0
0.742
1.484
2.969
5.938
11.875
23.75
47.5
95
190
380
Dose (µg/mL)

Fig. 51B

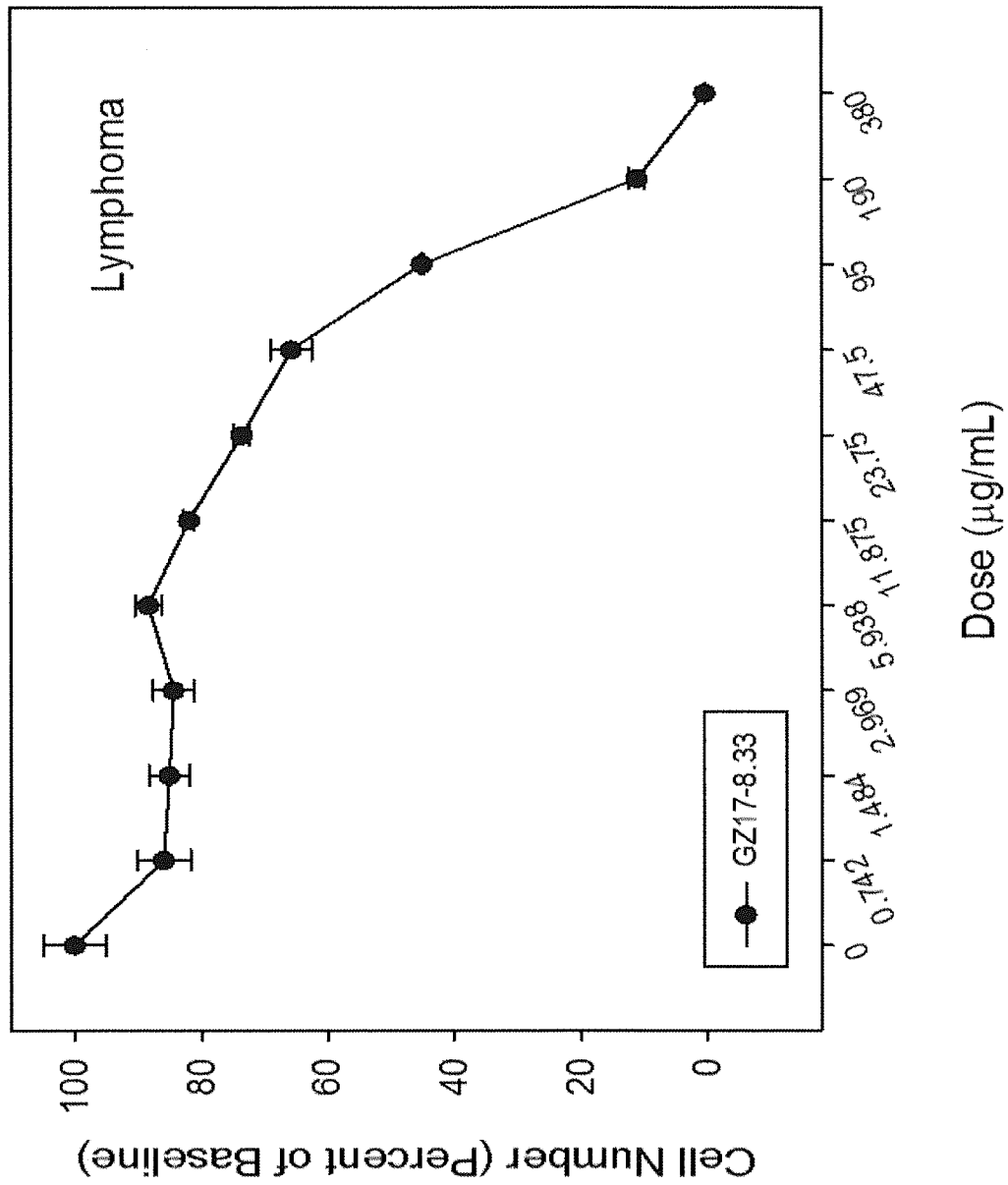

Lymphoma
Cell Number (Percent of Baseline)
100
80
60
40
20
0
GZ17-8.33
0
0.142
1.484
2.969
5.938
11.875
23.75
47.5
95
190
380
Dose (µg/mL)

Fig. 51C

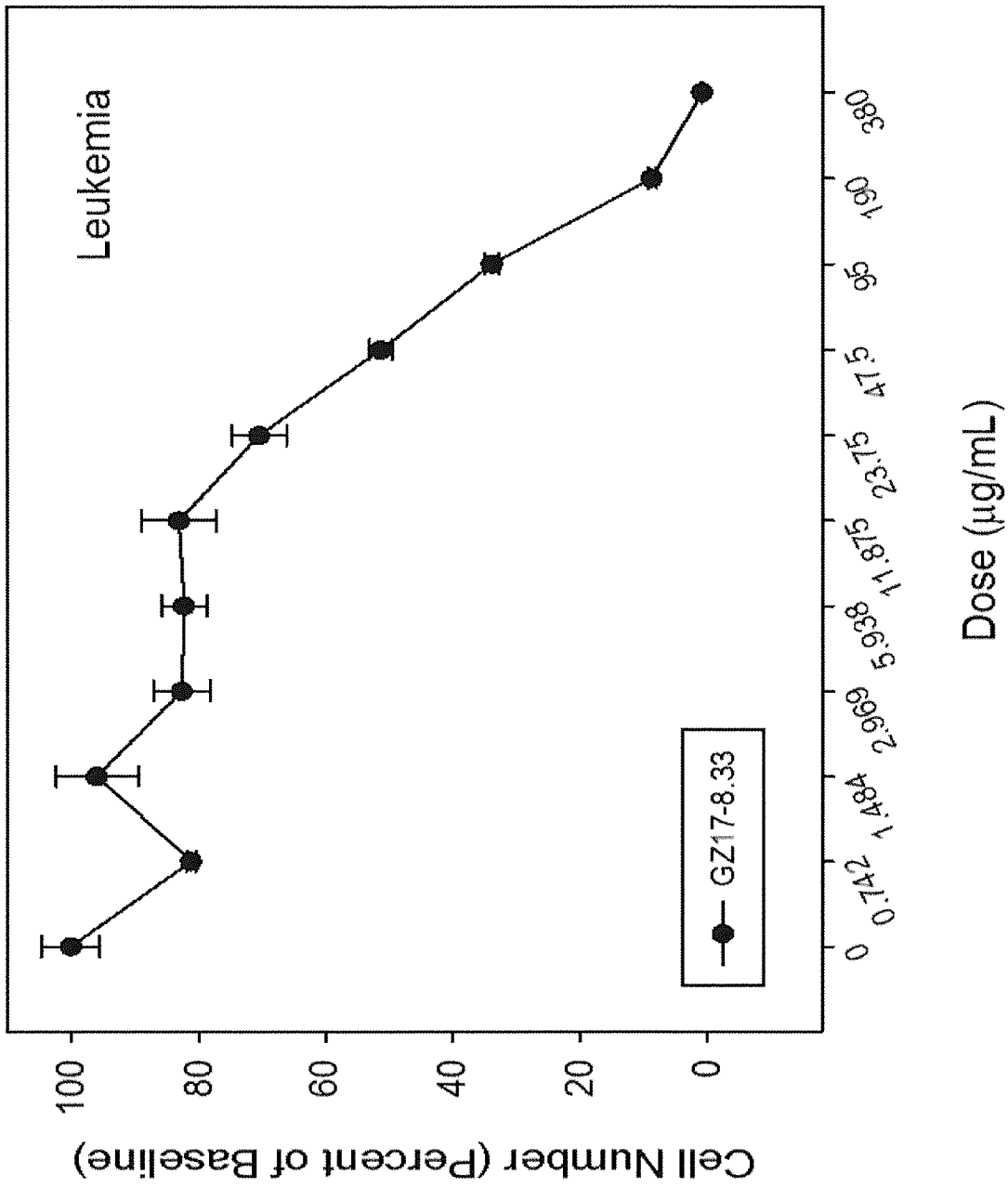

Leukemia
Cell Number (Percent of Baseline)
100
80
60
40
20
0
GZ17-8.33
0
0.742
1.484
2.969
5.938
11.875
23.75
47.5
95
190
380
Dose (µg/mL)

Fig. 51D

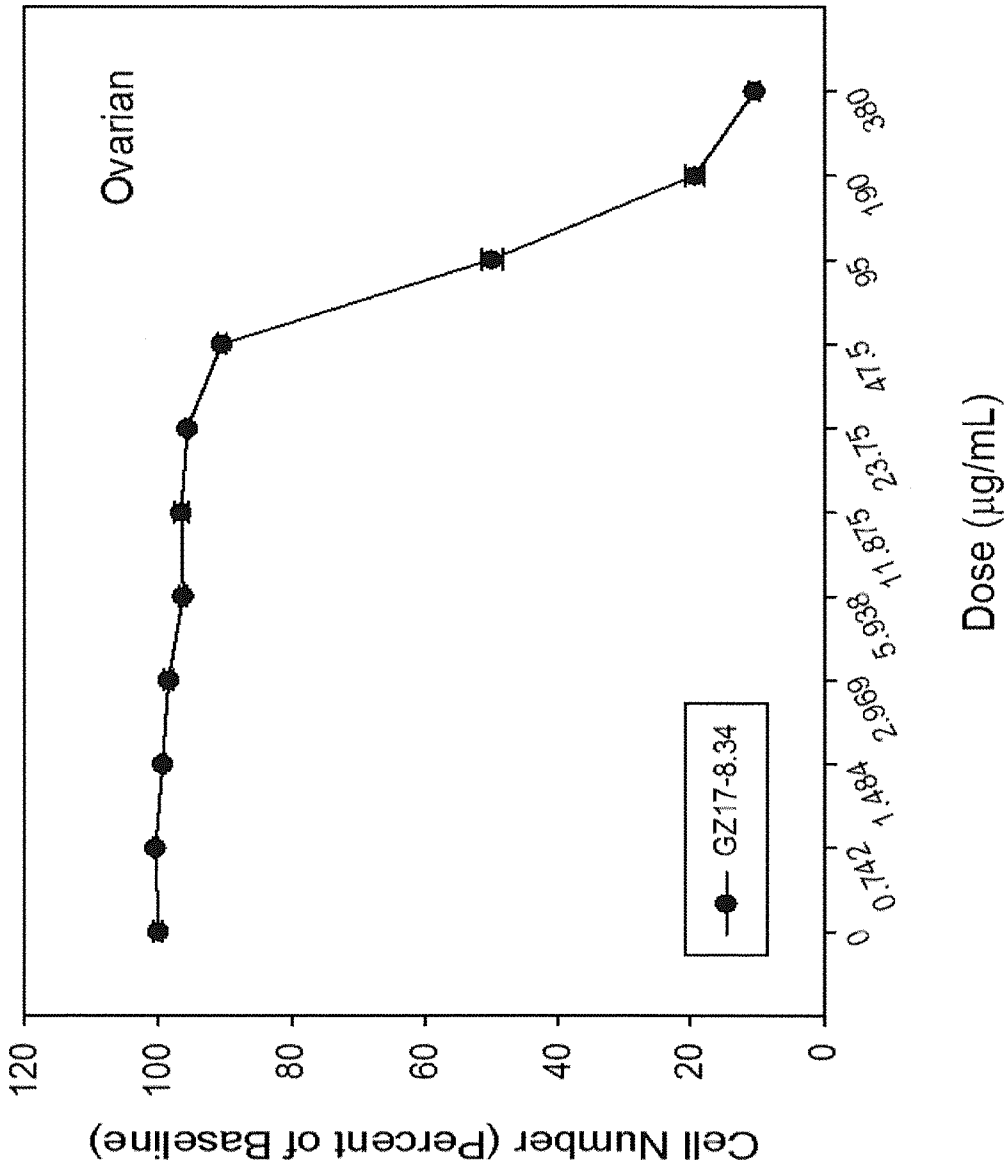

Ovarian
Cell Number (Percent of Baseline)
120
100
80
60
40
20
0
GZ17-8.34
0
0.742
1.484
2.969
5.938
11.875
23.75
47.5
95
190
380
Dose (µg/mL)

Fig. 52A

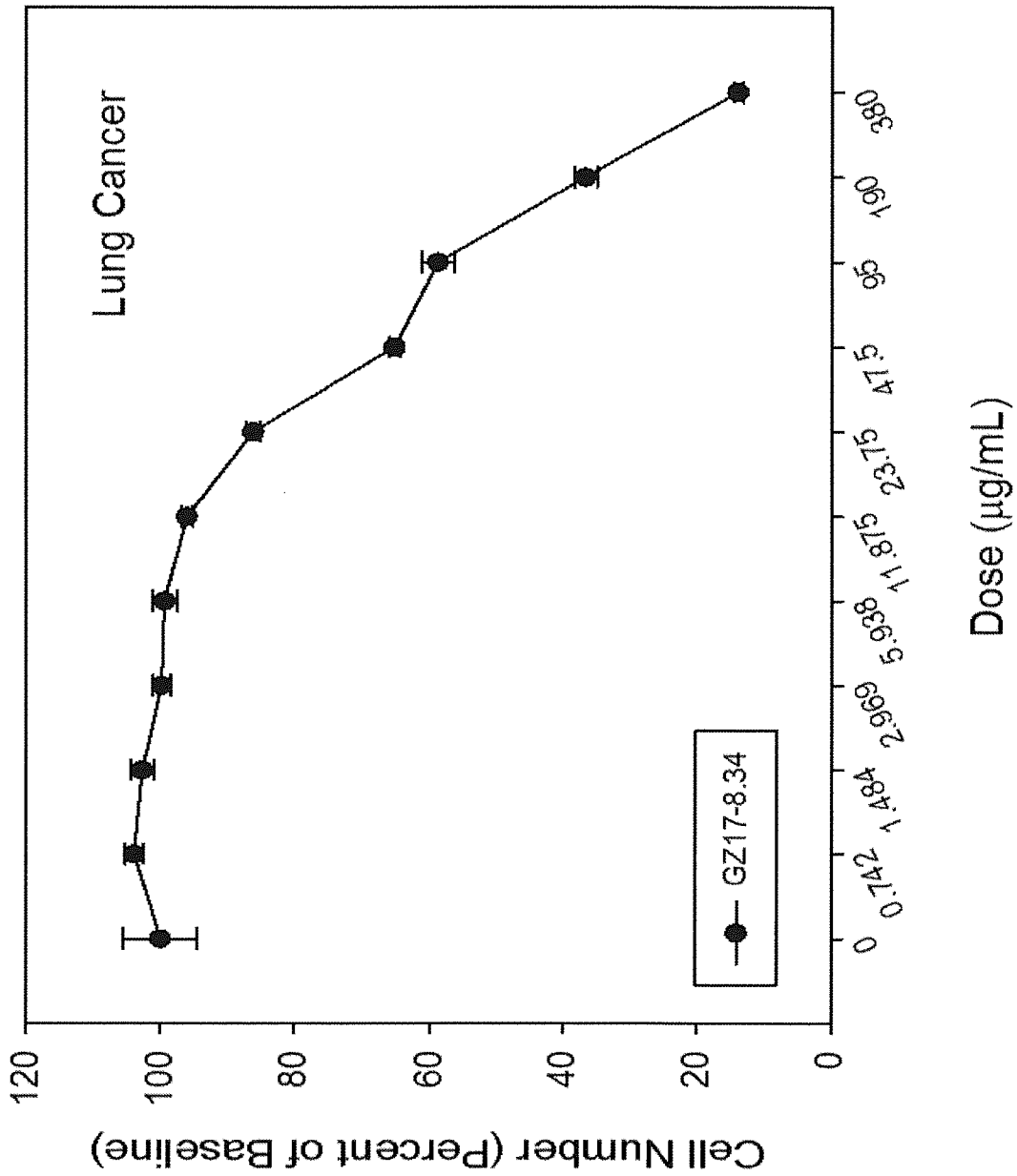

Lung Cancer
GZ17-8.34
Cell Number (Percent of Baseline)
0
20
40
60
80
100
120
0
0.742
1.484
2.969
5.938
11.875
23.75
47.5
95
190
380
Dose (µg/mL)

Fig. 52B

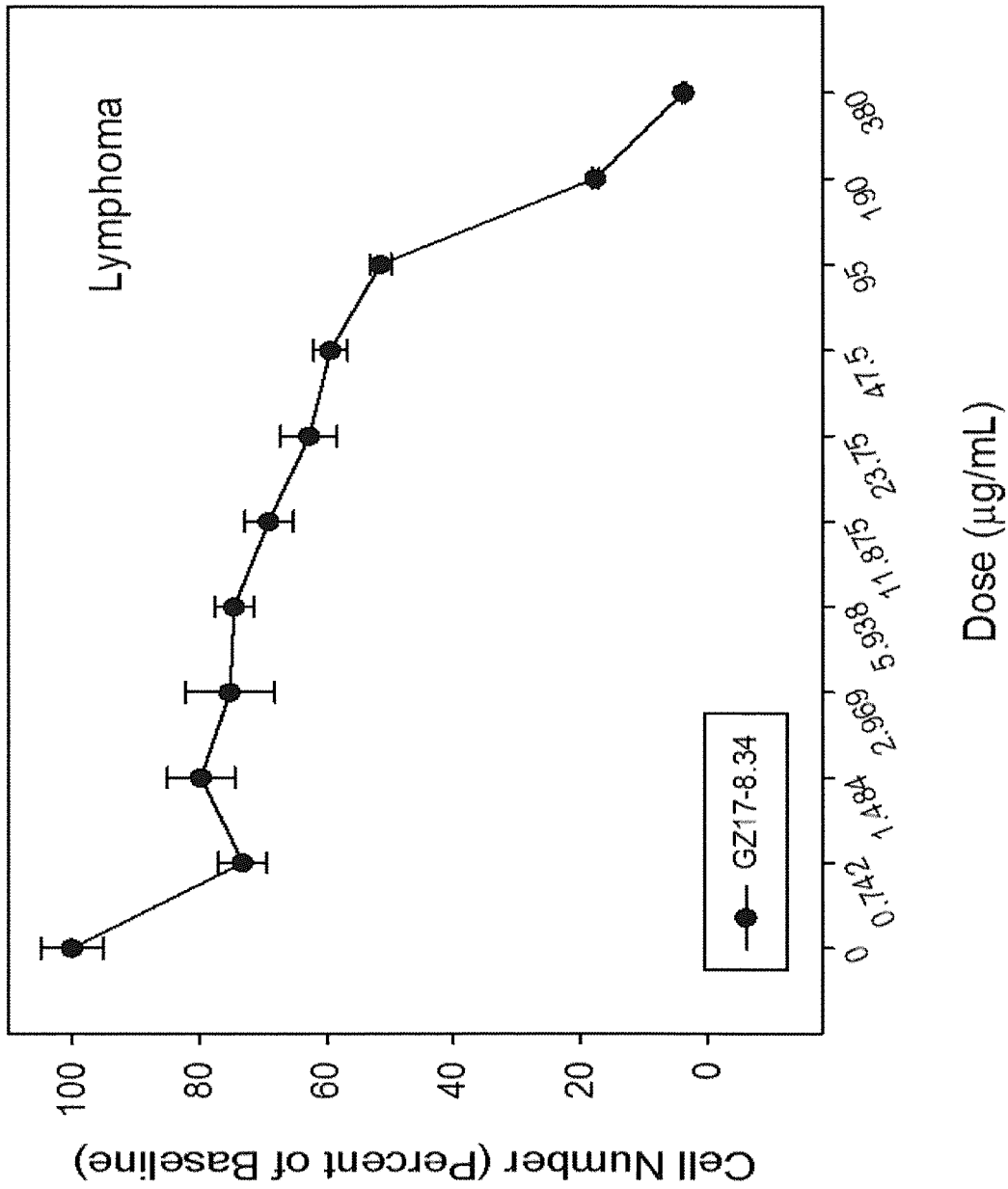

Lymphoma
GZ17-8.34
Cell Number (Percent of Baseline)
0
20
40
60
80
100
0
0.742
1.484
2.969
5.938
11.875
23.75
47.5
95
190
380
Dose (µg/mL)

Fig. 52C

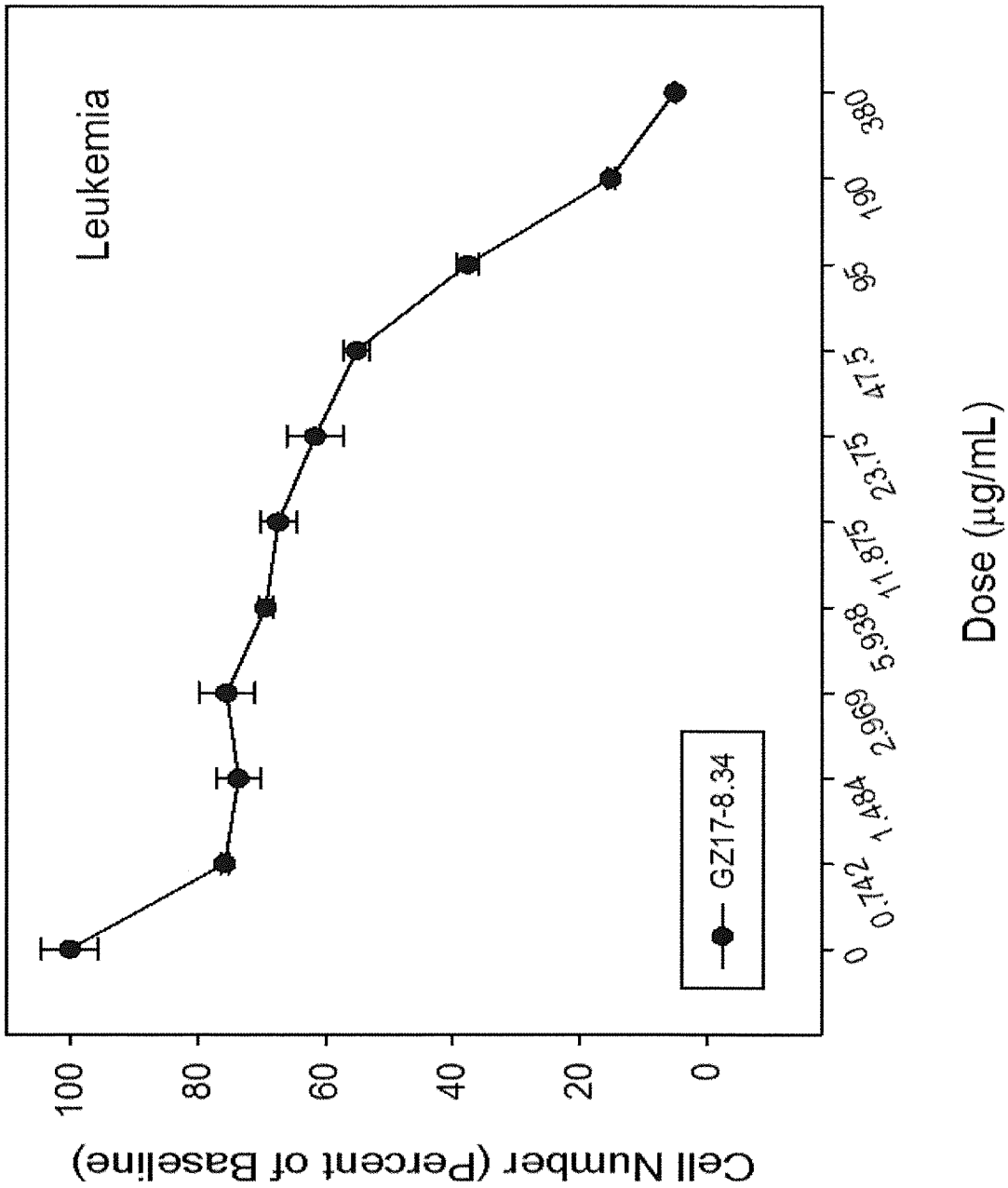

Leukemia
GZ17-8.34
Cell Number (Percent of Baseline)
0
20
40
60
80
100
0
0.142
1.484
2.969
5.938
11.875
23.75
47.5
95
190
380
Dose (µg/mL)

Fig. 52D

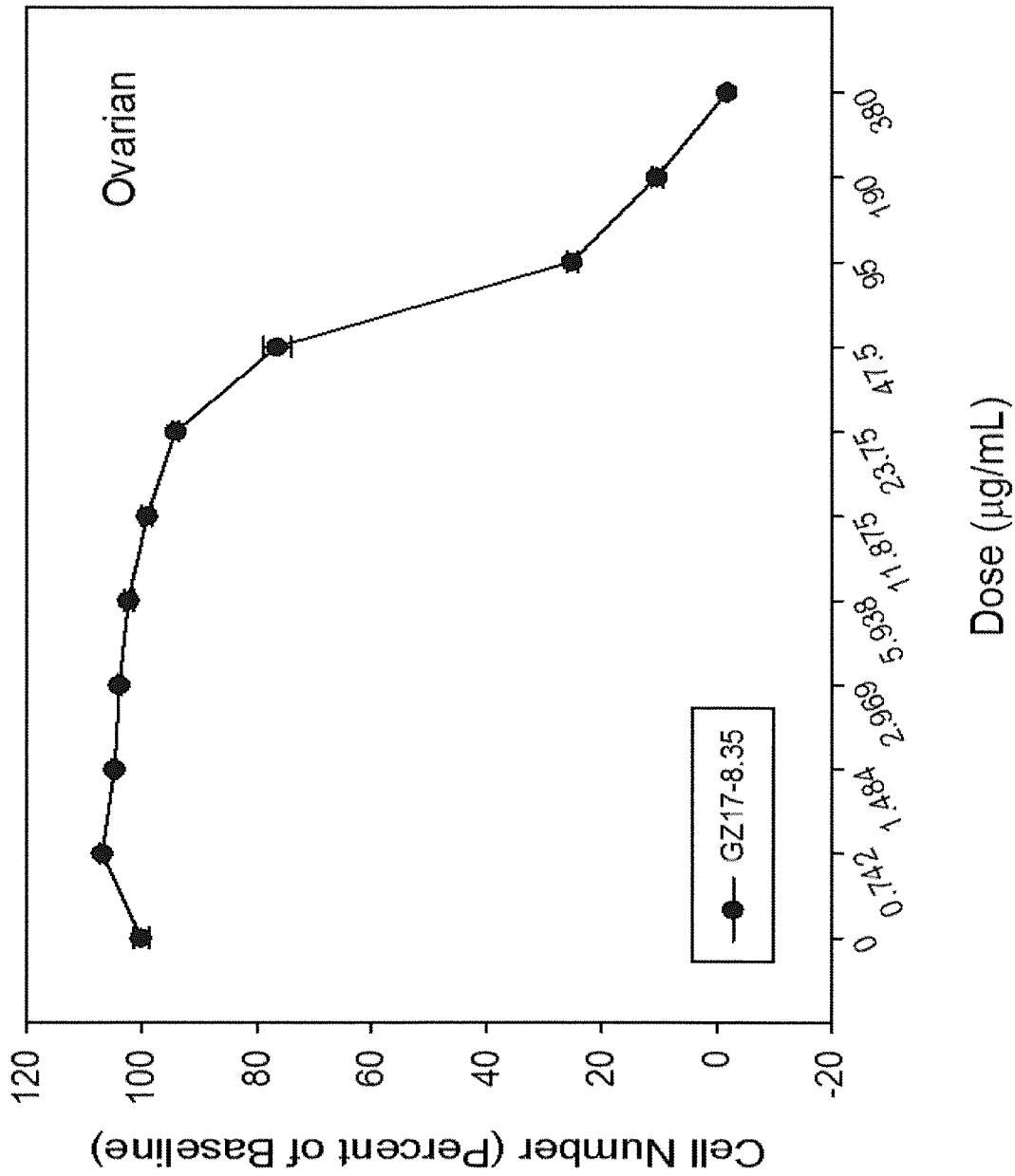

Ovarian
Cell Number (Percent of Baseline)
120
100
80
60
40
20
0
-20
GZ17-8.35
0
0.742
1.484
2.969
5.938
11.875
23.75
47.5
95
190
380
Dose (µg/mL)

Fig. 53A

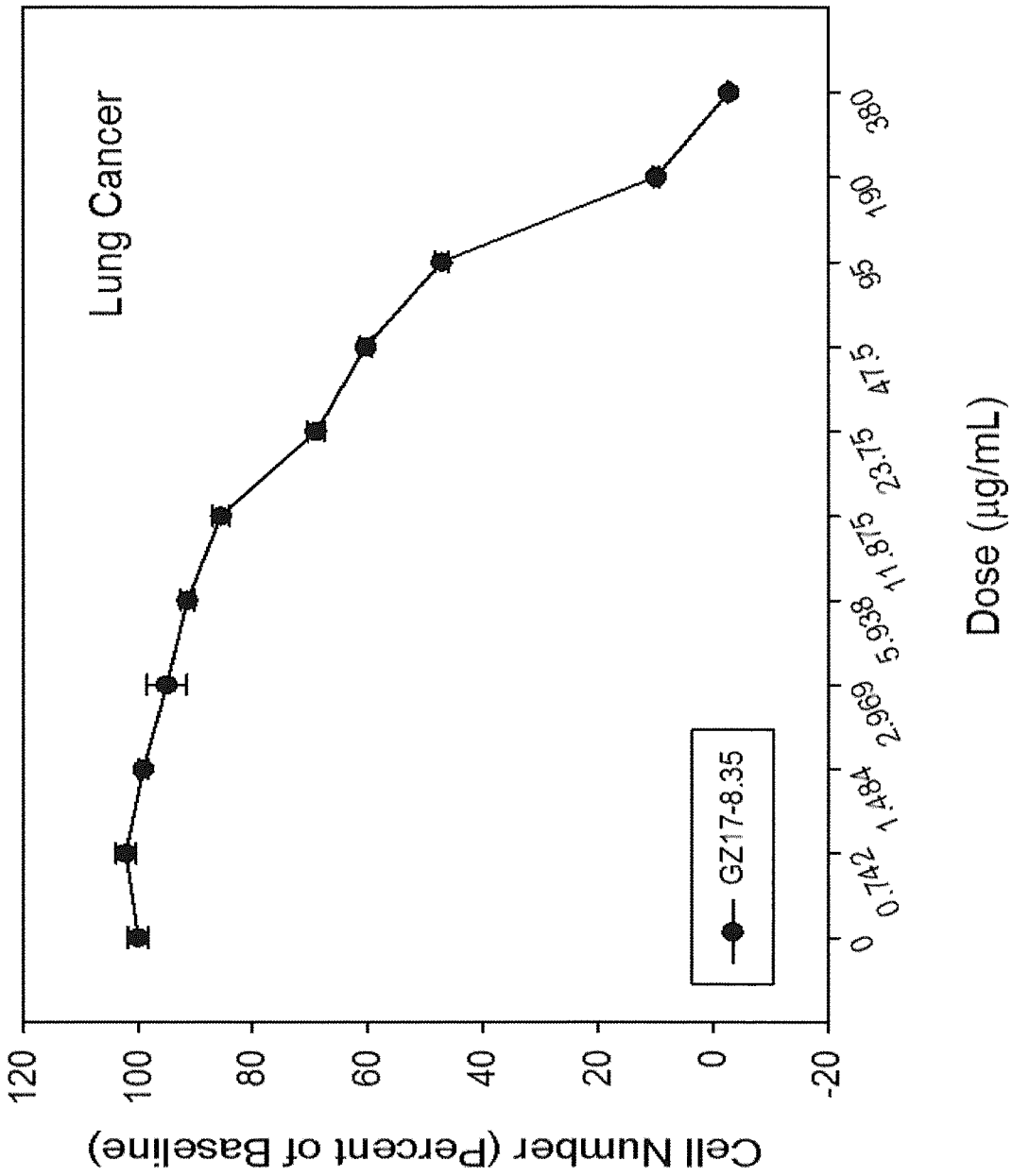

Lung Cancer
Cell Number (Percent of Baseline)
120
100
80
60
40
20
0
-20
GZ17-8.35
0
0.742
1.484
2.969
5.938
11.875
23.75
47.5
95
190
380
Dose (µg/mL)

Fig. 53B

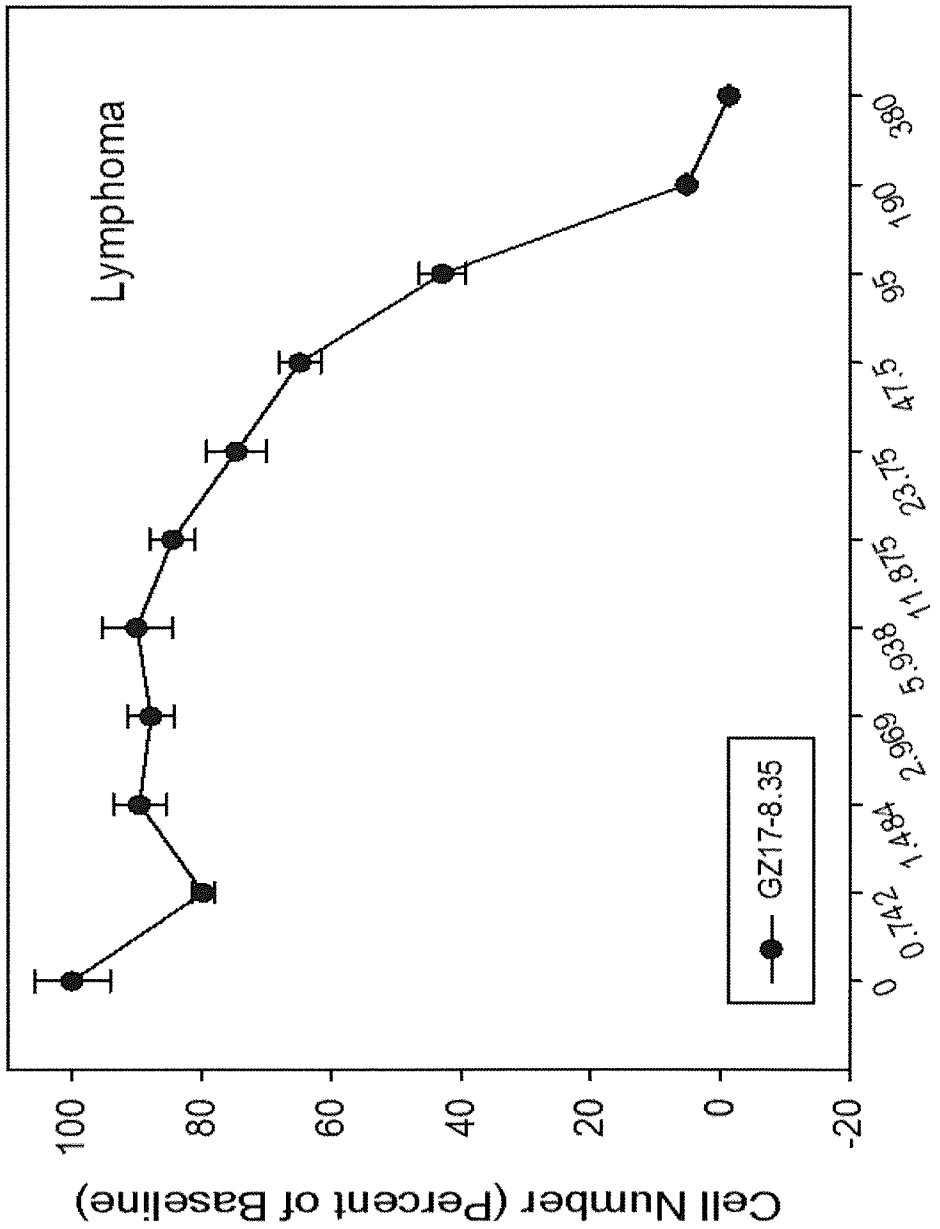

Lymphoma
Cell Number (Percent of Baseline)
100
80
60
40
20
0
-20
GZ17-8.35
0
0.742
1.484
2.969
5.938
11.875
23.75
47.5
95
190
380
Dose (µg/mL)

Fig. 53C

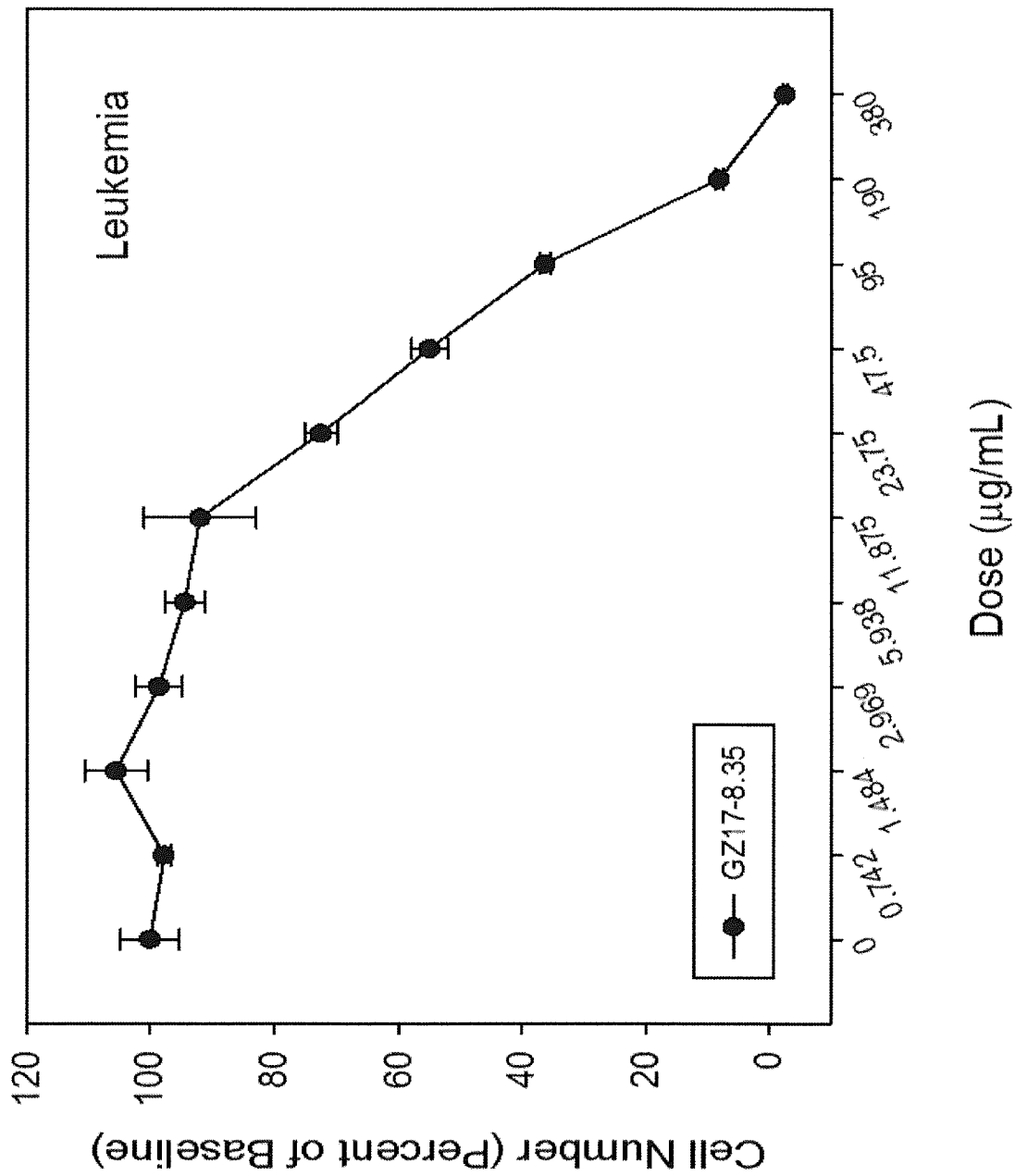

Leukemia
GZ17-8.35
Cell Number (Percent of Baseline)
120
100
80
60
40
20
0
0
0.742
1.484
2.969
5.938
11.875
23.75
47.5
95
190
380
Dose (µg/mL)

Fig. 53D

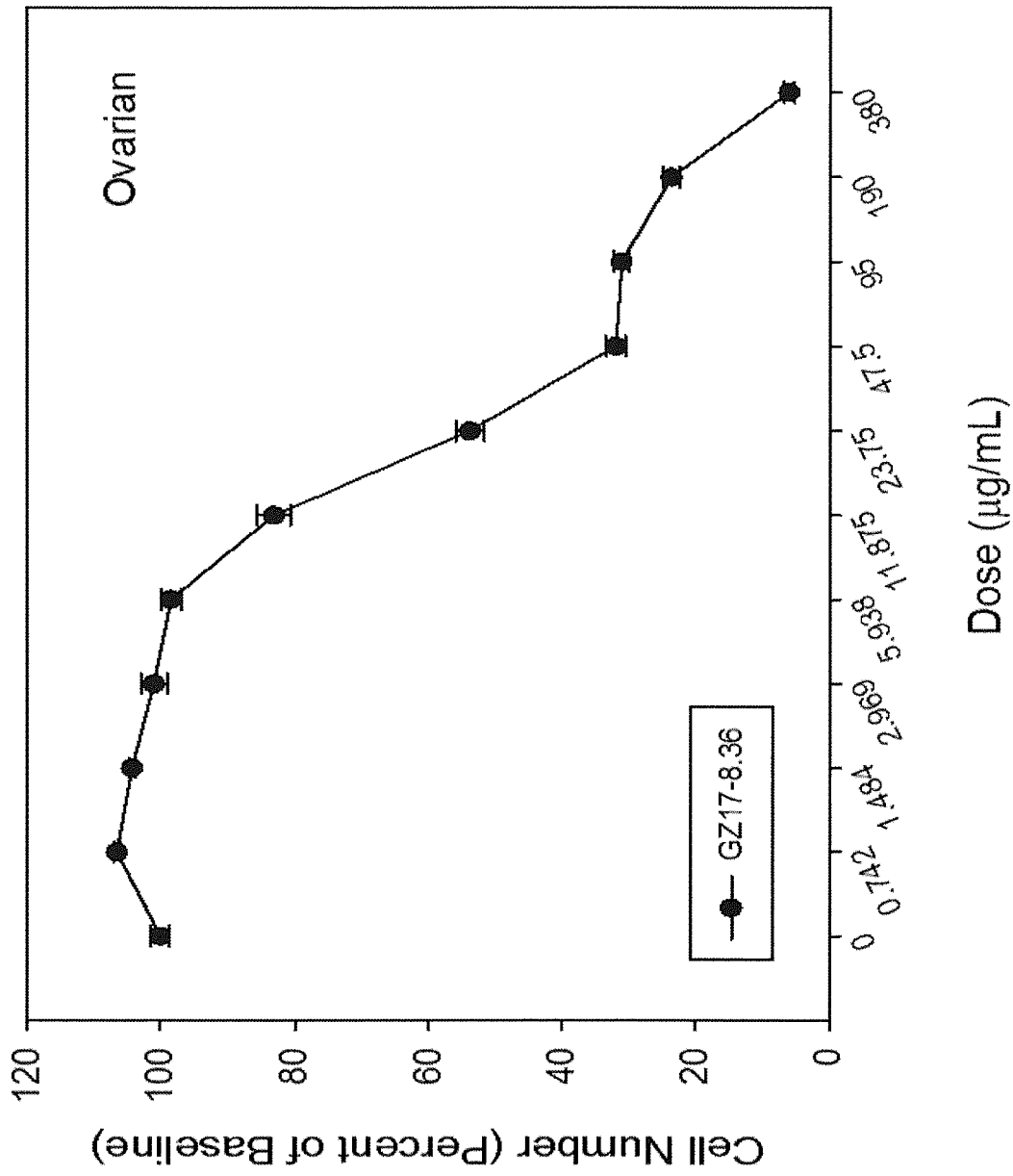

Ovarian
GZ17-8.36
Cell Number (Percent of Baseline)
Dose (µg/mL)
0
20
40
60
80
100
120
0
0.742
1.484
2.969
5.938
11.875
23.75
47.5
95
190
380

Fig. 54A

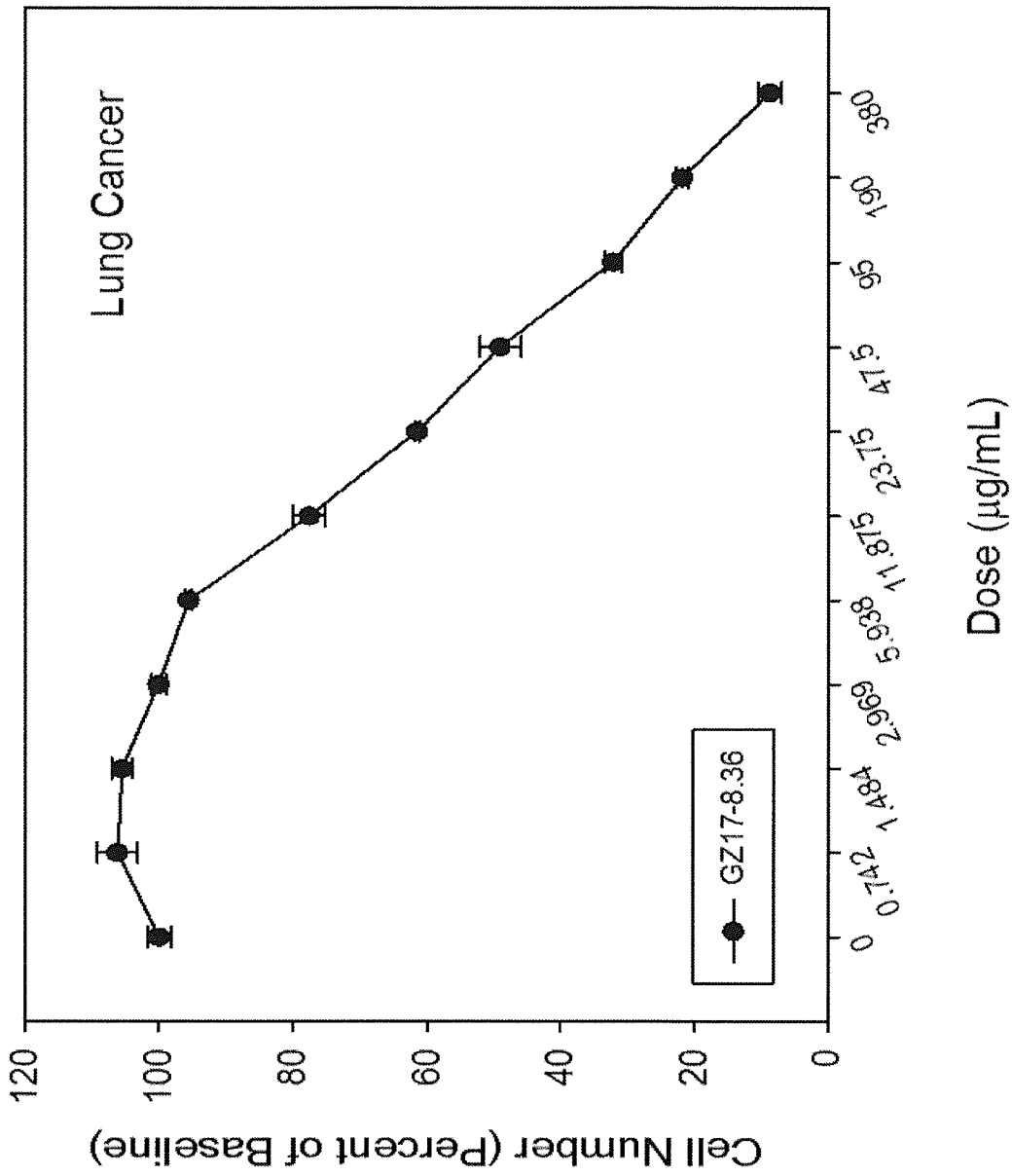

Lung Cancer
Cell Number (Percent of Baseline)
120
100
80
60
40
20
0
GZ17-8.36
0
0.742
1.484
2.969
5.938
11.875
23.75
47.5
95
190
380
Dose (µg/mL)

Fig. 54B

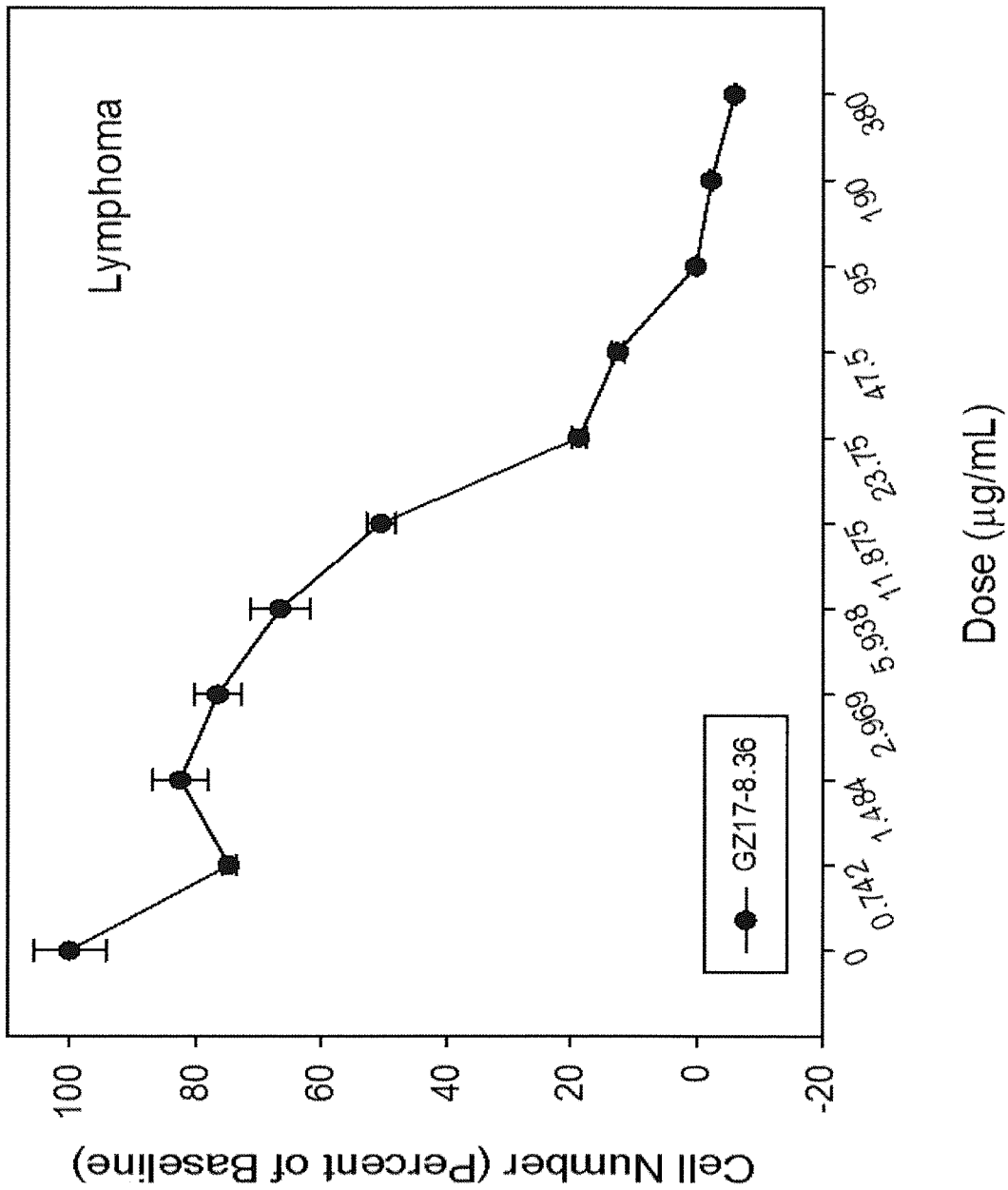

Lymphoma
GZ17-8.36
Cell Number (Percent of Baseline)
100
80
60
40
20
0
-20
0
0.742
1.484
2.969
5.938
11.875
23.75
47.5
95
190
380
Dose (µg/mL)

Fig. 54C

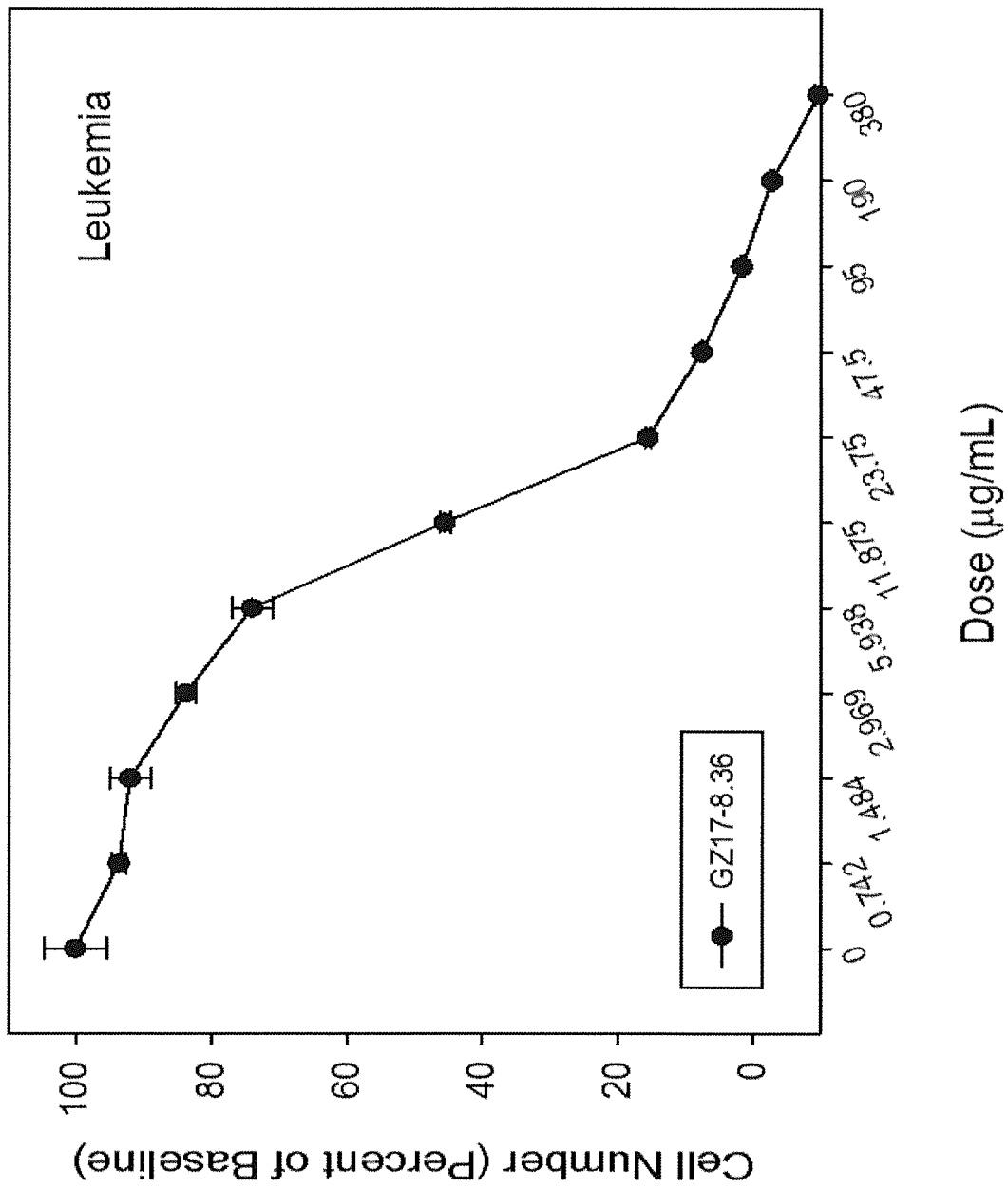

Leukemia
Cell Number (Percent of Baseline)
100
80
60
40
20
0
GZ17-8.36
0
0.742
1.484
2.969
5.938
11.875
23.75
47.5
95
190
380
Dose (µg/mL)

Fig. 54D

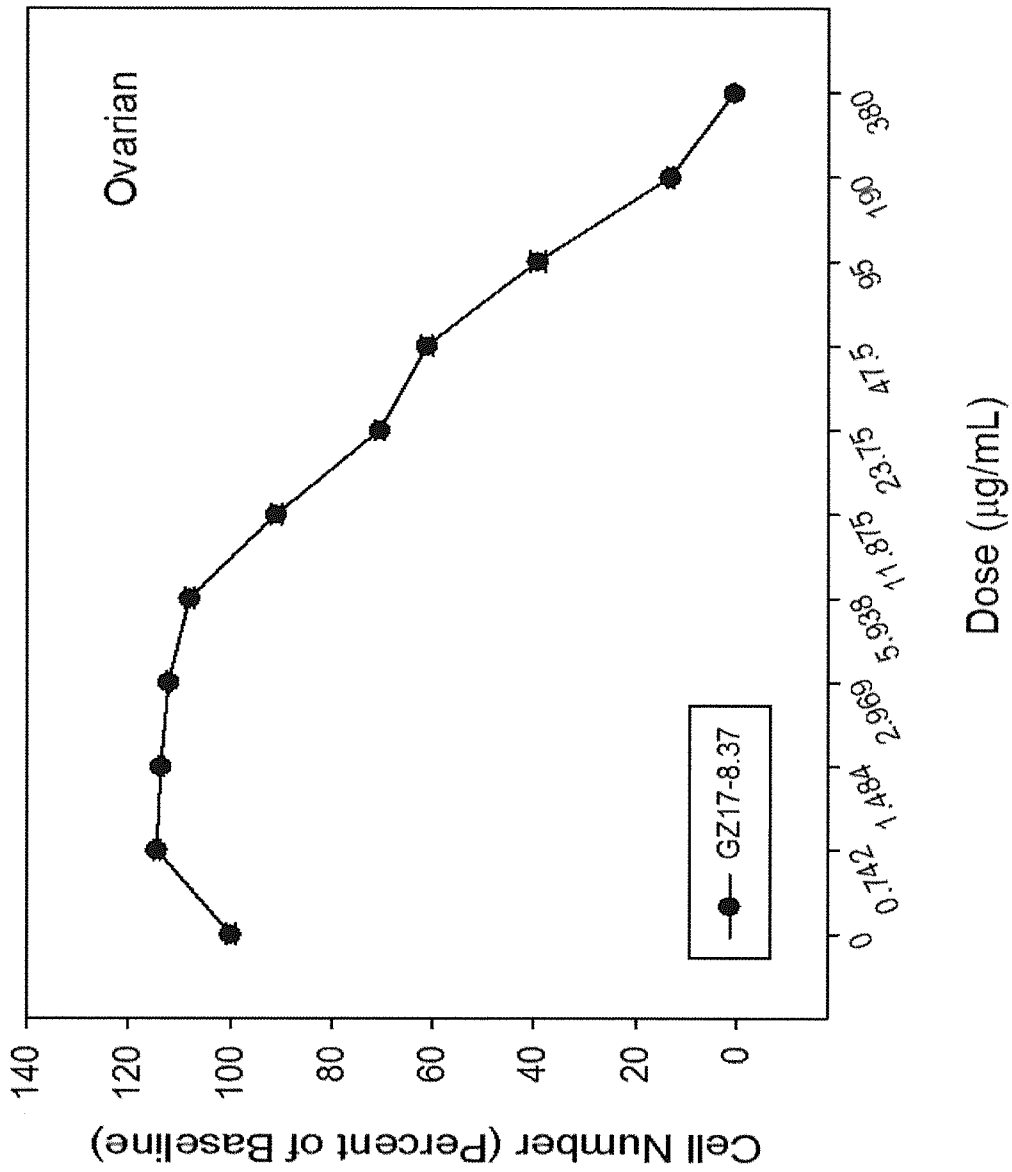

Ovarian
Cell Number (Percent of Baseline)
0
20
40
60
80
100
120
140
GZ17-8.37
0
0.142
1.484
2.969
5.938
11.875
23.75
47.5
95
190
380
Dose (µg/mL)

Fig. 55A

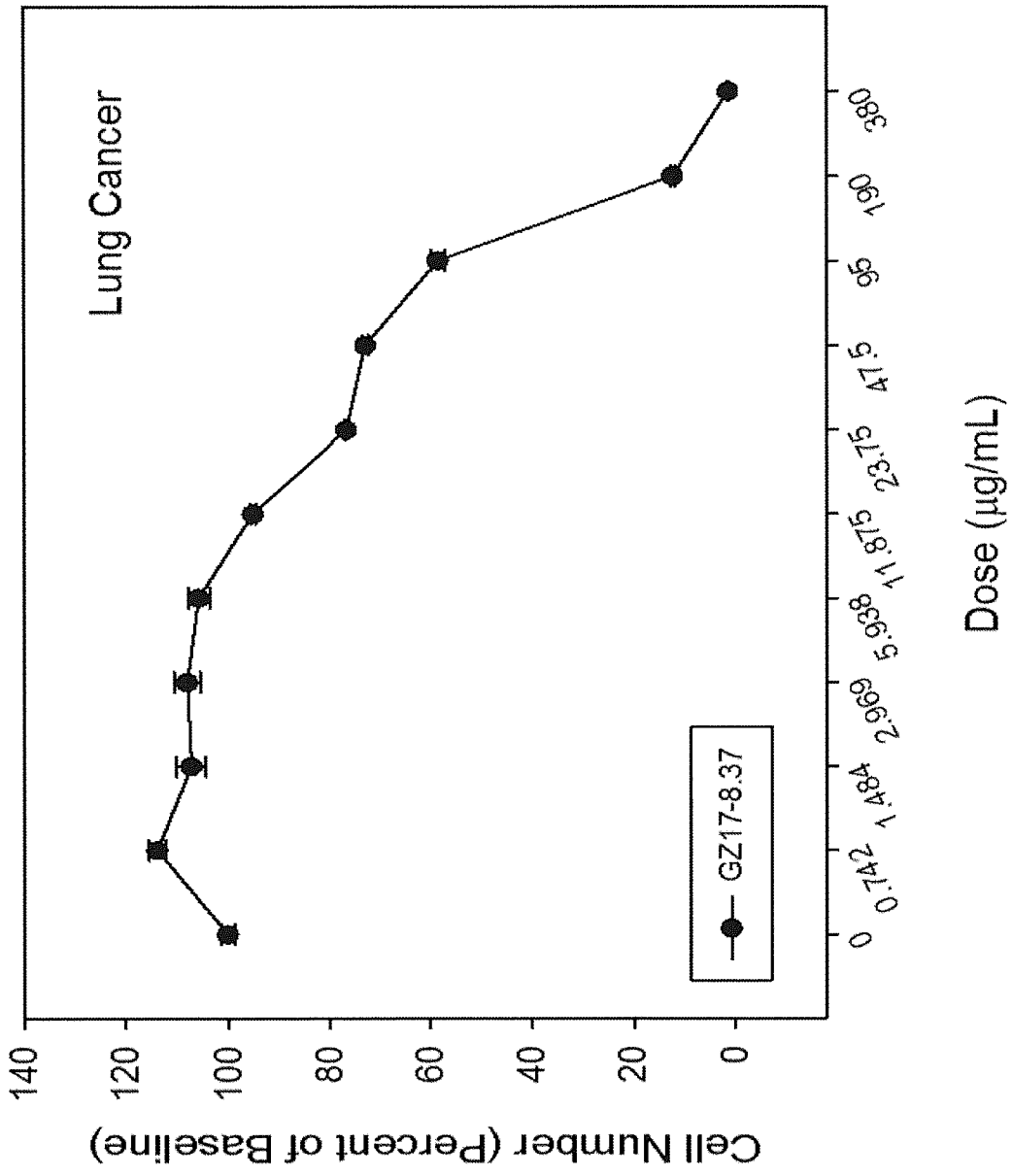

Lung Cancer
Cell Number (Percent of Baseline)
140
120
100
80
60
40
20
0
GZ17-8.37
0
0.742
1.484
2.969
5.938
11.875
23.75
47.5
95
190
380
Dose (µg/mL)

Fig. 55B

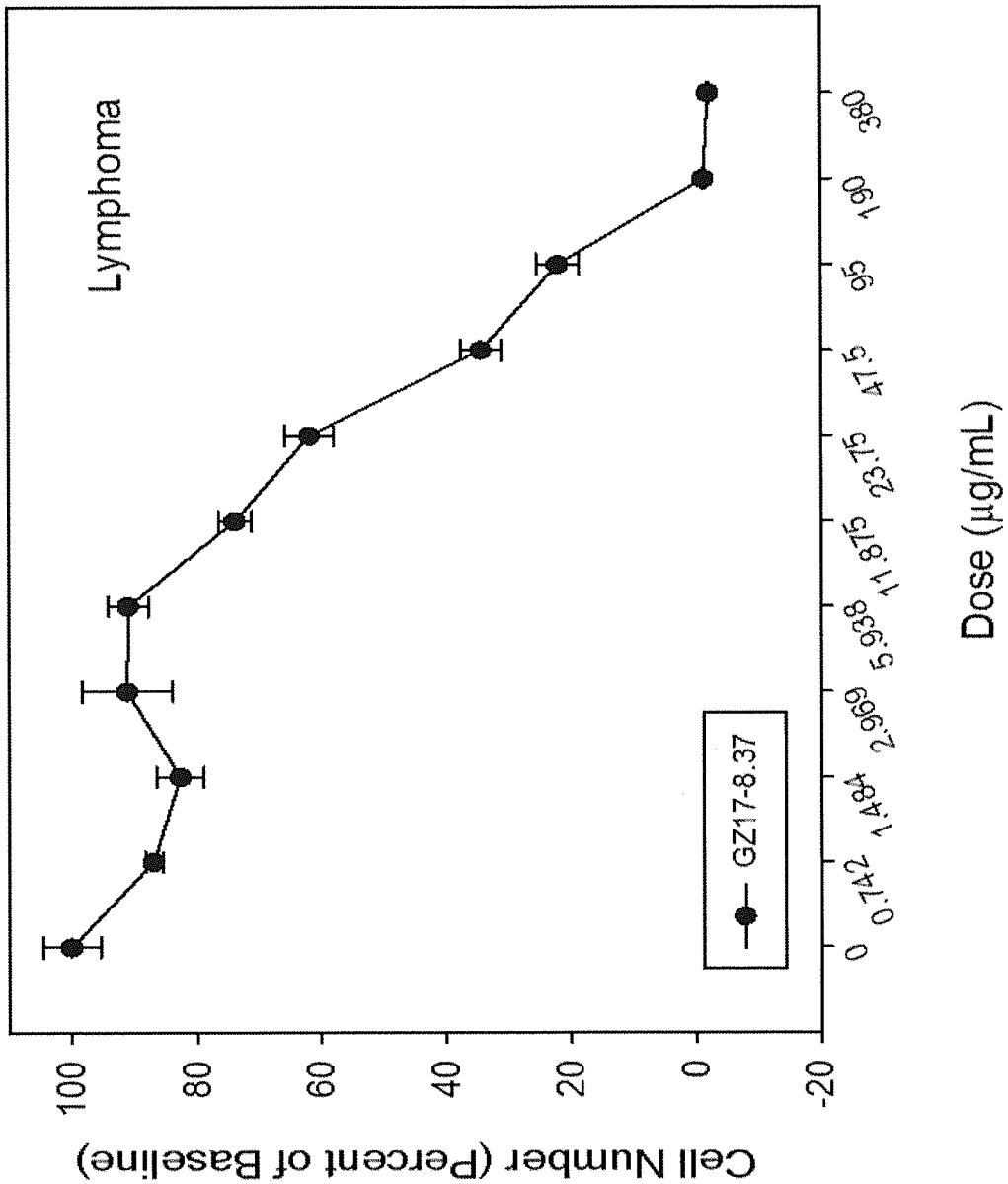

Lymphoma
GZ17-8.37
Cell Number (Percent of Baseline)
100
80
60
40
20
0
-20
0
0.742
1.484
2.969
5.938
11.875
23.75
47.5
95
190
380
Dose (µg/mL)

Fig. 55C

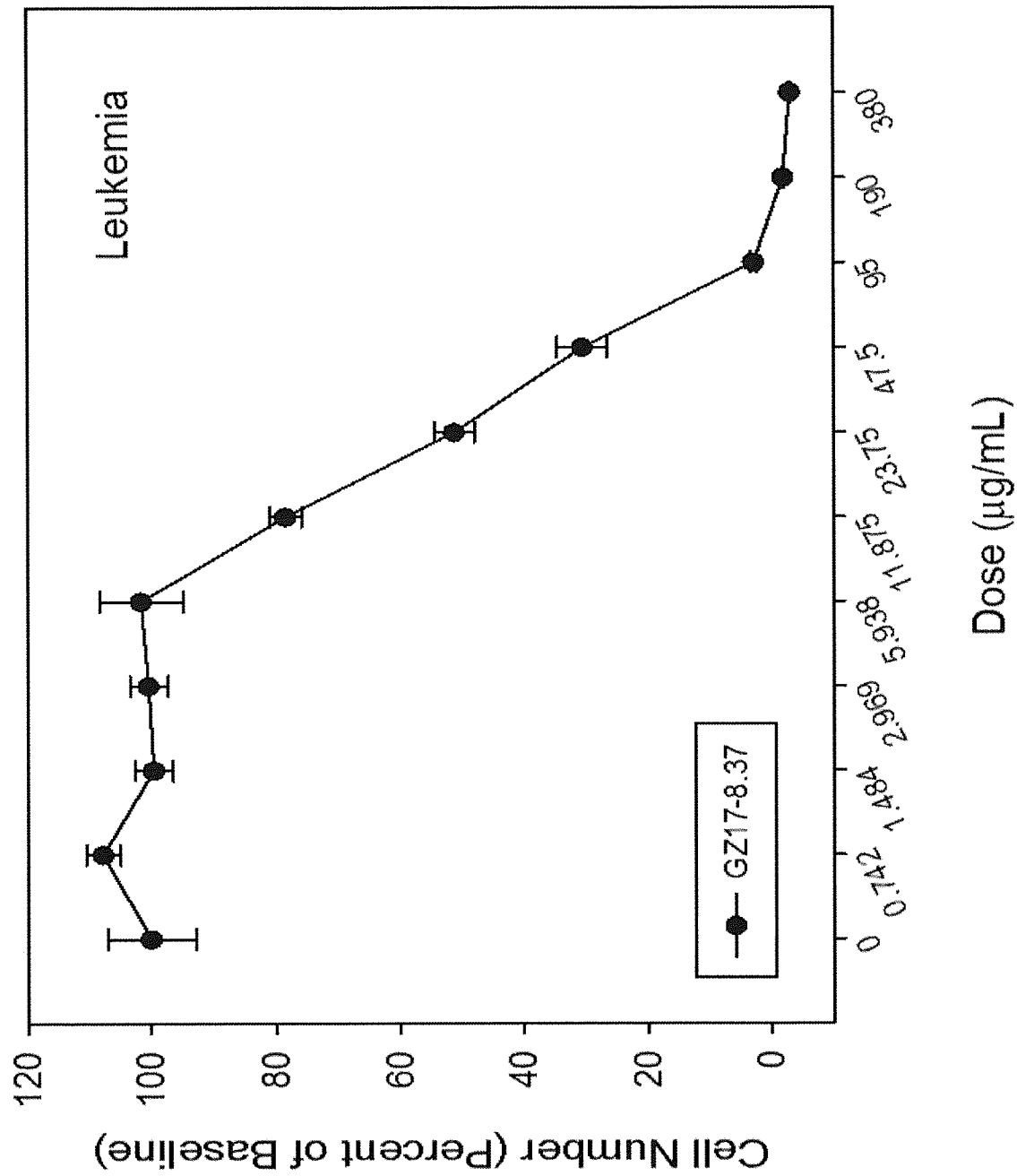

Leukemia
GZ17-8.37
Cell Number (Percent of Baseline)
0
20
40
60
80
100
120
0
0.742
1.484
2.969
5.938
11.875
23.75
47.5
95
190
380
Dose (µg/mL)

Fig. 55D

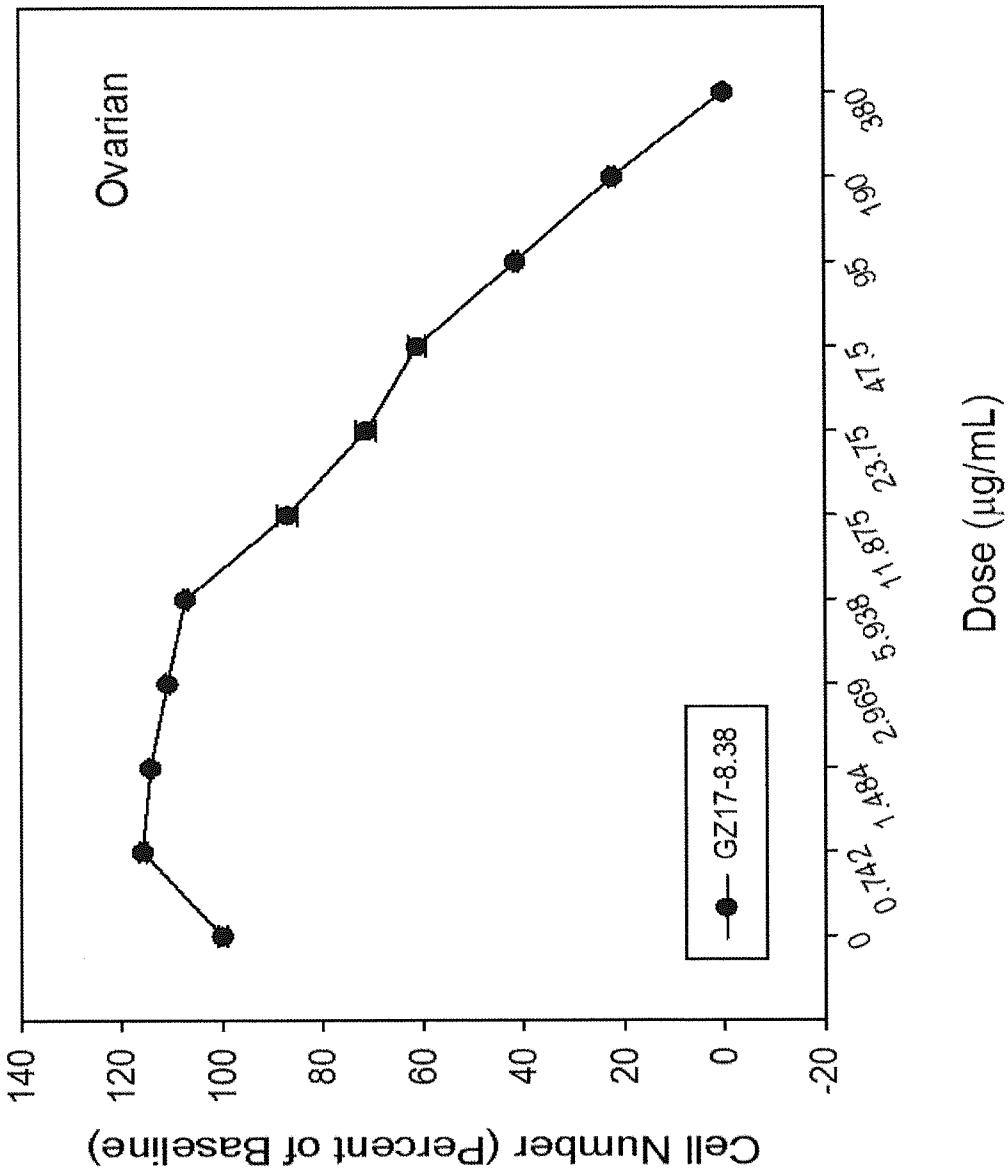

Ovarian
Cell Number (Percent of Baseline)
140
120
100
80
60
40
20
0
-20
GZ17-8.38
0
0.742
1.484
2.969
5.938
11.875
23.75
47.5
95
190
380
Dose (µg/mL)

Fig. 56A

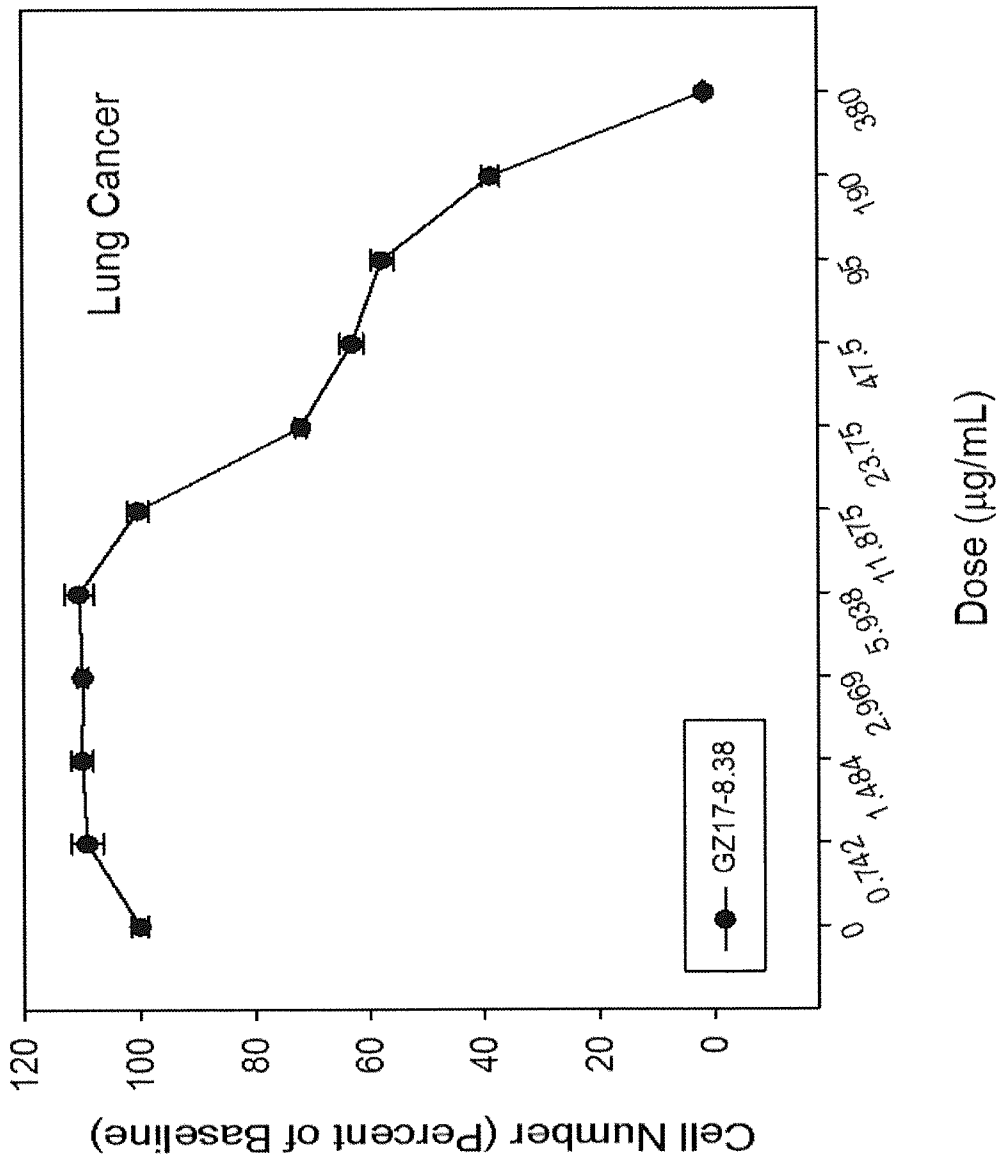

Lung Cancer
Cell Number (Percent of Baseline)
120
100
80
60
40
20
0
GZ17-8.38
0
0.142
1.484
2.969
5.938
11.875
23.75
47.5
95
190
380
Dose (µg/mL)

Fig. 56B

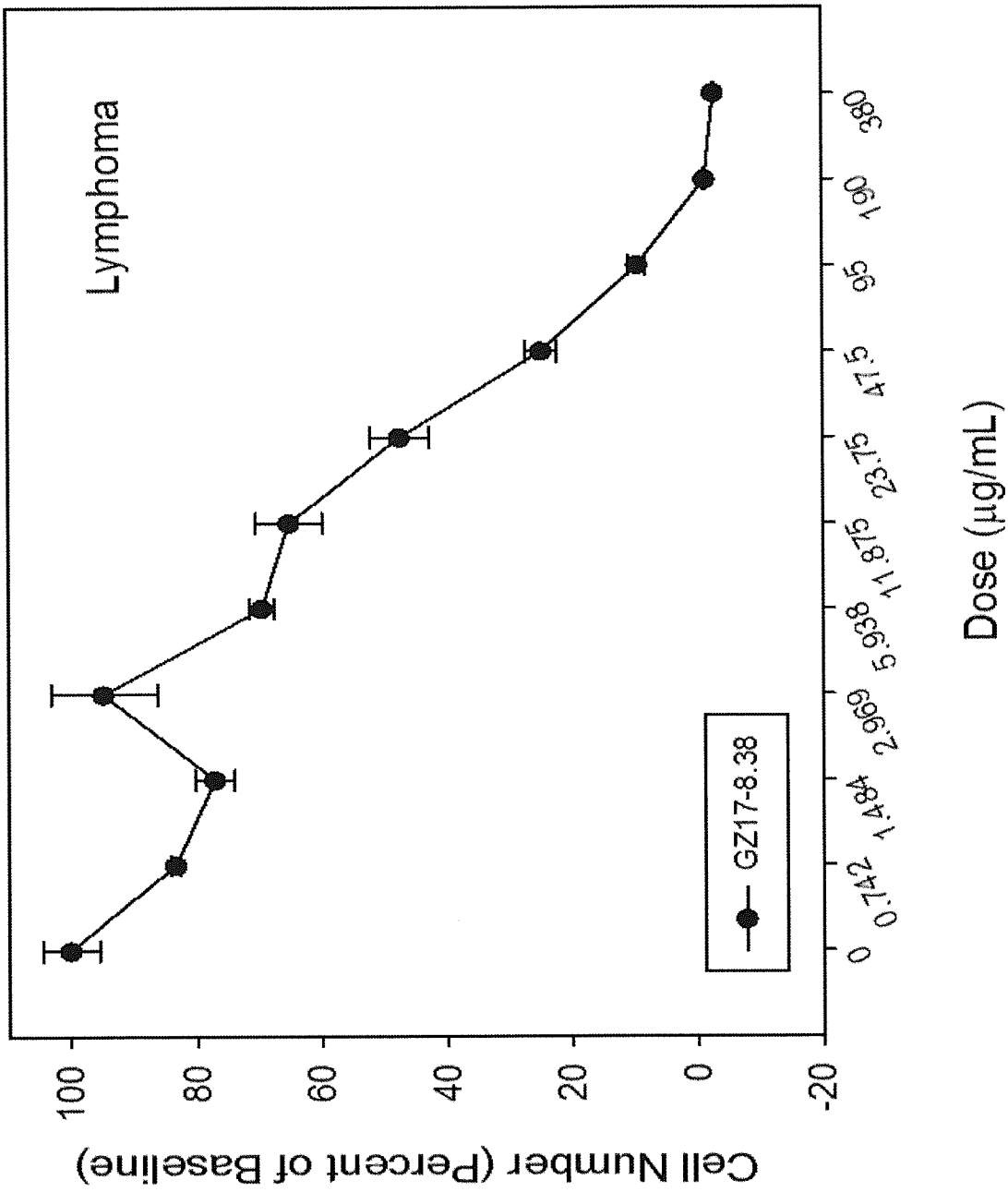

Lymphoma
Cell Number (Percent of Baseline)
100
80
60
40
20
0
-20
GZ17-8.38
0
0.742
1.484
2.969
5.938
11.875
23.75
47.5
95
190
380
Dose (µg/mL)

Fig. 56C

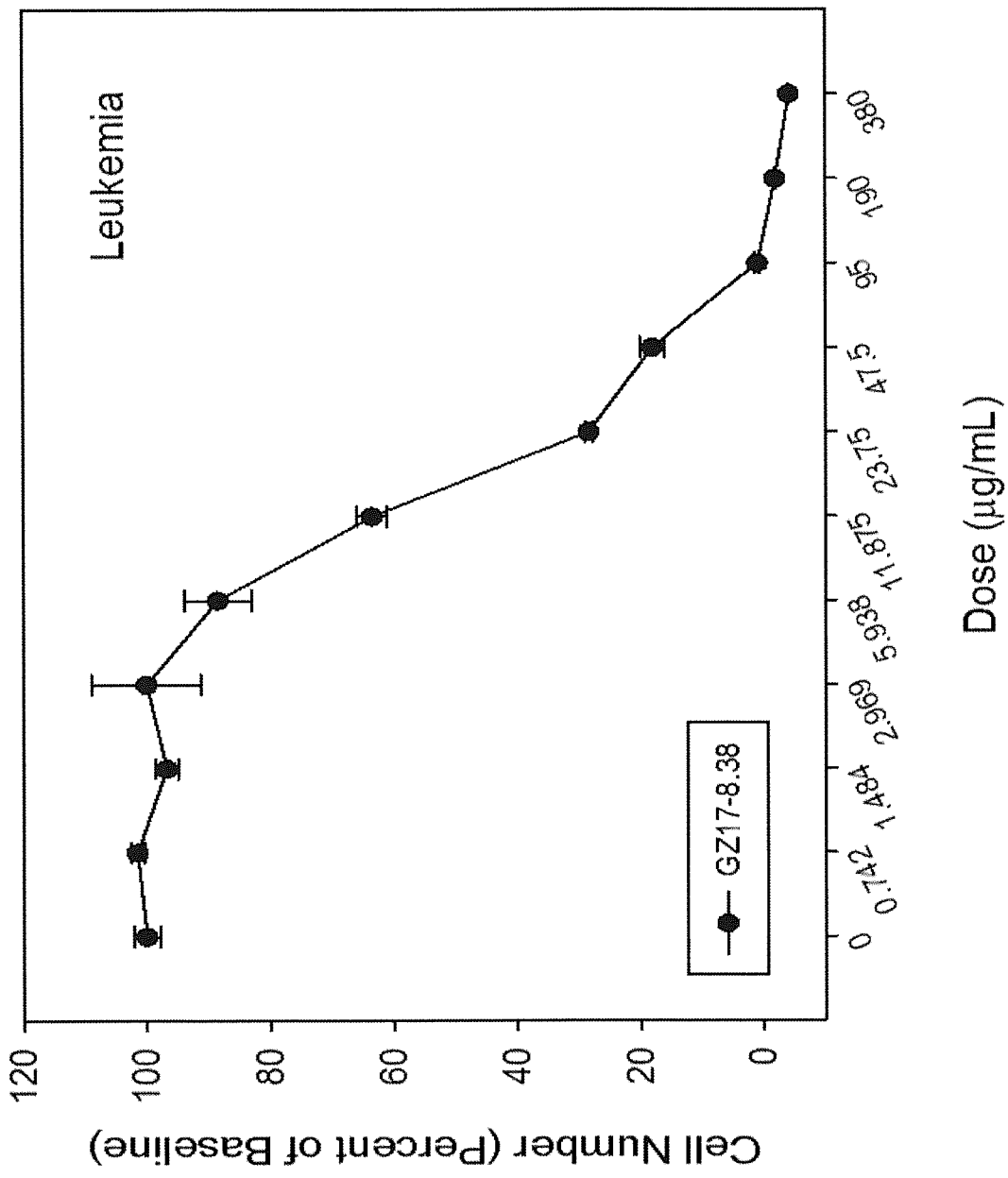

Leukemia
Cell Number (Percent of Baseline)
120
100
80
60
40
20
0
GZ17-8.38
0
0.742
1.484
2.969
5.938
11.875
23.75
47.5
95
190
380
Dose (µg/mL)

Fig. 56D

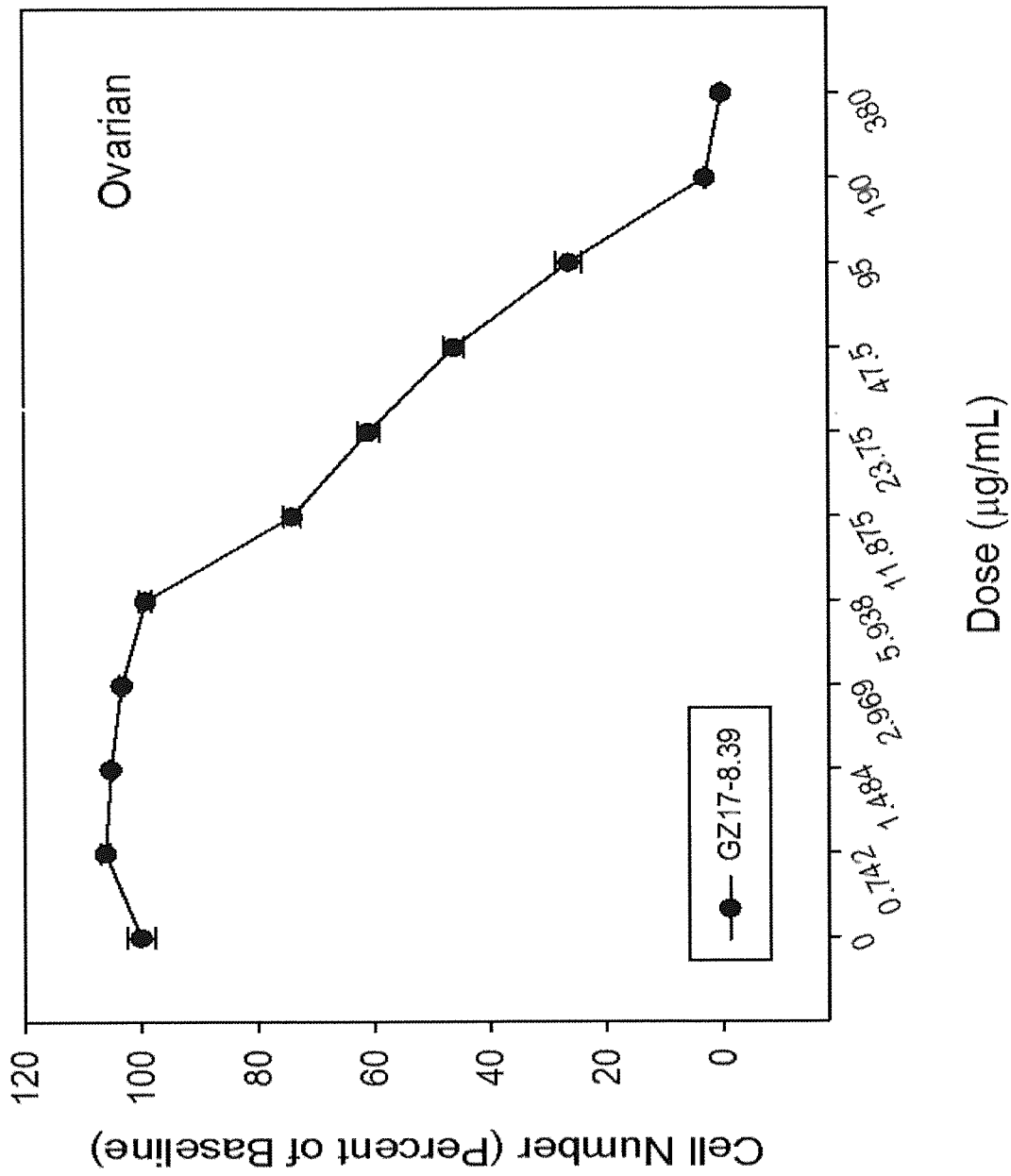

Ovarian
Cell Number (Percent of Baseline)
120
100
80
60
40
20
0
GZ17-8.39
0
0.742
1.484
2.969
5.938
11.875
23.75
47.5
95
190
380
Dose (µg/mL)

Fig. 57A

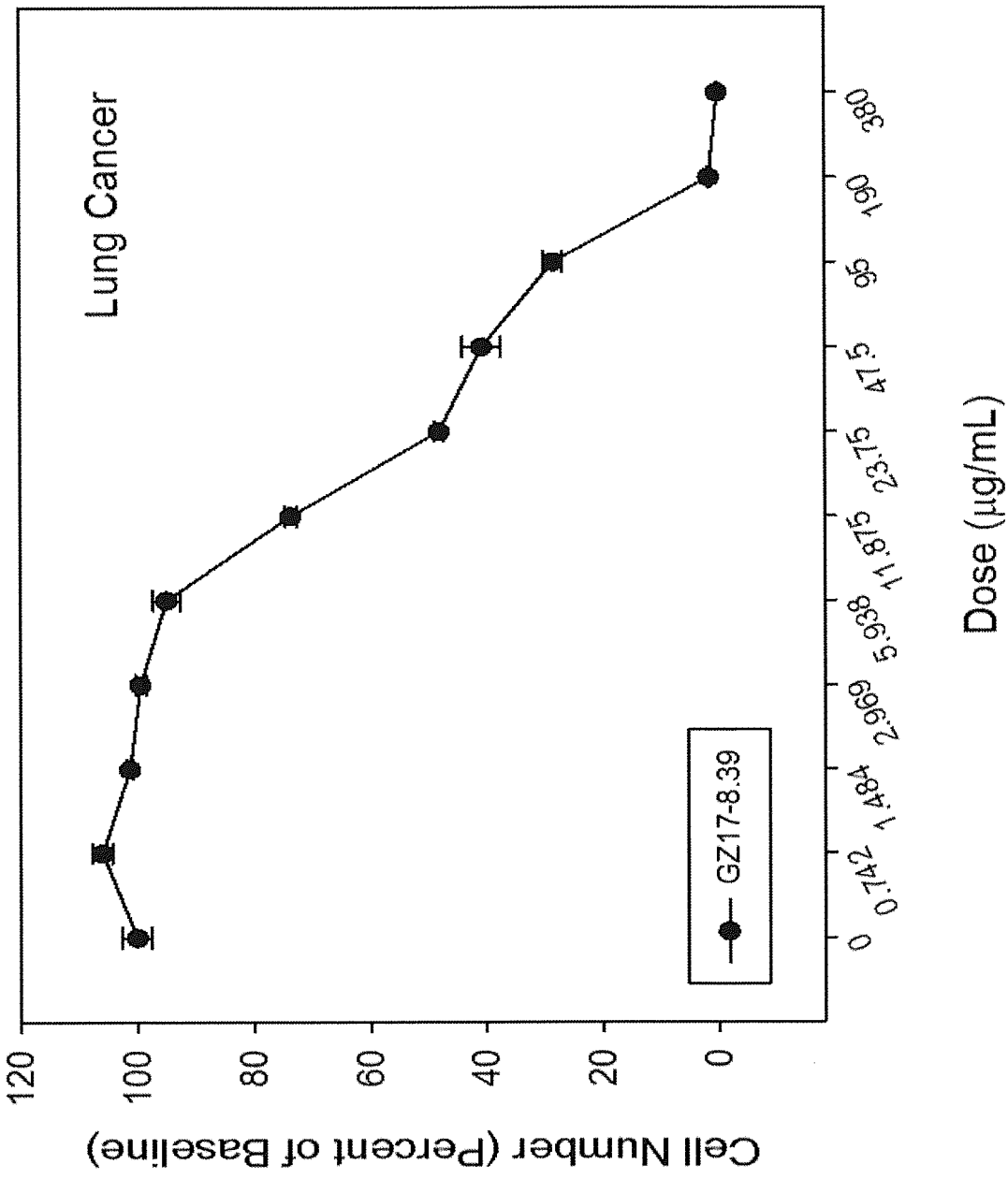

Lung Cancer
GZ17-8.39
Cell Number (Percent of Baseline)
120
100
80
60
40
20
0
0
0.742
1.484
2.969
5.938
11.875
23.75
47.5
95
190
380
Dose (µg/mL)

Fig. 57B

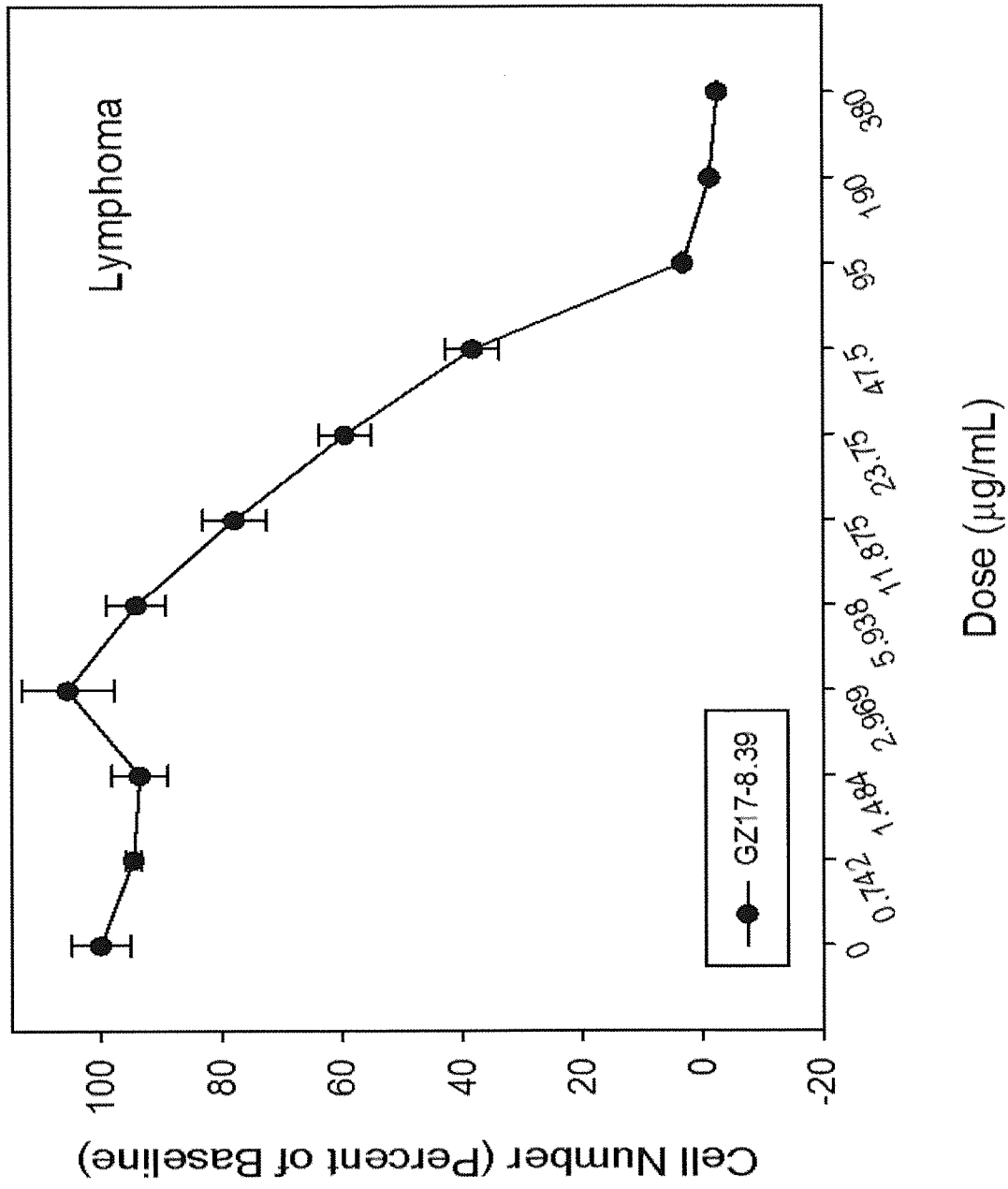

Lymphoma
Cell Number (Percent of Baseline)
100
80
60
40
20
0
-20
GZ17-8.39
0
0.142
1.484
2.969
5.938
11.875
23.75
47.5
95
190
380
Dose (µg/mL)

Fig. 57C

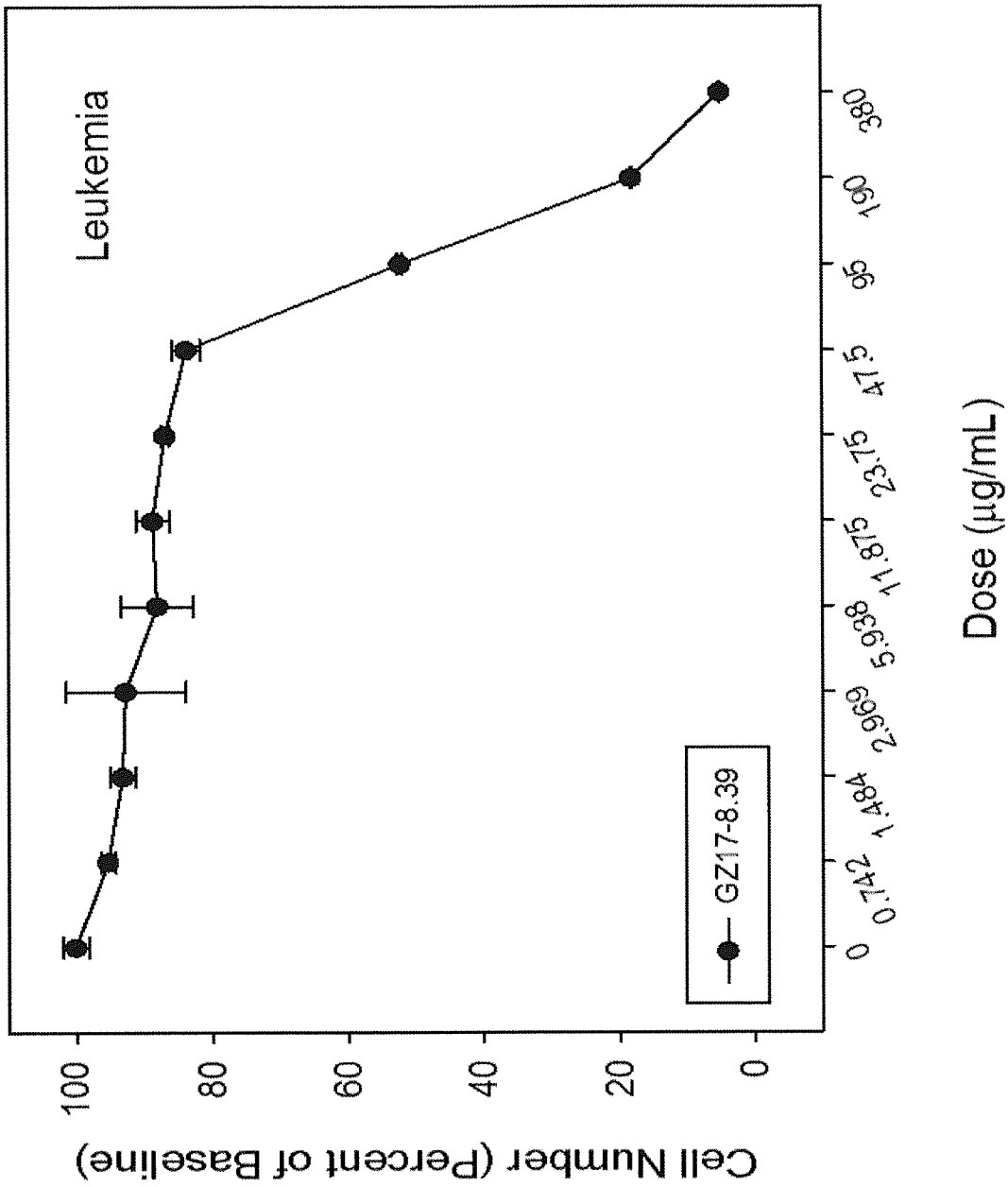

Leukemia
Cell Number (Percent of Baseline)
100
80
60
40
20
0
GZ17-8.39
0
0.742
1.484
2.969
5.938
11.875
23.75
47.5
95
190
380
Dose (µg/mL)

Fig. 57D

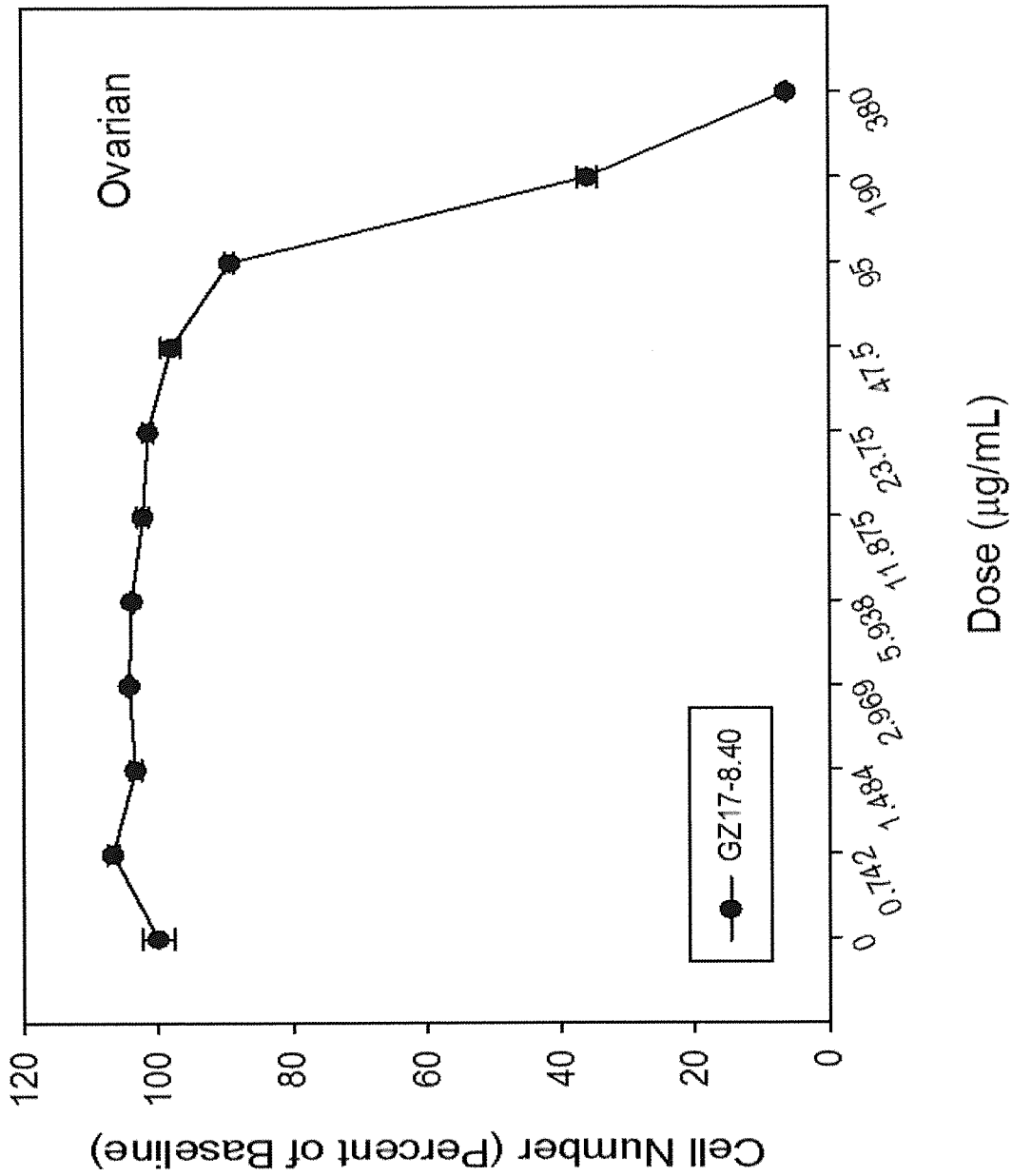

Ovarian
Cell Number (Percent of Baseline)
120
100
80
60
40
20
0
GZ17-8.40
0
0.742
1.484
2.969
5.938
11.875
23.75
47.5
95
190
380
Dose (µg/mL)

Fig. 58A

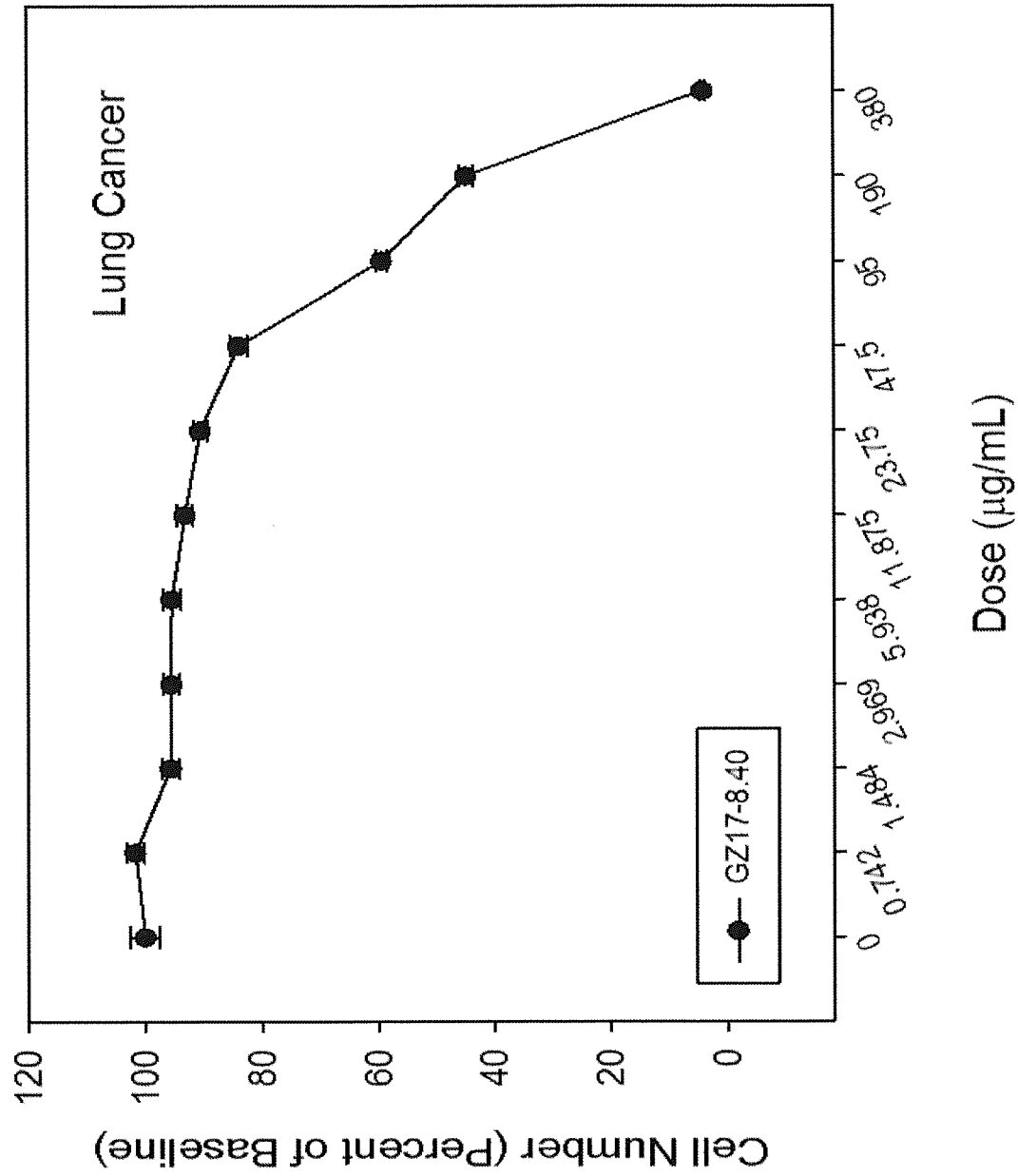

Lung Cancer
Cell Number (Percent of Baseline)
120
100
80
60
40
20
0
GZ17-8.40
0
0.742
1.484
2.969
5.938
11.875
23.75
47.5
95
190
380
Dose (µg/mL)

Fig. 58B

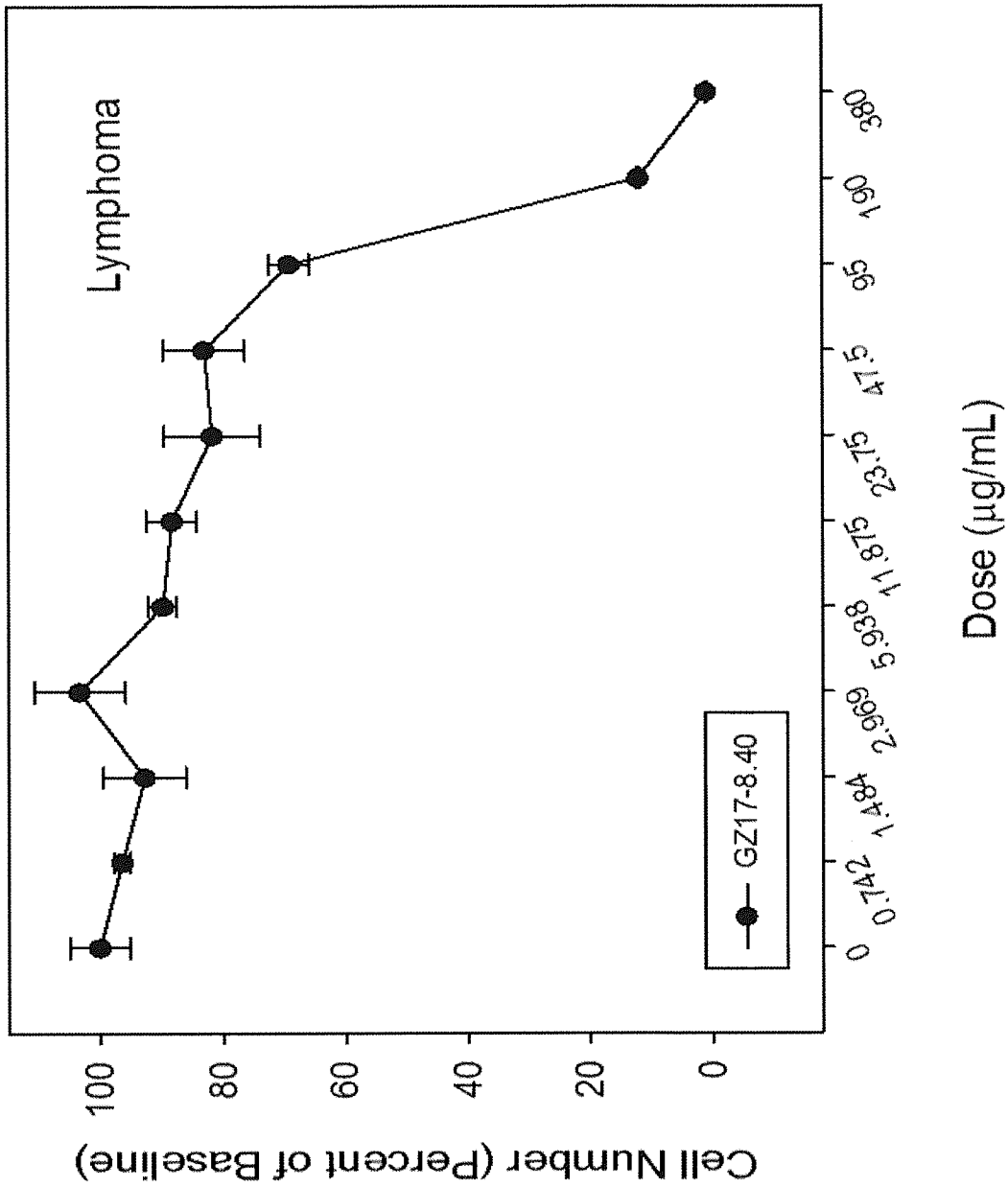

Lymphoma
Cell Number (Percent of Baseline)
100
80
60
40
20
0
GZ17-8.40
0
0.742
1.484
2.969
5.938
11.875
23.75
47.5
95
190
380
Dose (µg/mL)

Fig. 58C

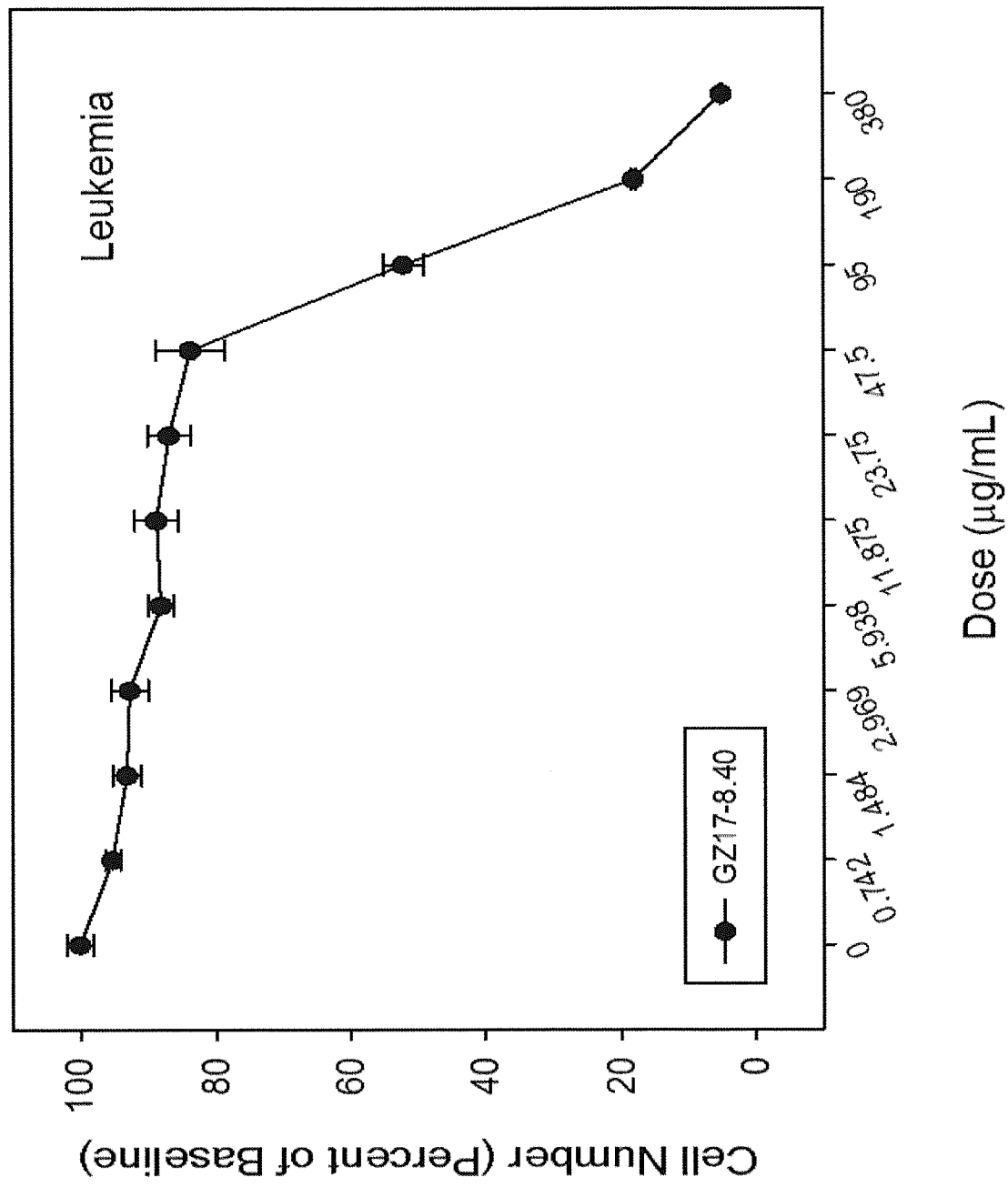

Leukemia
Cell Number (Percent of Baseline)
100
80
60
40
20
0
GZ17-8.40
0
0.142
1.484
2.969
5.938
11.875
23.75
47.5
95
190
380
Dose (µg/mL)

Fig. 58D

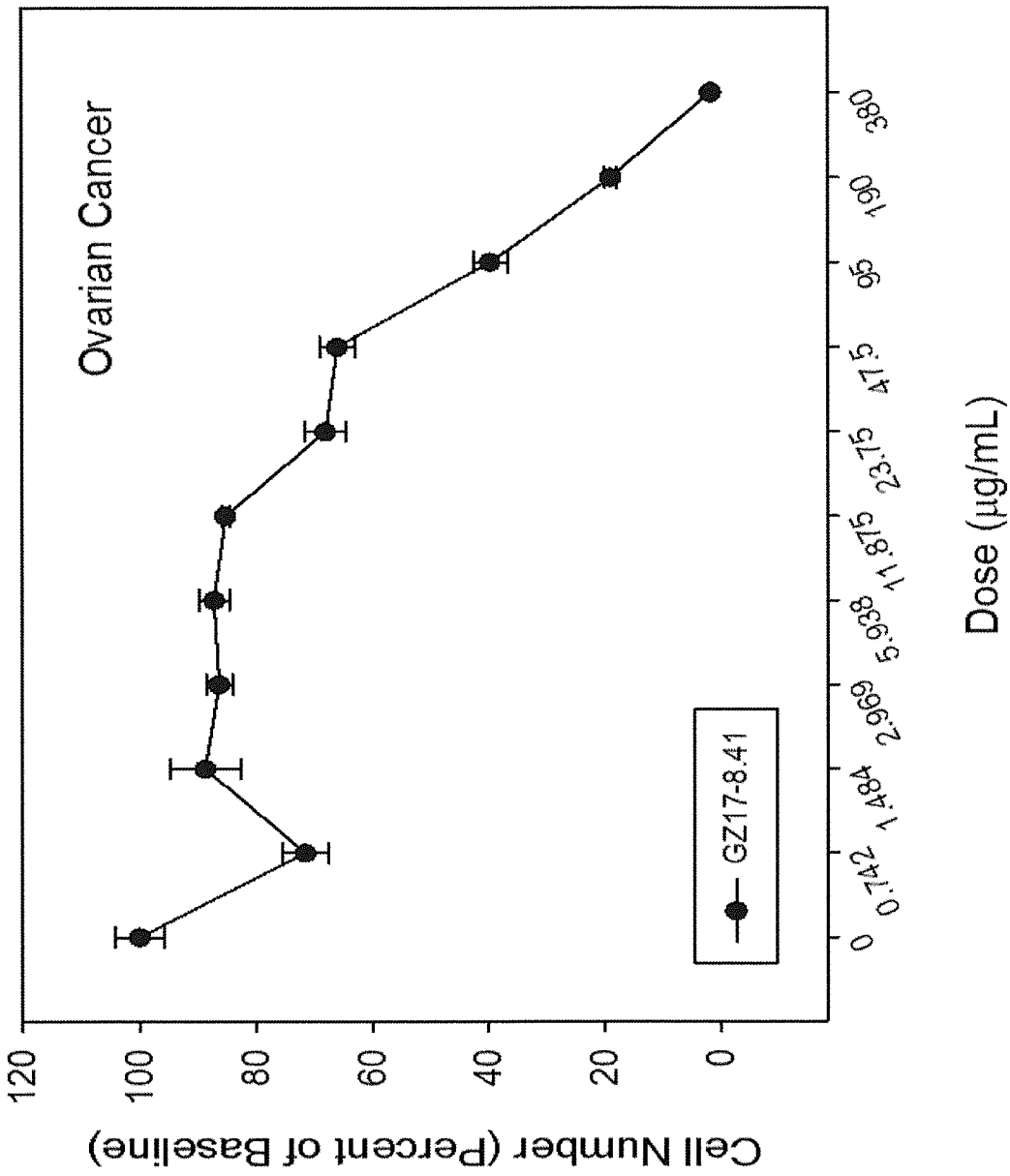

Ovarian Cancer
Cell Number (Percent of Baseline)
120
100
80
60
40
20
0
GZ17-8.41
0
0.742
1.484
2.969
5.938
11.875
23.75
47.5
95
190
380
Dose (µg/mL)

Fig. 59A

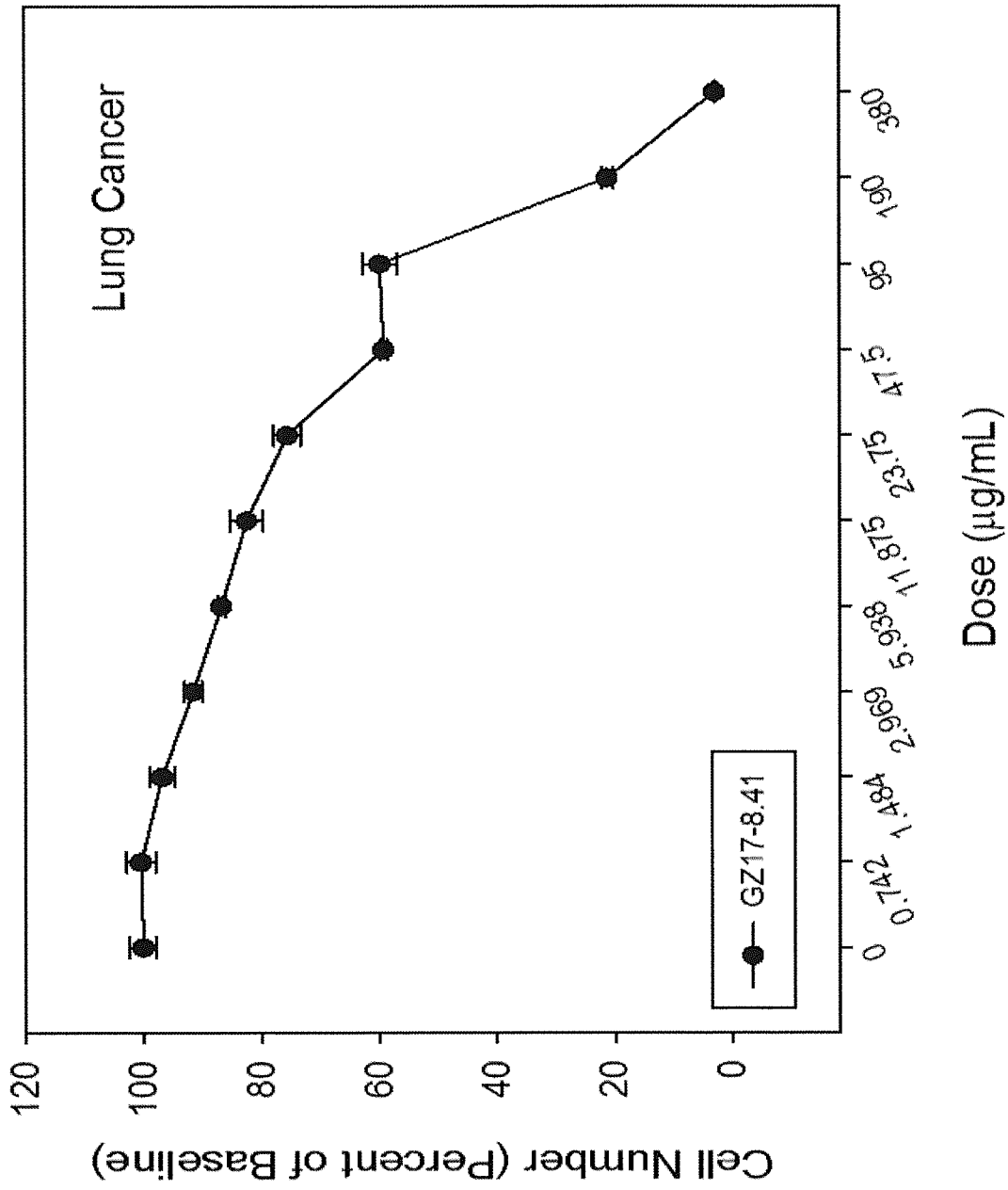

Lung Cancer
Cell Number (Percent of Baseline)
120
100
80
60
40
20
0
GZ17-8.41
0
0.742
1.484
2.969
5.938
11.875
23.75
47.5
95
190
380
Dose (µg/mL)

Fig. 59B

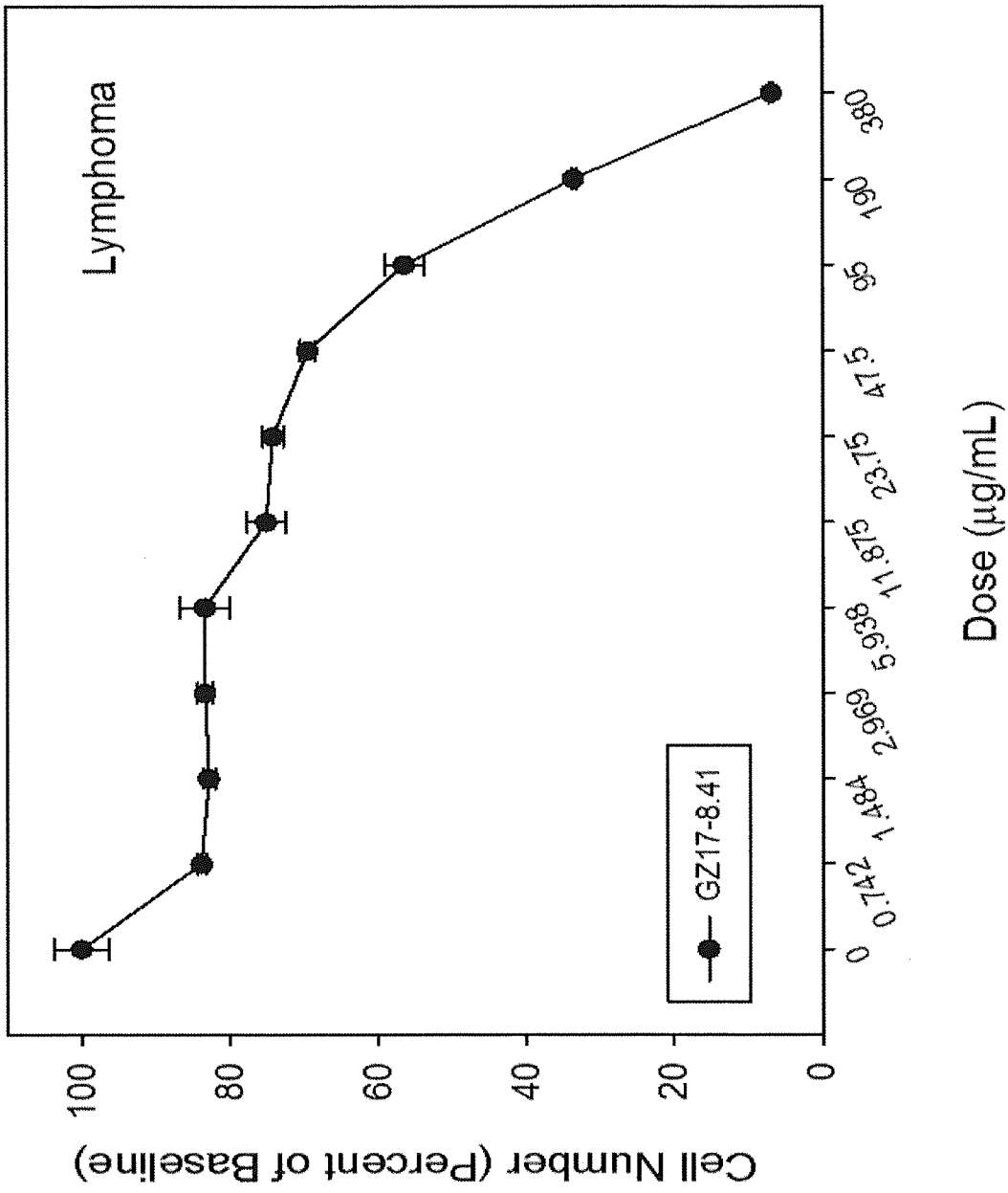

Lymphoma
Cell Number (Percent of Baseline)
100
80
60
40
20
0
GZ17-8.41
0
0.742
1.484
2.969
5.938
11.875
23.75
47.5
95
190
380
Dose (µg/mL)

Fig. 59C

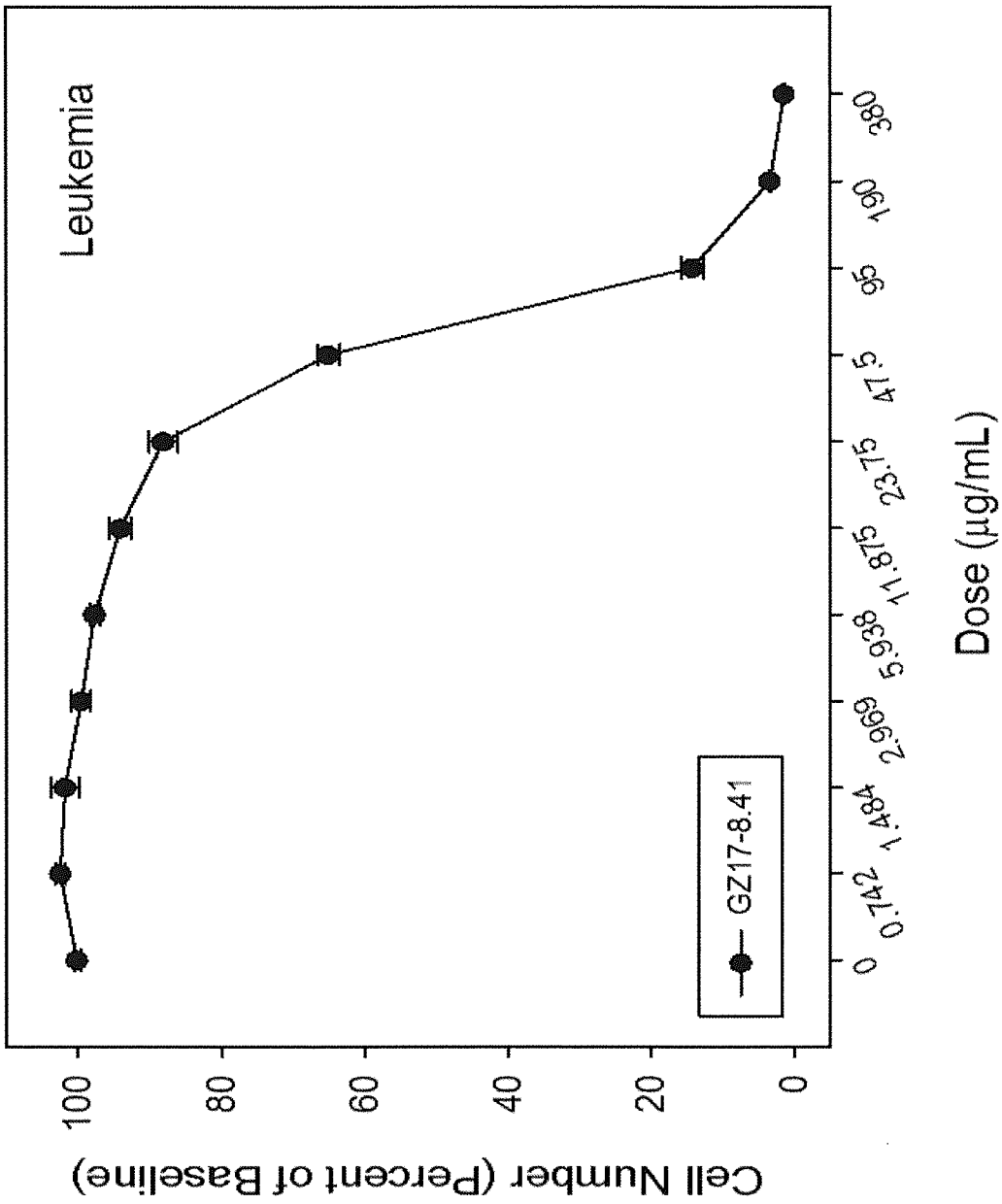

Leukemia
Cell Number (Percent of Baseline)
0
20
40
60
80
100
GZ17-8.41
0
0.7812
1.484
2.969
5.938
11.875
23.75
47.5
95
190
380
Dose (µg/mL)

Fig. 59D

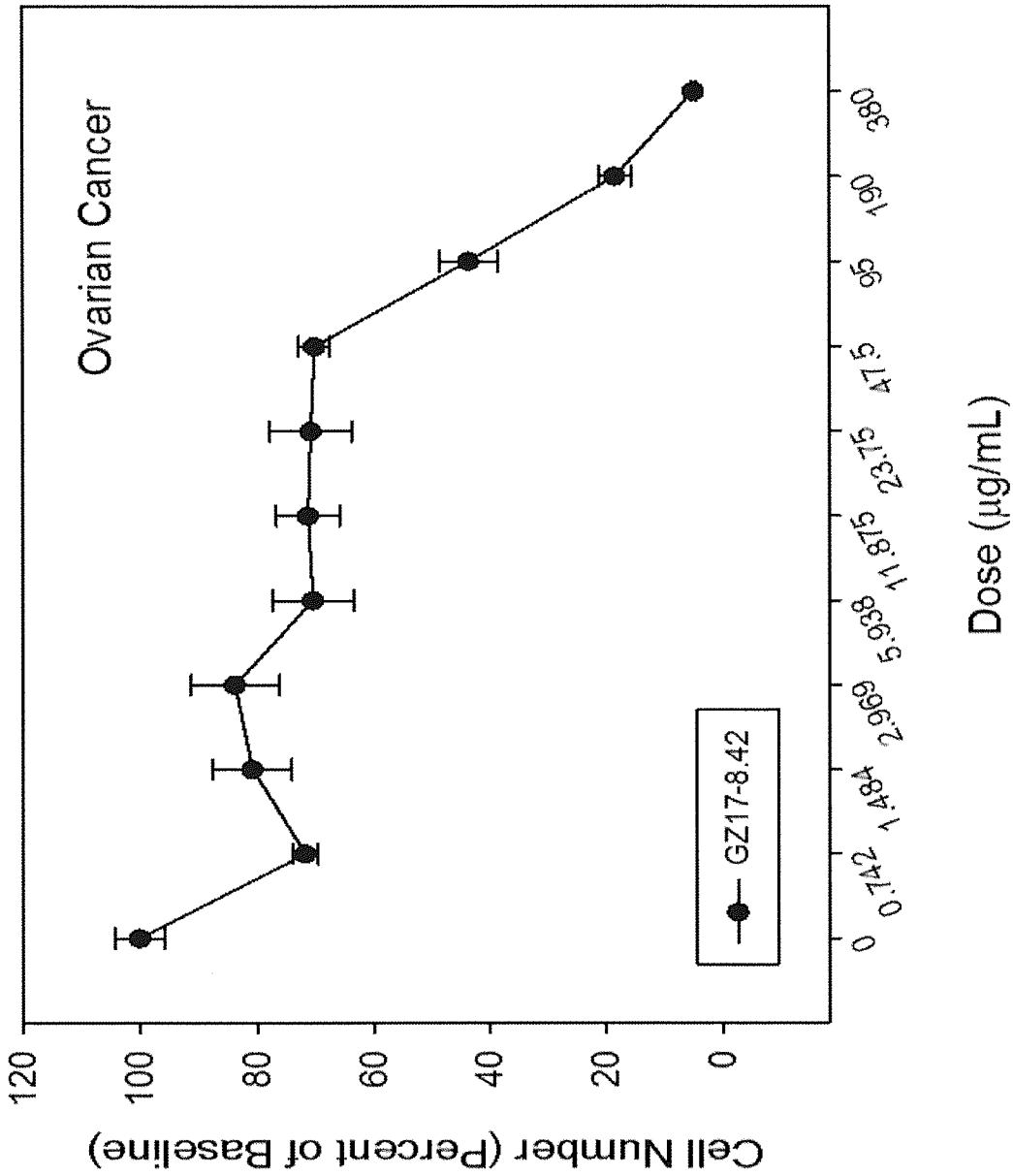

Ovarian Cancer
Cell Number (Percent of Baseline)
120
100
80
60
40
20
0
GZ17-8.42
0
0.742
1.484
2.969
5.938
11.875
23.75
47.5
95
190
380
Dose (µg/mL)

Fig. 60A

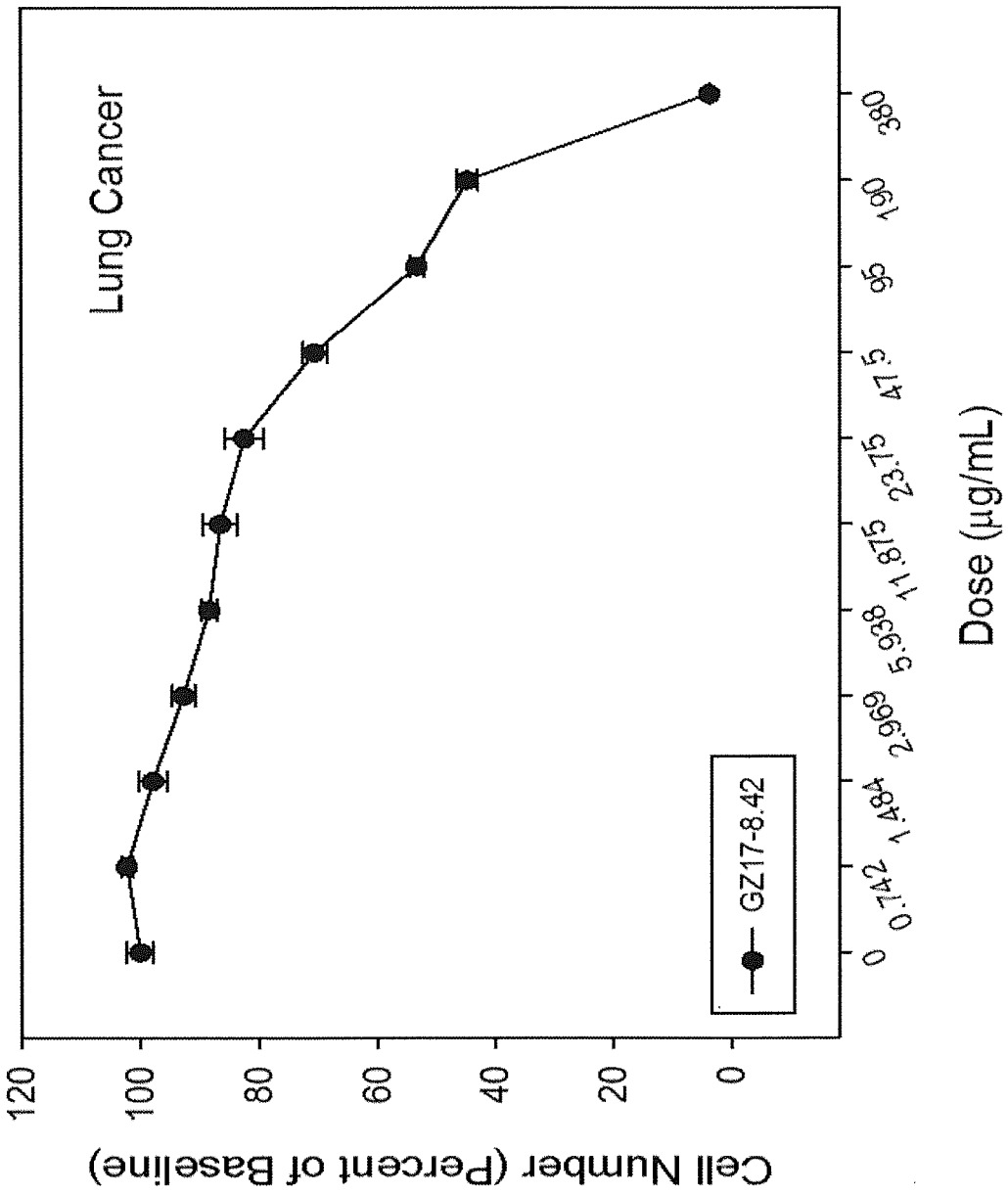

Lung Cancer
GZ17-8.42
Cell Number (Percent of Baseline)
120
100
80
60
40
20
0
0
0.742
1.484
2.969
5.938
11.875
23.75
47.5
95
190
380
Dose (µg/mL)

Fig. 60B

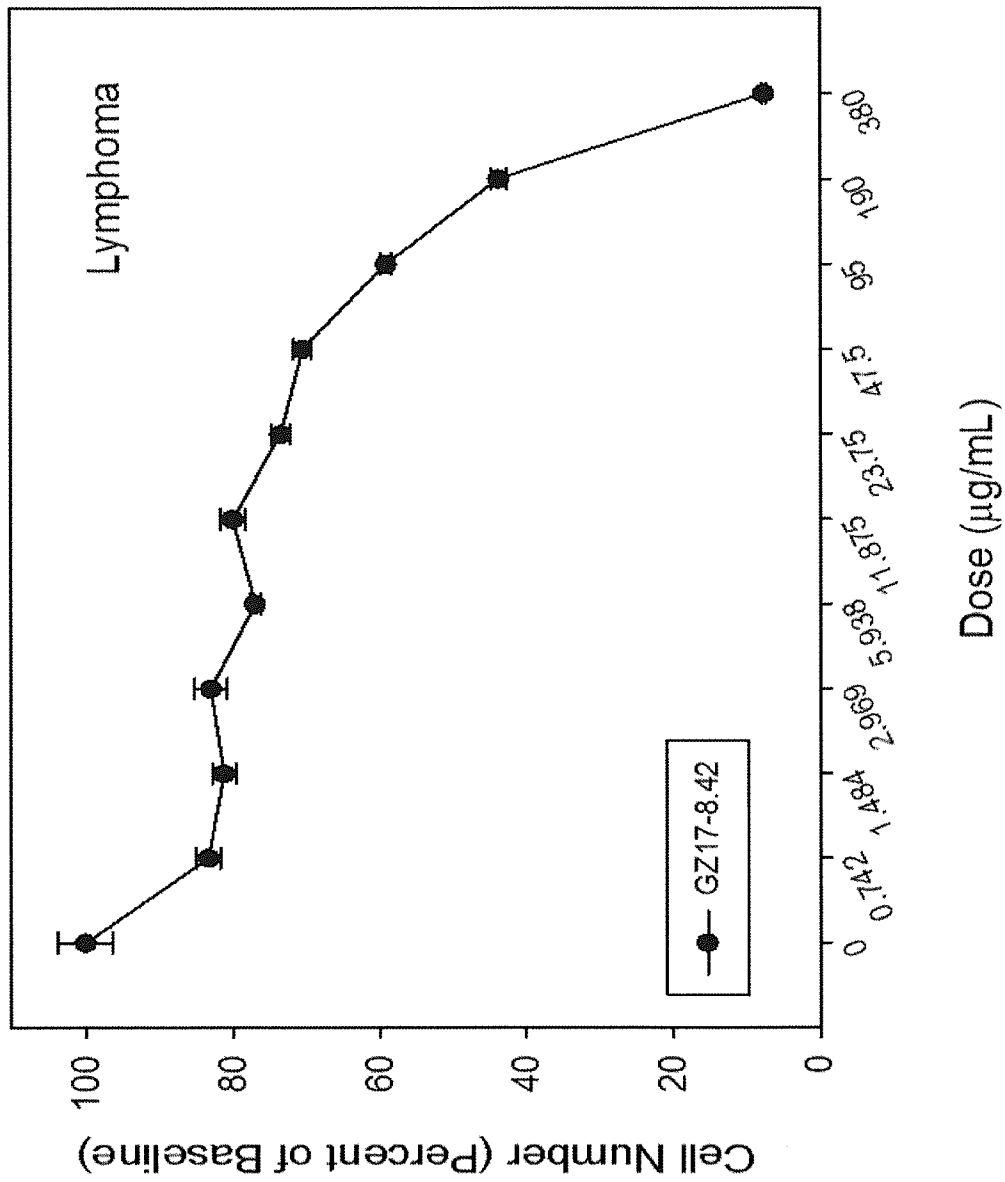

Lymphoma
Cell Number (Percent of Baseline)
0
20
40
60
80
100
GZ17-8.42
0
0.742
1.484
2.969
5.938
11.875
23.75
47.5
95
190
380
Dose (µg/mL)

Fig. 60C

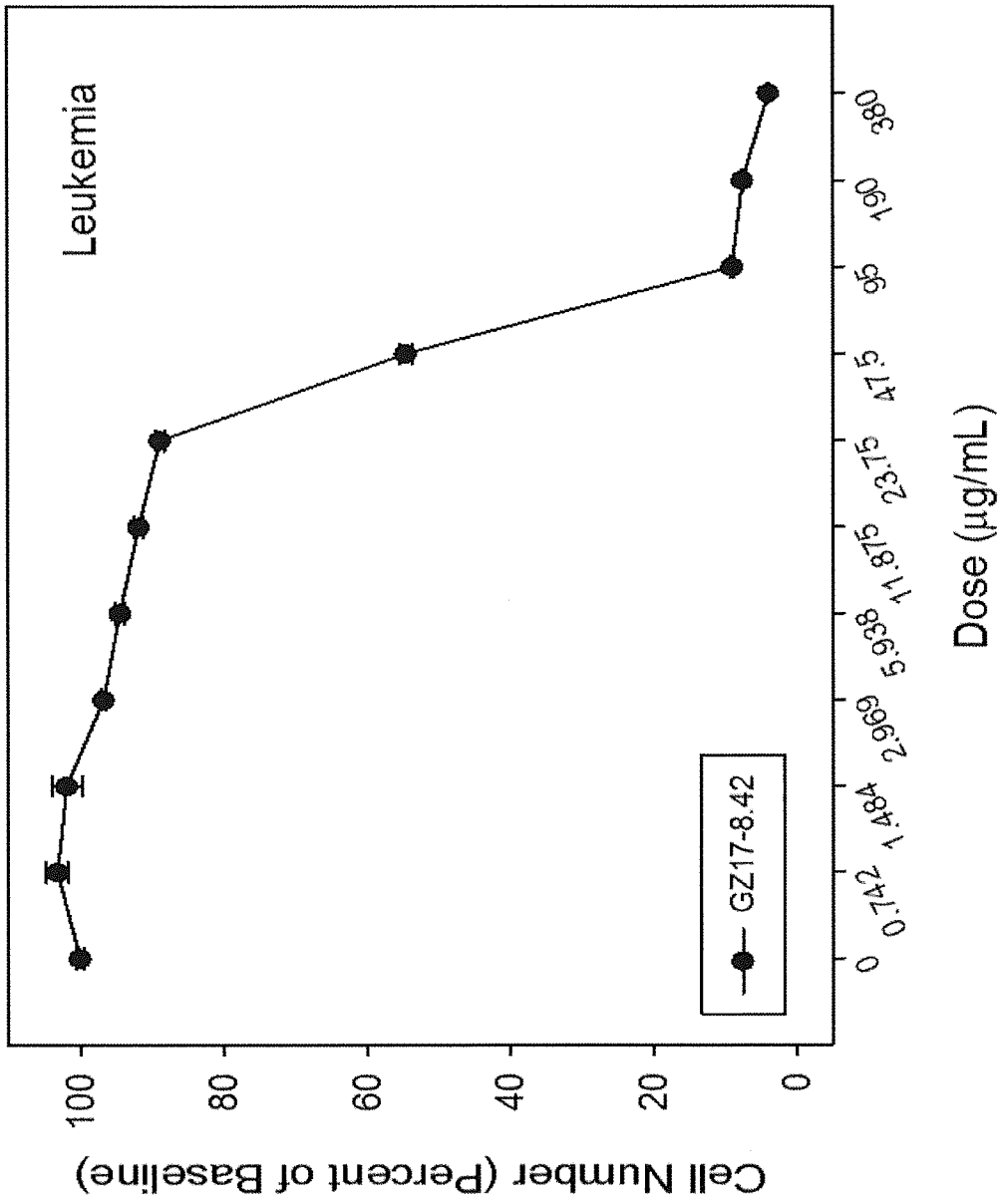

Leukemia
GZ17-8.42
Cell Number (Percent of Baseline)
0
20
40
60
80
100
0
0.742
1.484
2.969
5.938
11.875
23.75
47.5
95
190
380
Dose (µg/mL)

Fig. 60D

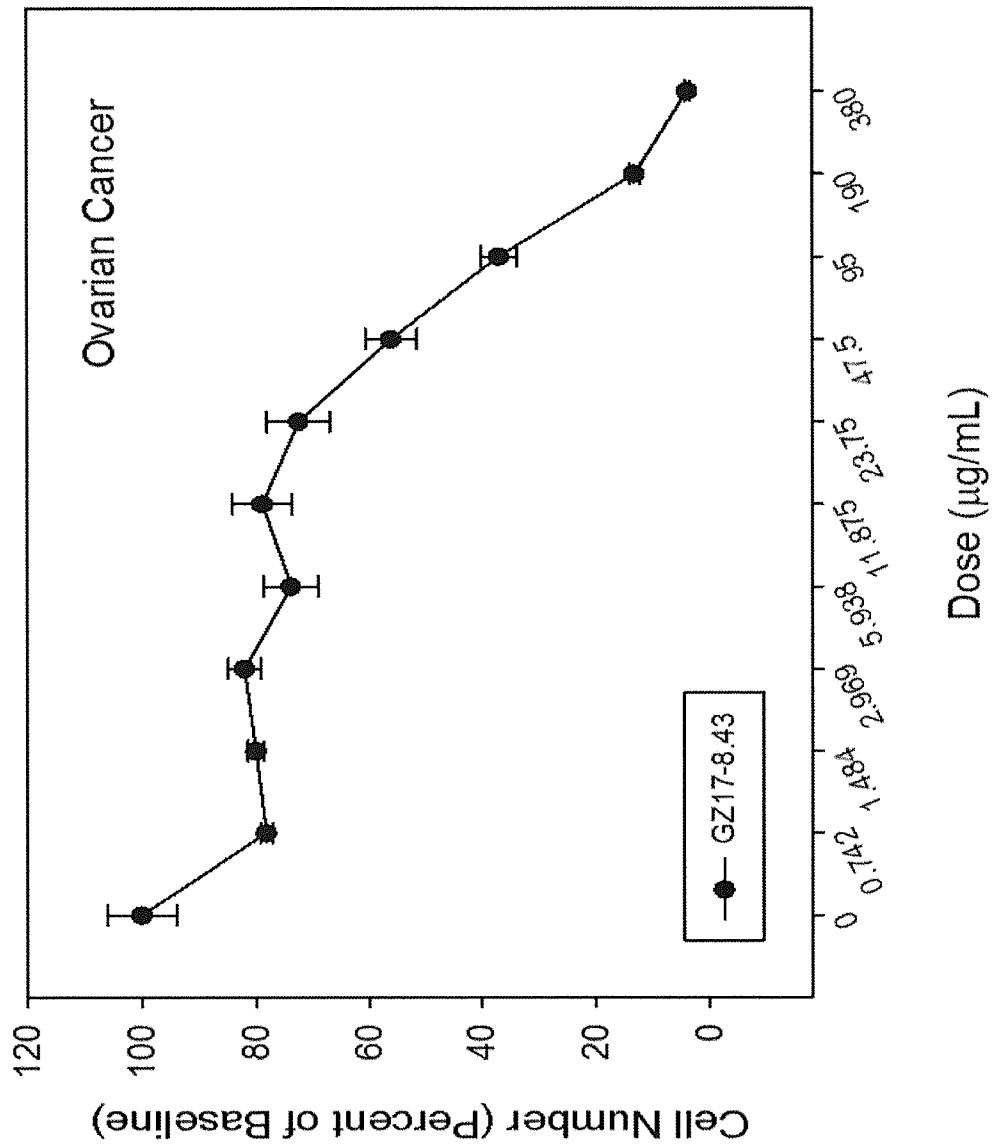

Ovarian Cancer
Cell Number (Percent of Baseline)
120
100
80
60
40
20
0
GZ17-8.43
0
0.742
1.484
2.969
5.938
11.875
23.75
47.5
95
190
380
Dose (µg/mL)

Fig. 61A

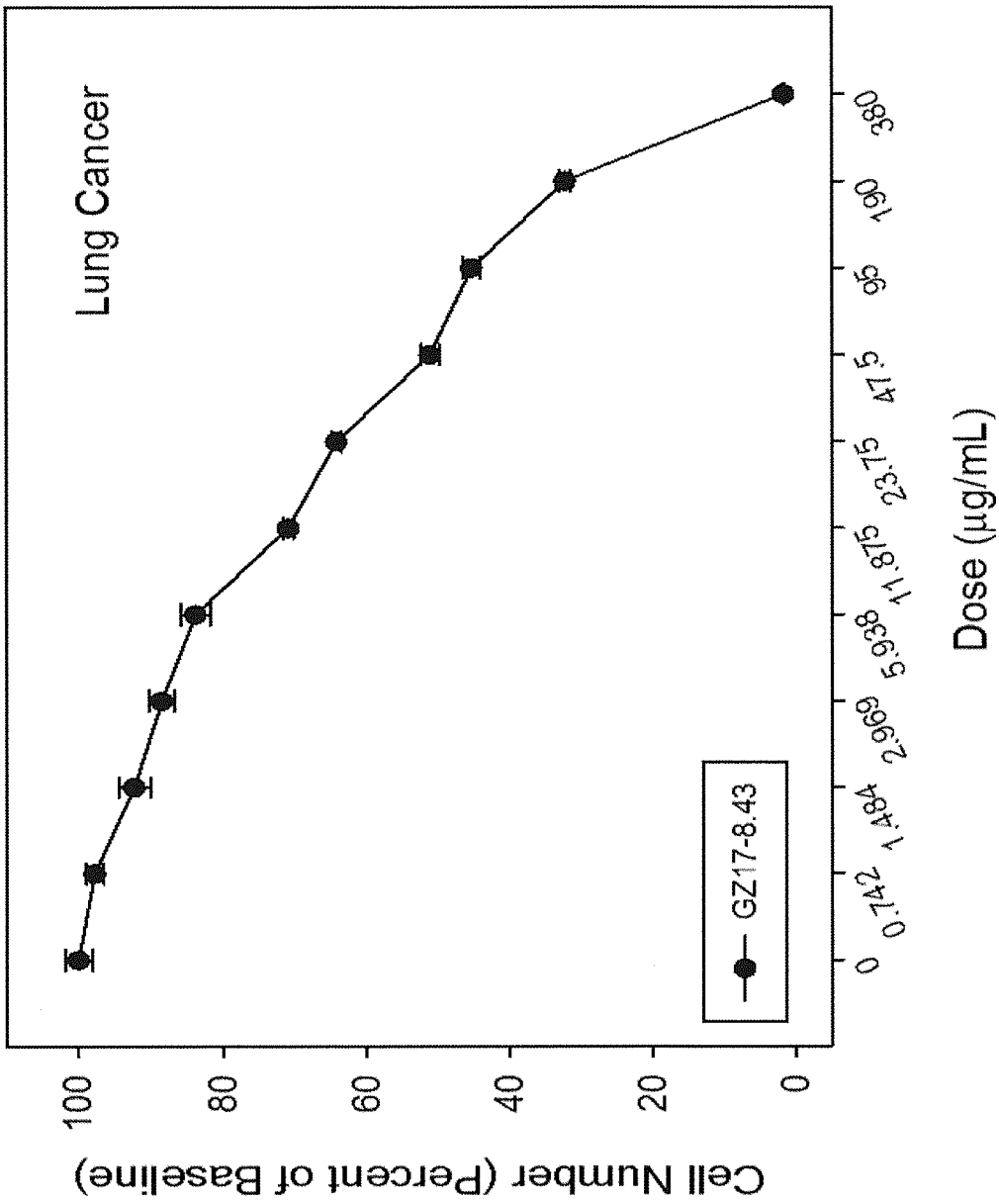

Lung Cancer
Cell Number (Percent of Baseline)
0
20
40
60
80
100
GZ17-8.43
0
0.742
1.484
2.969
5.938
11.875
23.75
47.5
95
190
380
Dose (µg/mL)

Fig. 61B

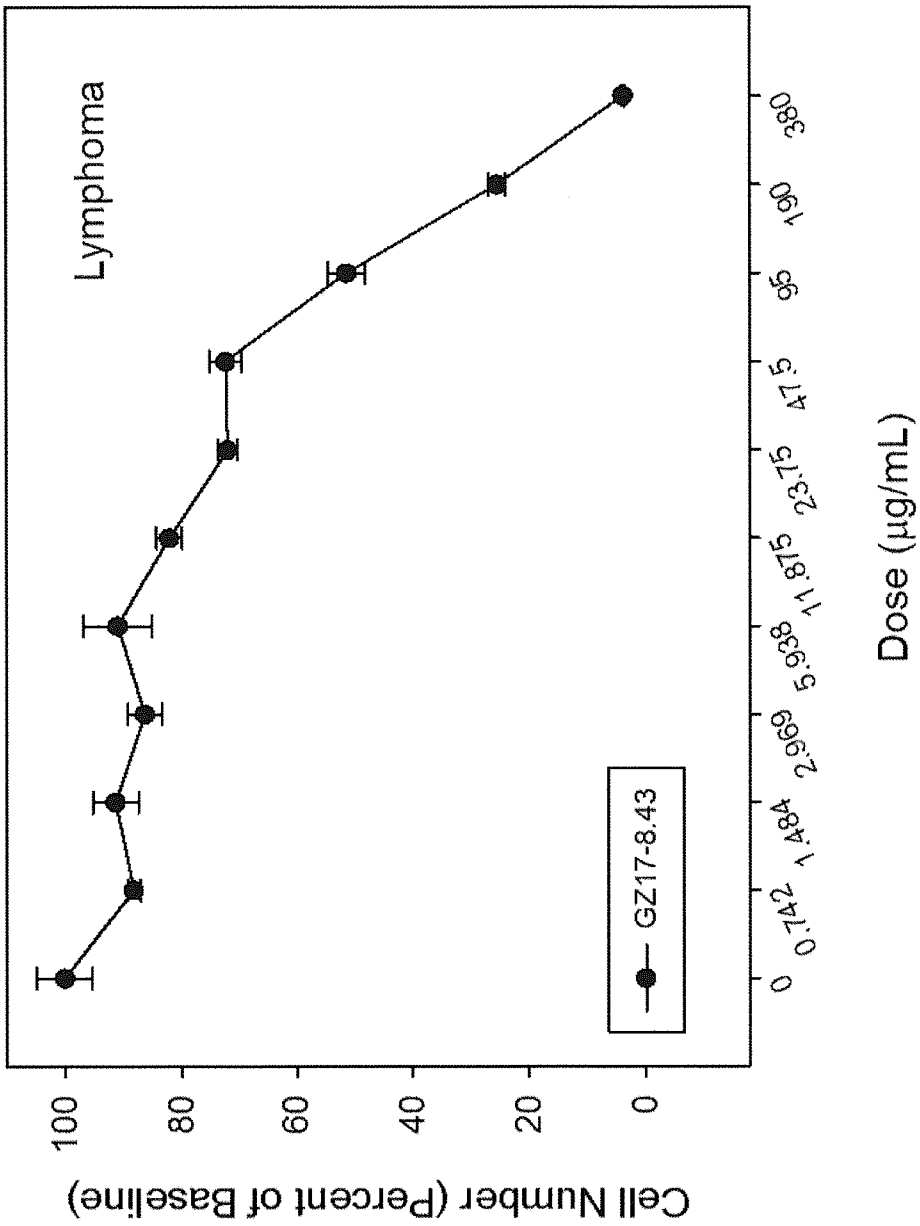

Lymphoma
Cell Number (Percent of Baseline)
100
80
60
40
20
0
GZ17-8.43
0
0.742
1.484
2.969
5.938
11.875
23.75
47.5
95
190
380
Dose (µg/mL)

Fig. 61C

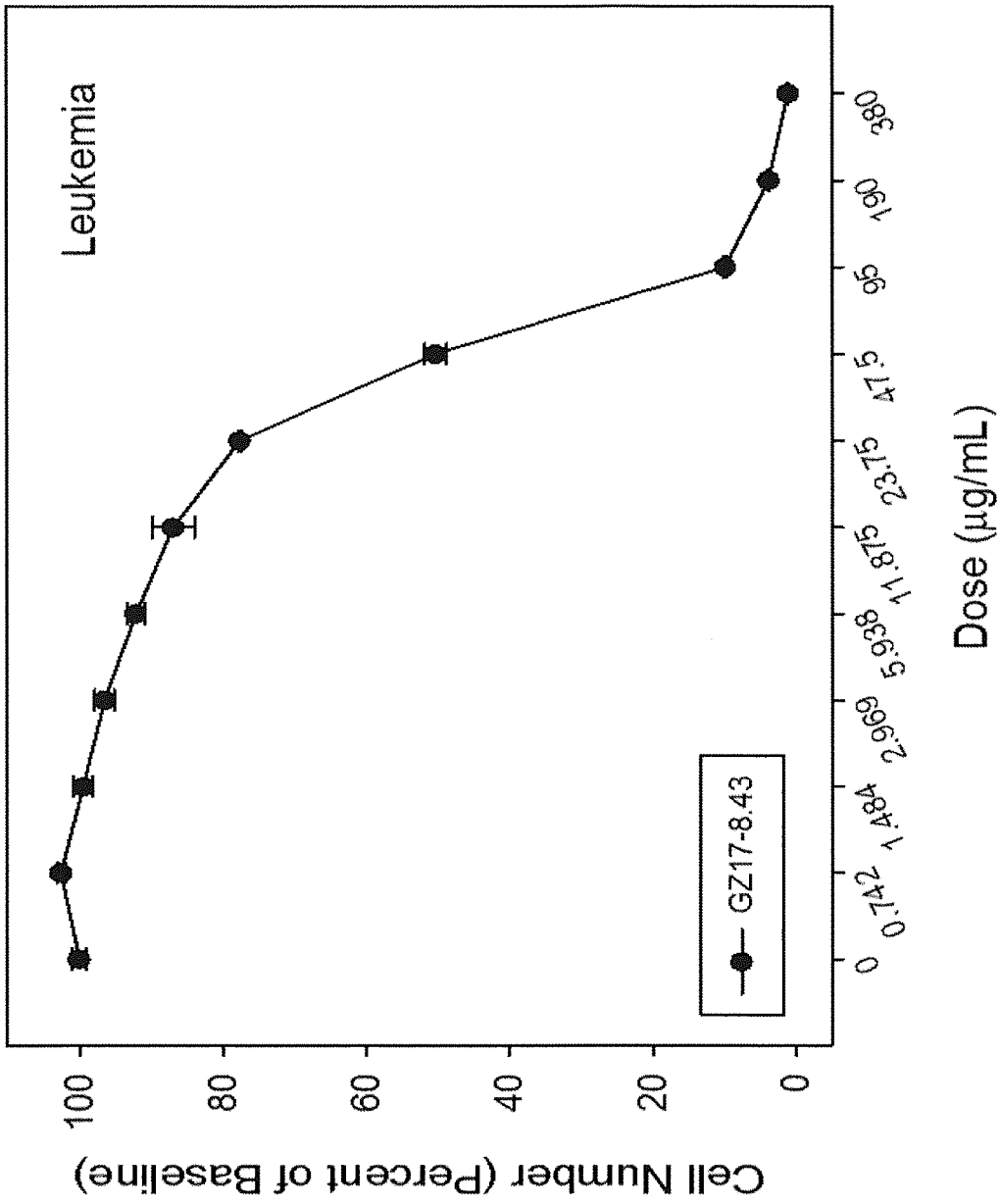

Leukemia
GZ17-8.43
Cell Number (Percent of Baseline)
0
20
40
60
80
100
0
0.742
1.484
2.969
5.938
11.875
23.75
47.5
95
190
380
Dose (µg/mL)

Fig. 61D

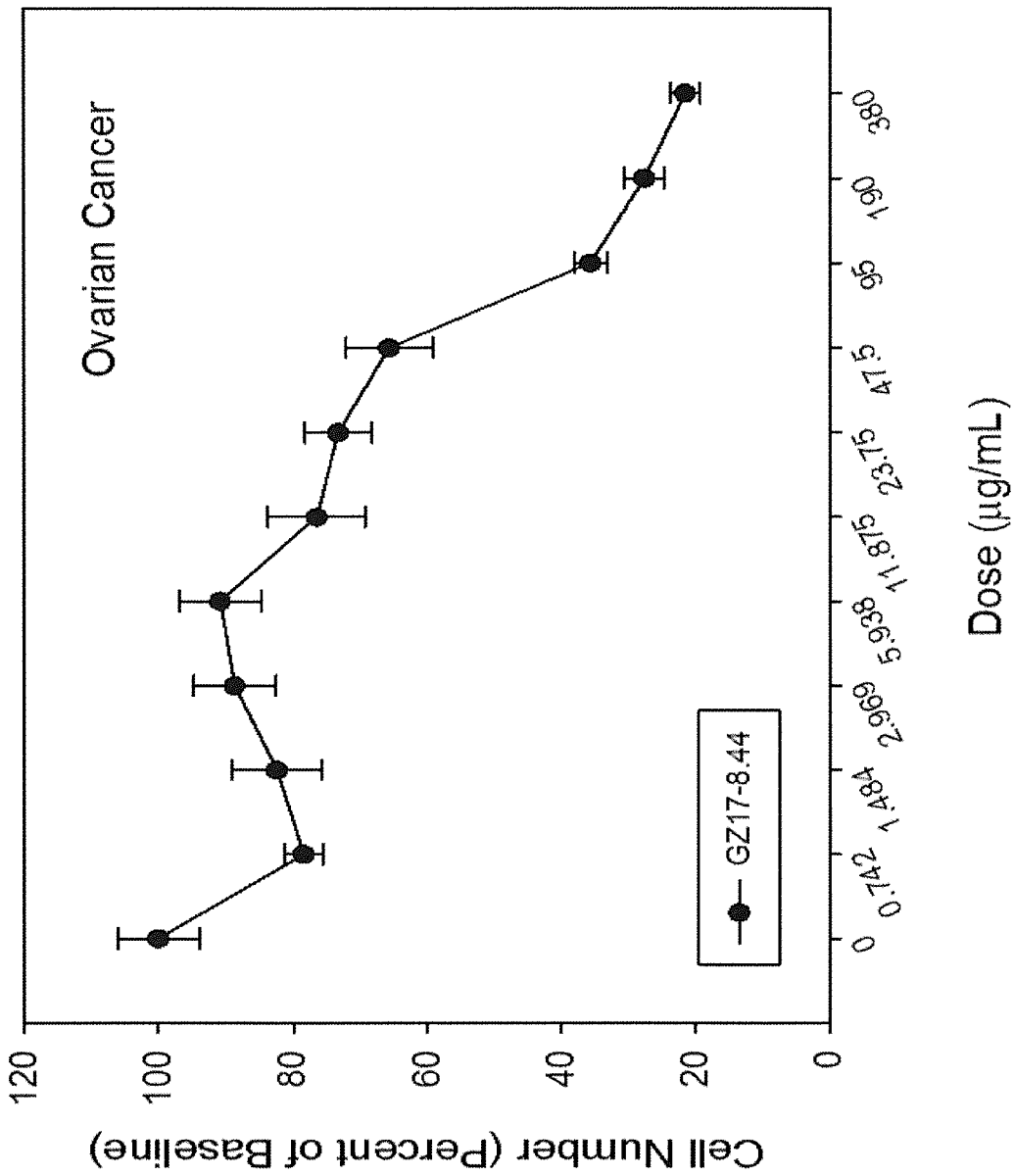

Ovarian Cancer
Cell Number (Percent of Baseline)
120
100
80
60
40
20
0
GZ17-8.44
0
0.742
1.484
2.969
5.938
11.875
23.75
47.5
95
190
380
Dose (µg/mL)

Fig. 62A

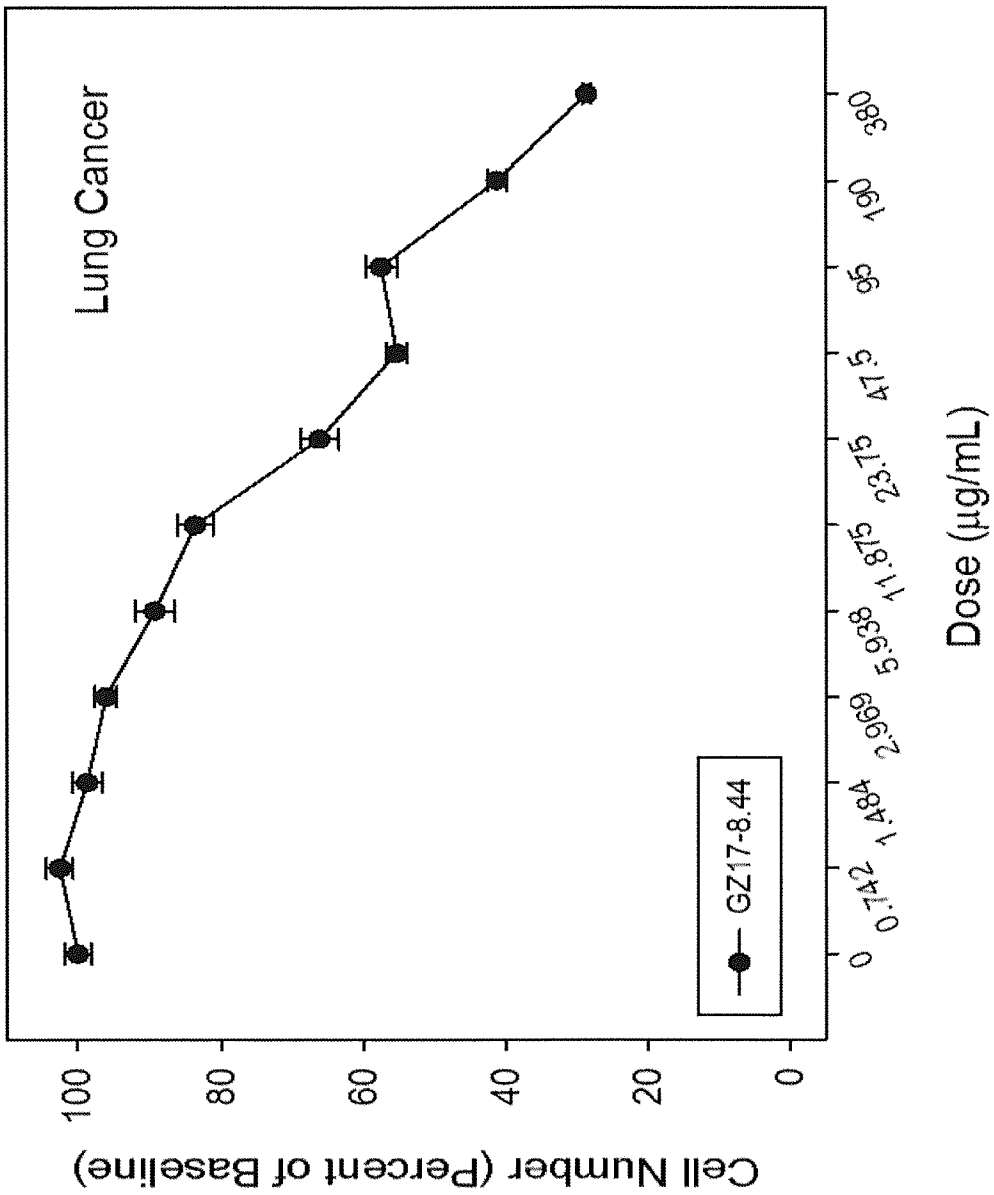

Lung Cancer
GZ17-8.44
Cell Number (Percent of Baseline)
0
20
40
60
80
100
0
0.742
1.484
2.969
5.938
11.875
23.75
47.5
95
190
380
Dose (µg/mL)

Fig. 62B

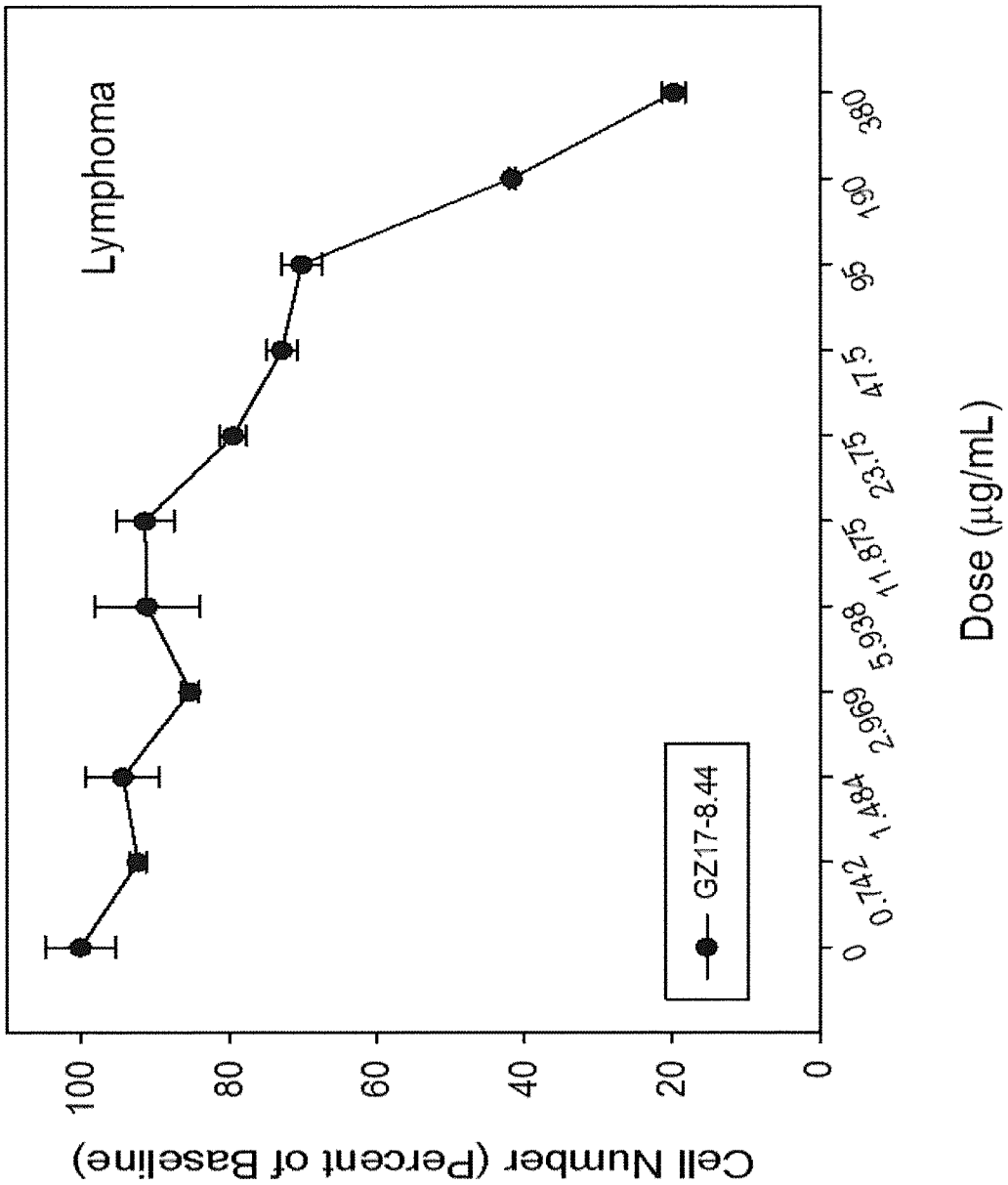

Lymphoma
Cell Number (Percent of Baseline)
0
20
40
60
80
100
GZ17-8.44
0
0.742
1.484
2.969
5.938
11.875
23.75
47.5
95
190
380
Dose (µg/mL)

Fig. 62C

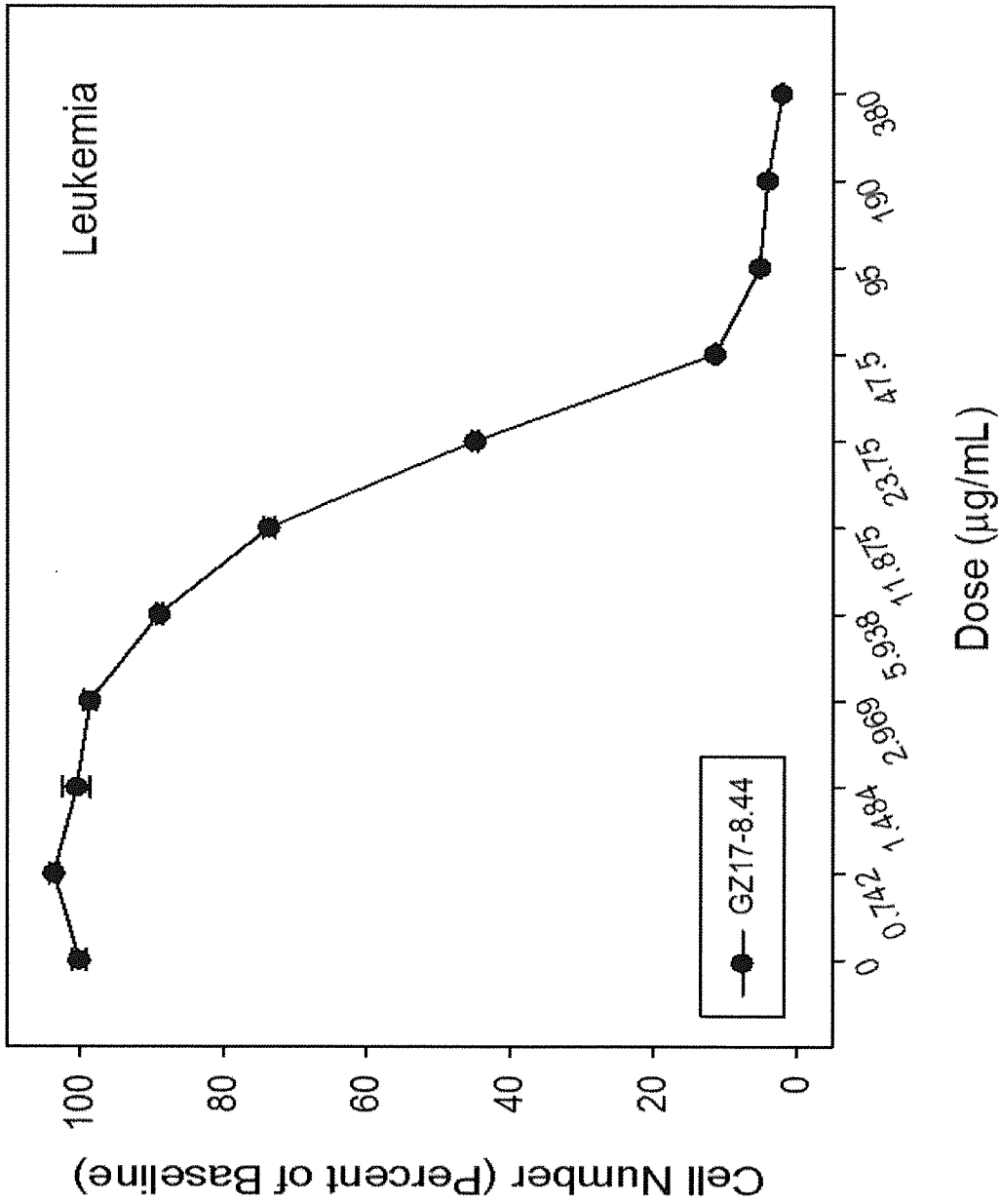

Leukemia
Cell Number (Percent of Baseline)
0
20
40
60
80
100
GZ17-8.44
0
0.742
1.484
2.969
5.938
11.875
23.75
47.5
95
190
380
Dose (µg/mL)

Fig. 62D

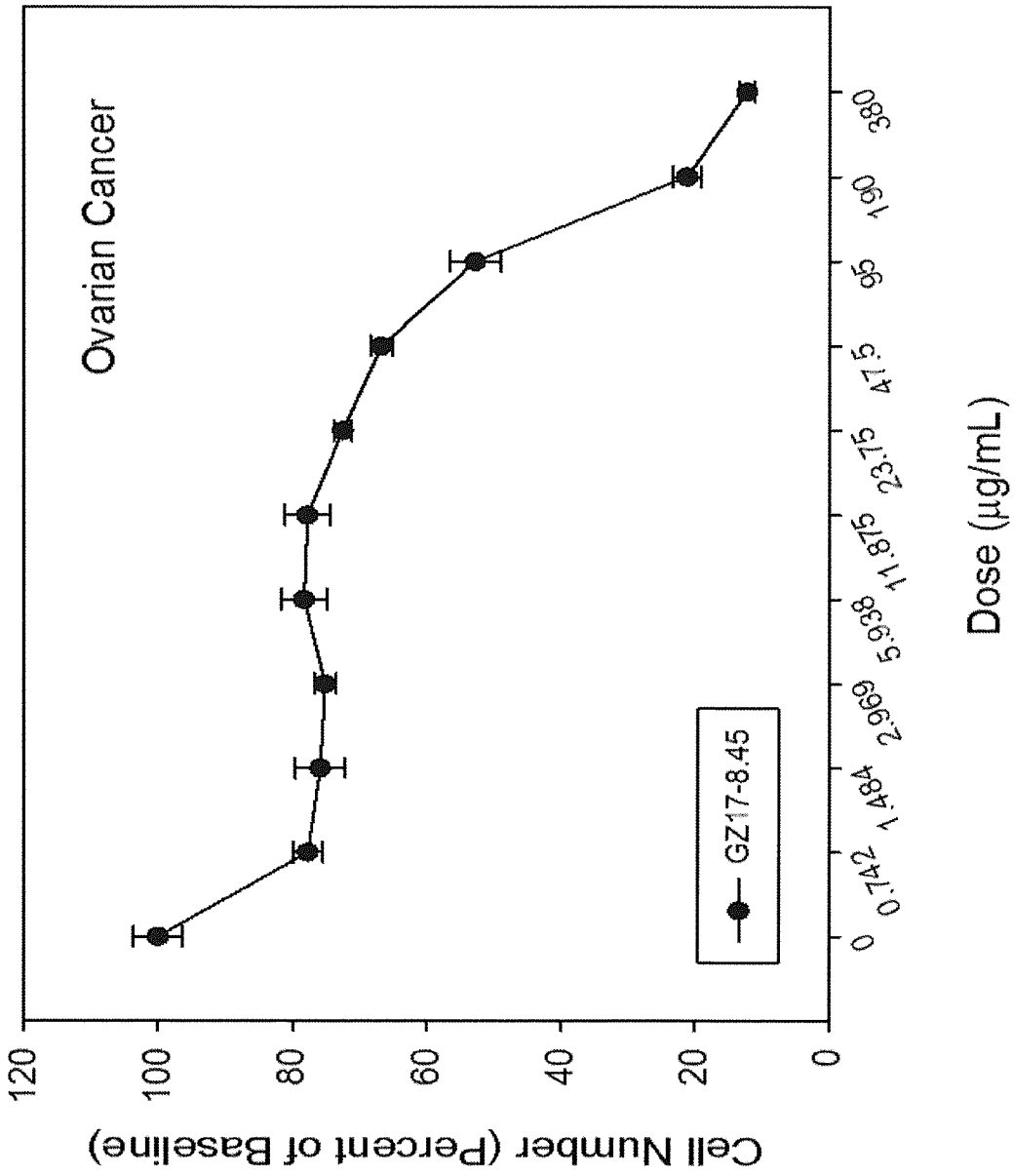

Ovarian Cancer
Cell Number (Percent of Baseline)
120
100
80
60
40
20
0
GZ17-8.45
0
0.742
1.484
2.969
5.938
11.875
23.75
47.5
95
190
380
Dose (µg/mL)

Fig. 63A

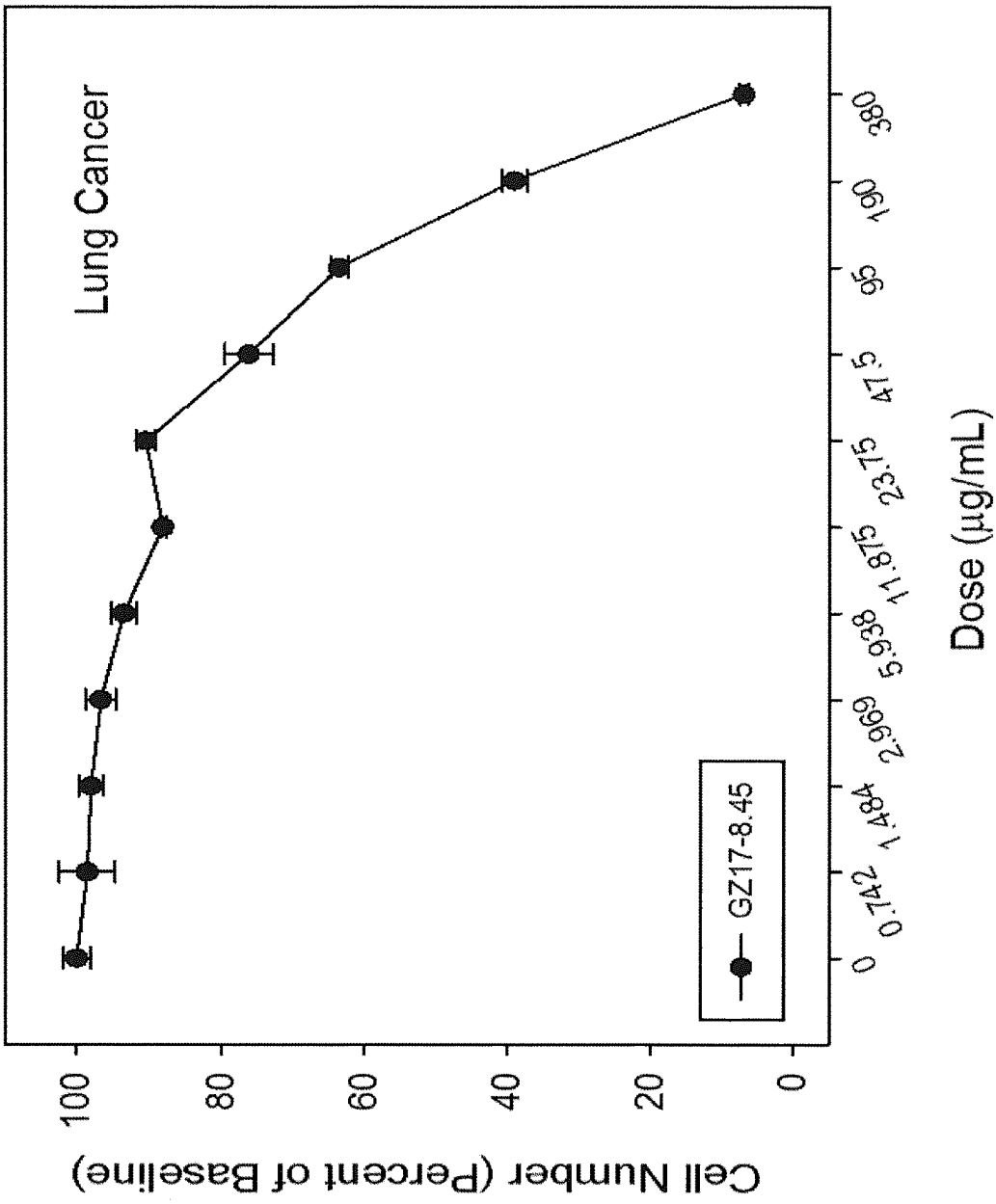

Lung Cancer
GZ17-8.45
Cell Number (Percent of Baseline)
0
20
40
60
80
100
0
0.742
1.484
2.969
5.938
11.875
23.75
47.5
95
190
380
Dose (µg/mL)

Fig. 63B

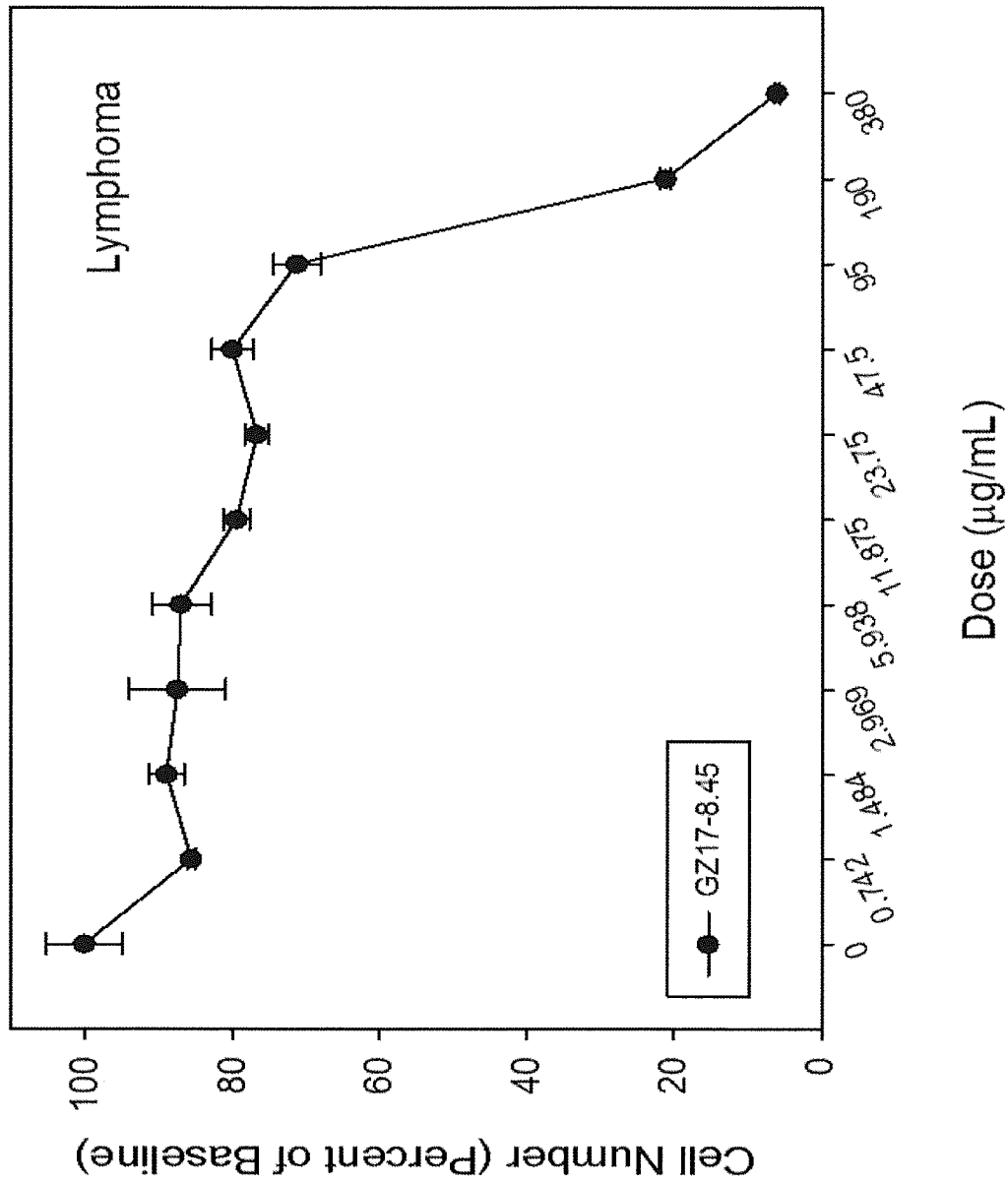

Lymphoma
Cell Number (Percent of Baseline)
0
20
40
60
80
100
GZ17-8.45
0
0.742
1.484
2.969
5.938
11.875
23.75
47.5
95
190
380
Dose (µg/mL)

Fig. 63C

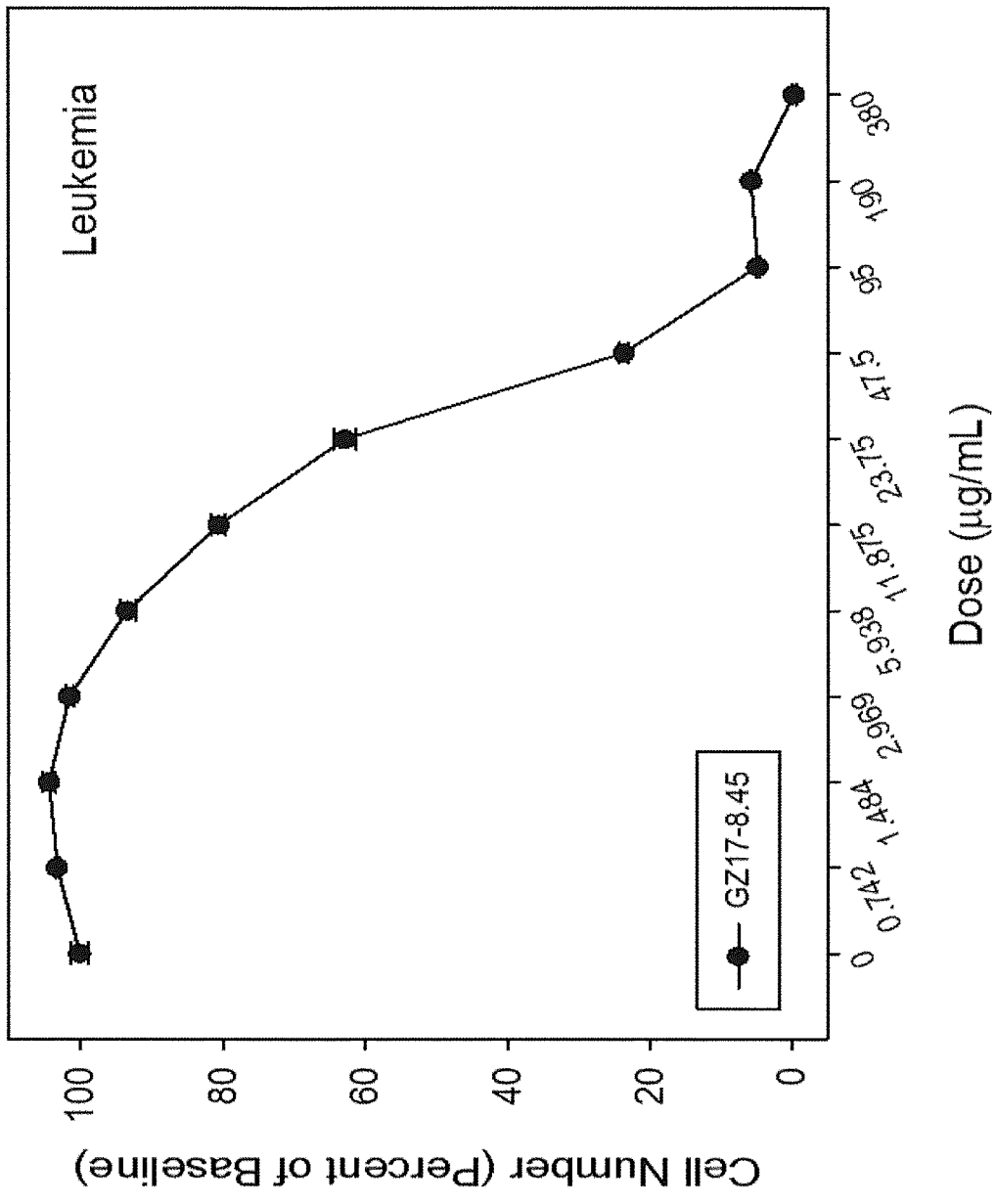

Leukemia
GZ17-8.45
Cell Number (Percent of Baseline)
0
20
40
60
80
100
0
0.742
1.484
2.969
5.938
11.875
23.75
47.5
95
190
380
Dose (µg/mL)

Fig. 63D

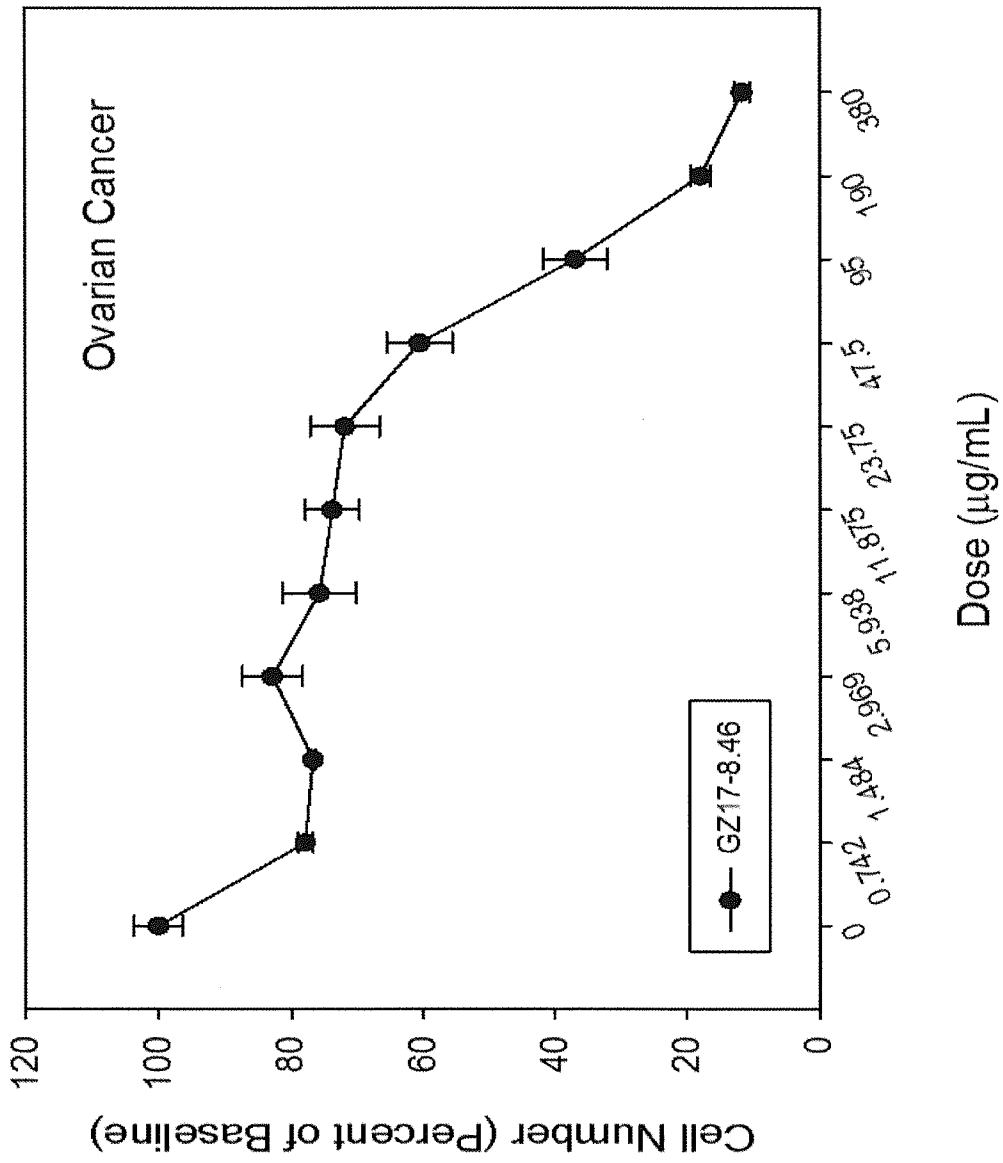

Ovarian Cancer
Cell Number (Percent of Baseline)
120
100
80
60
40
20
0
GZ17-8.46
0
0.742
1.484
2.969
5.938
11.875
23.75
47.5
95
190
380
Dose (µg/mL)

Fig. 64A

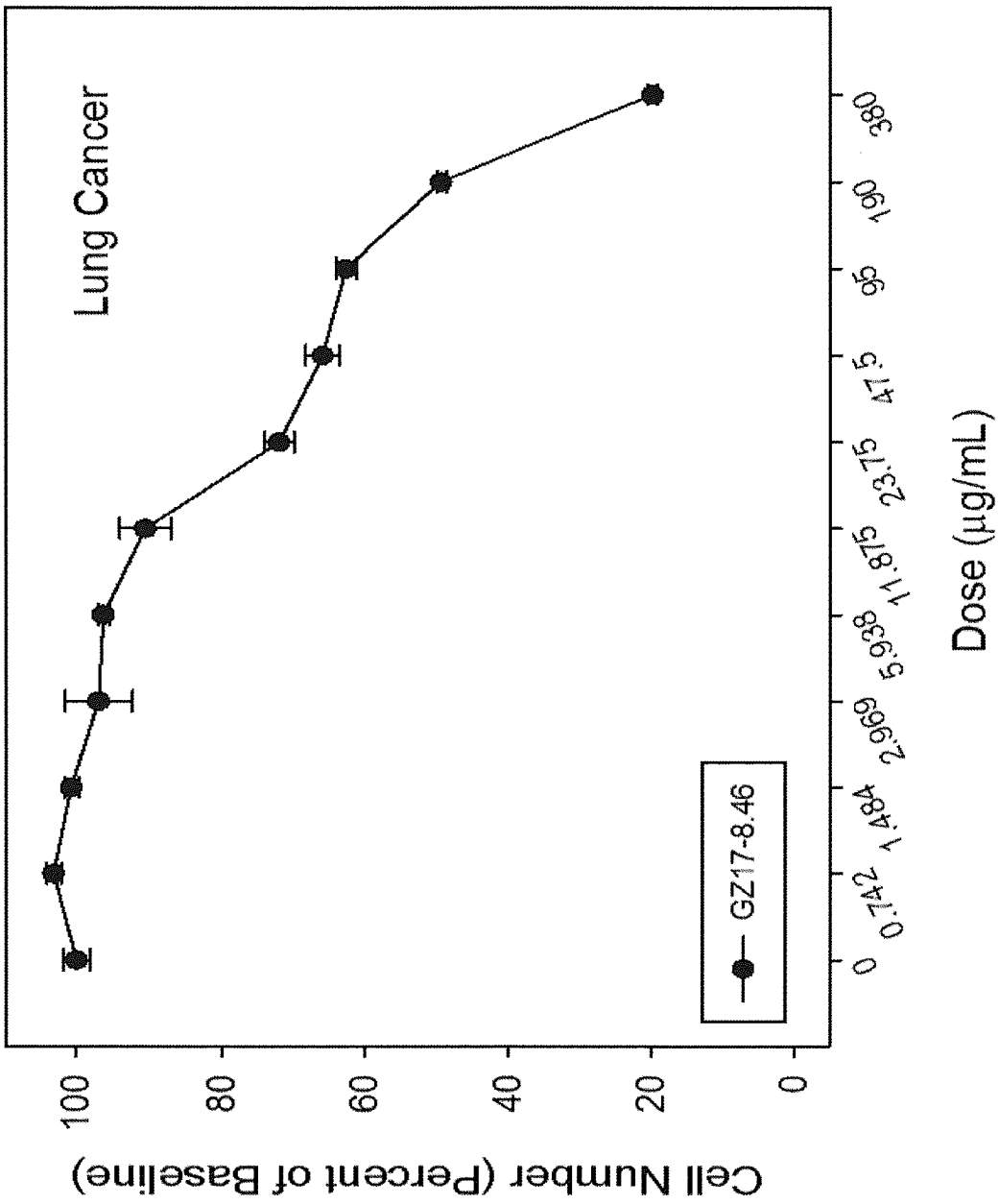

Lung Cancer
Cell Number (Percent of Baseline)
0
20
40
60
80
100
GZ17-8.46
0
0.742
1.484
2.969
5.938
11.875
23.75
47.5
95
190
380
Dose (µg/mL)

Fig. 64B

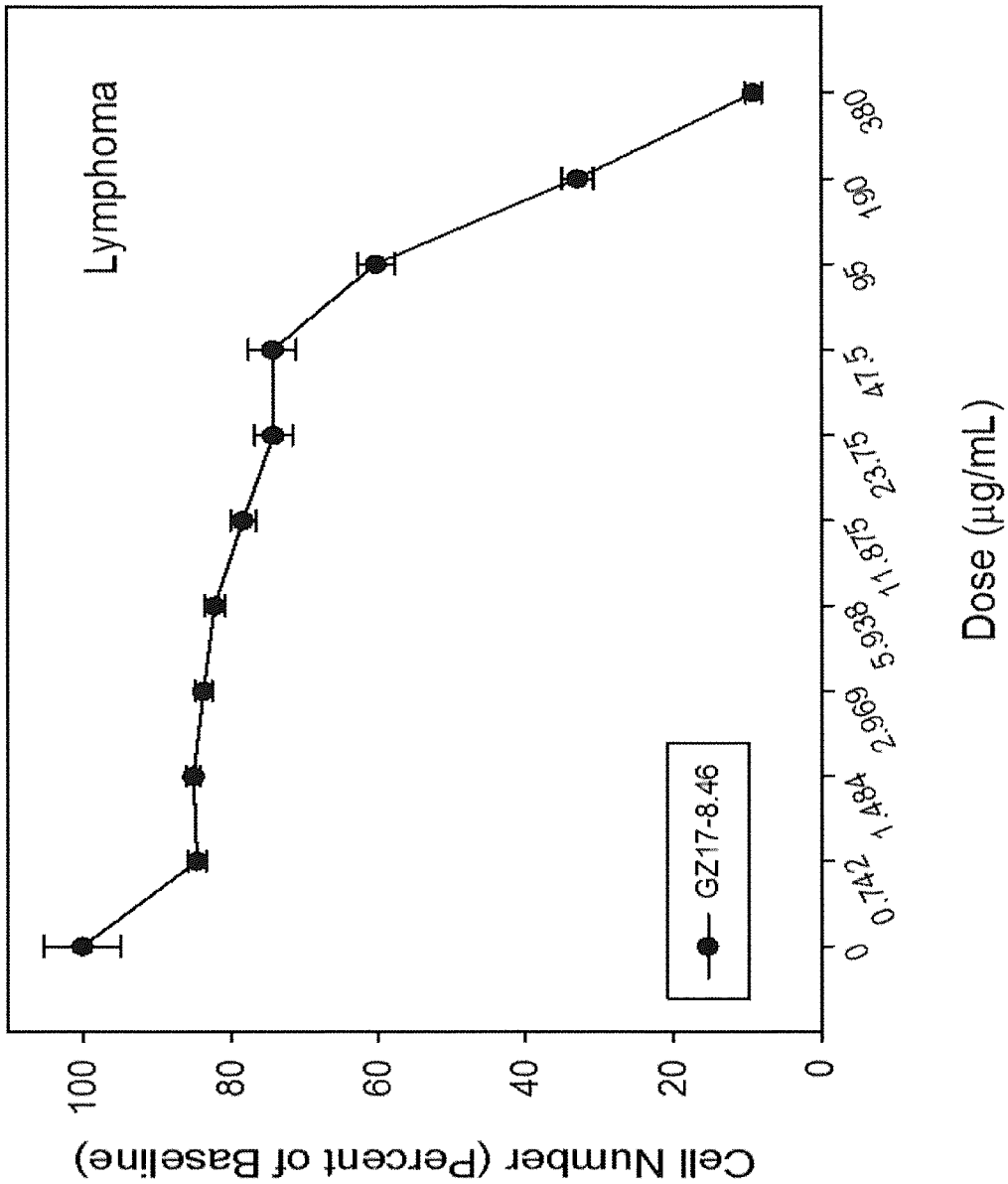

Lymphoma
Cell Number (Percent of Baseline)
0
20
40
60
80
100
GZ17-8.46
0
0.742
1.484
2.969
5.938
11.875
23.75
47.5
95
190
380
Dose (µg/mL)

Fig. 64C

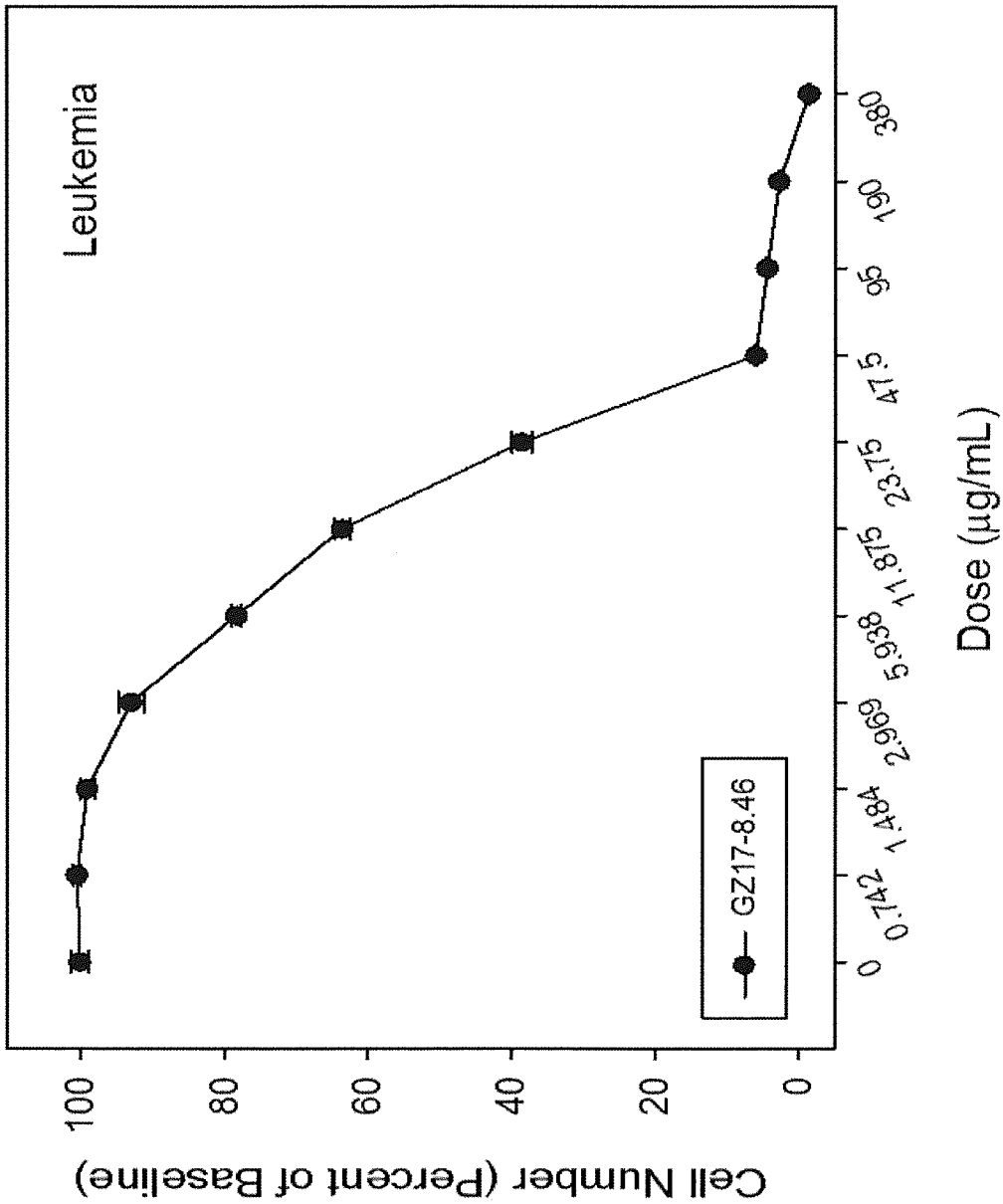

Leukemia
GZ17-8.46
Cell Number (Percent of Baseline)
0
20
40
60
80
100
0
0.142
1.484
2.969
5.938
11.875
23.75
47.5
95
190
380
Dose (µg/mL)

Fig. 64D

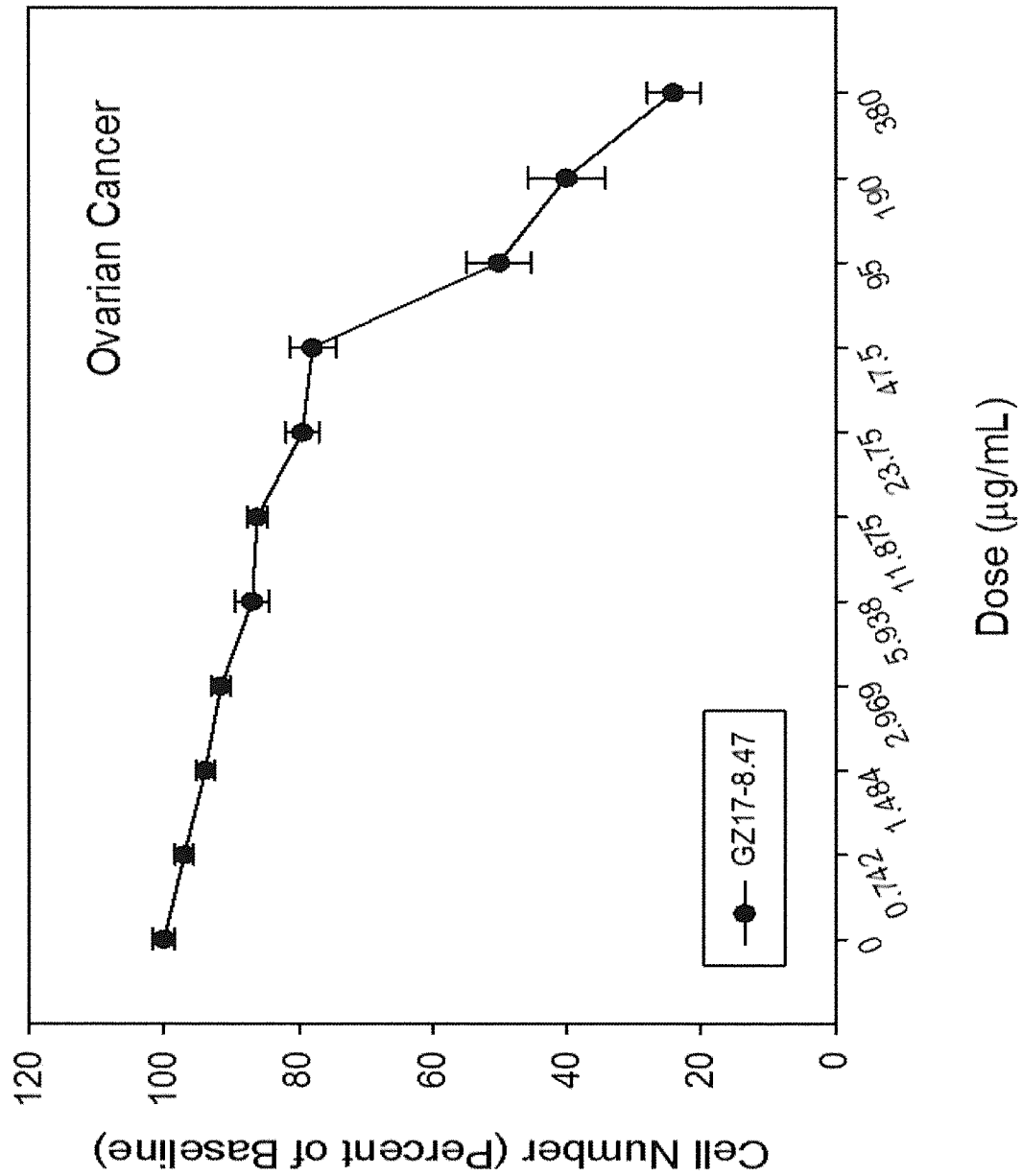

Ovarian Cancer
Cell Number (Percent of Baseline)
120
100
80
60
40
20
0
GZ17-8.47
0
0.742
1.484
2.969
5.938
11.875
23.75
47.5
95
190
380
Dose (µg/mL)

Fig. 65A

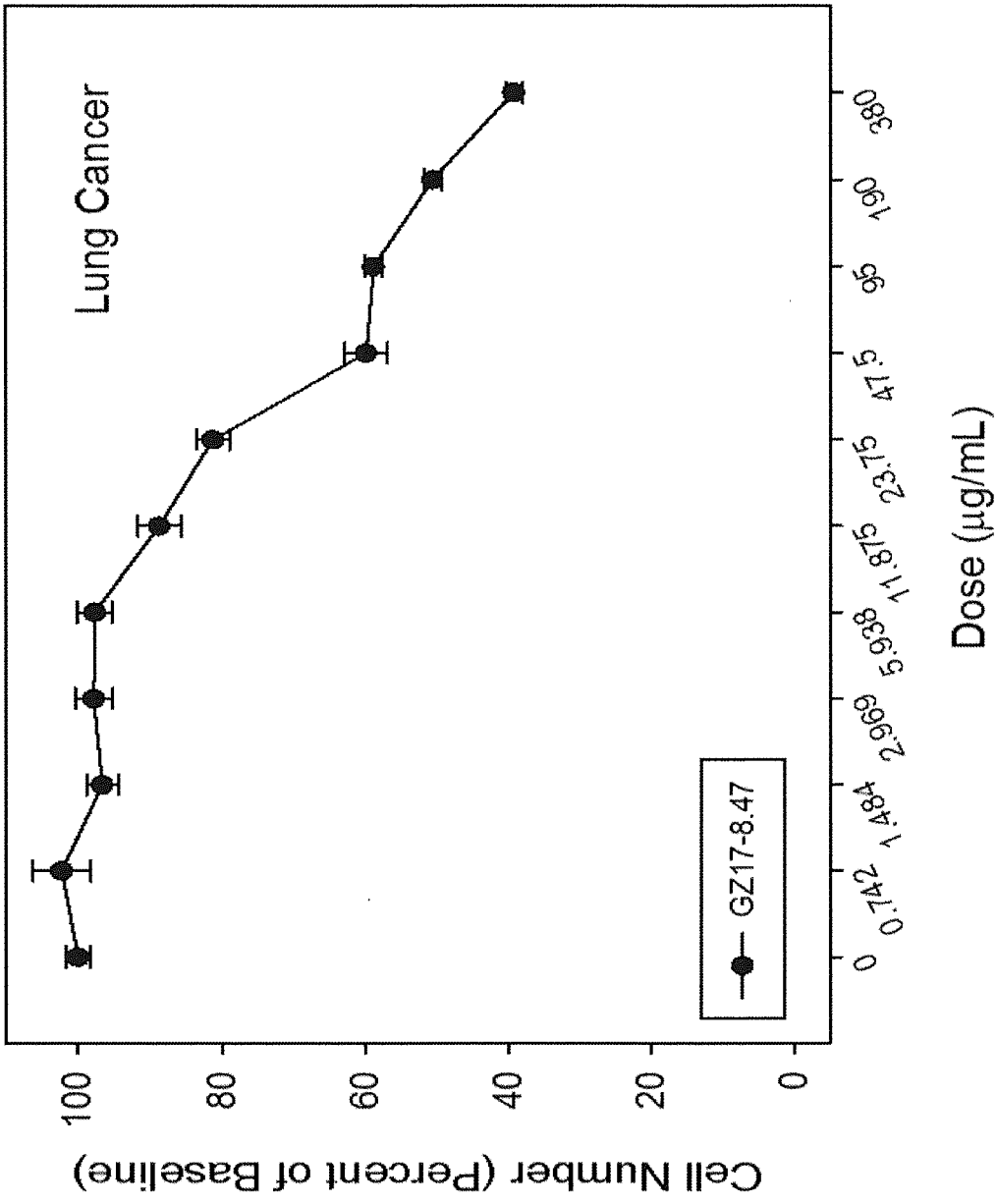

Lung Cancer
GZ17-8.47
Cell Number (Percent of Baseline)
0
20
40
60
80
100
0
0.742
1.484
2.969
5.938
11.875
23.75
47.5
95
190
380
Dose (μg/mL)

Fig. 65B

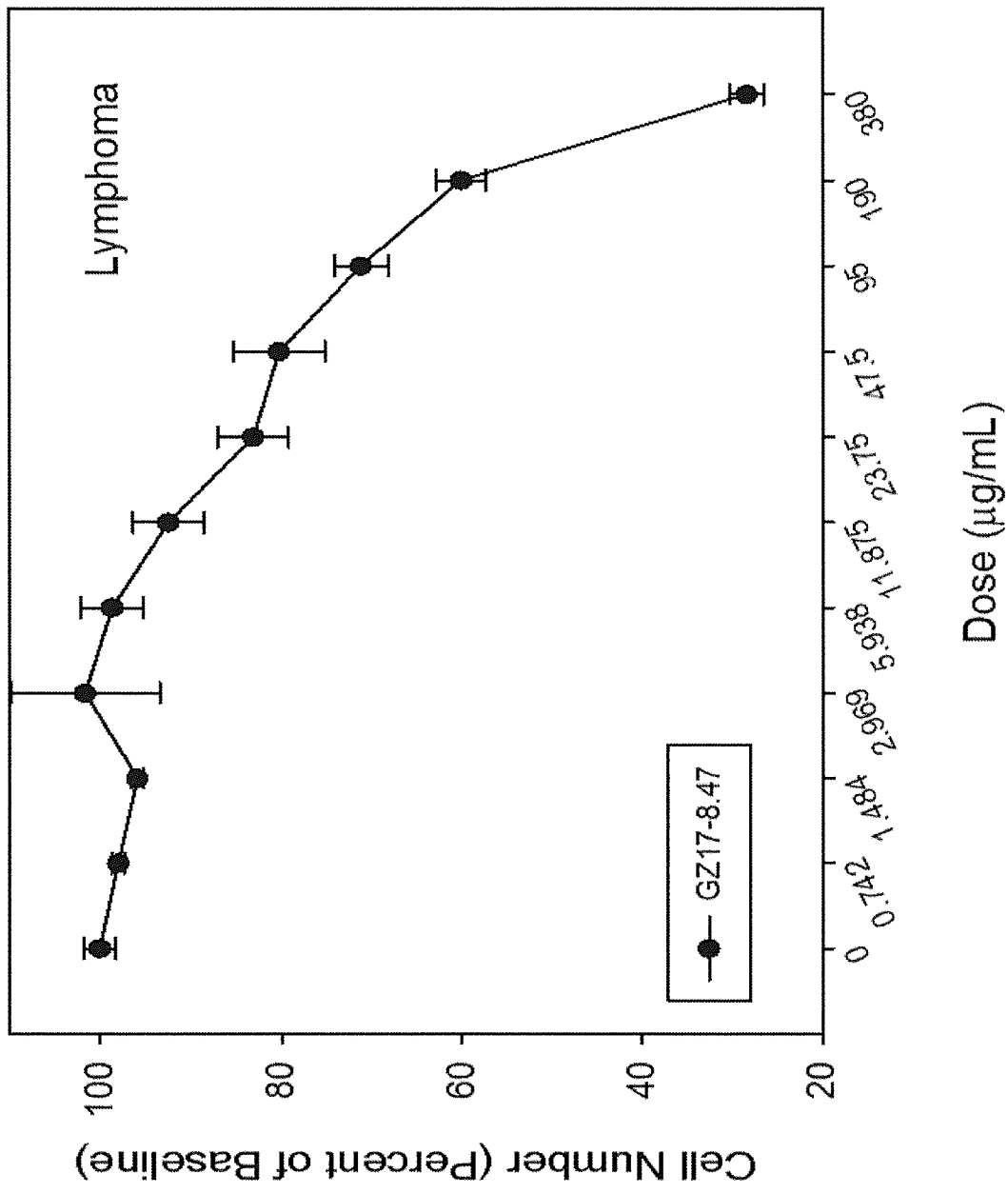

Lymphoma
Cell Number (Percent of Baseline)
100
80
60
40
20
GZ17-8.47
0
0.7422
1.484
2.969
5.938
11.875
23.75
47.5
95
190
380
Dose (µg/mL)

Fig. 65C

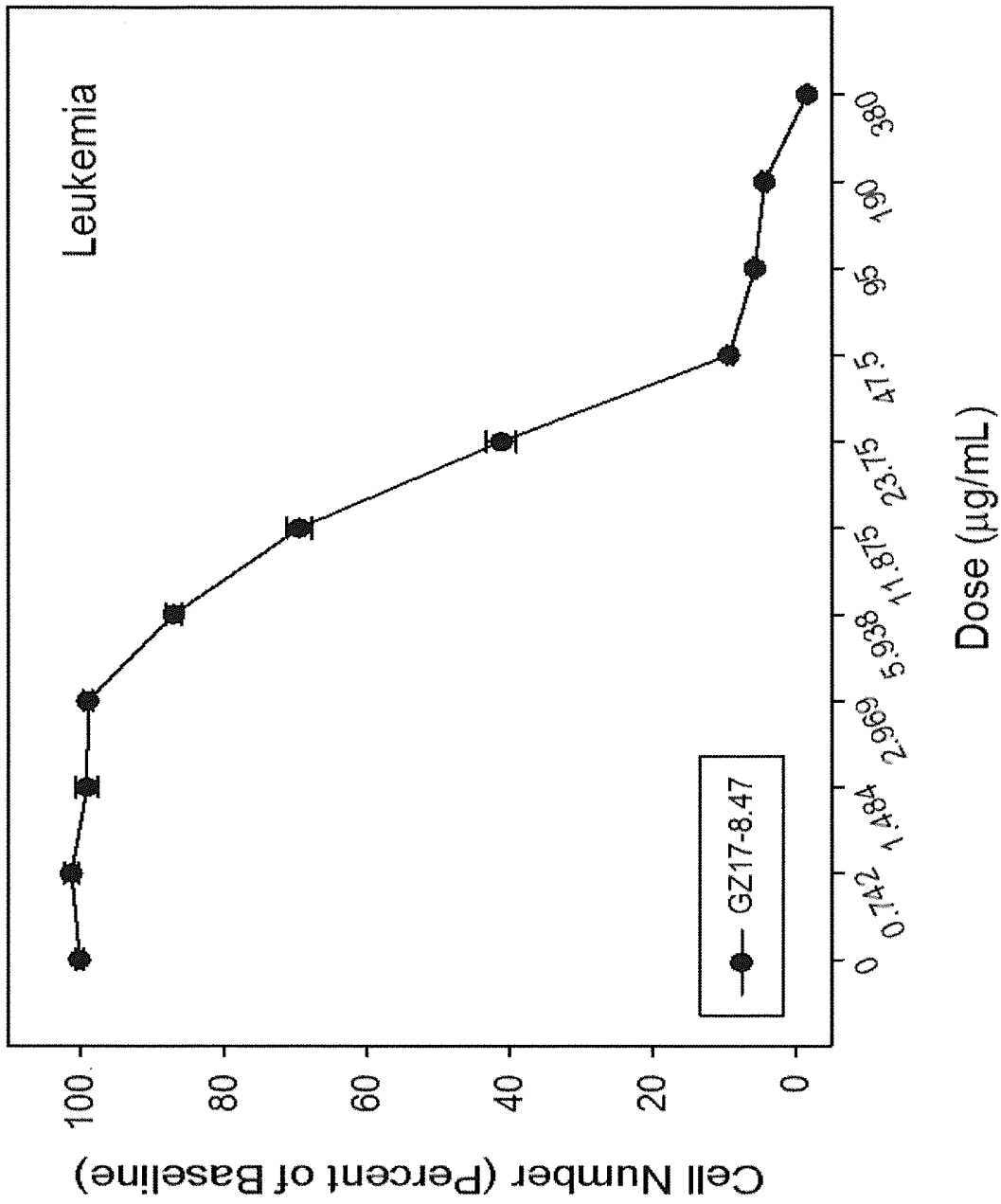

Leukemia
Cell Number (Percent of Baseline)
100
80
60
40
20
0
GZ17-8.47
0
0.742
1.484
2.969
5.938
11.875
23.75
47.5
95
190
380
Dose (µg/mL)

Fig. 65D

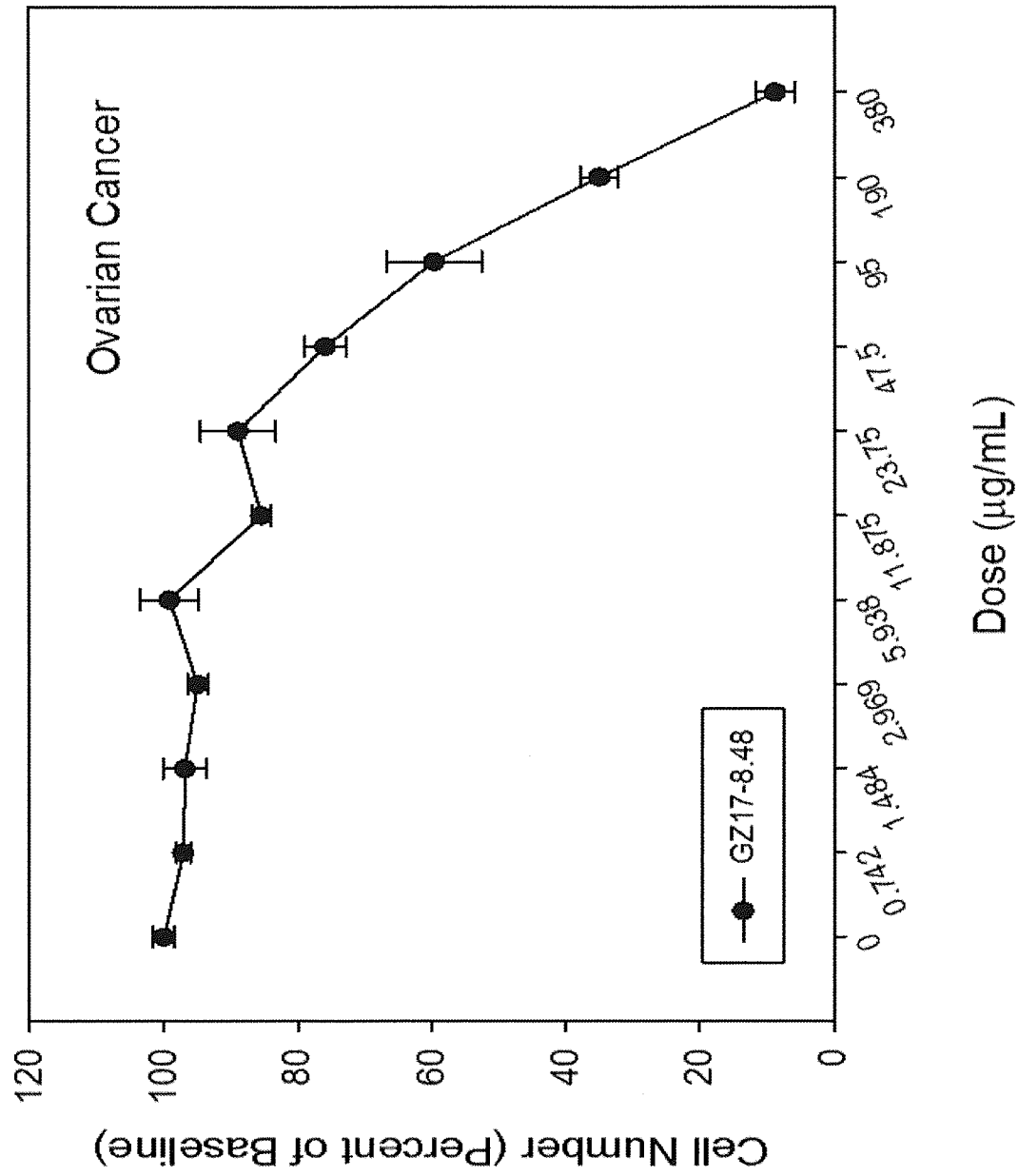

Ovarian Cancer
Cell Number (Percent of Baseline)
120
100
80
60
40
20
0
GZ17-8.48
0
0.742
1.484
2.969
5.938
11.875
23.75
47.5
95
190
380
Dose (µg/mL)

Fig. 66A

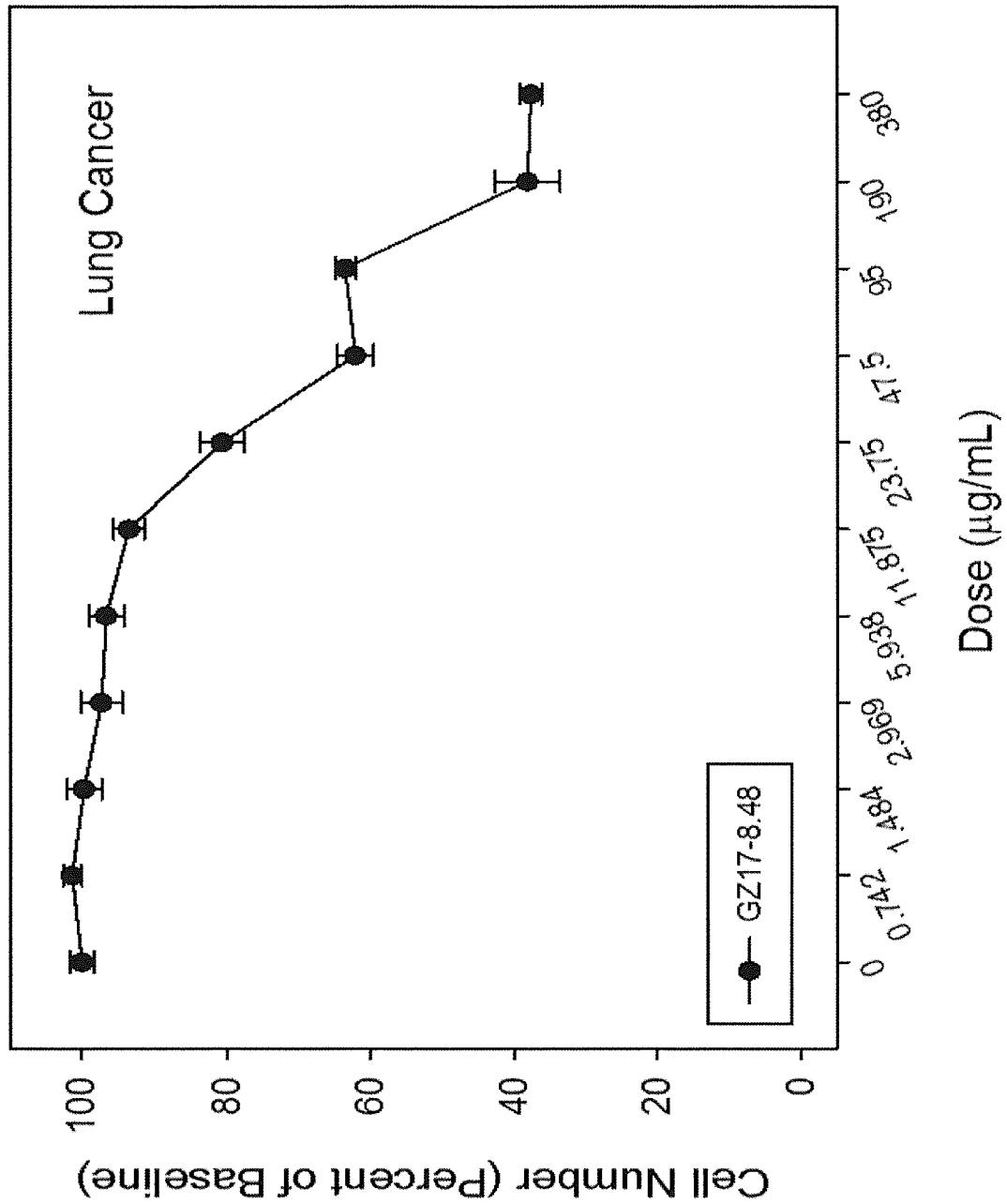

Lung Cancer
Cell Number (Percent of Baseline)
100
80
60
40
20
0
GZ17-8.48
0
0.742
1.484
2.969
5.938
11.875
23.75
47.5
95
190
380
Dose (µg/mL)

Fig. 66B

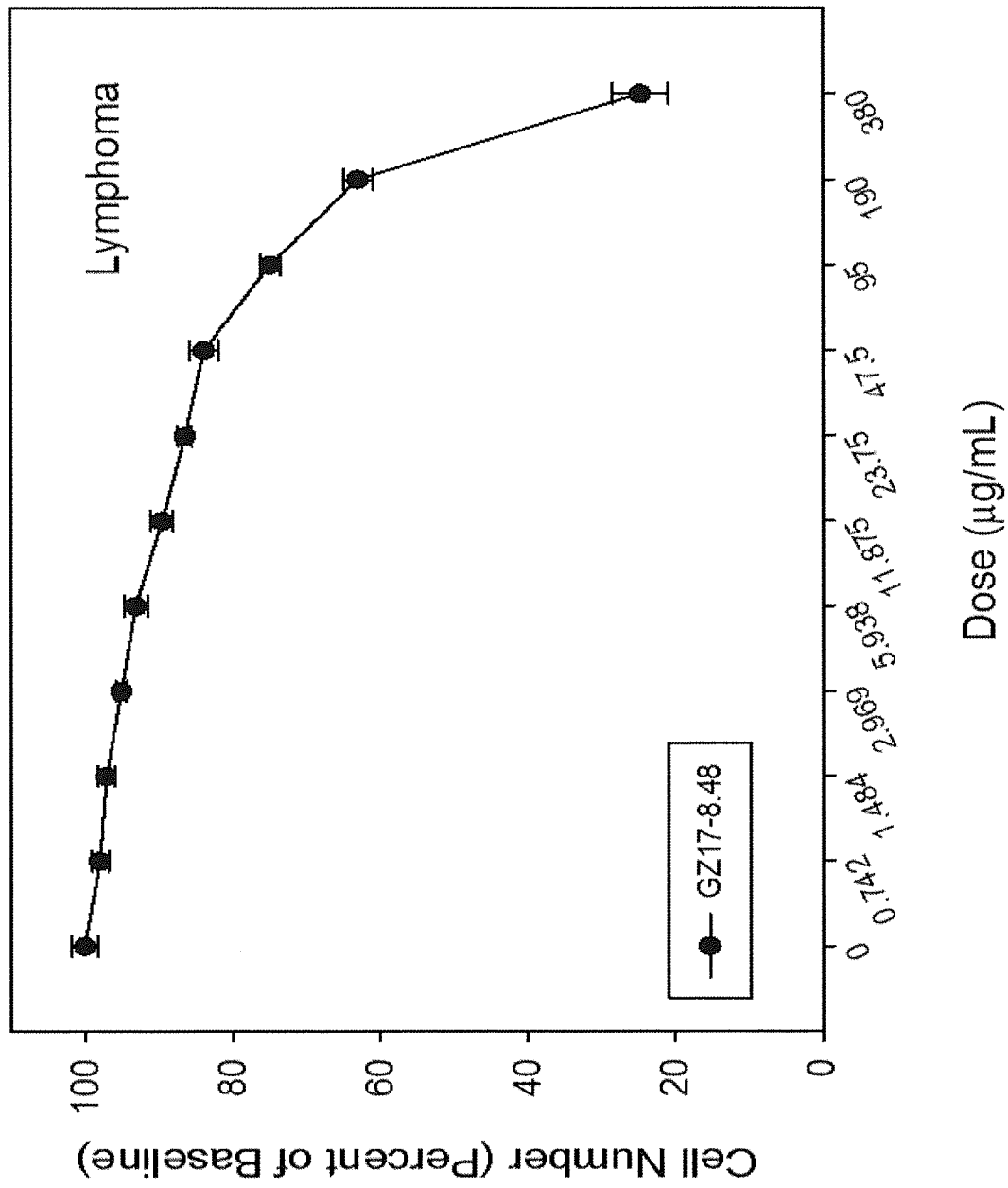

Lymphoma
GZ17-8.48
Cell Number (Percent of Baseline)
0
20
40
60
80
100
0
0.142
1.484
2.969
5.938
11.875
23.75
47.5
95
190
380
Dose (µg/mL)

Fig. 66C

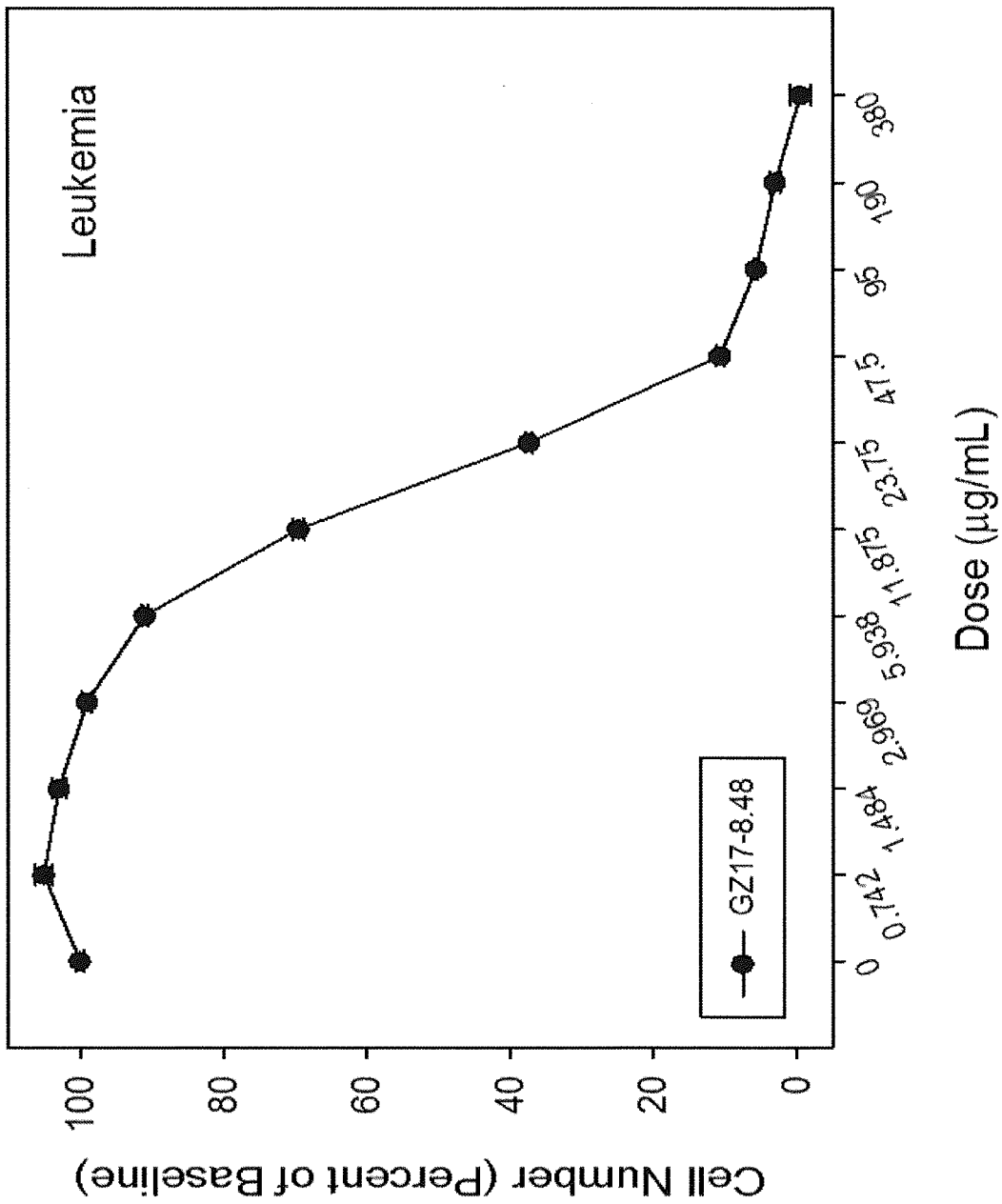

Leukemia
GZ17-8.48
Cell Number (Percent of Baseline)
0
20
40
60
80
100
0
0.742
1.484
2.969
5.938
11.875
23.75
47.5
95
190
380
Dose (µg/mL)

Fig. 66D

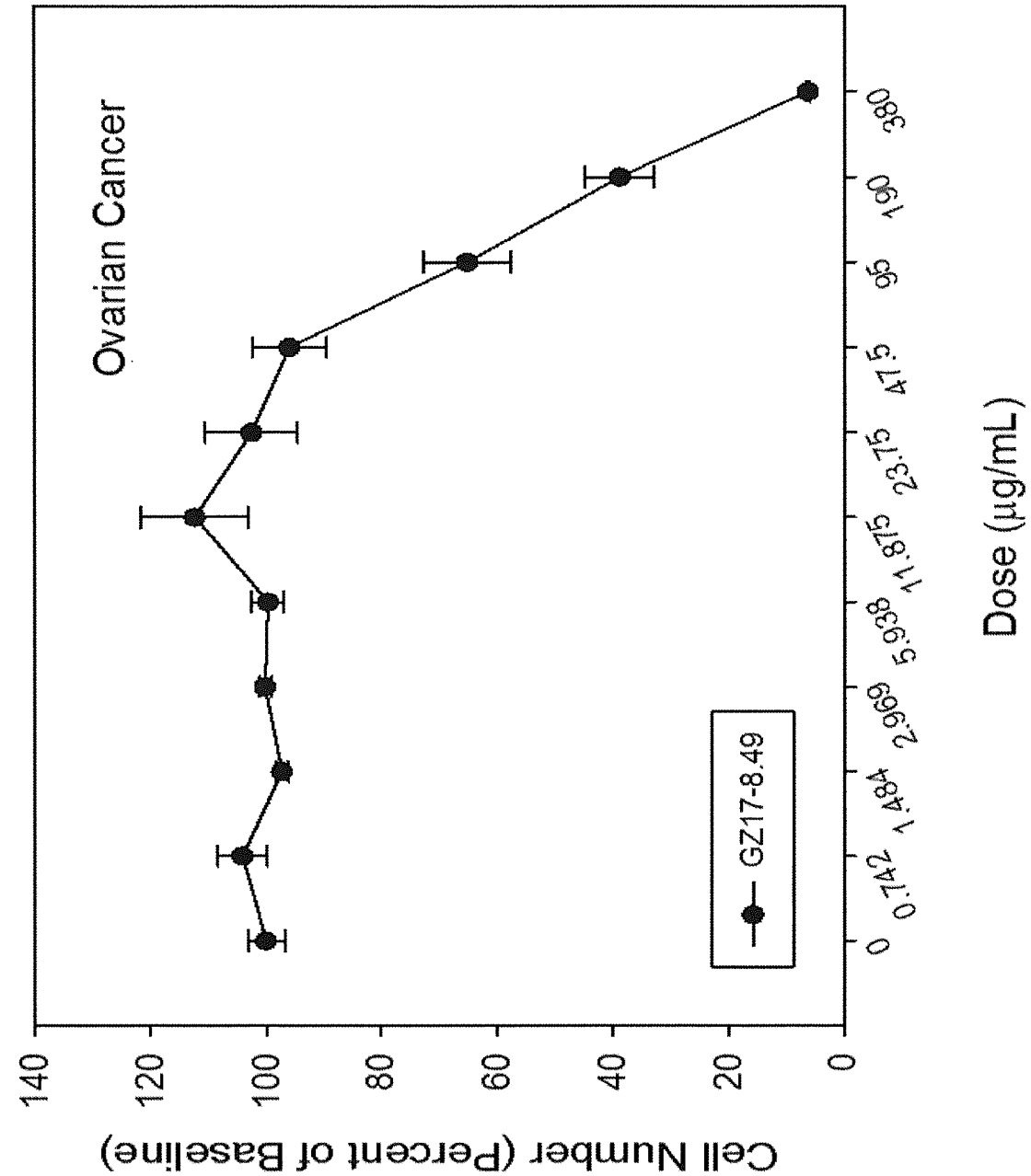

Ovarian Cancer
Cell Number (Percent of Baseline)
140
120
100
80
60
40
20
0
GZ17-8.49
0
0.142
1.484
2.969
5.938
11.875
23.75
47.5
95
190
380
Dose (µg/mL)

Fig. 67A

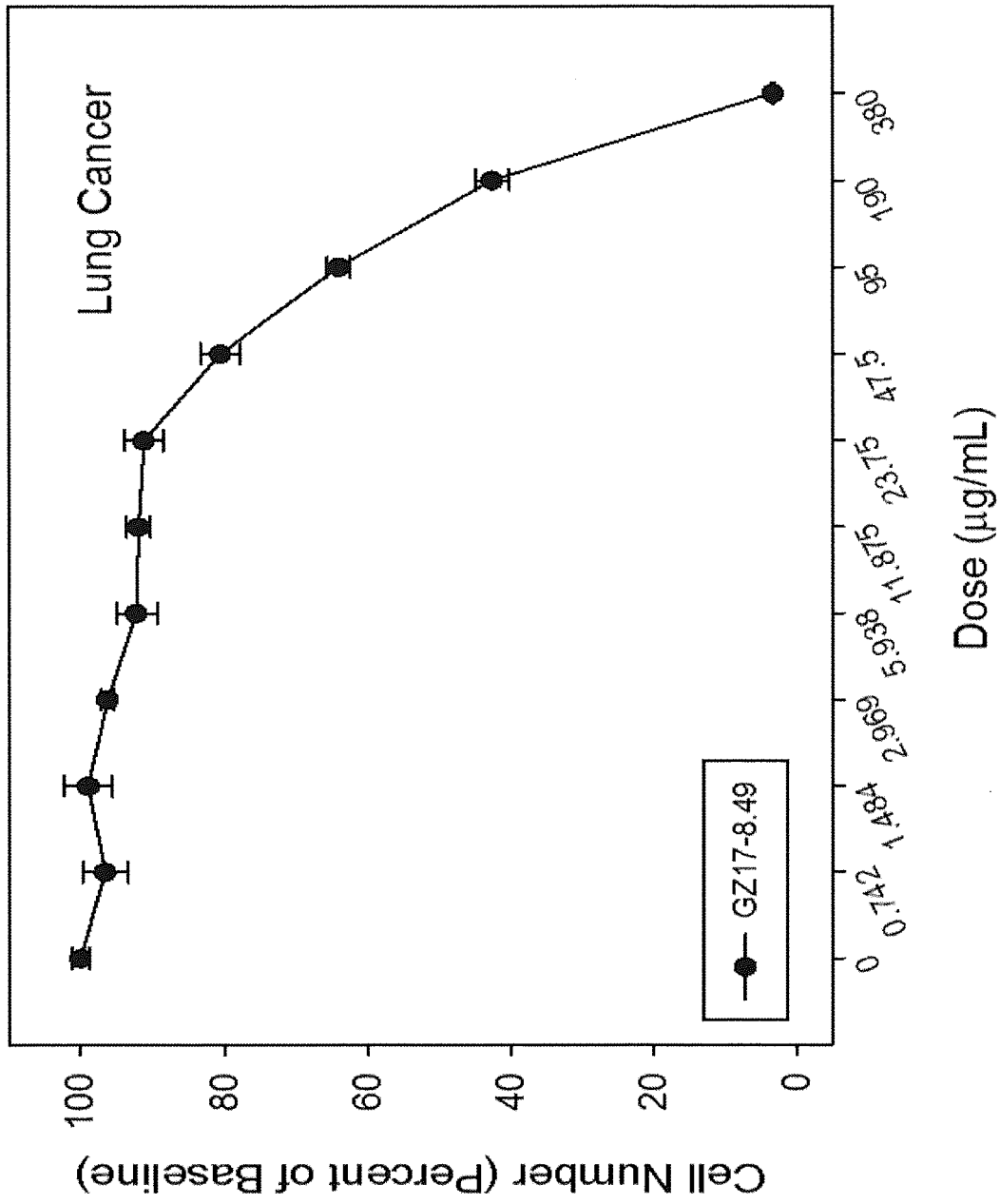

Lung Cancer
Cell Number (Percent of Baseline)
100
80
60
40
20
0
GZ17-8.49
0
0.742
1.484
2.969
5.938
11.875
23.75
47.5
95
190
380
Dose (µg/mL)

Fig. 67B

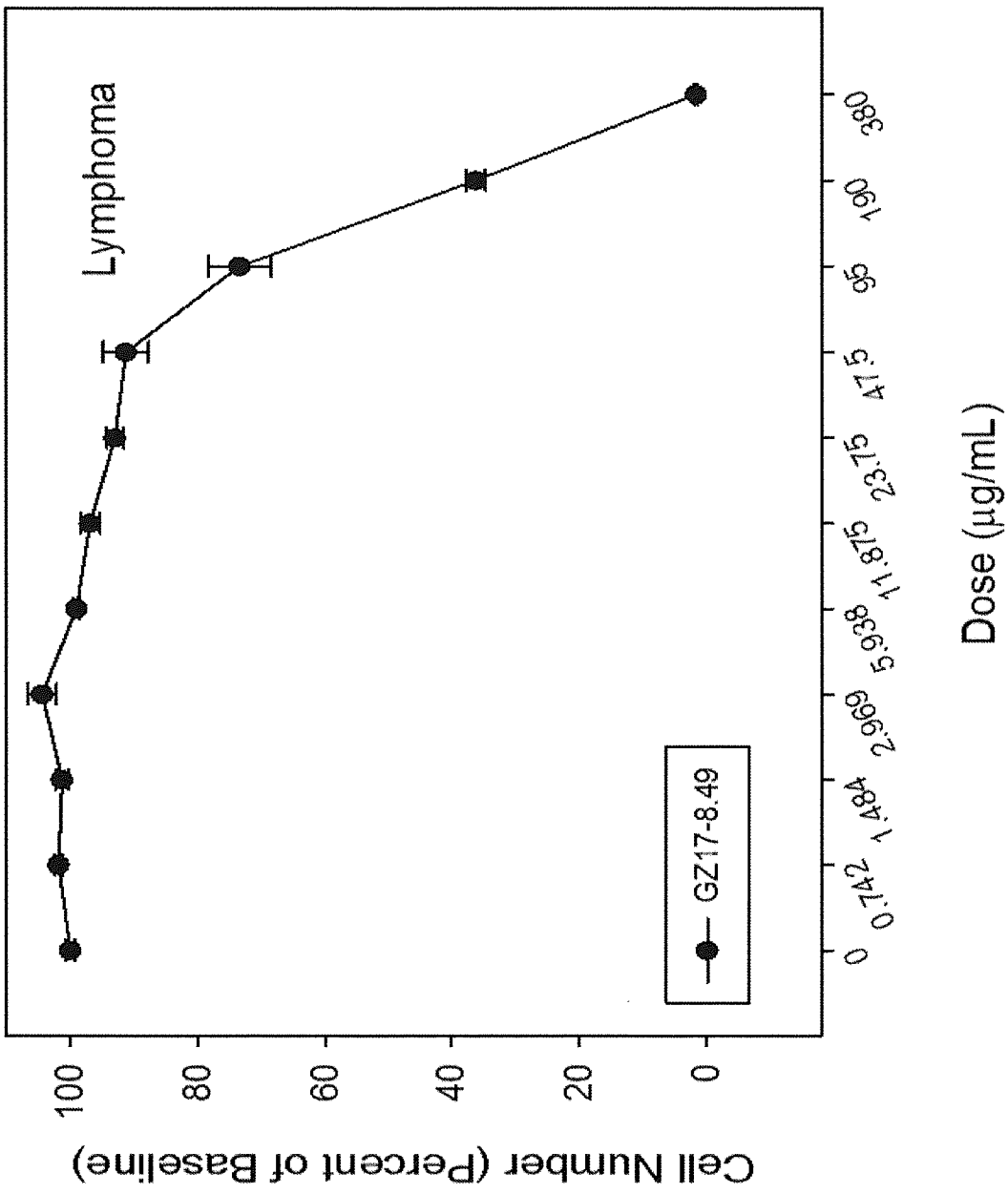

Lymphoma
Cell Number (Percent of Baseline)
100
80
60
40
20
0
GZ17-8.49
0
0.742
1.484
2.969
5.938
11.875
23.75
47.5
95
190
380
Dose (µg/mL)

Fig. 67C

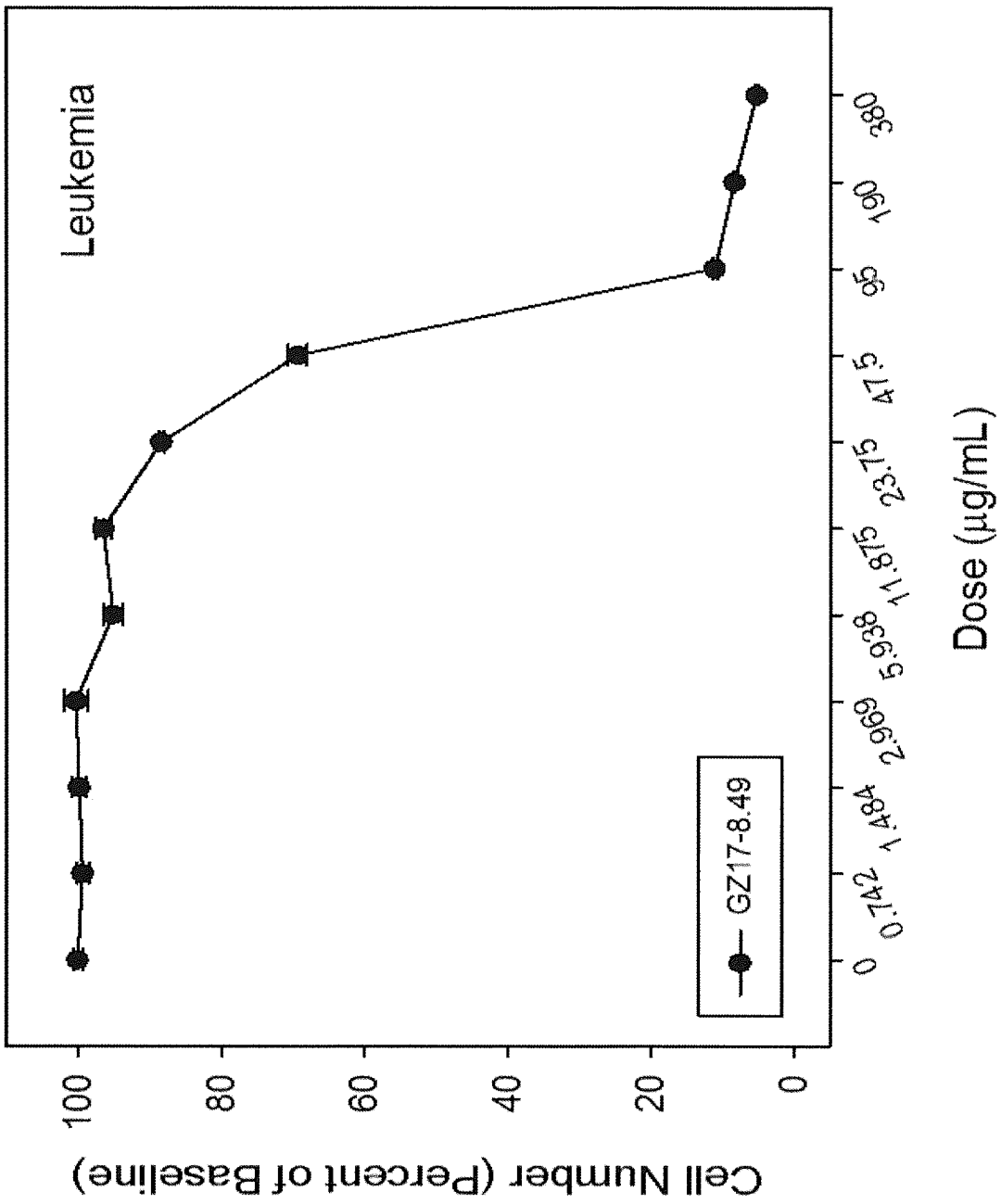

Leukemia
GZ17-8.49
Cell Number (Percent of Baseline)
0
20
40
60
80
100
0
0.742
1.484
2.969
5.938
11.875
23.75
47.5
95
190
380
Dose (µg/mL)

Fig. 67D

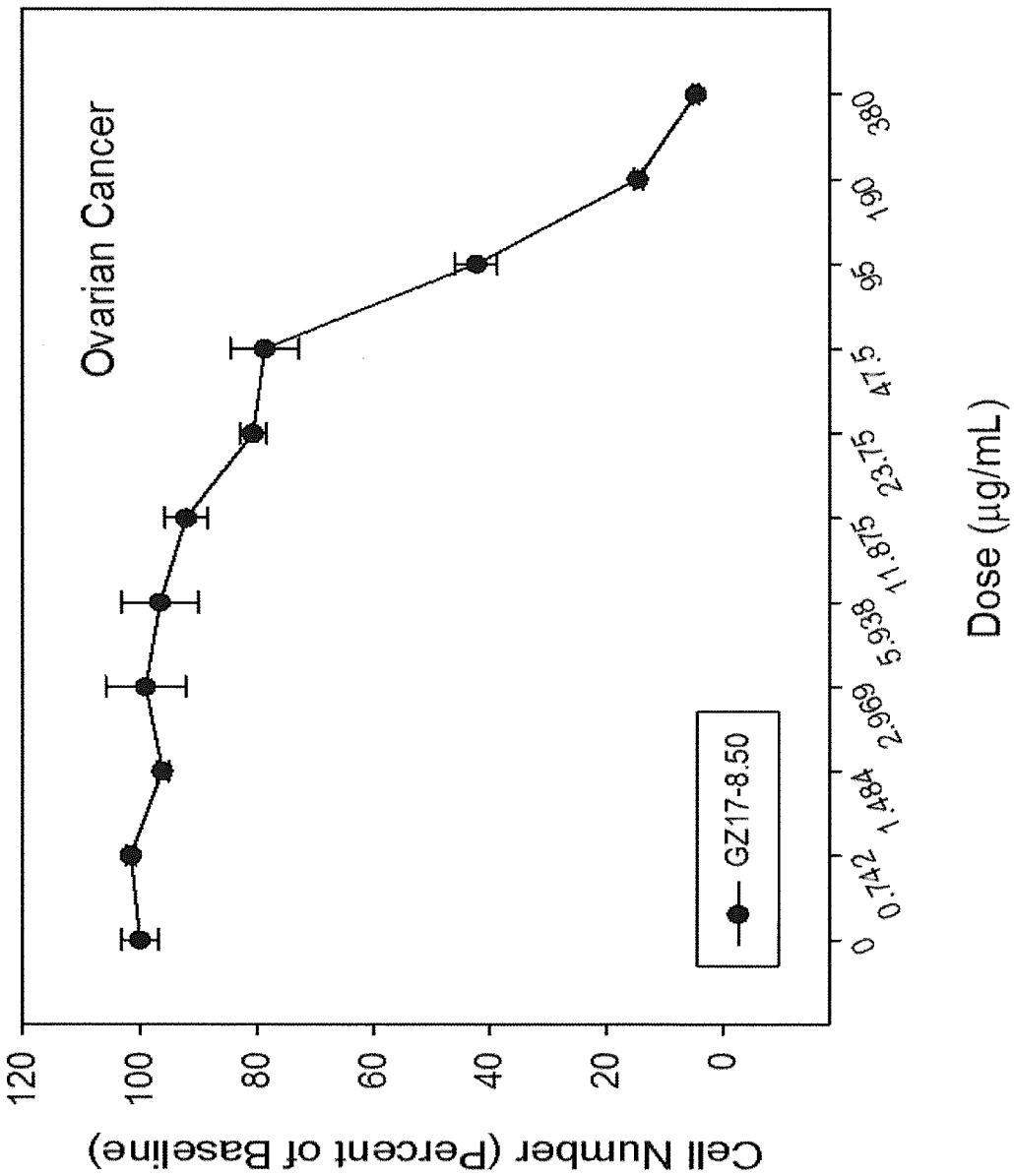

Ovarian Cancer
Cell Number (Percent of Baseline)
120
100
80
60
40
20
0
GZ17-8.50
0
0.742
1.484
2.969
5.938
11.875
23.75
47.5
95
190
380
Dose (µg/mL)

Fig. 68A

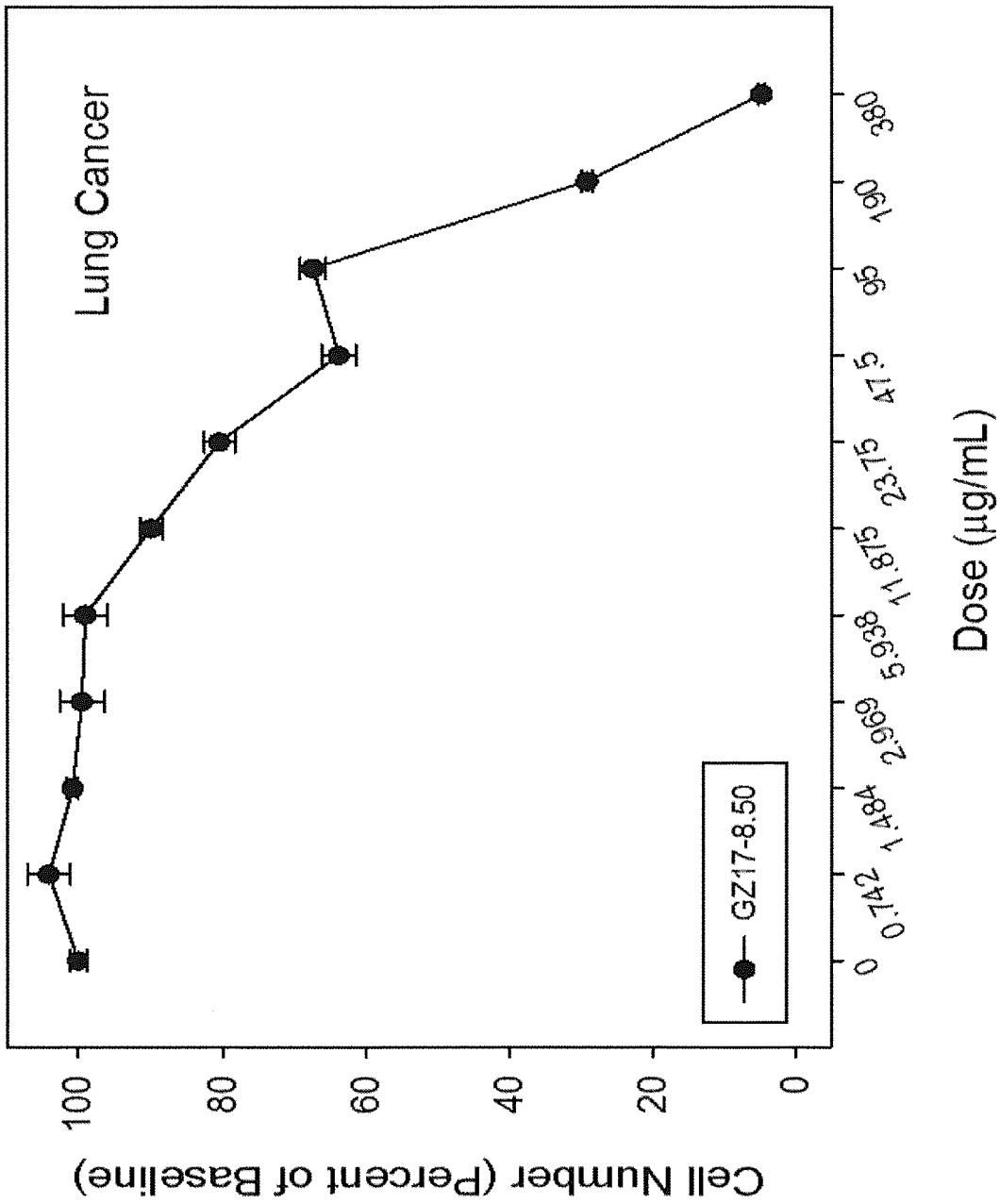

Lung Cancer
GZ17-8.50
Cell Number (Percent of Baseline)
0
20
40
60
80
100
0
0.742
1.484
2.969
5.938
11.875
23.75
47.5
95
190
380
Dose (µg/mL)

Fig. 68B

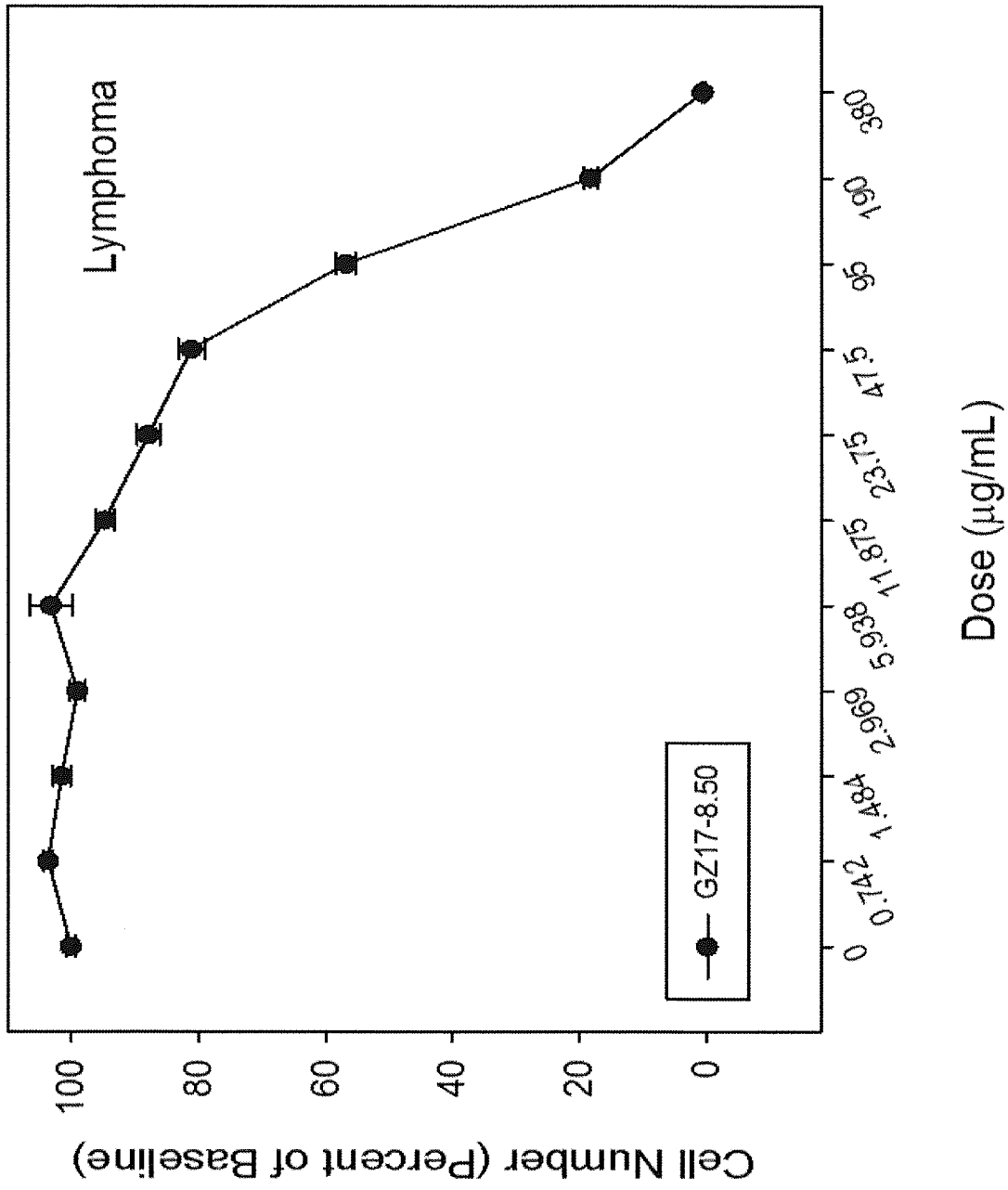

Lymphoma
Cell Number (Percent of Baseline)
100
80
60
40
20
0
GZ17-8.50
0
0.742
1.484
2.969
5.938
11.875
23.75
47.5
95
190
380
Dose (µg/mL)

Fig. 68C

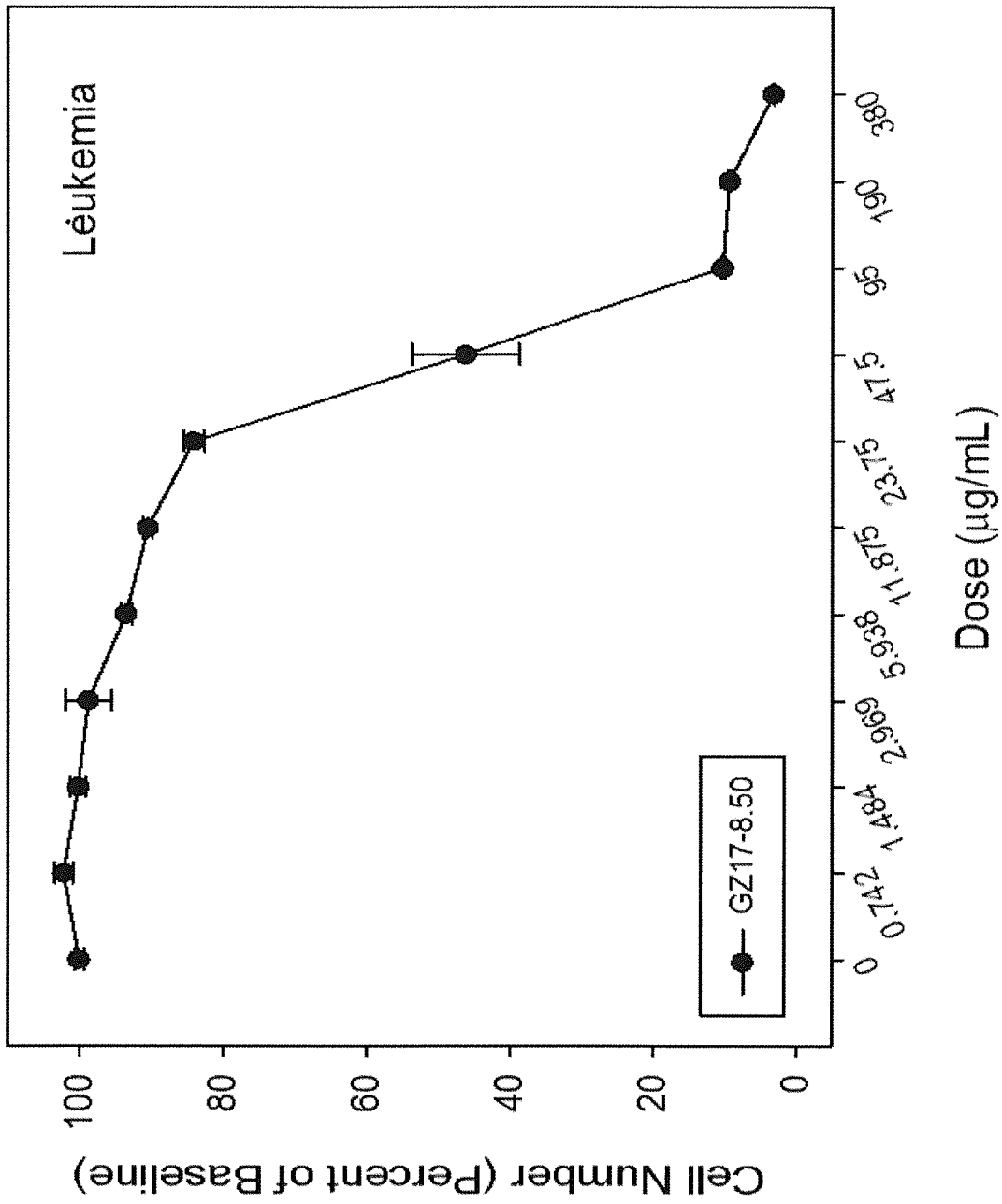

Leukemia
Cell Number (Percent of Baseline)
0
20
40
60
80
100
GZ17-8.50
0
0.742
1.484
2.969
5.938
11.875
23.75
47.5
95
190
380
Dose (µg/mL)

Fig. 68D

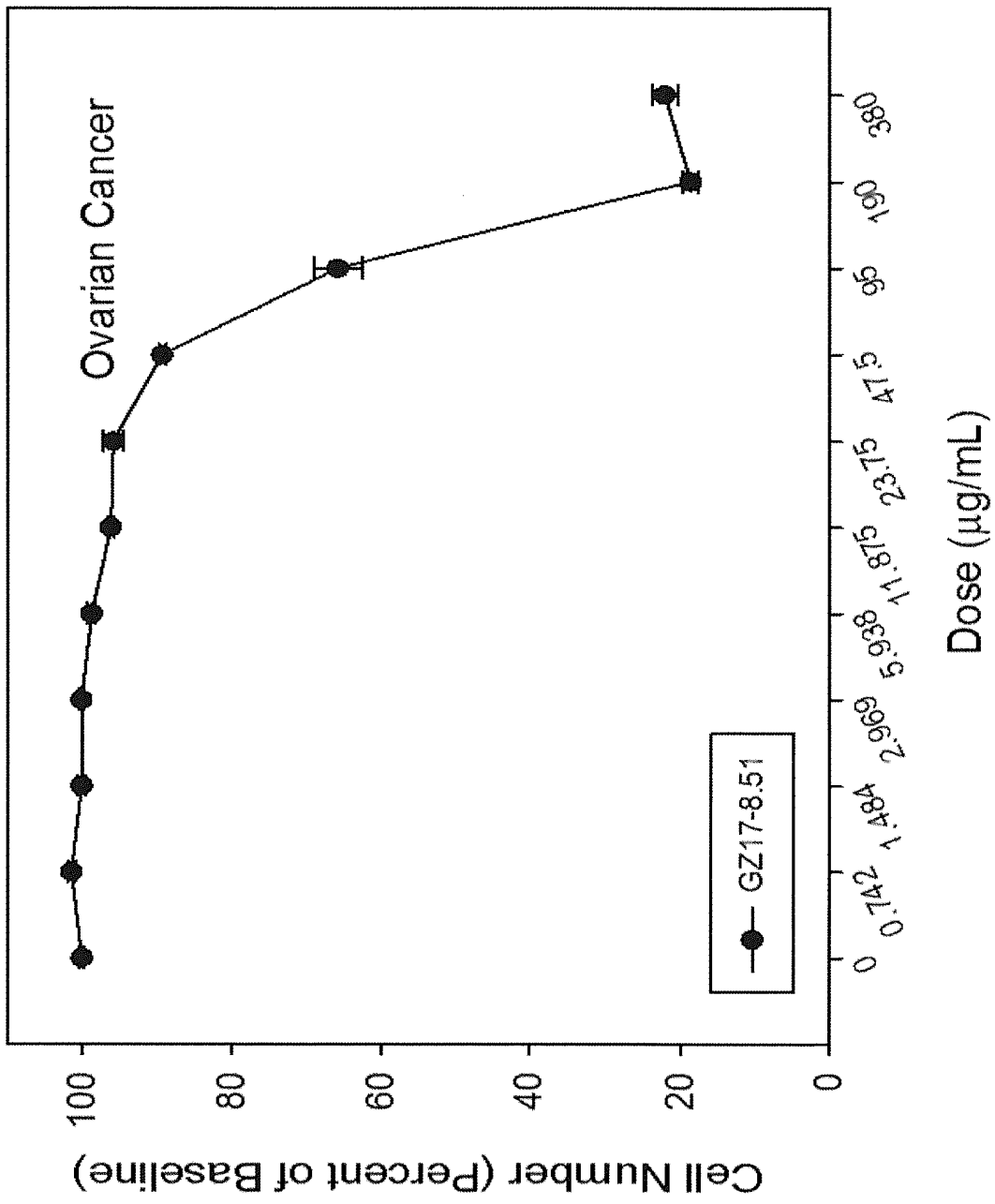

Ovarian Cancer
GZ17-8.51
Cell Number (Percent of Baseline)
0
20
40
60
80
100
0
0.742
1.484
2.969
5.938
11.875
23.75
47.5
95
190
380
Dose (µg/mL)

Fig. 69A

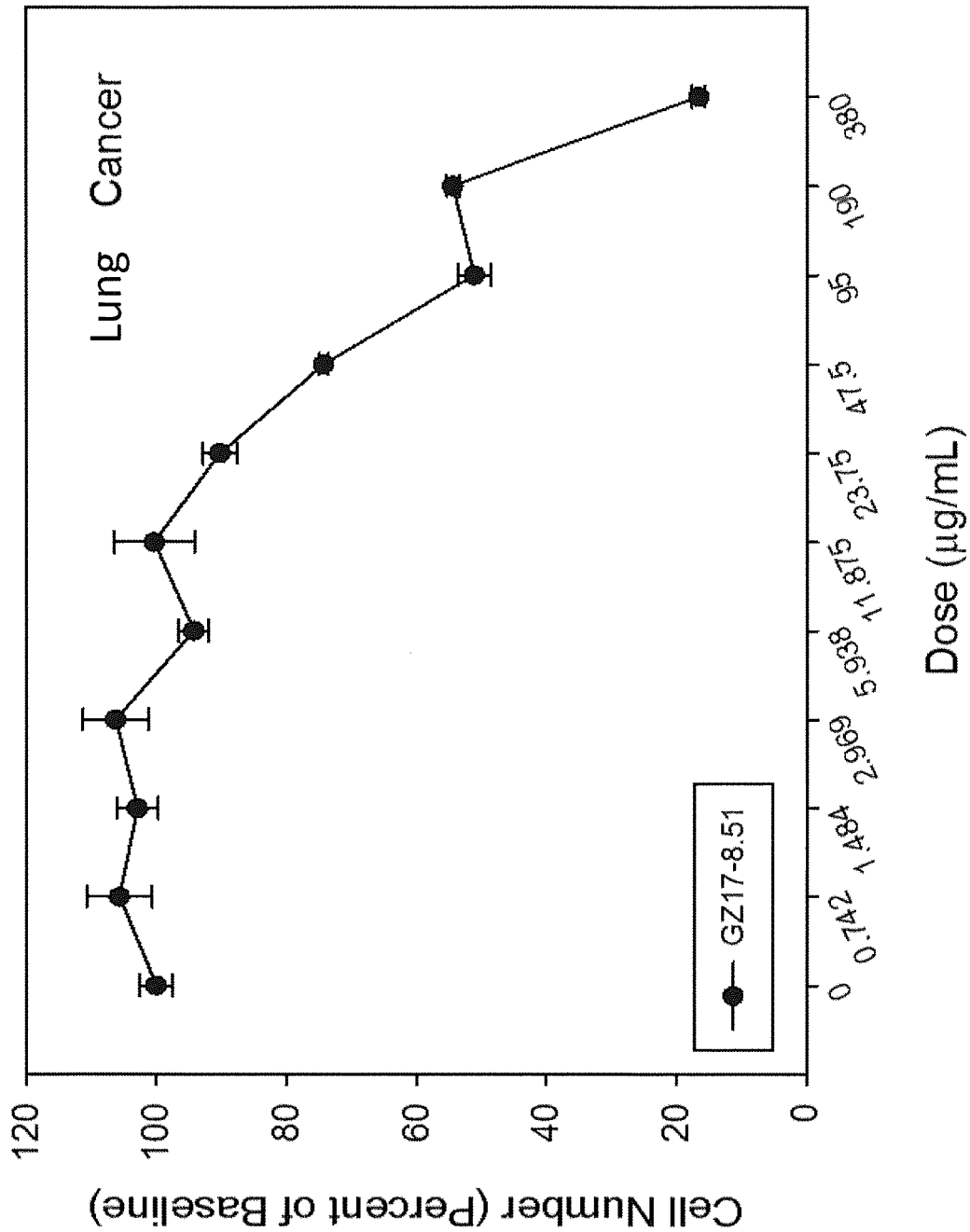

Lung Cancer
Cell Number (Percent of Baseline)
120
100
80
60
40
20
0
GZ17-8.51
0
0.142
1.484
2.969
5.938
11.875
23.75
47.5
95
190
380
Dose (µg/mL)

Fig. 69B

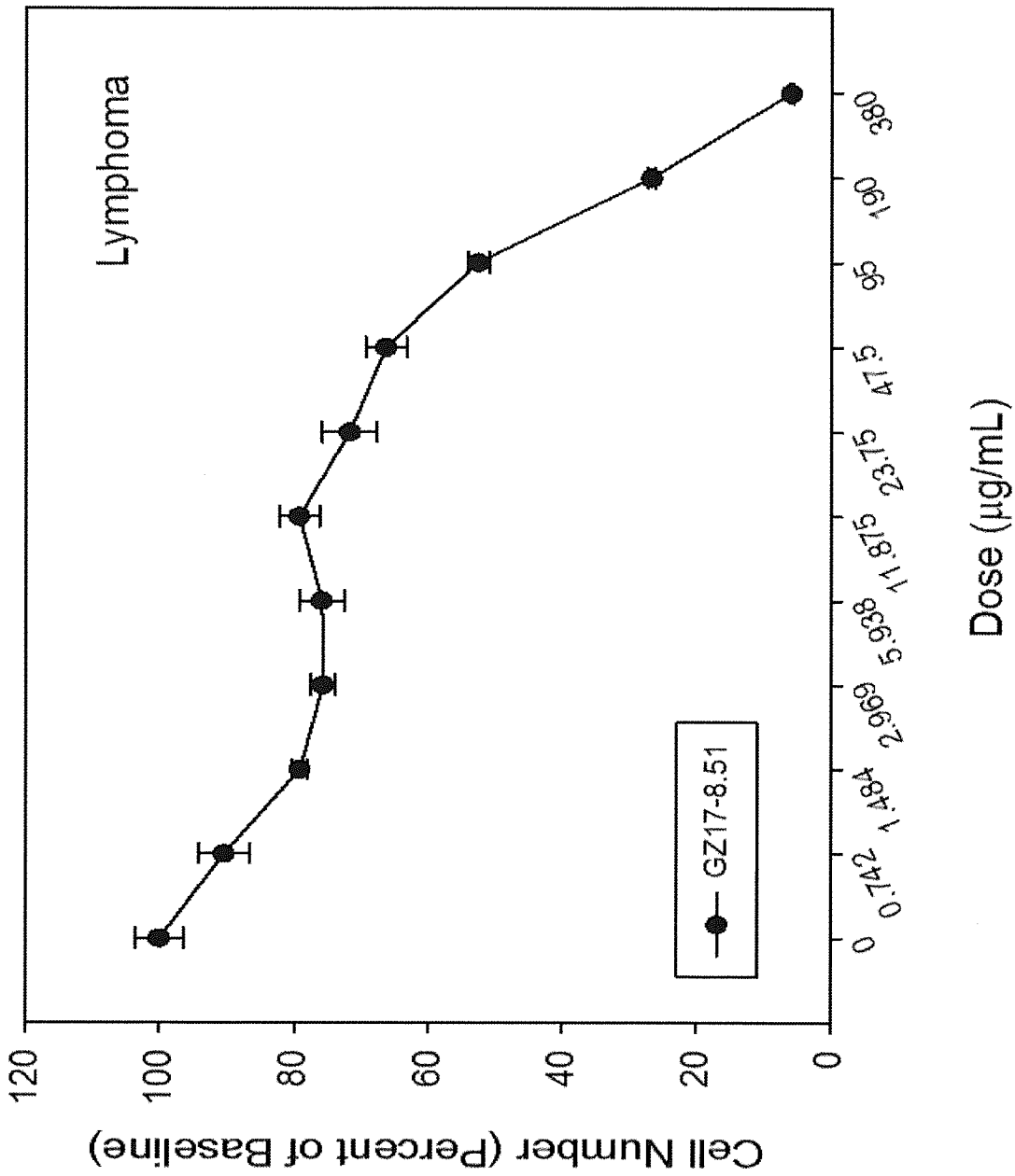

Lymphoma
Cell Number (Percent of Baseline)
120
100
80
60
40
20
0
GZ17-8.51
0
0.742
1.484
2.968
5.938
11.875
23.75
47.5
95
190
380
Dose (µg/mL)

Fig. 69C

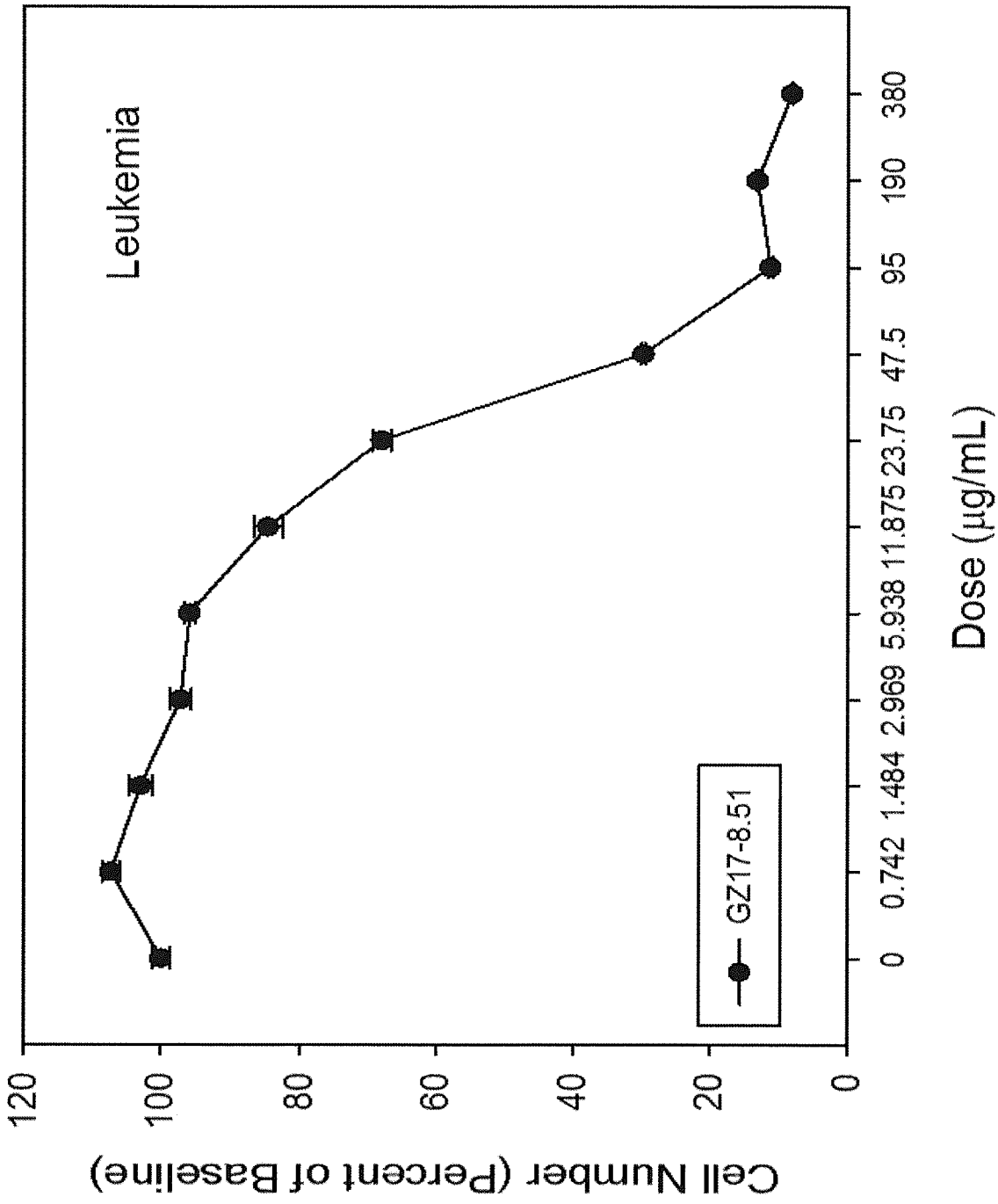

Leukemia
Cell Number (Percent of Baseline)
120
100
80
60
40
20
0
GZ17-8.51
0
0.742
1.484
2.969
5.938
11.875
23.75
47.5
95
190
380
Dose (µg/mL)

Fig. 69D

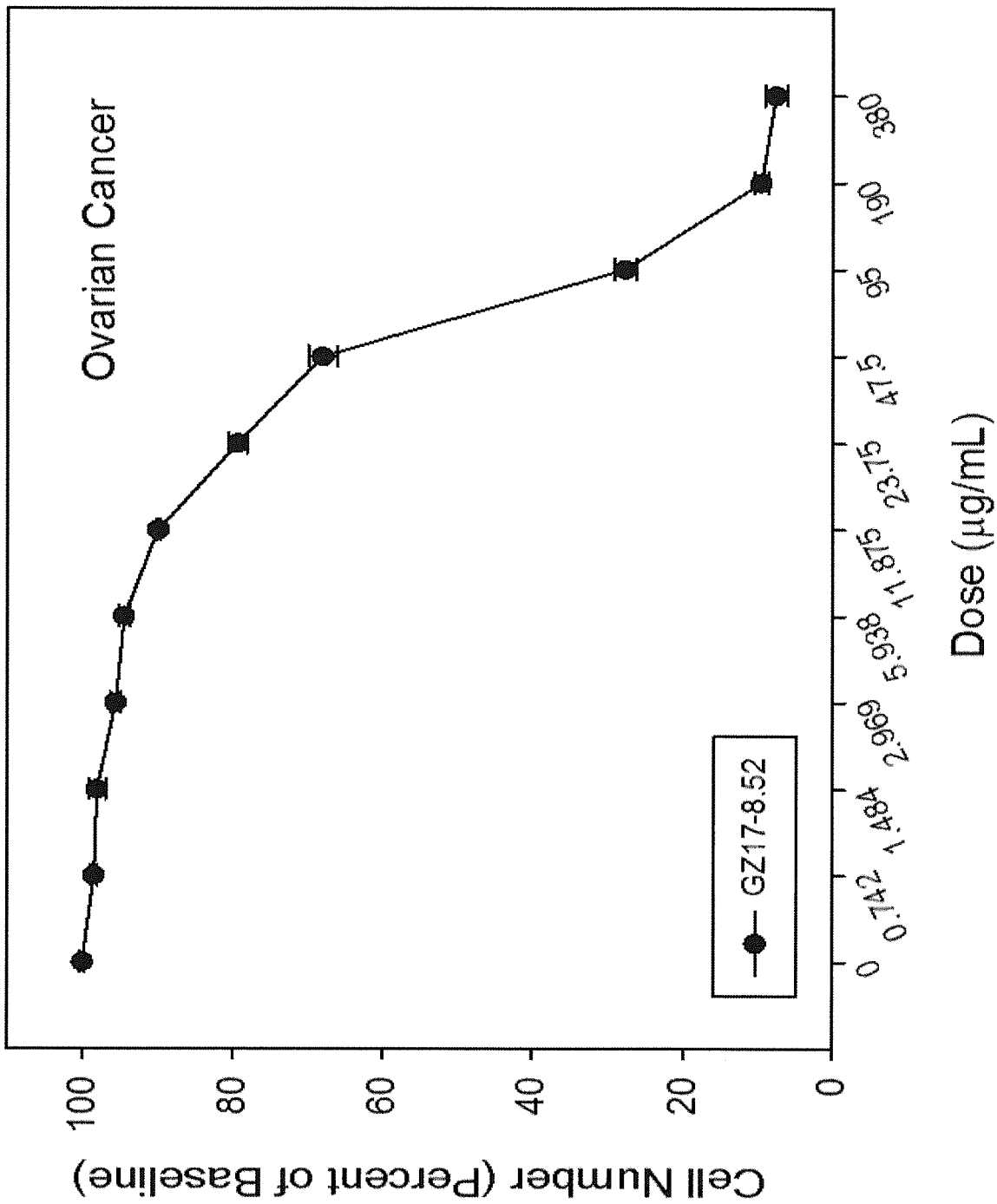

Ovarian Cancer
Cell Number (Percent of Baseline)
0
20
40
60
80
100
GZ17-8.52
0
0.742
1.484
2.969
5.938
11.875
23.75
47.5
95
190
380
Dose (µg/mL)

Fig. 70A

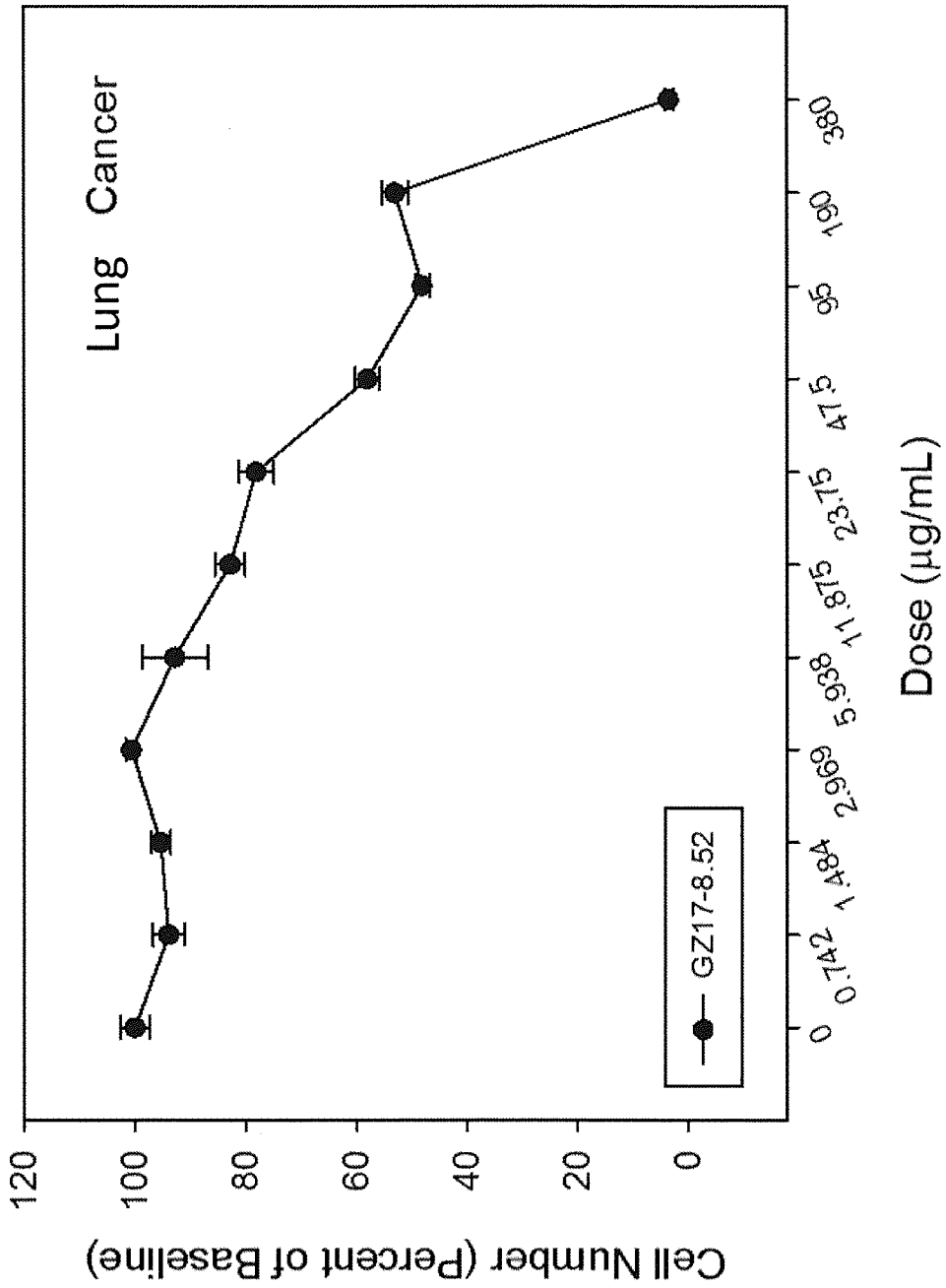

Lung Cancer
GZ17-8.52
Cell Number (Percent of Baseline)
120
100
80
60
40
20
0
0
0.742
1.484
2.969
5.938
11.875
23.75
47.5
95
190
380
Dose (µg/mL)

Fig. 70B

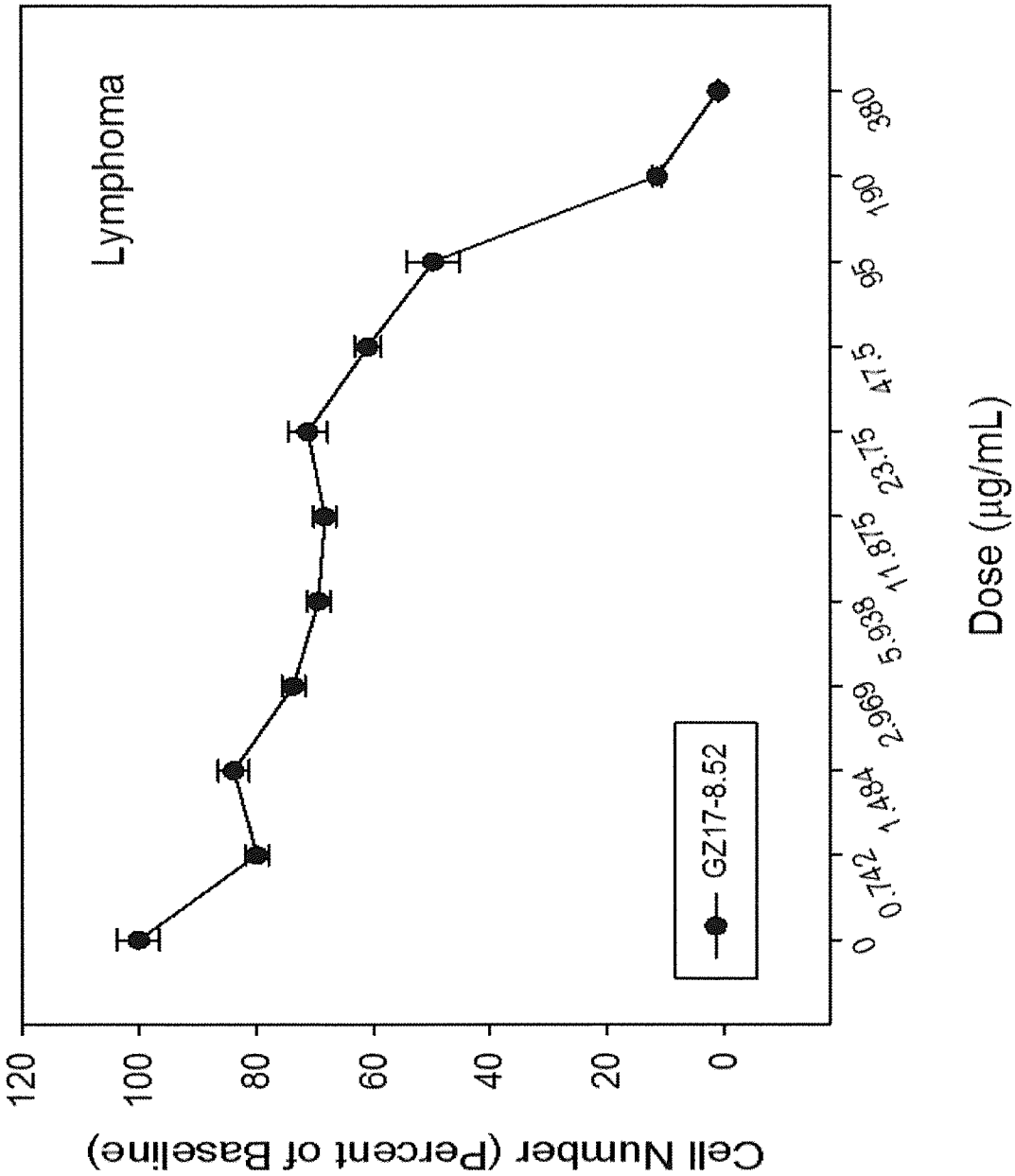

Lymphoma
Cell Number (Percent of Baseline)
120
100
80
60
40
20
0
GZ17-8.52
0
0.742
1.484
2.969
5.938
11.875
23.75
47.5
95
190
380
Dose (µg/mL)

Fig. 70C

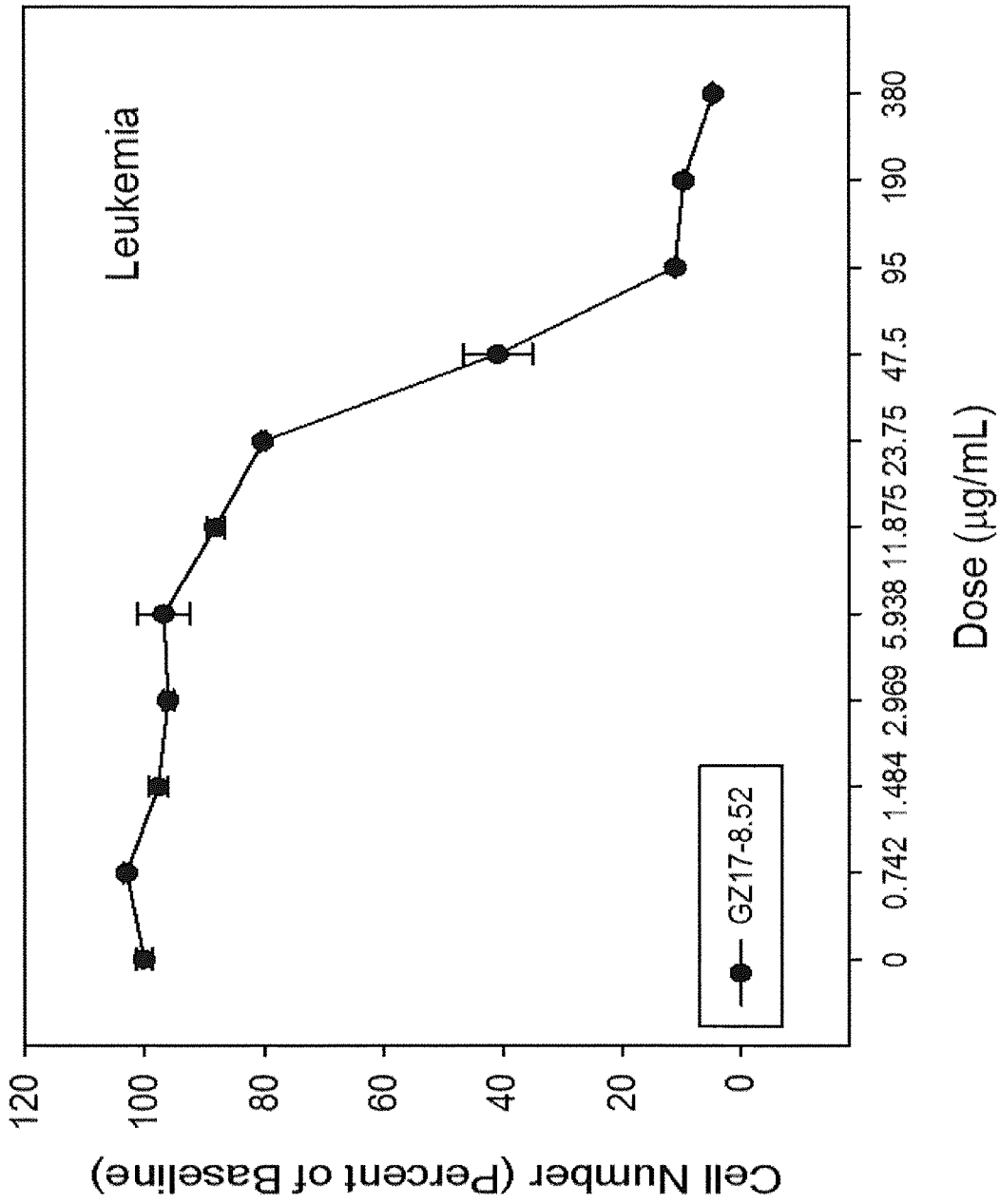

Leukemia
Cell Number (Percent of Baseline)
120
100
80
60
40
20
0
0
0.742
1.484
2.969
5.938
11.875
23.75
47.5
95
190
380
Dose (µg/mL)
GZ17-8.52

Fig. 70D

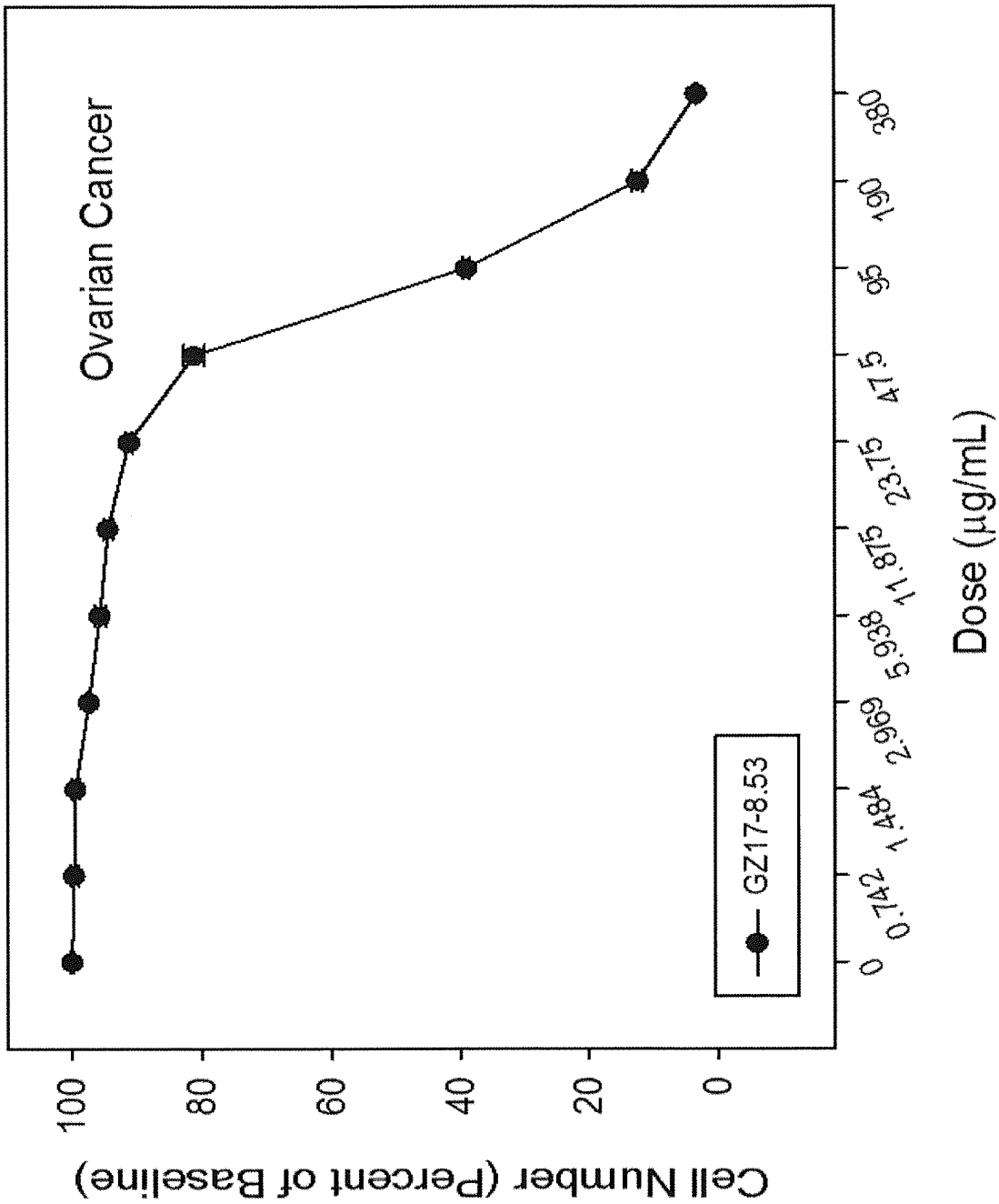

Ovarian Cancer
Cell Number (Percent of Baseline)
100
80
60
40
20
0
GZ17-8.53
0
0.742
1.484
2.969
5.938
11.875
23.75
47.5
95
190
380
Dose (µg/mL)

Fig. 71A

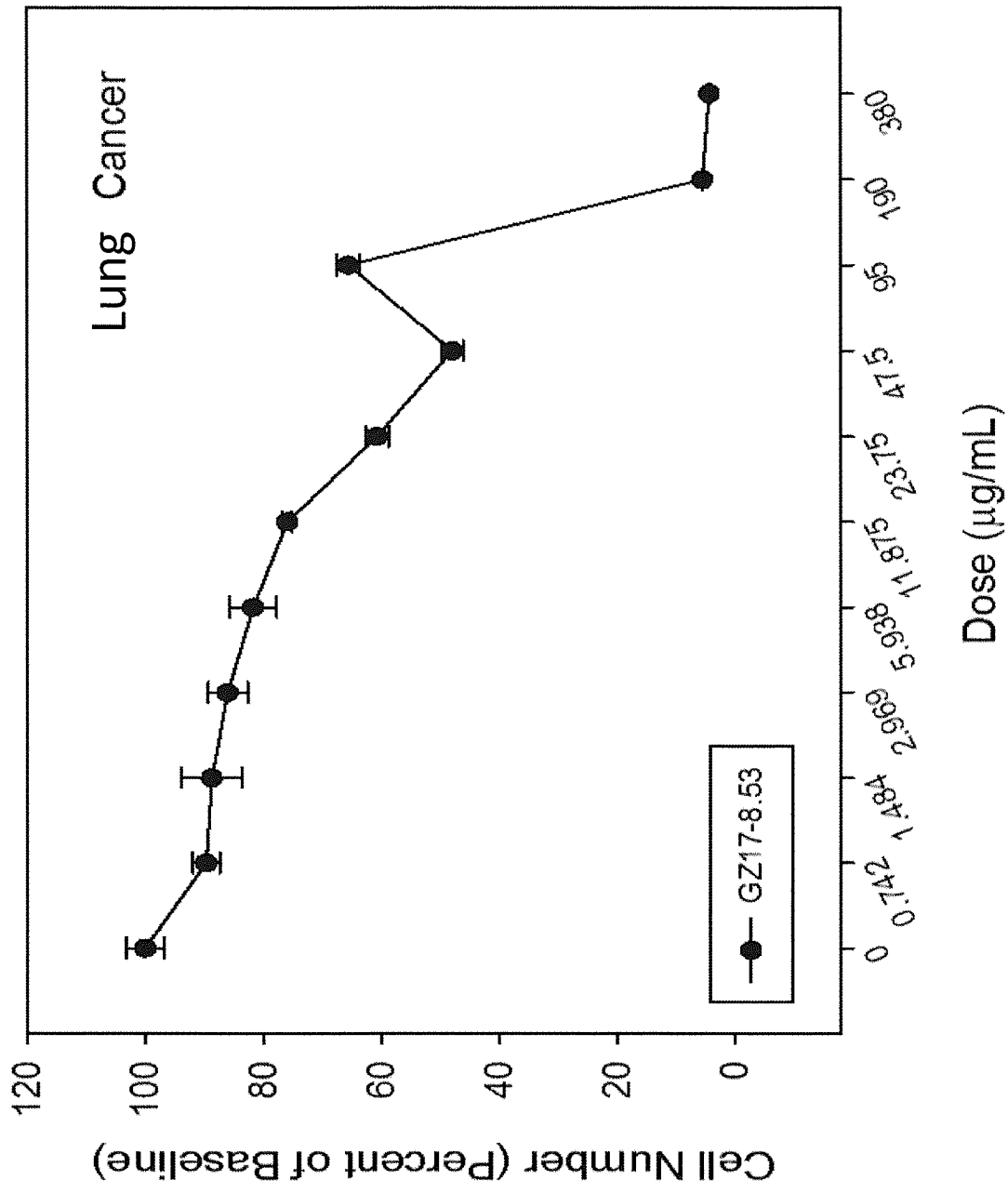

Lung Cancer
GZ17-8.53
Cell Number (Percent of Baseline)
120
100
80
60
40
20
0
0
0.742
1.484
2.969
5.938
11.875
23.75
47.5
95
190
380
Dose (μg/mL)

Fig. 71B

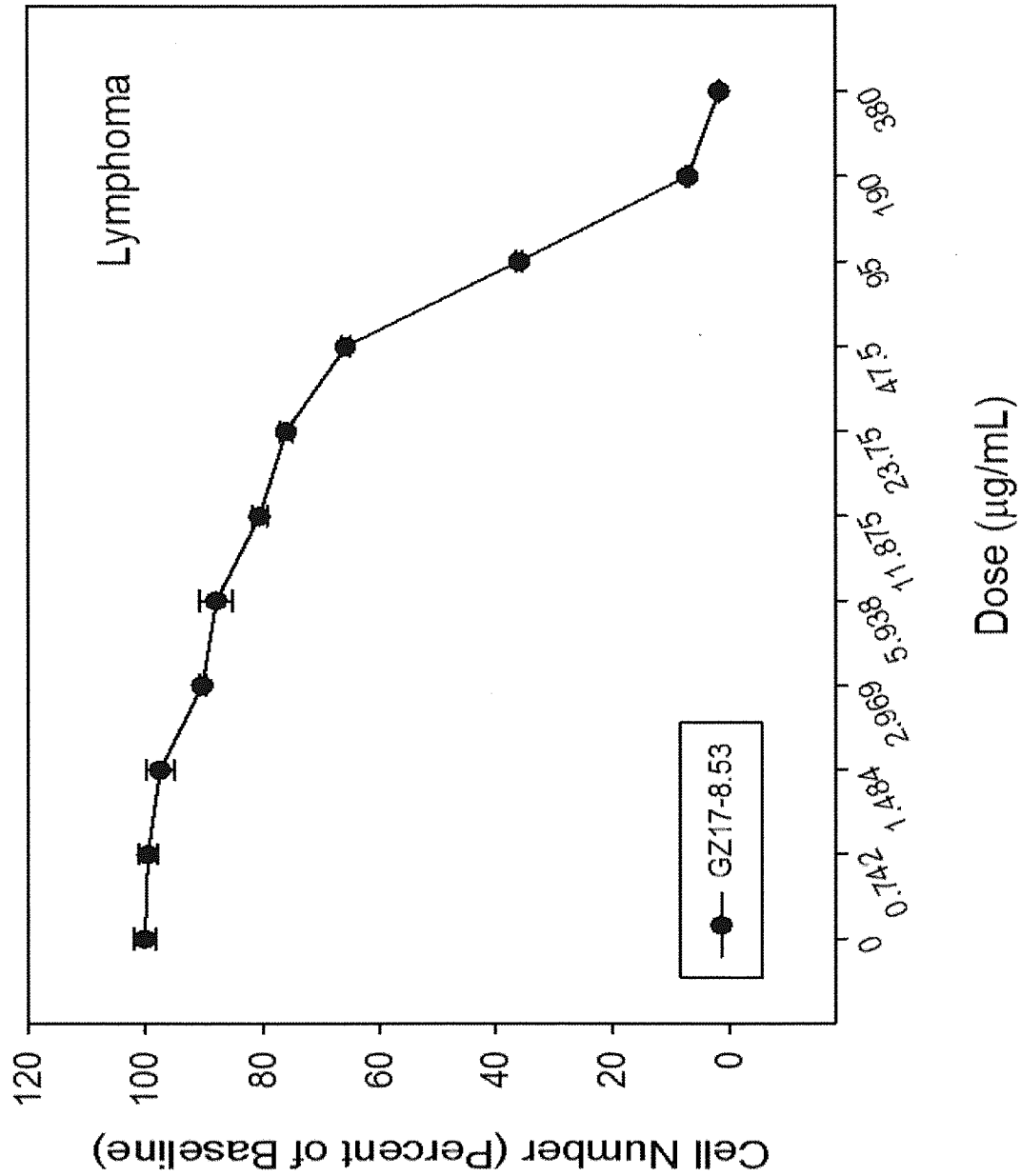

Lymphoma
Cell Number (Percent of Baseline)
120
100
80
60
40
20
0
GZ17-8.53
0
0.742
1.484
2.969
5.938
11.875
23.75
47.5
95
190
380
Dose (µg/mL)

Fig. 71C

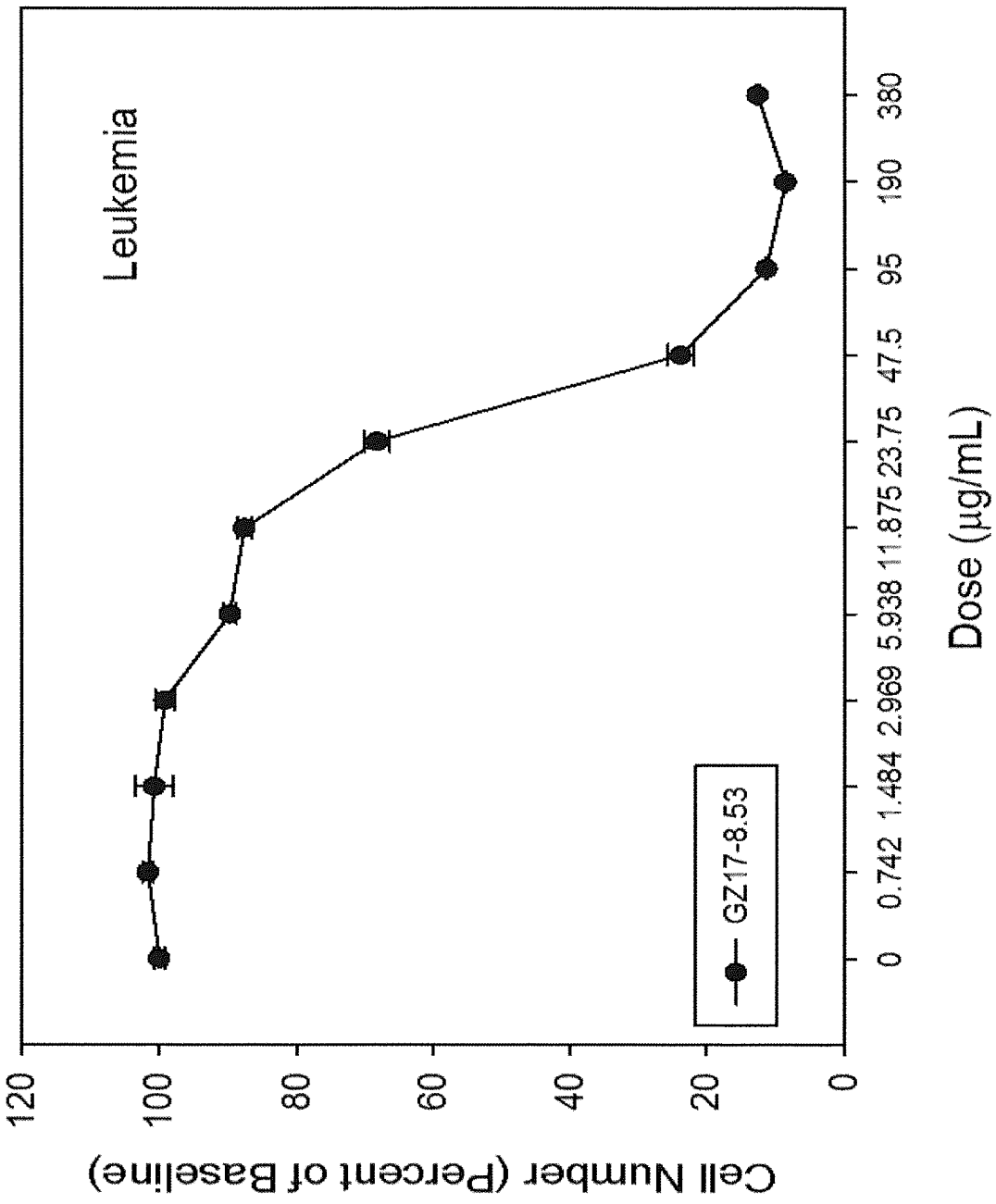

Leukemia
GZ17-8.53
Cell Number (Percent of Baseline)
0
20
40
60
80
100
120
0
0.742
1.484
2.969
5.938
11.875
23.75
47.5
95
190
380
Dose (µg/mL)

Fig. 71D

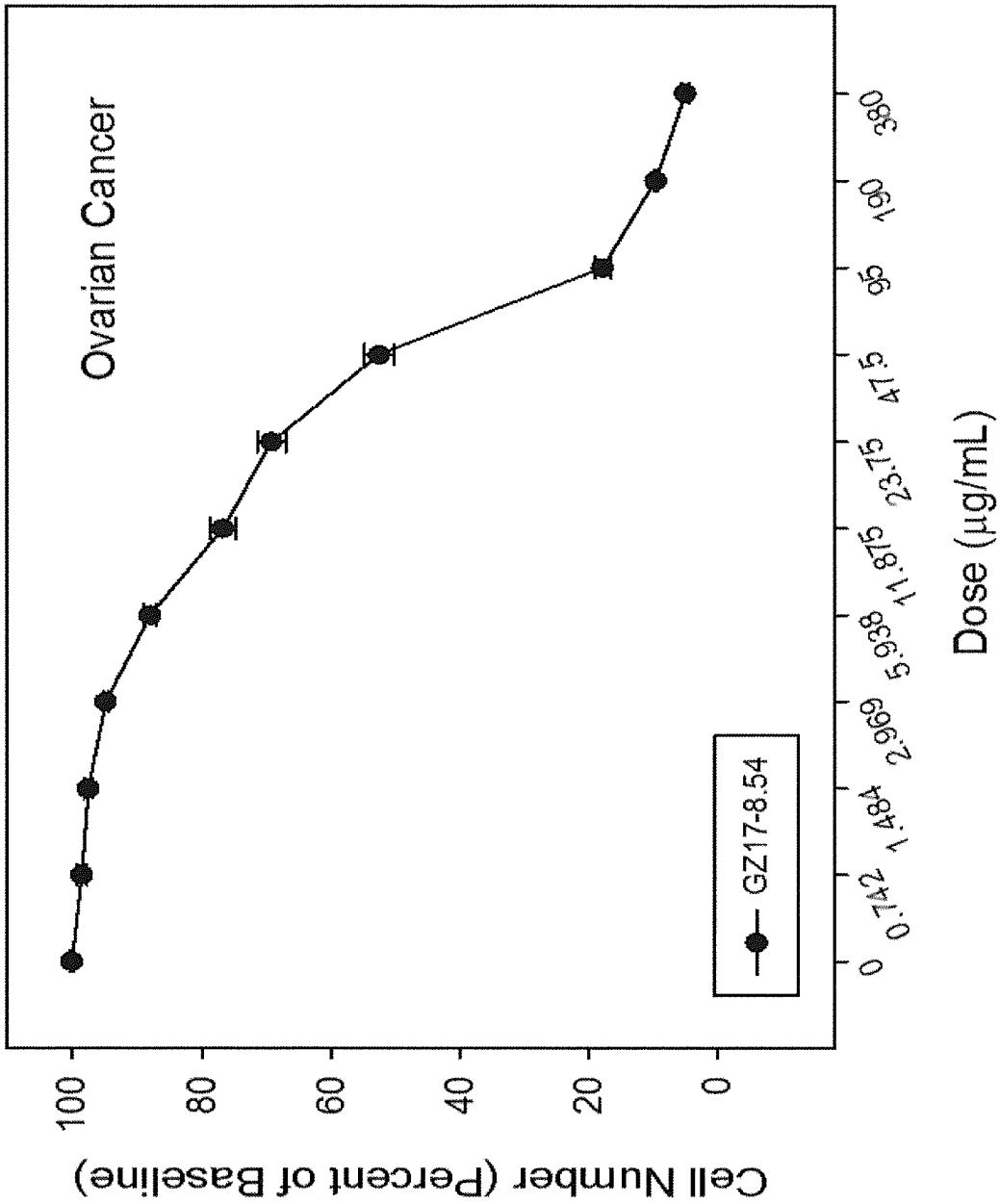

Ovarian Cancer
Cell Number (Percent of Baseline)
0
20
40
60
80
100
GZ17-8.54
0
0.742
1.484
2.969
5.938
11.875
23.75
47.5
95
190
380
Dose (µg/mL)

Fig. 72A

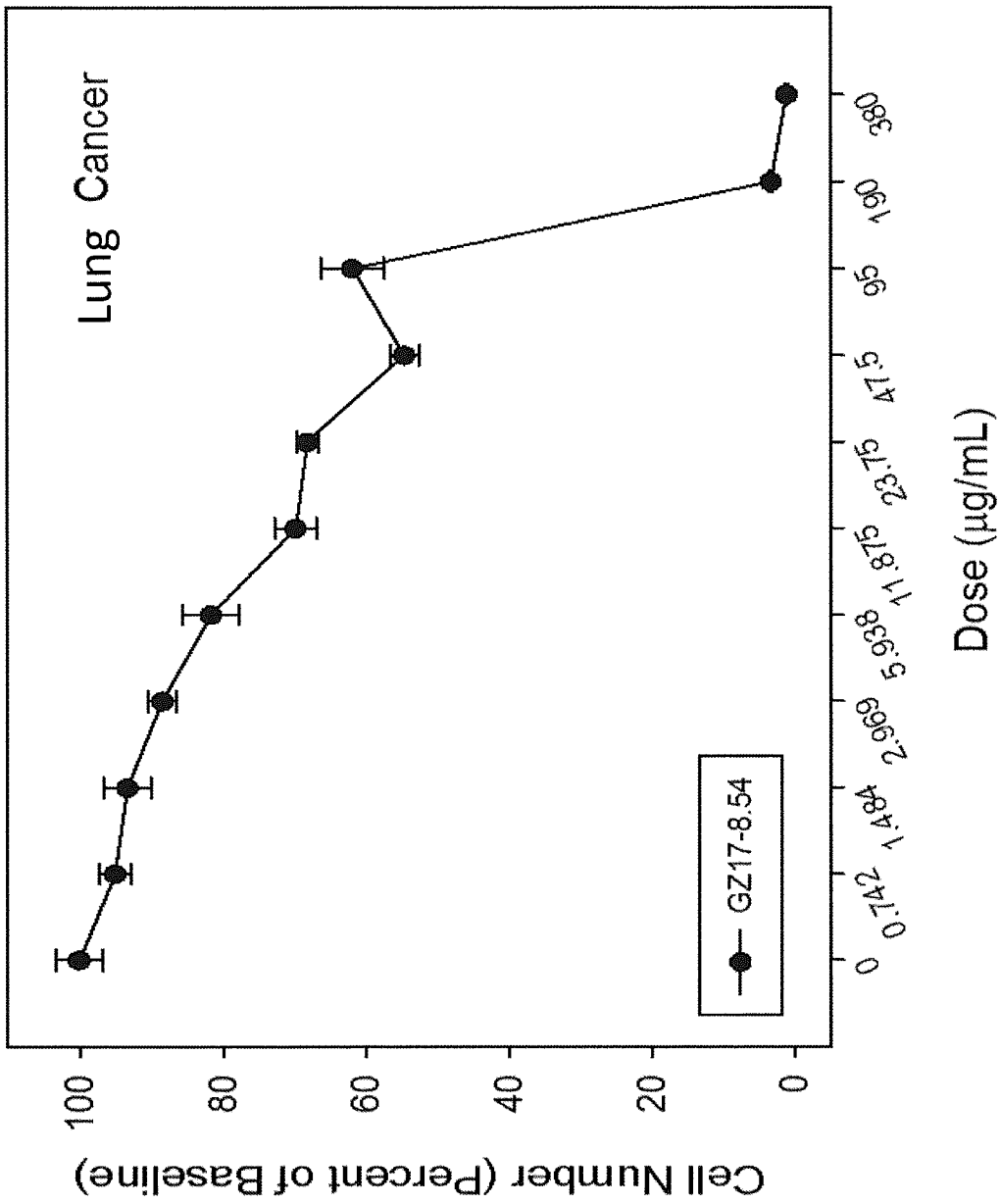

Lung Cancer
GZ17-8.54
Cell Number (Percent of Baseline)
0
20
40
60
80
100
0
0.742
1.484
2.969
5.938
11.875
23.75
47.5
95
190
380
Dose (µg/mL)

Fig. 72B

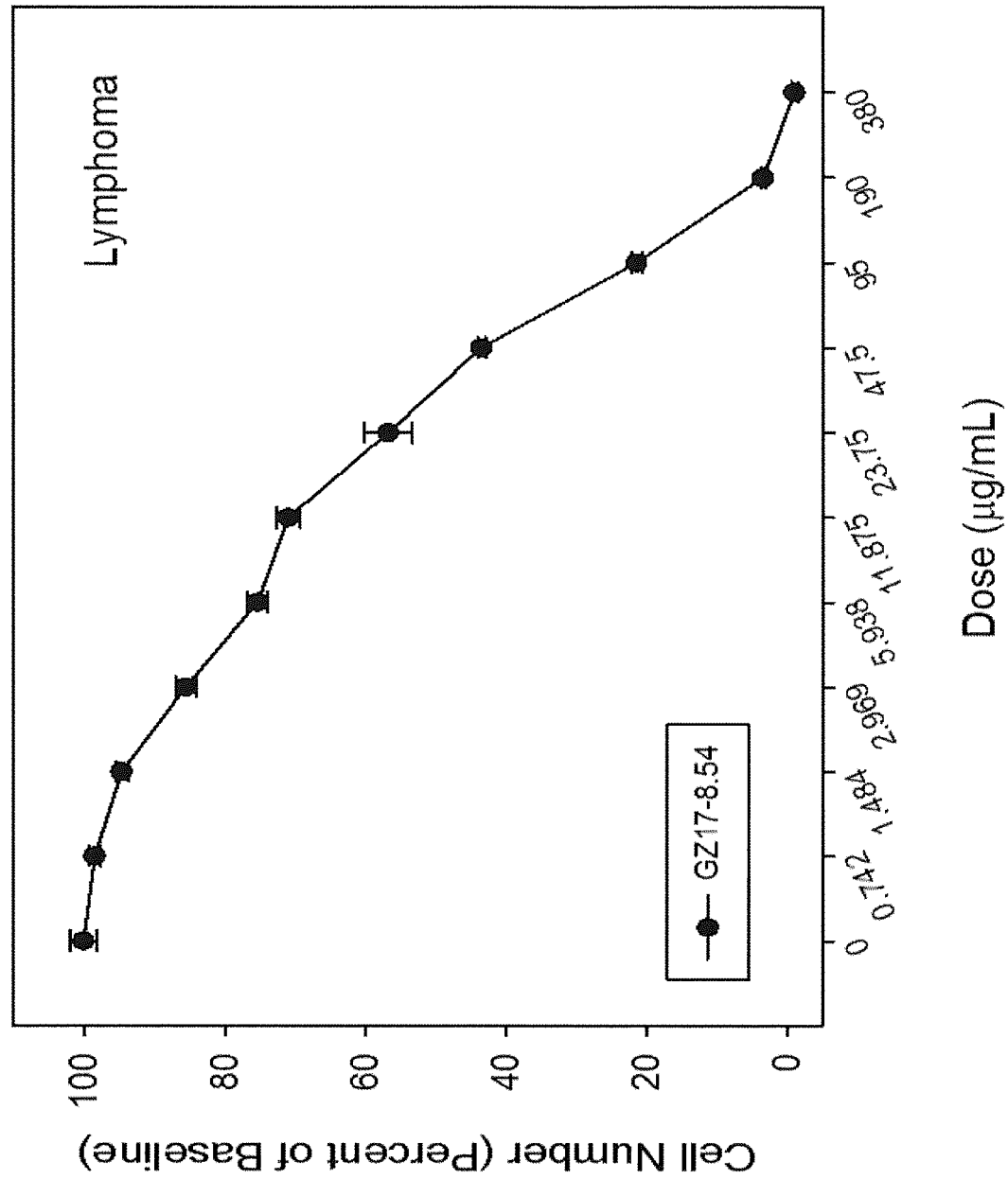

Lymphoma
Cell Number (Percent of Baseline)
100
80
60
40
20
0
GZ17-8.54
0
0.742
1.484
2.969
5.938
11.875
23.75
47.5
95
190
380
Dose (µg/mL)

Fig. 72C

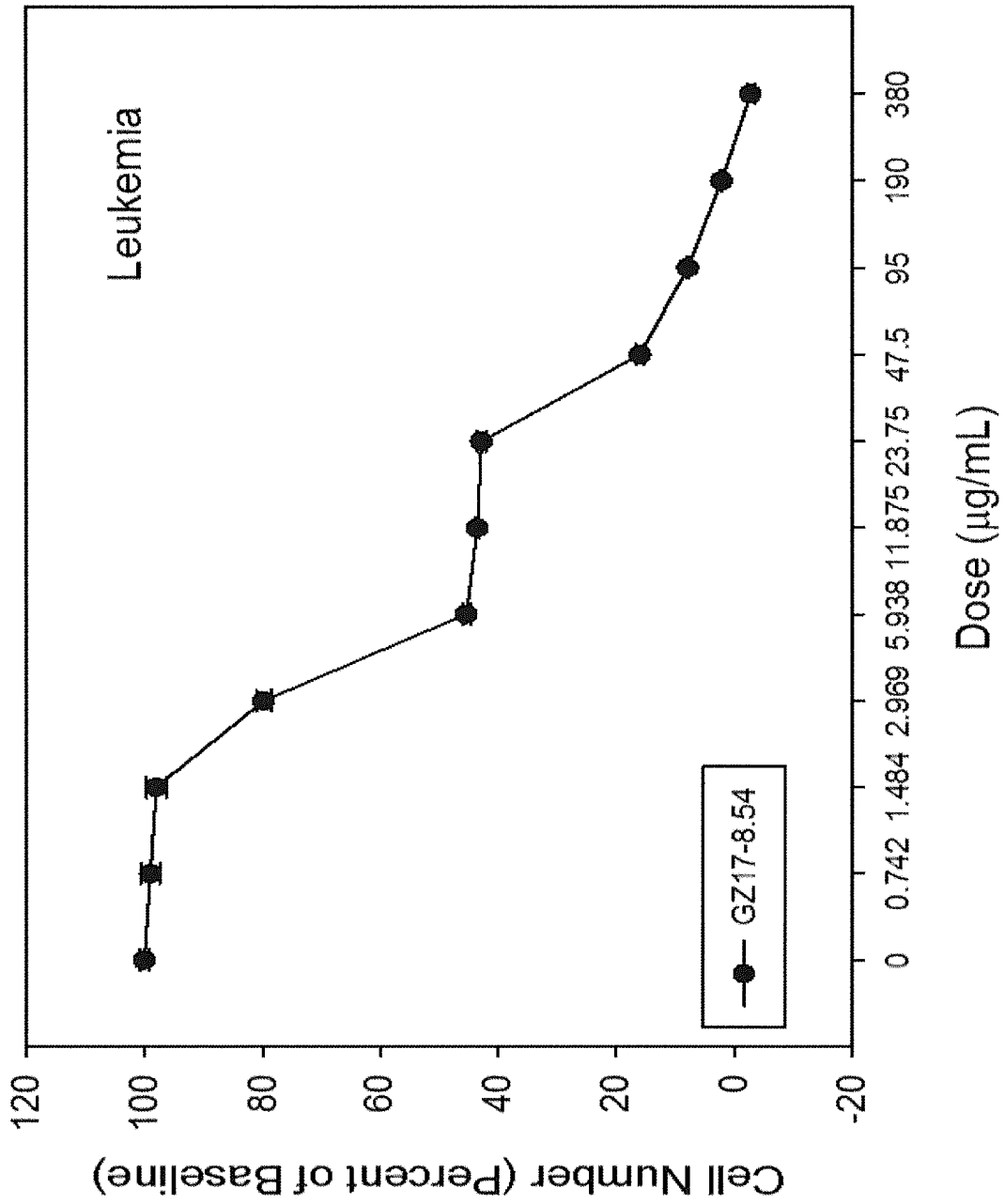

Leukemia
Cell Number (Percent of Baseline)
120
100
80
60
40
20
0
-20
GZ17-8.54
0
0.742
1.484
2.969
5.938
11.875
23.75
47.5
95
190
380
Dose (µg/mL)

Fig. 72D

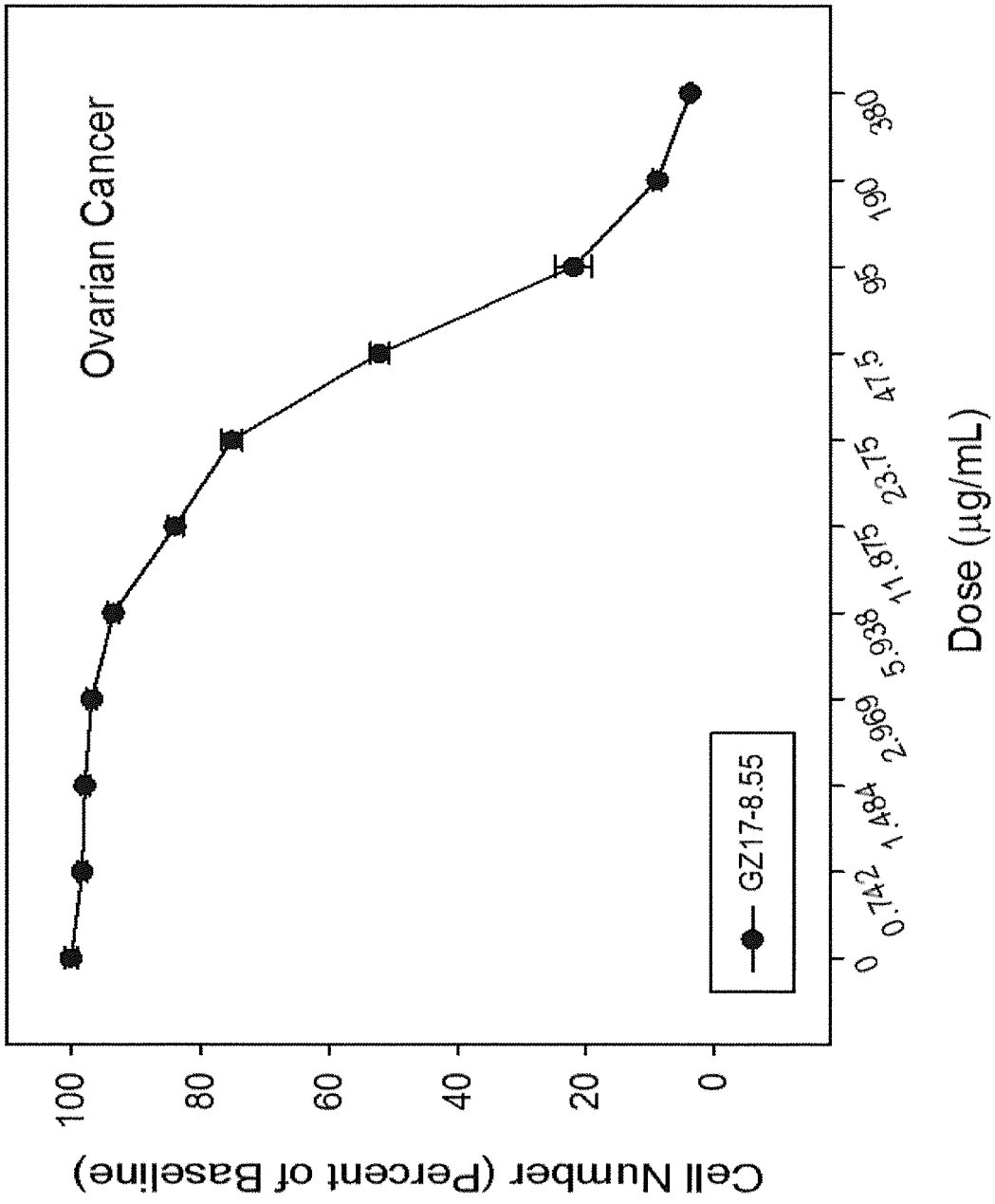

Ovarian Cancer
GZ17-8.55
Cell Number (Percent of Baseline)
0
20
40
60
80
100
0
0.742
1.484
2.969
5.938
11.875
23.75
47.5
95
190
380
Dose (µg/mL)

Fig. 73A

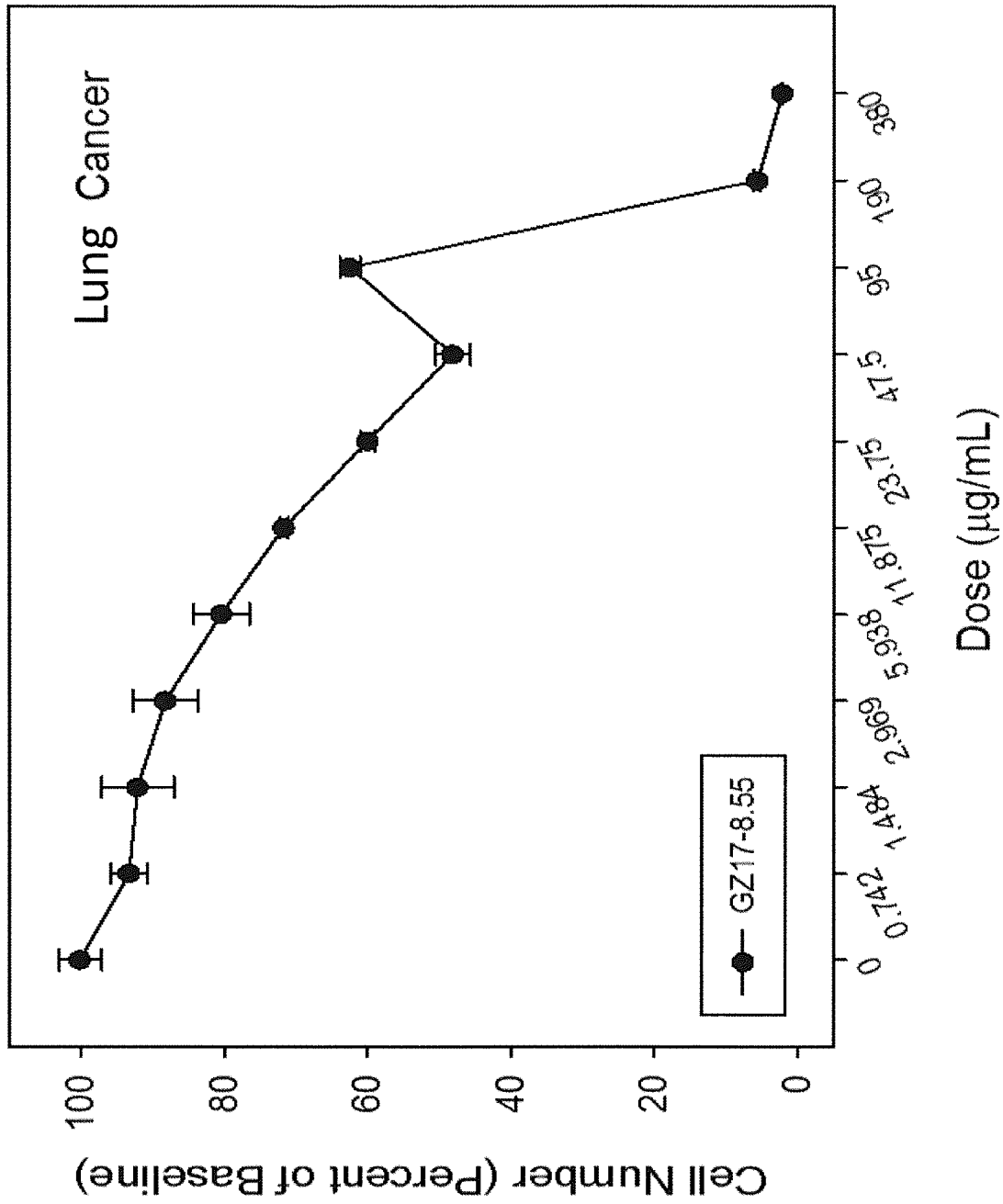

Lung Cancer
Cell Number (Percent of Baseline)
100
80
60
40
20
0
GZ17-8.55
0
0.142
0.484
1.094
2.969
5.938
11.875
23.75
47.5
95
190
380
Dose (µg/mL)

Fig. 73B

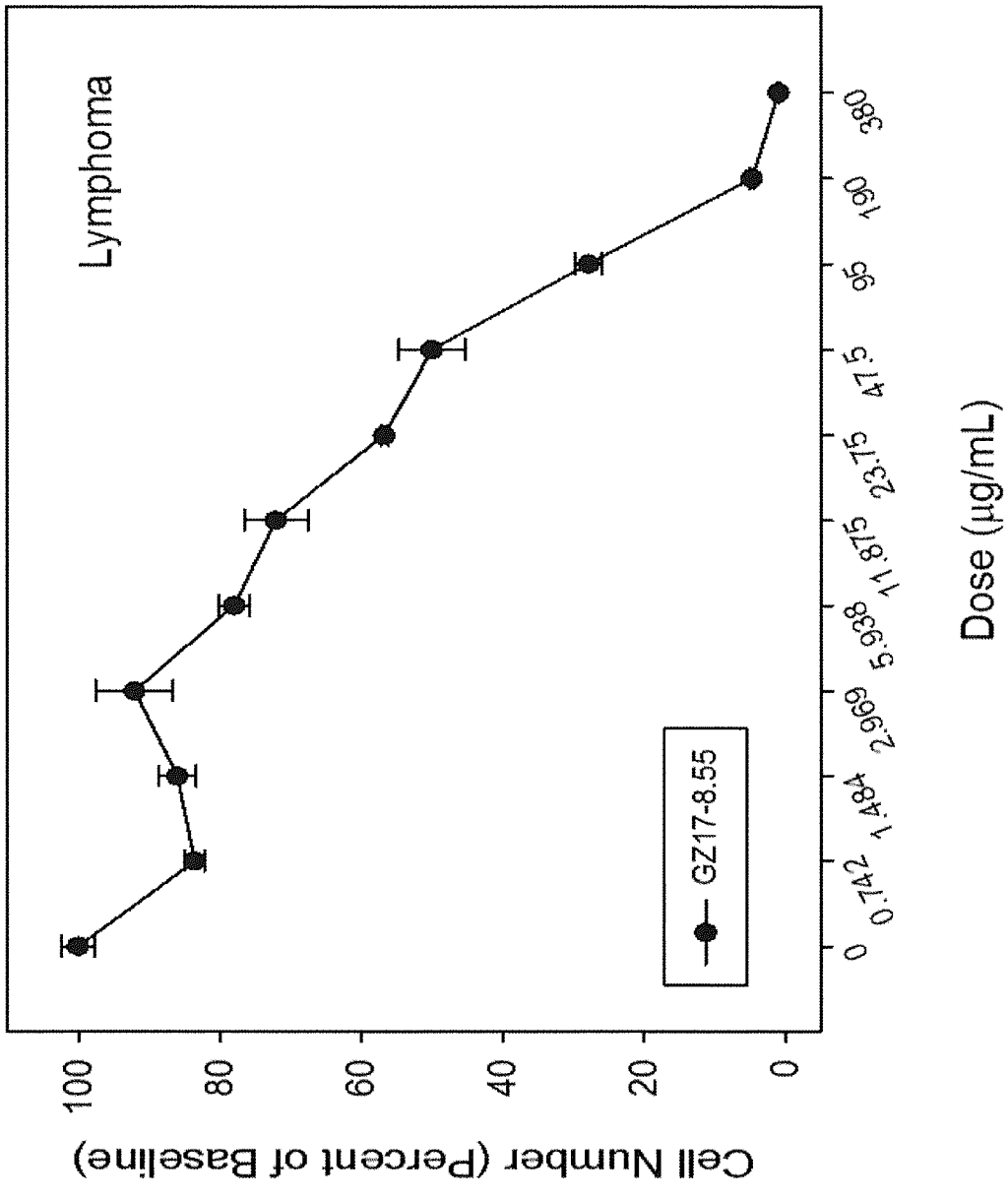

Lymphoma
GZ17-8.55
Cell Number (Percent of Baseline)
0
20
40
60
80
100
0
0.742
1.484
2.969
5.938
11.875
23.75
47.5
95
190
380
Dose (µg/mL)

Fig. 73C

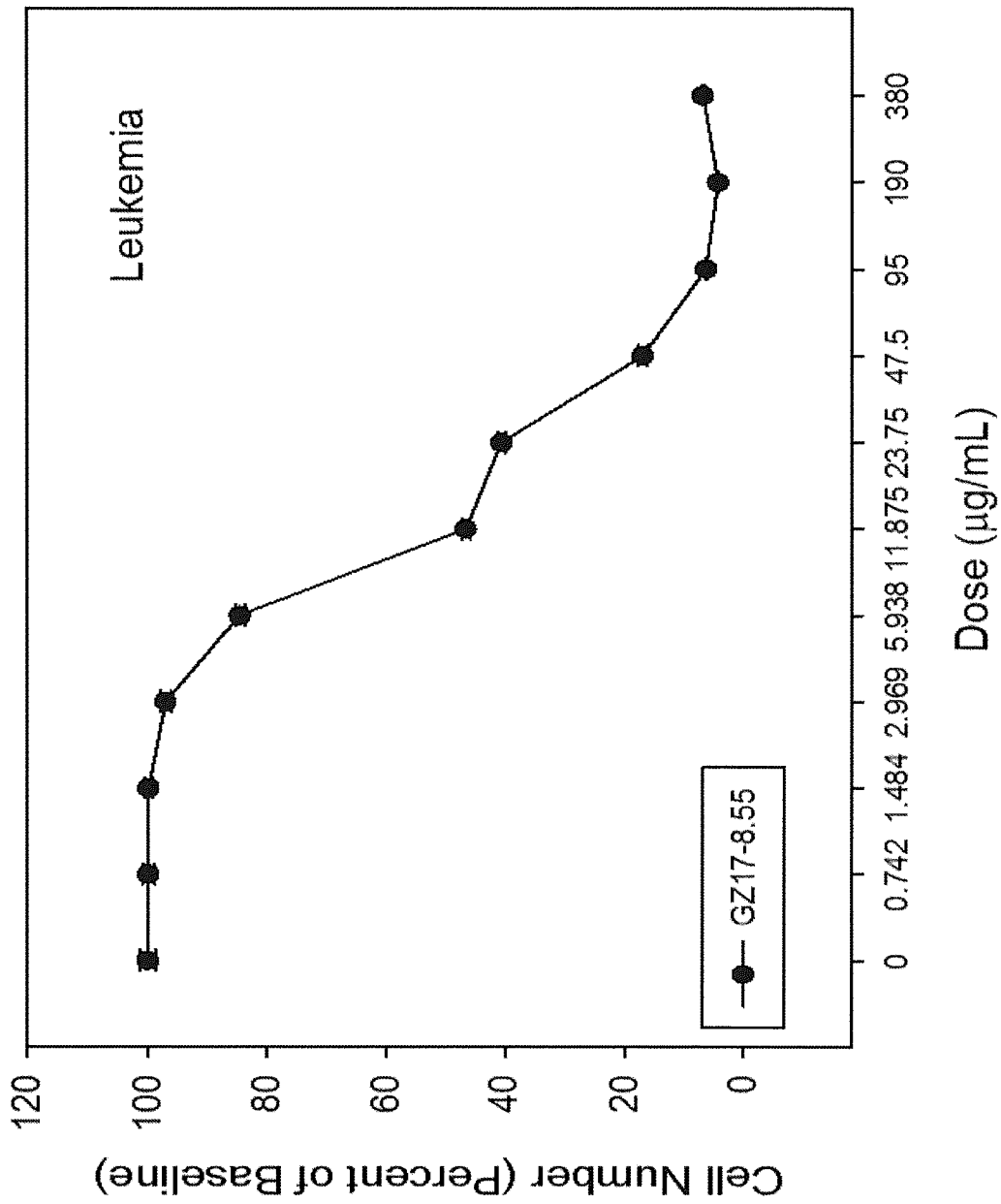

Leukemia
GZ17-8.55
Cell Number (Percent of Baseline)
120
100
80
60
40
20
0
0
0.742
1.484
2.969
5.938
11.875
23.75
47.5
95
190
380
Dose (µg/mL)

Fig. 73D

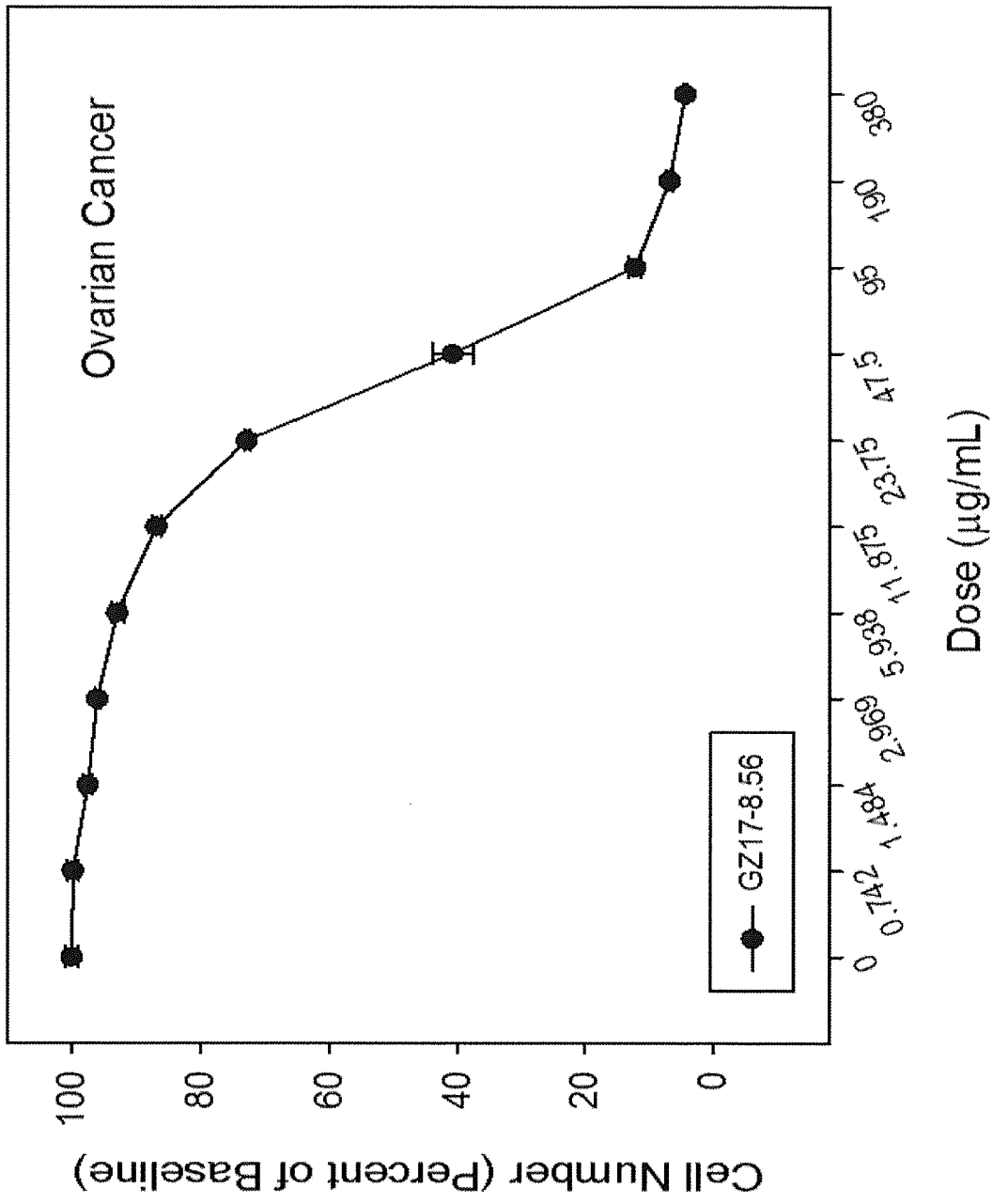

Ovarian Cancer
Cell Number (Percent of Baseline)
100
80
60
40
20
0
GZ17-8.56
0
0.142
1.484
2.969
5.938
11.875
23.75
47.5
95
190
380
Dose (µg/mL)

Fig. 74A

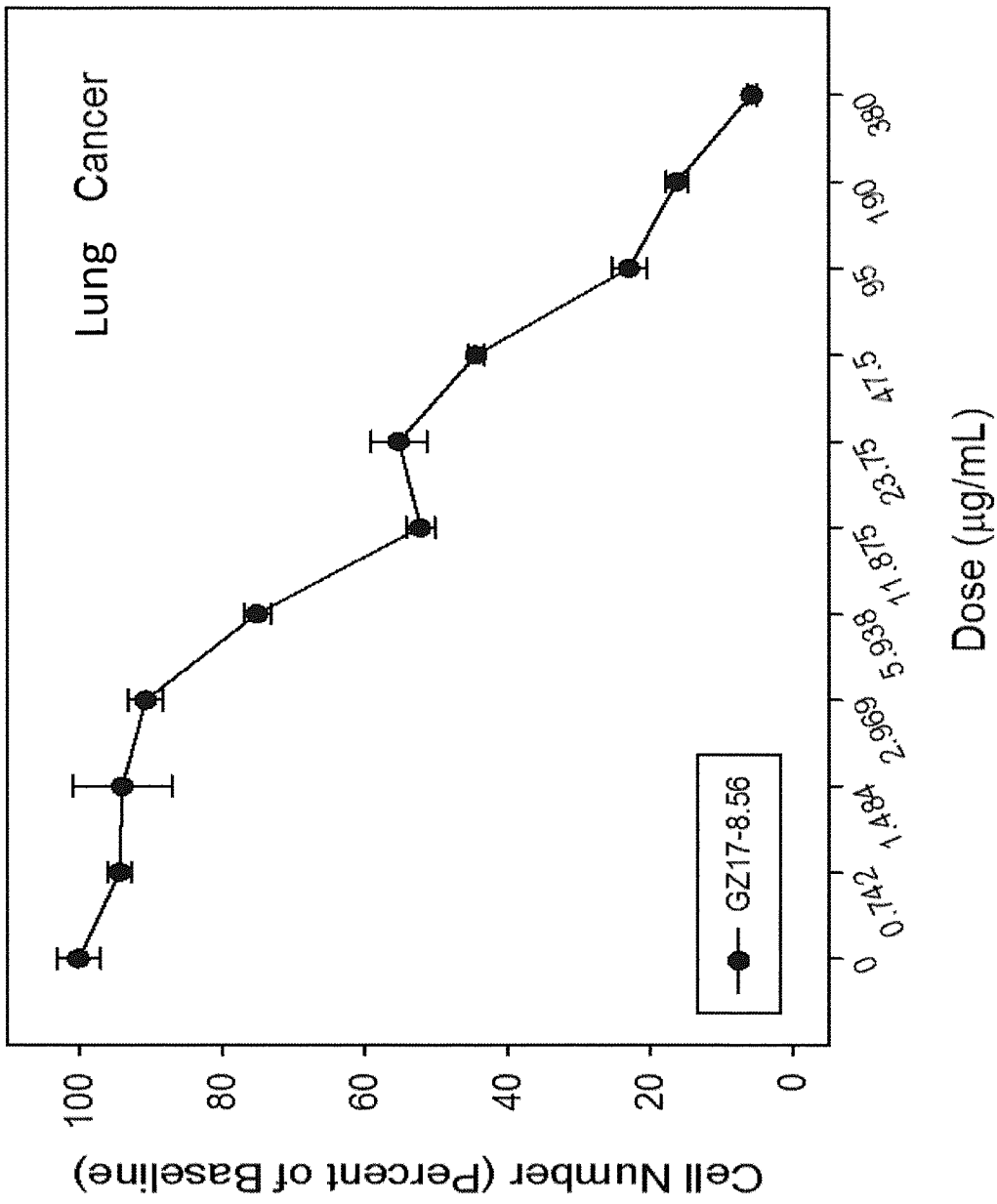

Lung Cancer
GZ17-8.56
Cell Number (Percent of Baseline)
0
20
40
60
80
100
0
0.742
1.484
2.969
5.938
11.875
23.75
47.5
95
190
380
Dose (µg/mL)

Fig. 74B

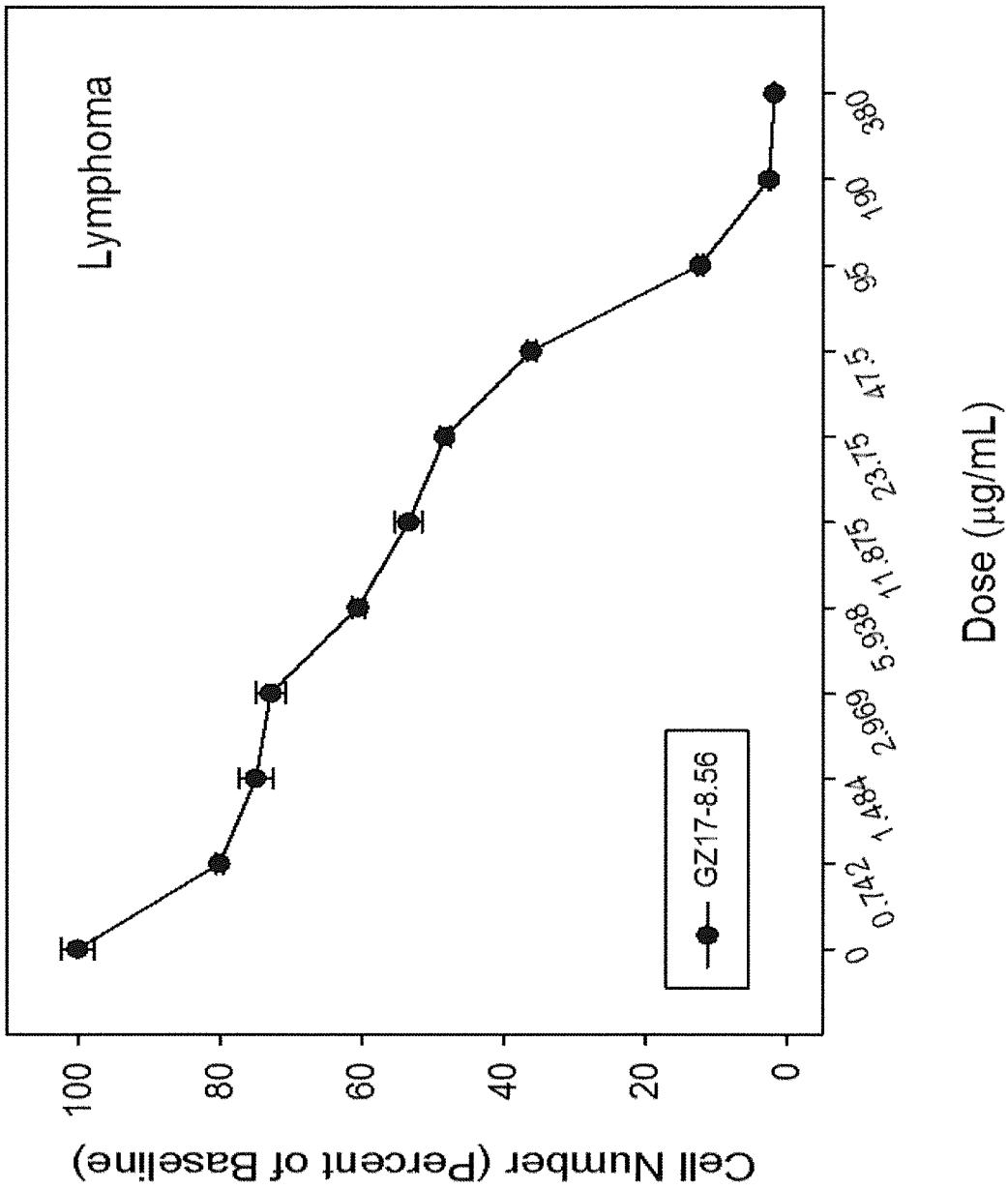

Lymphoma
GZ17-8.56
Cell Number (Percent of Baseline)
0
20
40
60
80
100
0
0.742
1.484
2.969
5.938
11.875
23.75
47.5
95
190
380
Dose (µg/mL)

Fig. 74C

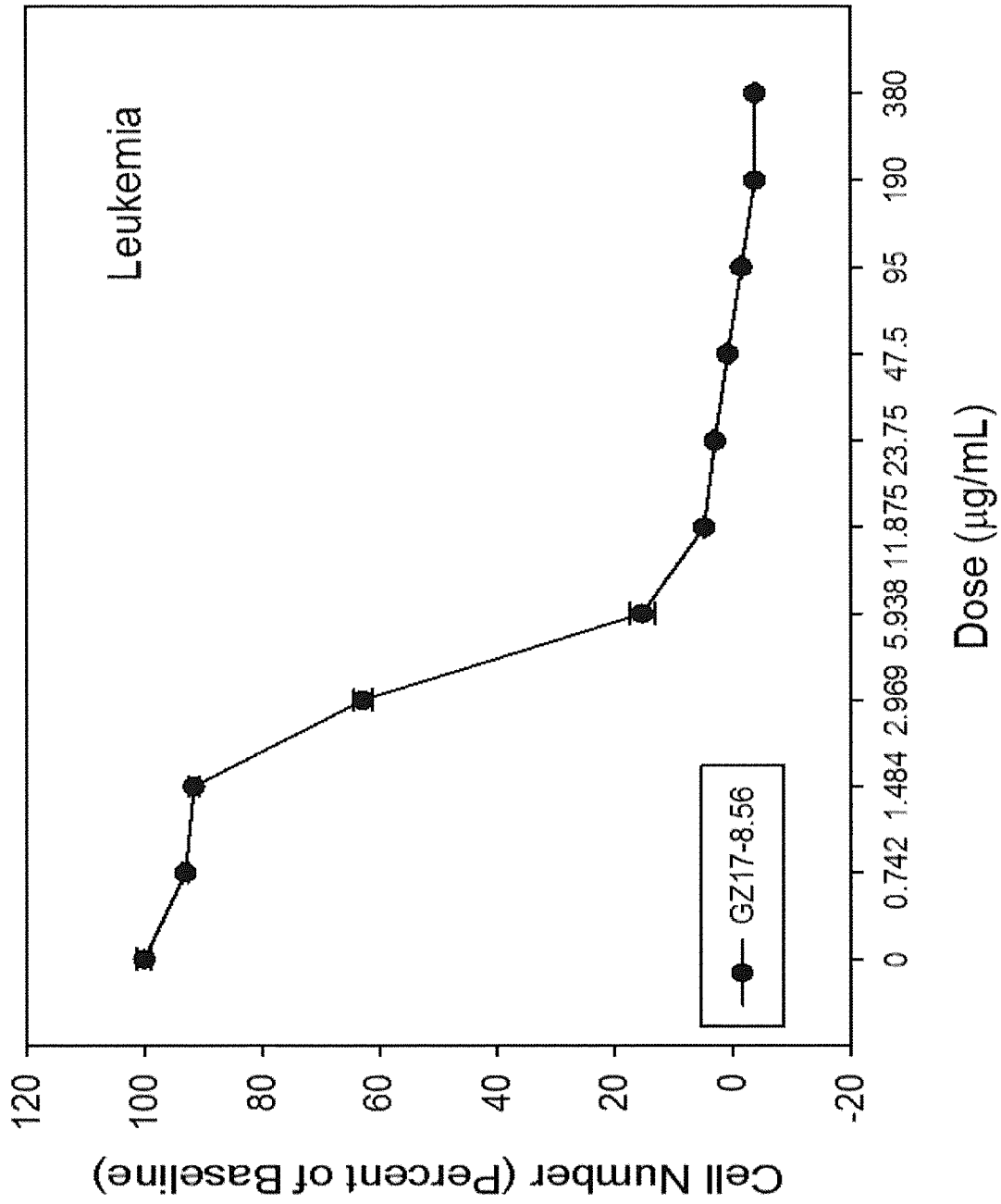

Leukemia
GZ17-8.56
Cell Number (Percent of Baseline)
120
100
80
60
40
20
0
-20
0
0.742
1.484
2.969
5.938
11.875
23.75
47.5
95
190
380
Dose (µg/mL)

Fig. 74D

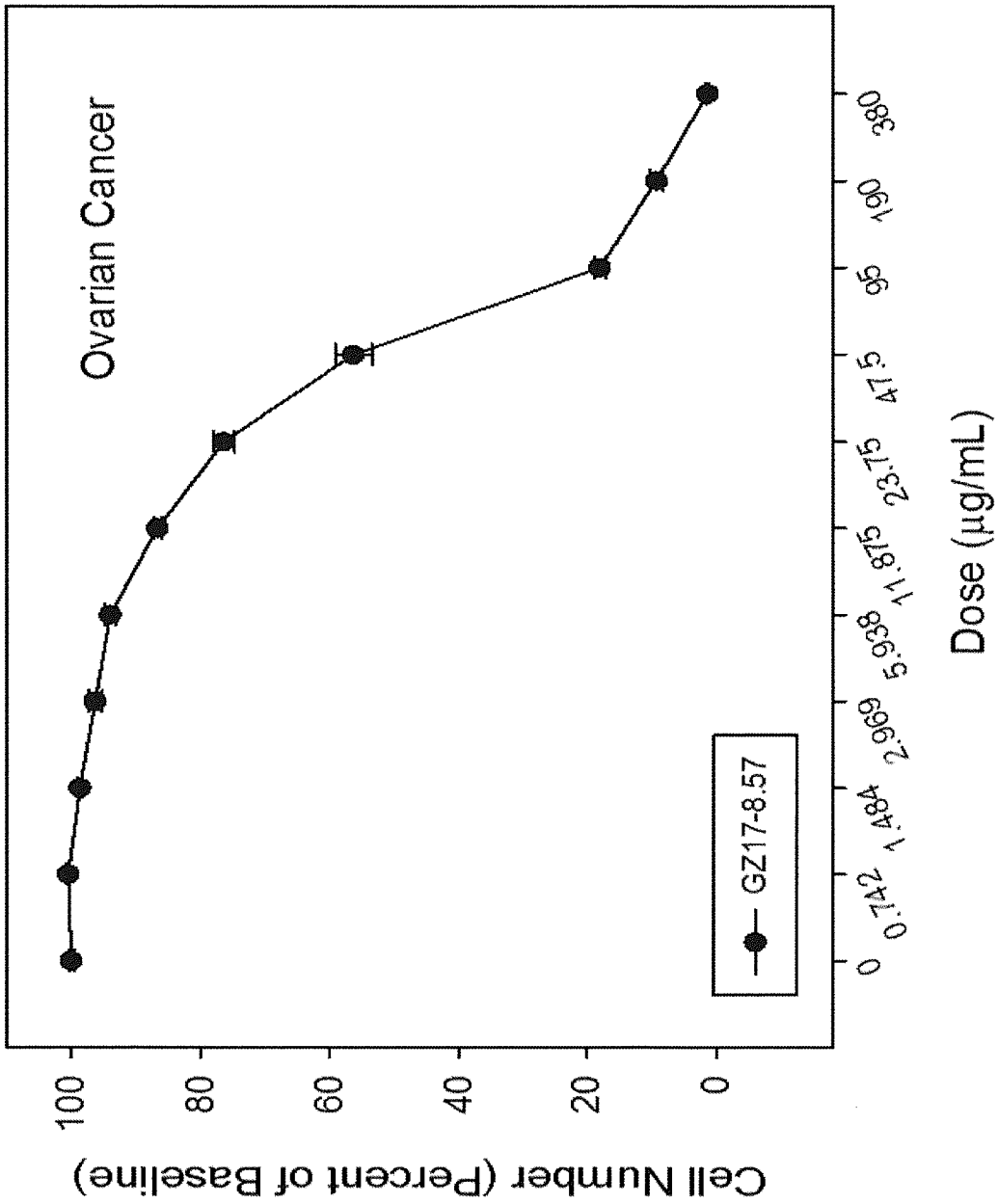

Ovarian Cancer
Cell Number (Percent of Baseline)
100
80
60
40
20
0
GZ17-8.57
0
0.742
1.484
2.969
5.938
11.875
23.75
47.5
95
190
380
Dose (µg/mL)

Fig. 75A

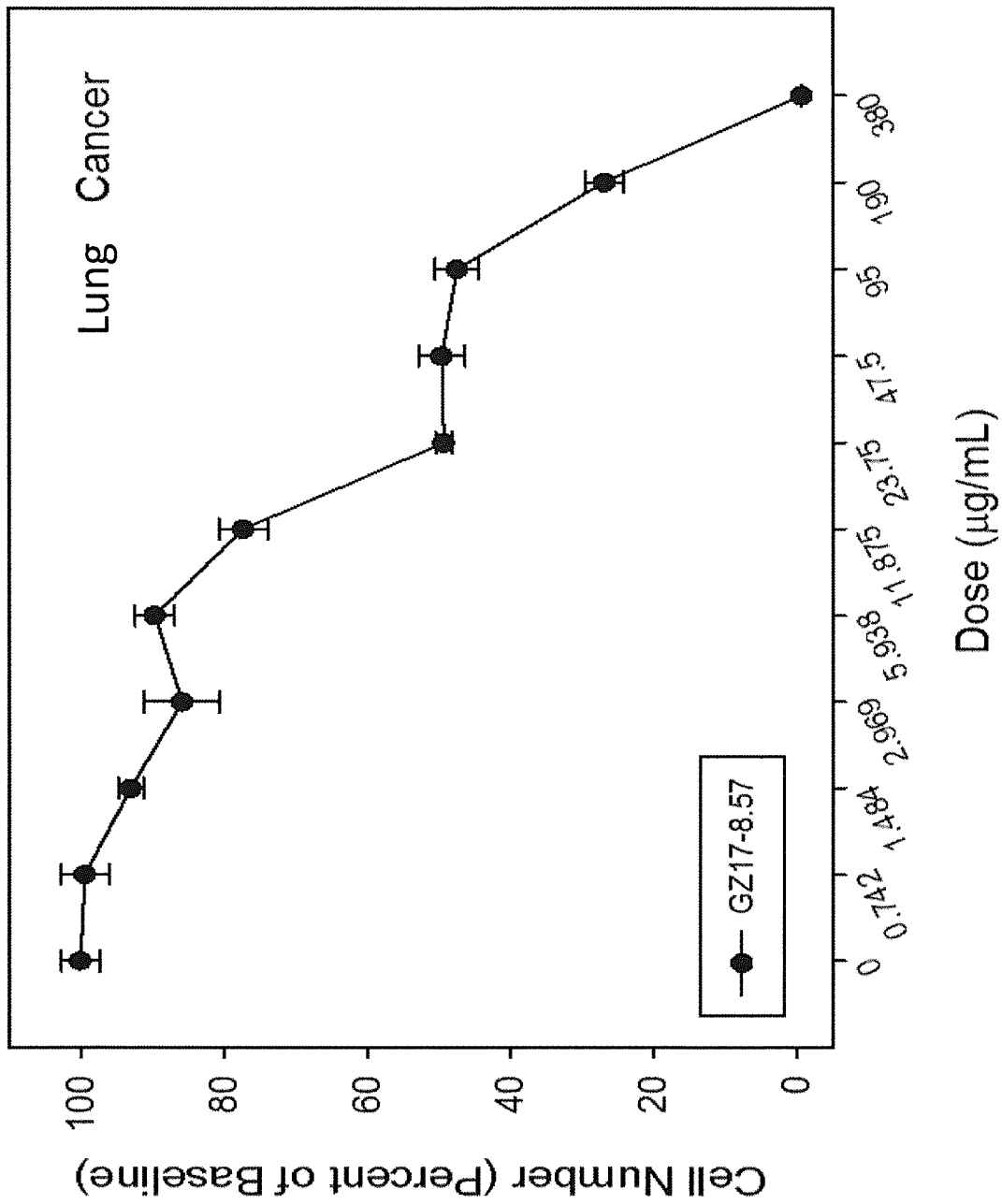

Lung Cancer
Cell Number (Percent of Baseline)
0
20
40
60
80
100
GZ17-8.57
0
0.742
1.484
2.969
5.938
11.875
23.75
47.5
95
190
380
Dose (µg/mL)

Fig. 75B

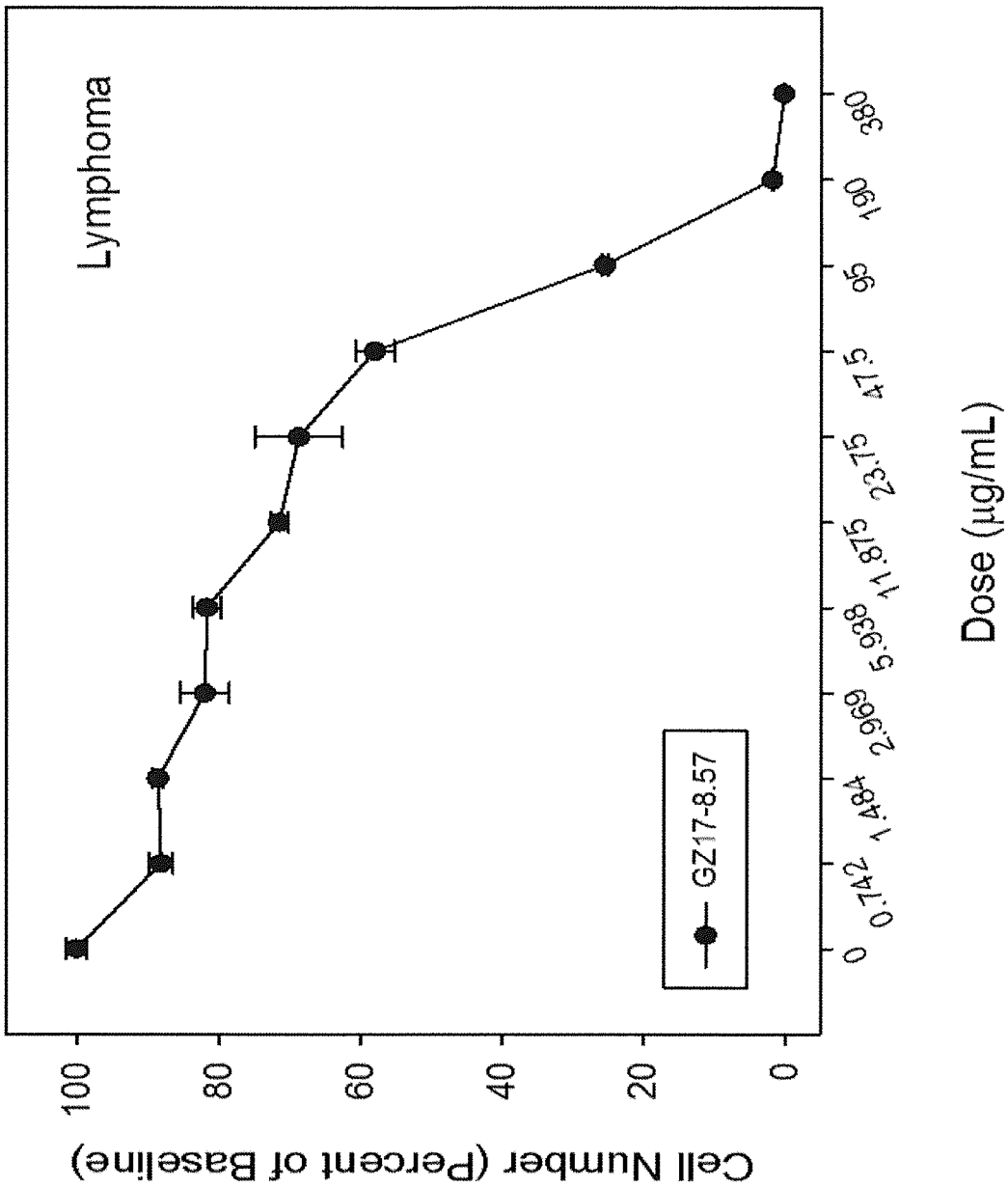

Lymphoma
GZ17-8.57
Cell Number (Percent of Baseline)
0
20
40
60
80
100
0
0.742
1.484
2.969
5.938
11.875
23.75
47.5
95
190
380
Dose (µg/mL)

Fig. 75C

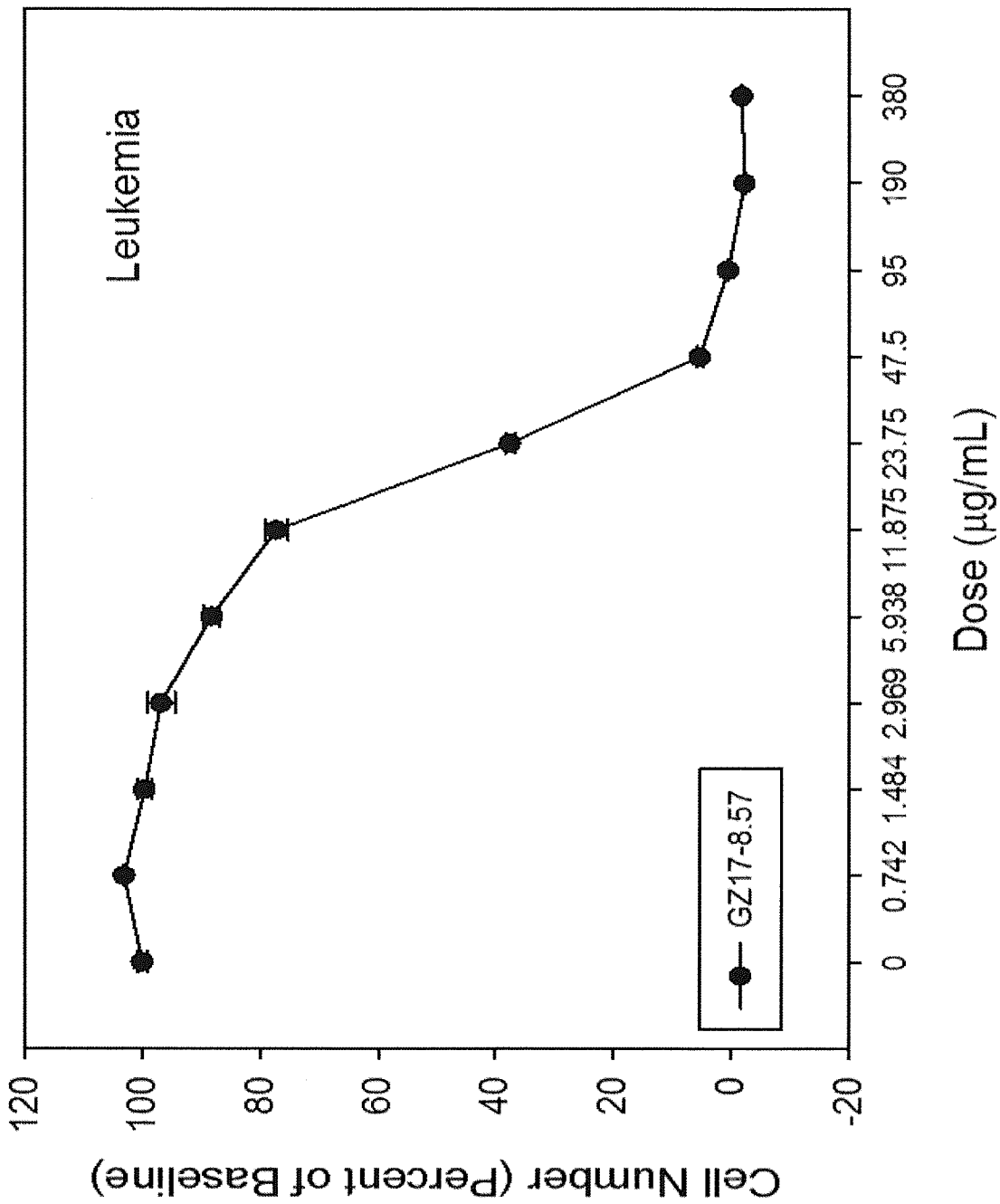

Leukemia
Cell Number (Percent of Baseline)
120
100
80
60
40
20
0
-20
GZ17-8.57
0
0.742
1.484
2.969
5.938
11.875
23.75
47.5
95
190
380
Dose (µg/mL)

Fig. 75D

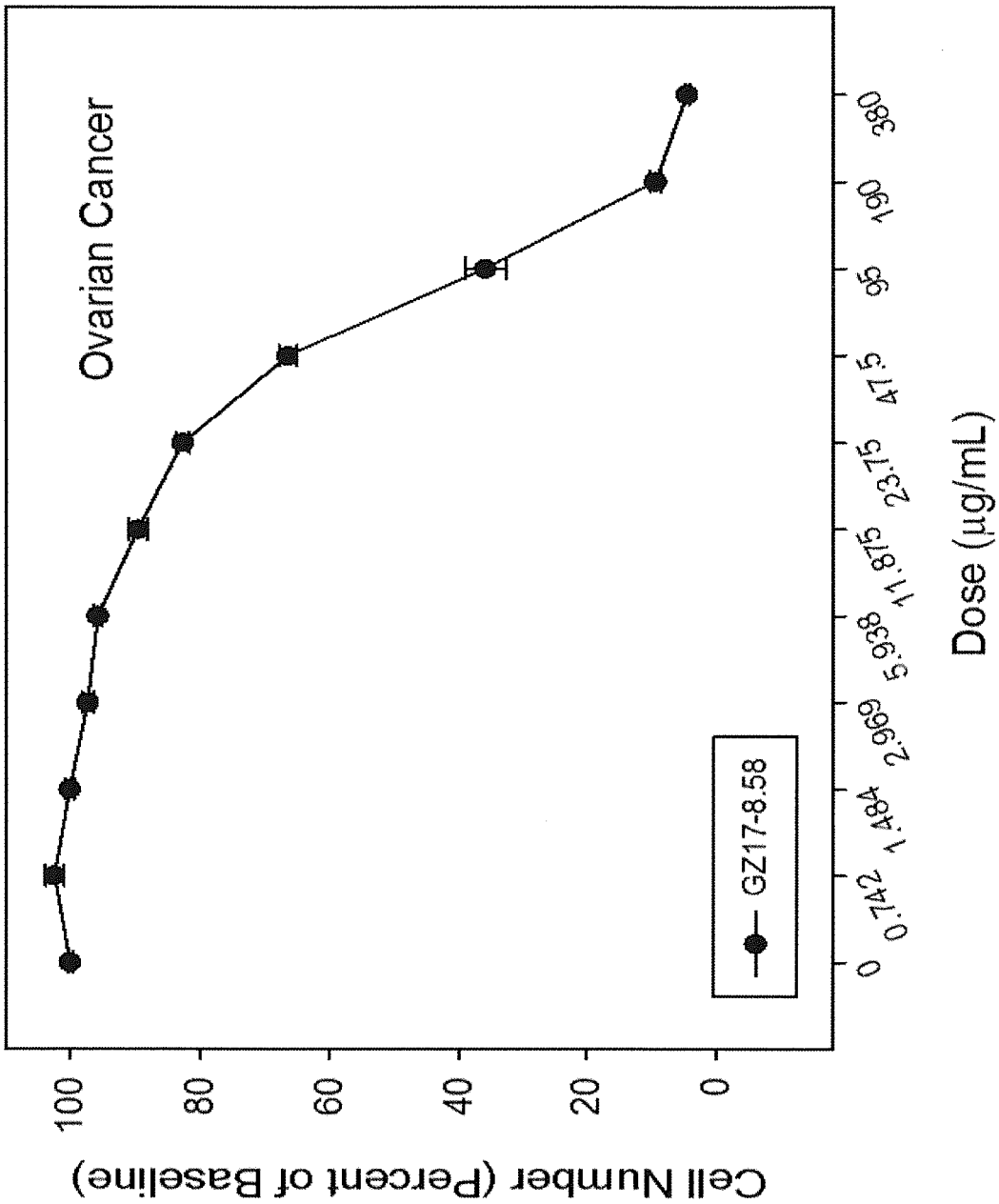

Ovarian Cancer
Cell Number (Percent of Baseline)
100
80
60
40
20
0
GZ17-8.58
0
0.742
1.484
2.969
5.938
11.875
23.75
47.5
95
190
380
Dose (µg/mL)

Fig. 76A

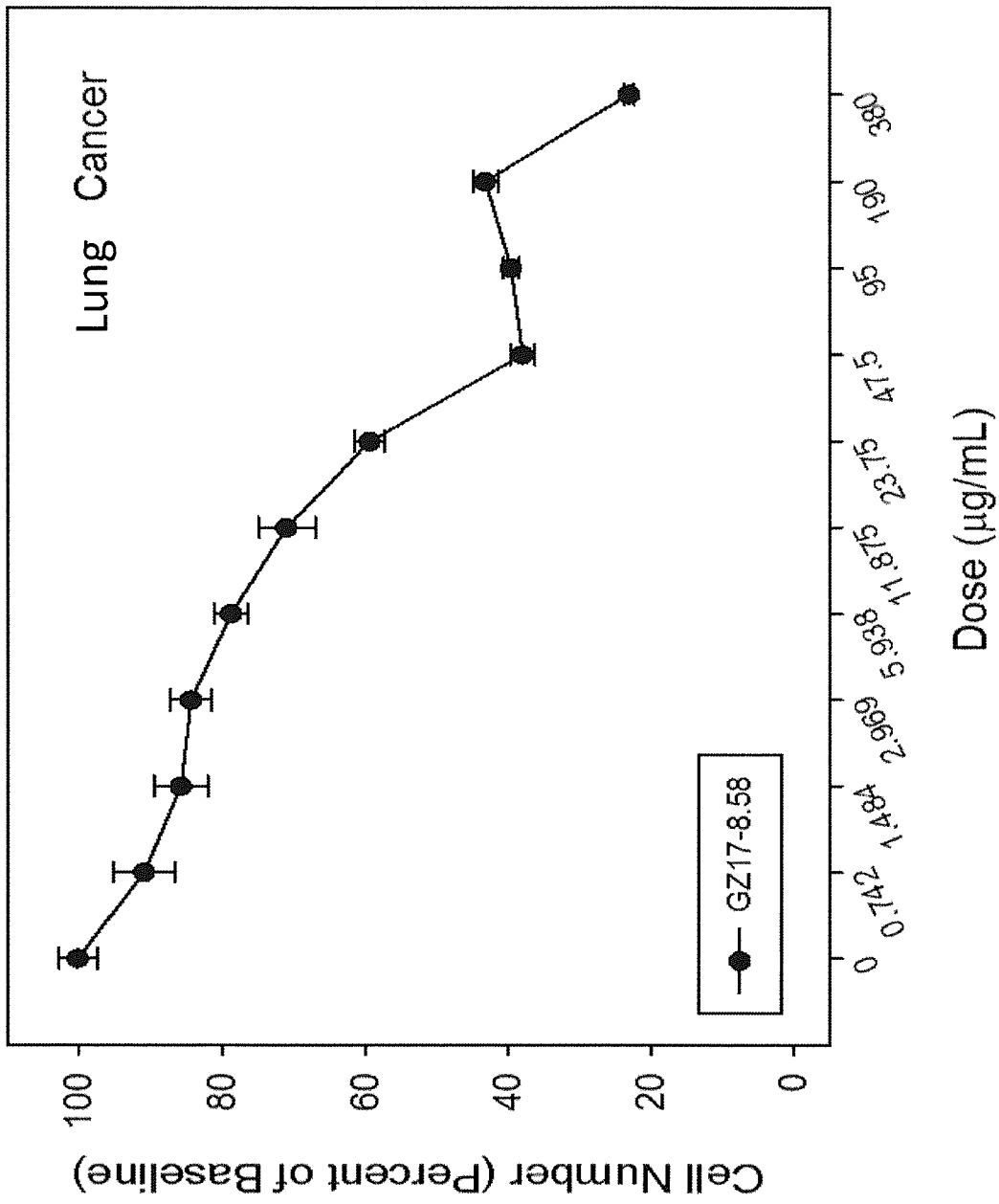

Lung Cancer
Cell Number (Percent of Baseline)
100
80
60
40
20
0
GZ17-8.58
0
0.742
1.484
2.969
5.938
11.875
23.75
47.5
95
190
380
Dose (µg/mL)

Fig. 76B

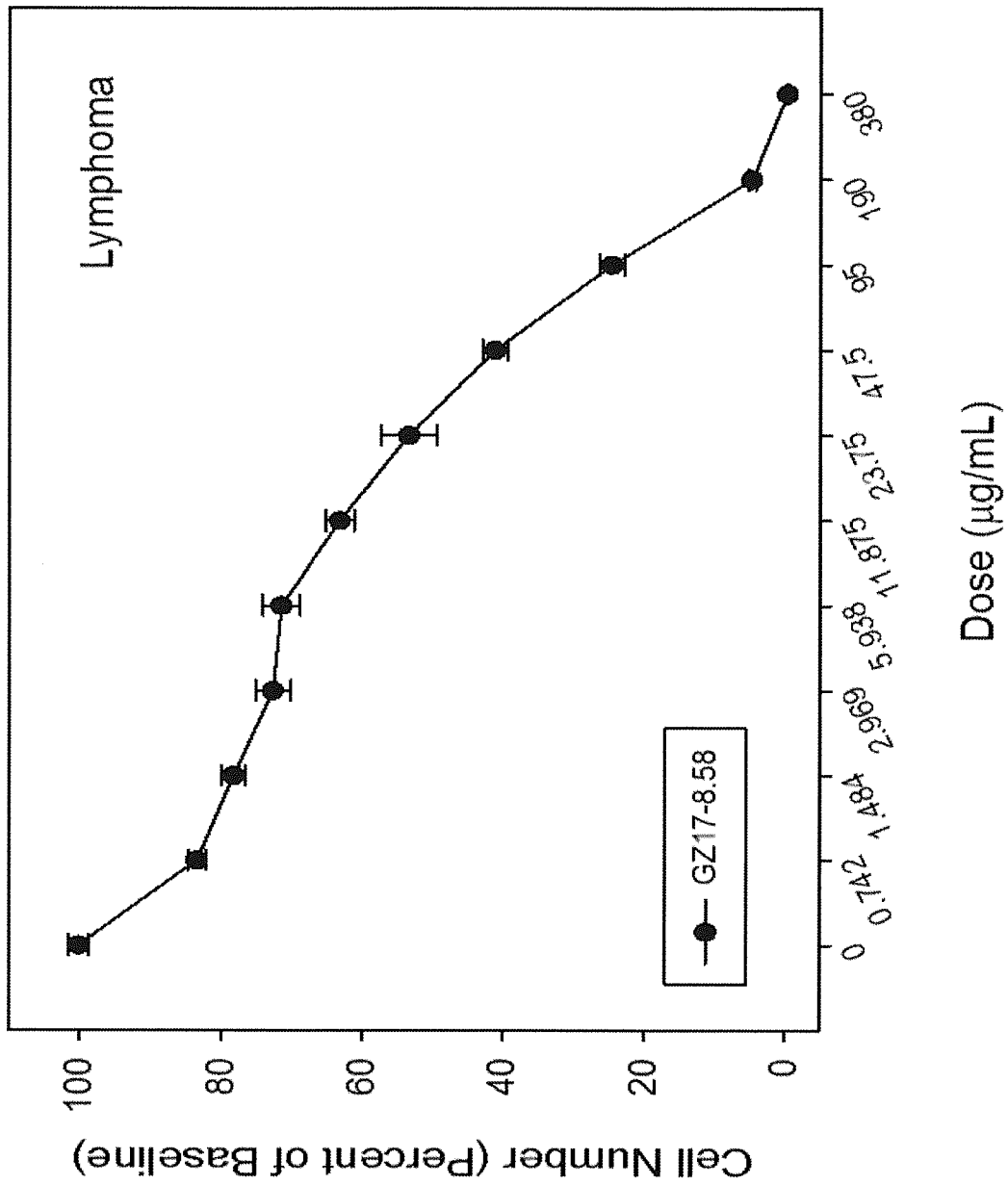

Lymphoma
Cell Number (Percent of Baseline)
0
20
40
60
80
100
GZ17-8.58
0
0.742
1.484
2.969
5.938
11.875
23.75
47.5
95
190
380
Dose (µg/mL)

Fig. 76C

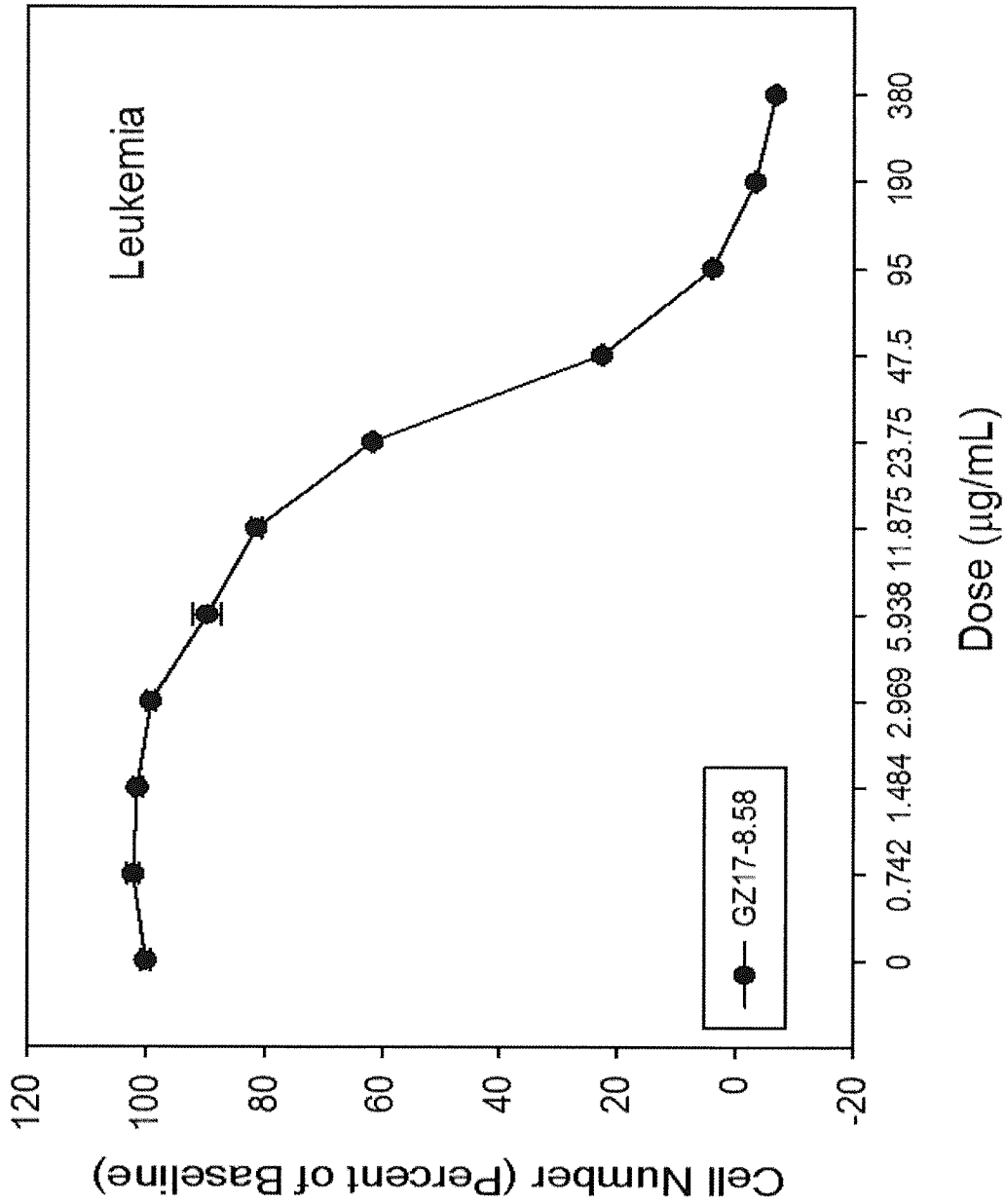

Leukemia
GZ17-8.58
Cell Number (Percent of Baseline)
120
100
80
60
40
20
0
-20
0
0.742
1.484
2.969
5.938
11.875
23.75
47.5
95
190
380
Dose (µg/mL)

Fig. 76D

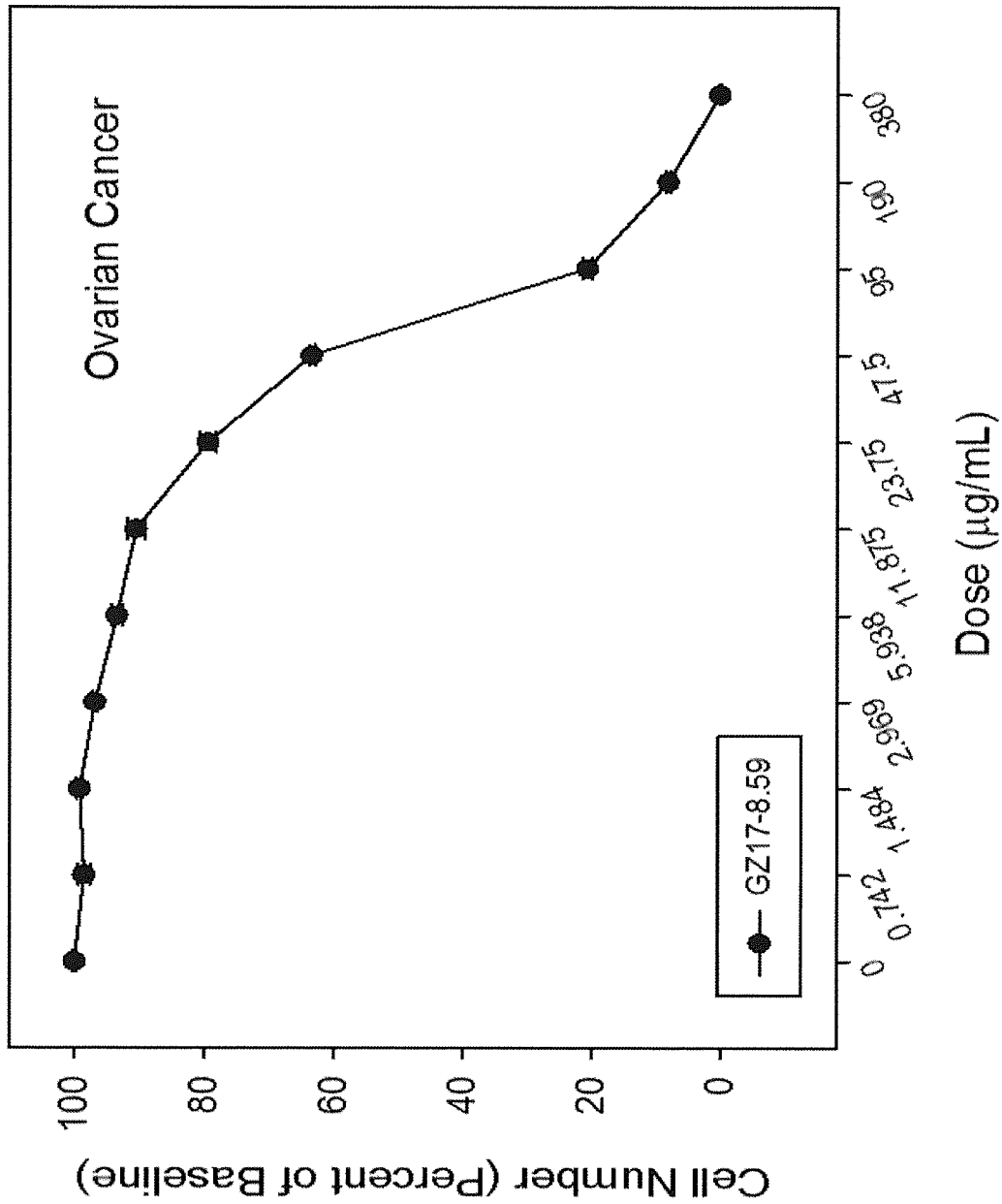

Ovarian Cancer
Cell Number (Percent of Baseline)
100
80
60
40
20
0
GZ17-8.59
0
0.742
1.484
2.969
5.938
11.875
23.75
47.5
95
190
380
Dose (µg/mL)

Fig. 77A

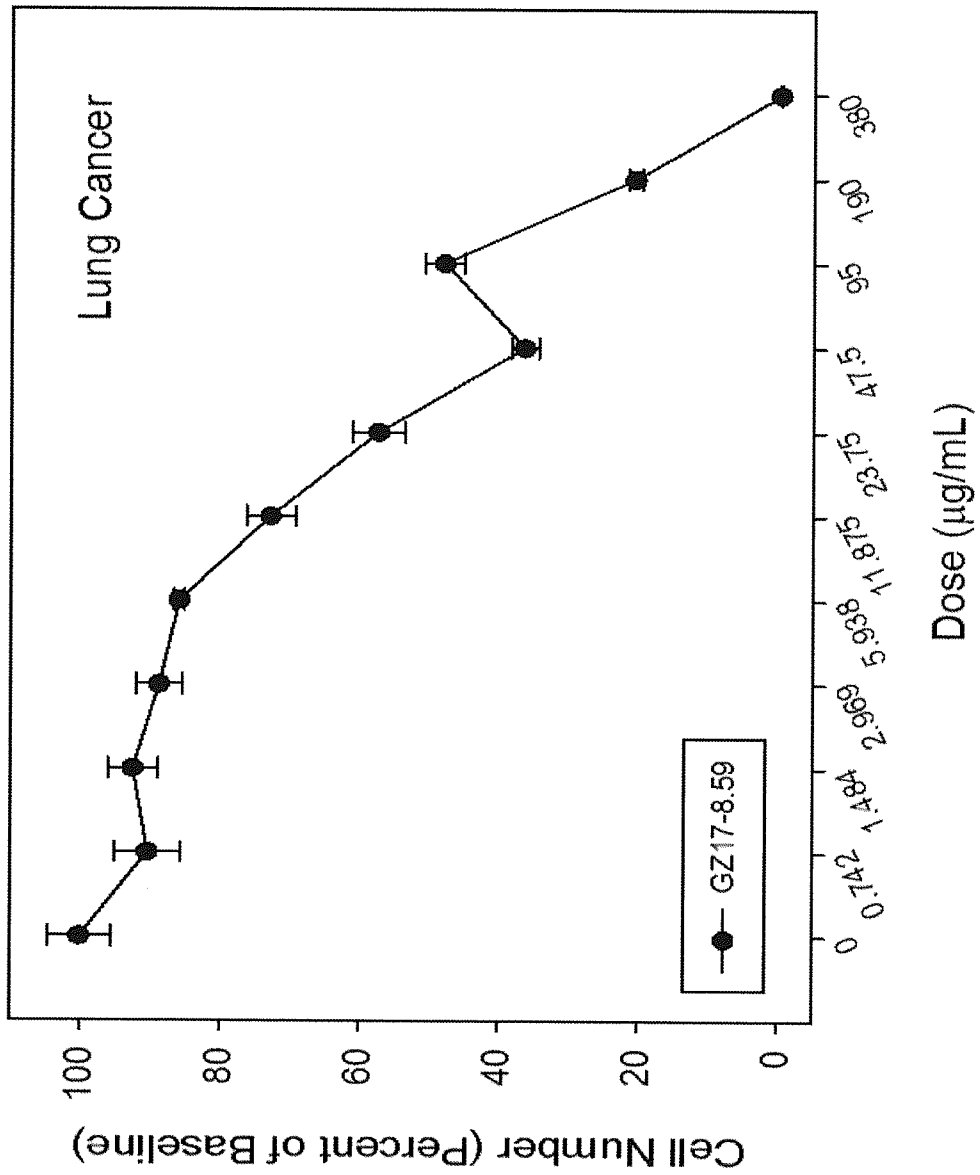

Lung Cancer
Cell Number (Percent of Baseline)
0
20
40
60
80
100
GZ17-8.59
0
0.742
1.484
2.969
5.938
11.875
23.75
47.5
95
190
380
Dose (µg/mL)

Fig. 77B

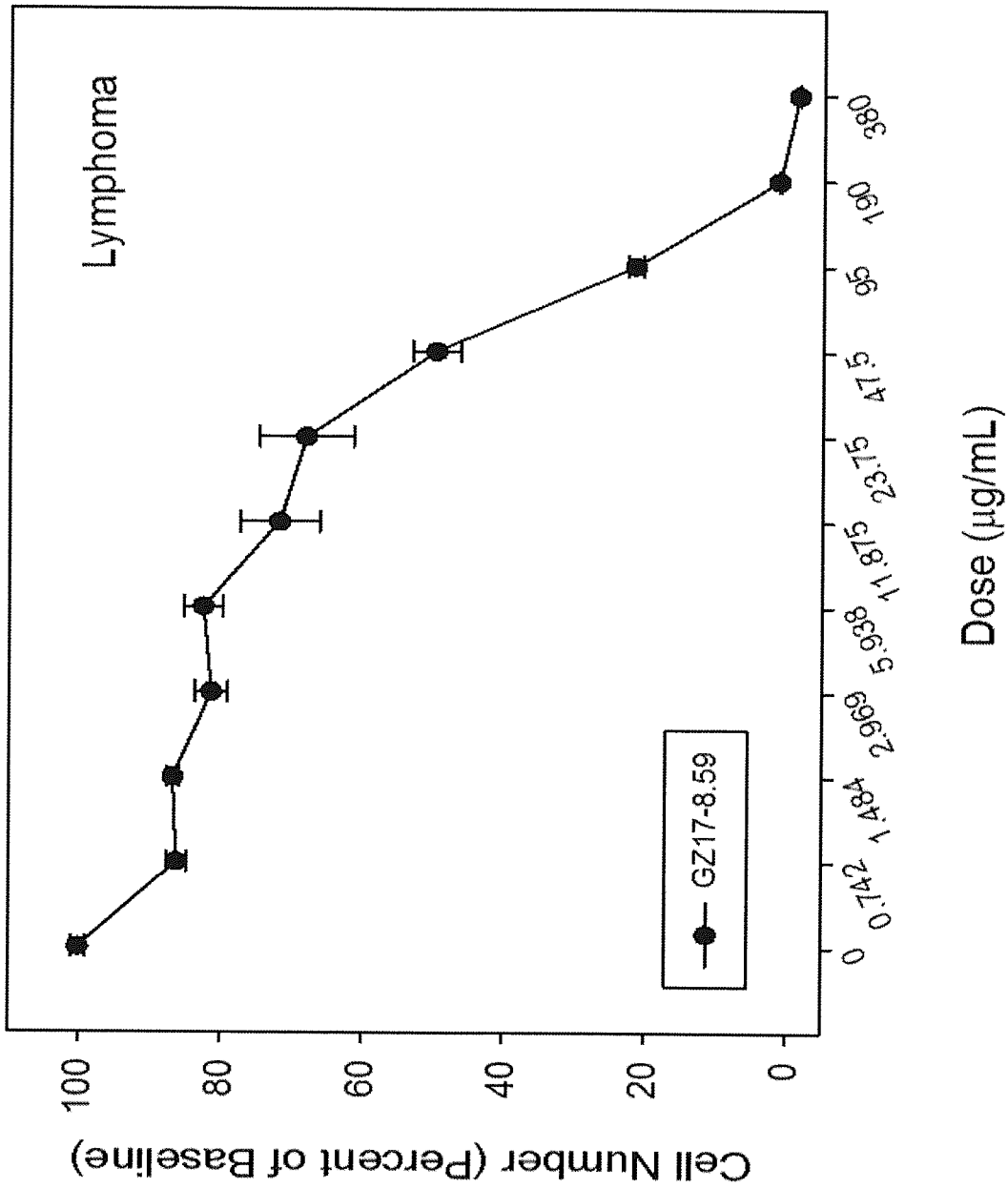

Lymphoma
Cell Number (Percent of Baseline)
100
80
60
40
20
0
GZ17-8.59
0
0.742
1.484
2.969
5.938
11.875
23.75
47.5
95
190
380
Dose (μg/mL)

Fig. 77C

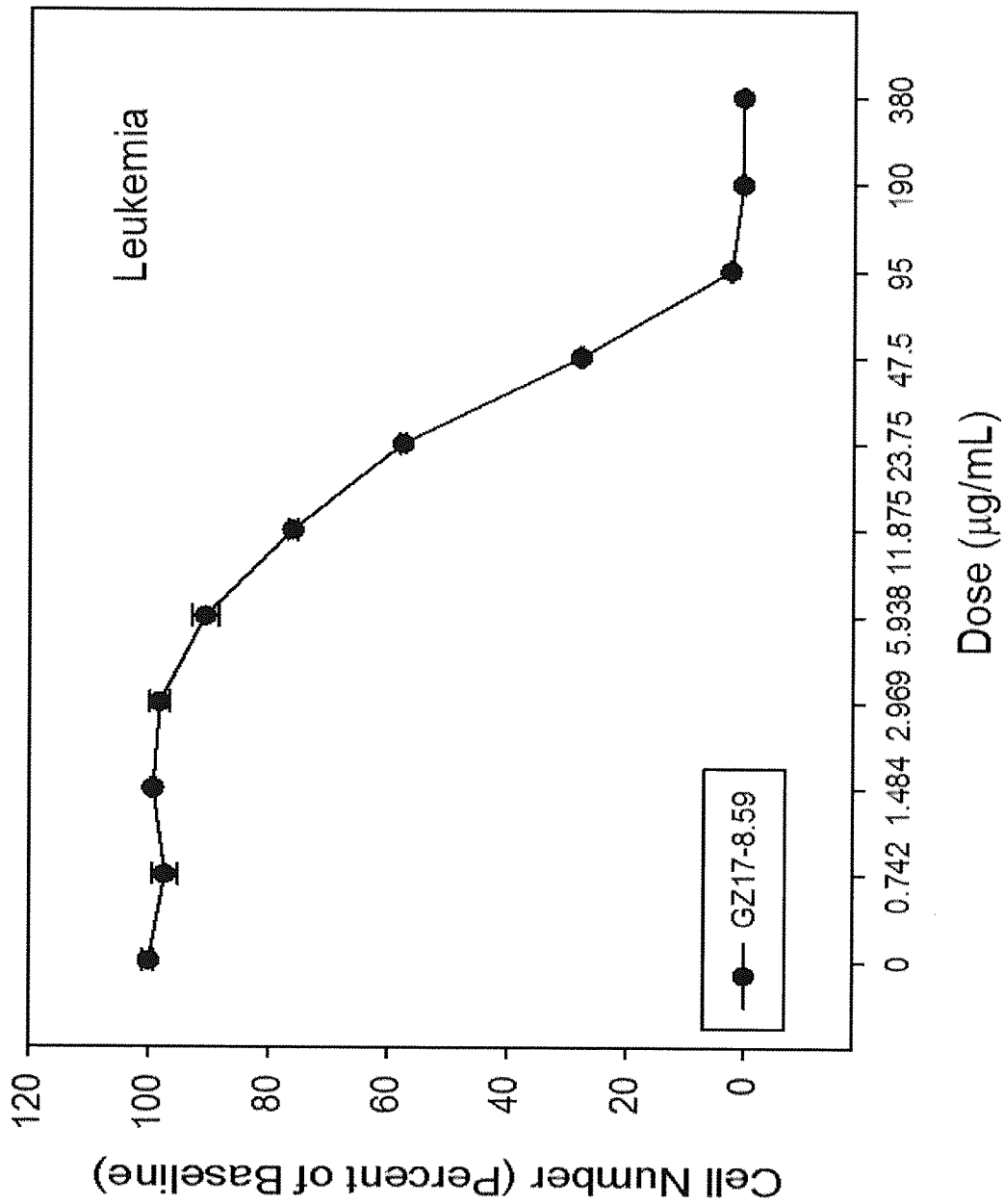

Leukemia
Cell Number (Percent of Baseline)
120
100
80
60
40
20
0
GZ17-8.59
0
0.742
1.484
2.969
5.938
11.875
23.75
47.5
95
190
380
Dose (µg/mL)

Fig. 77D

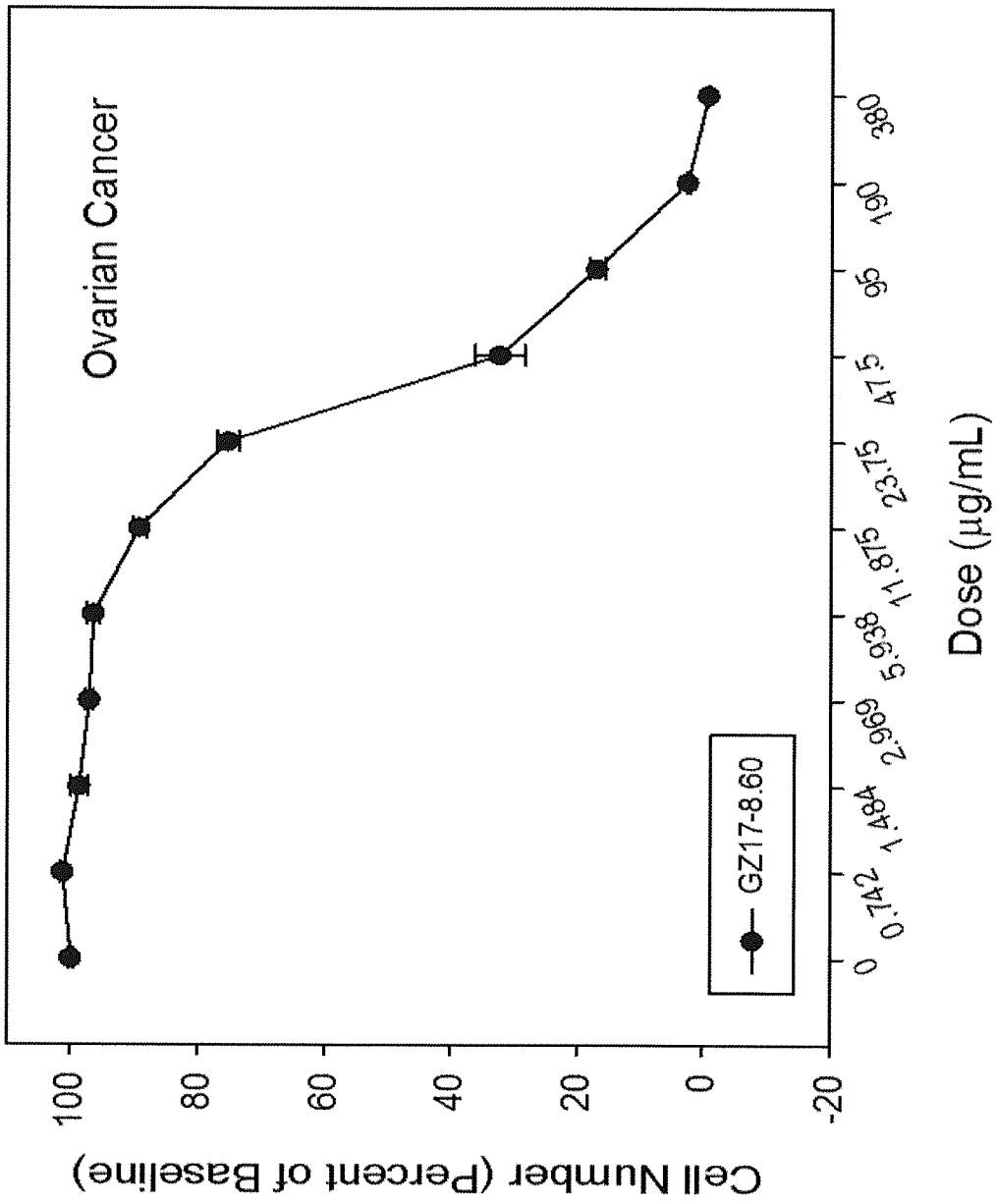

Ovarian Cancer
Cell Number (Percent of Baseline)
100
80
60
40
20
0
-20
GZ17-8.60
0
0.742
1.484
2.969
5.938
11.875
23.75
47.5
95
190
380
Dose (µg/mL)

Fig. 78A

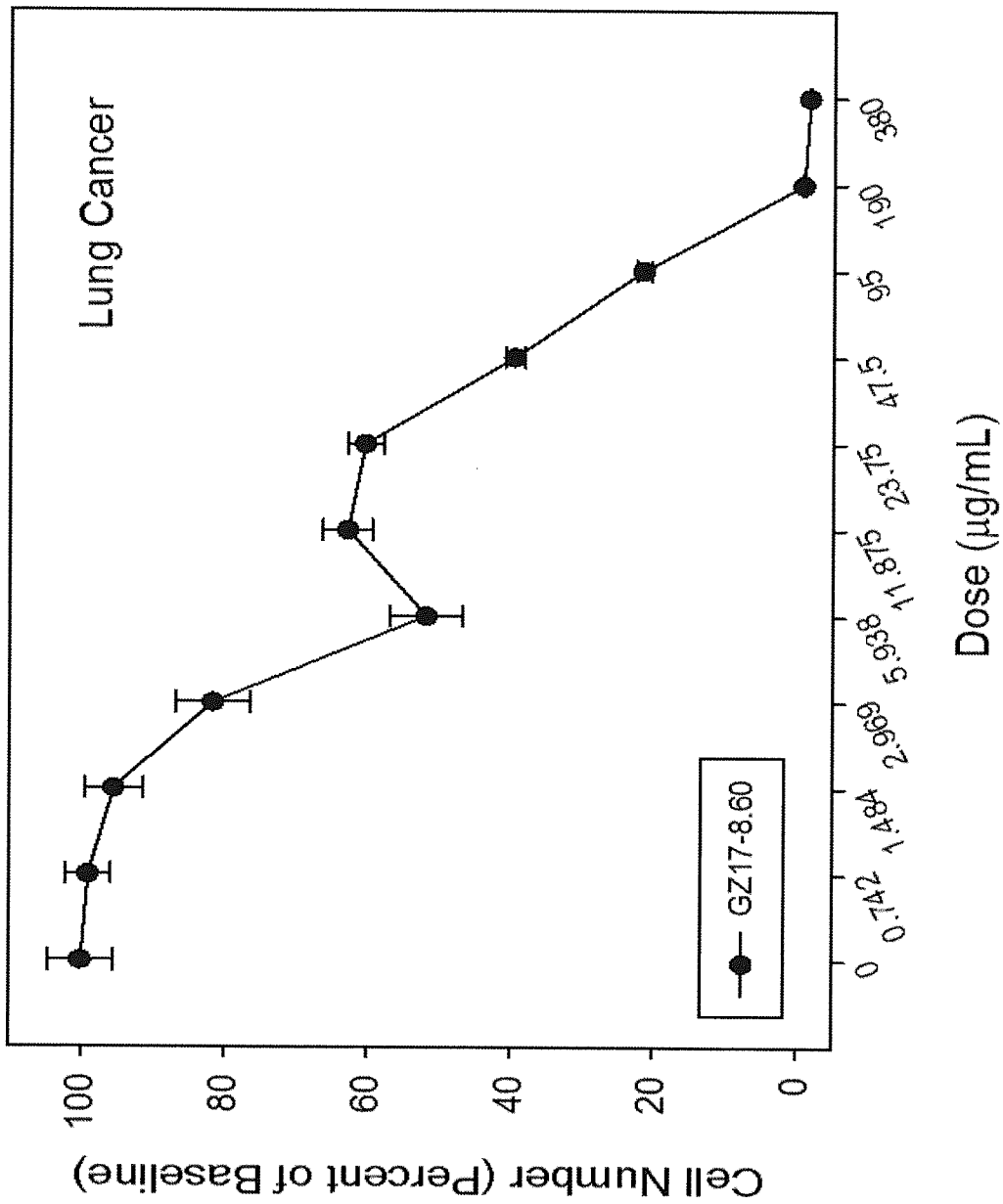

Lung Cancer
Cell Number (Percent of Baseline)
0
20
40
60
80
100
GZ17-8.60
0
0.742
1.484
2.969
5.938
11.875
23.75
47.5
95
190
380
Dose (µg/mL)

Fig. 78B

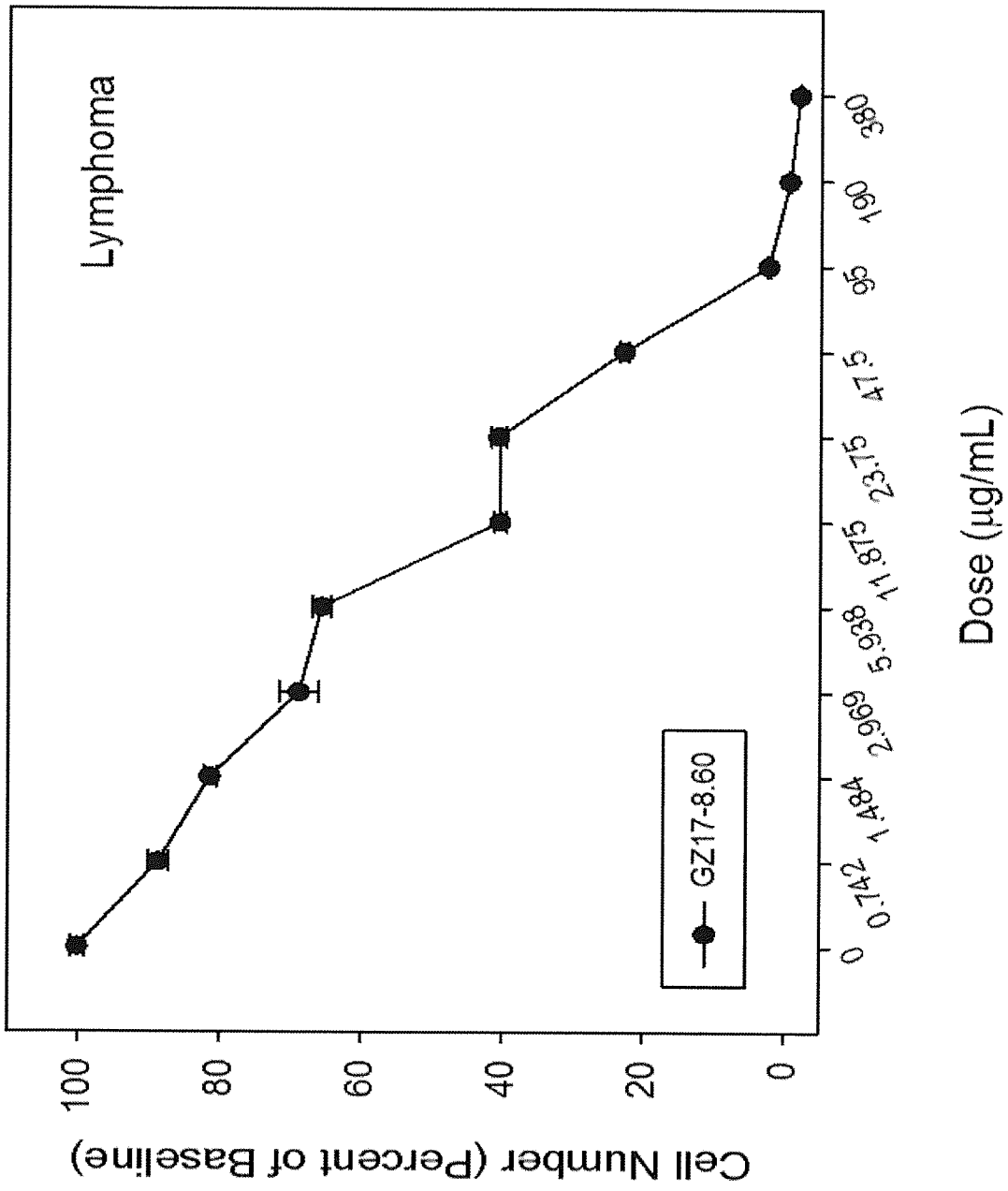

Lymphoma
Cell Number (Percent of Baseline)
100
80
60
40
20
0
GZ17-8.60
0
0.742
1.484
2.969
5.938
11.875
23.75
47.5
95
190
380
Dose (µg/mL)

Fig. 78C

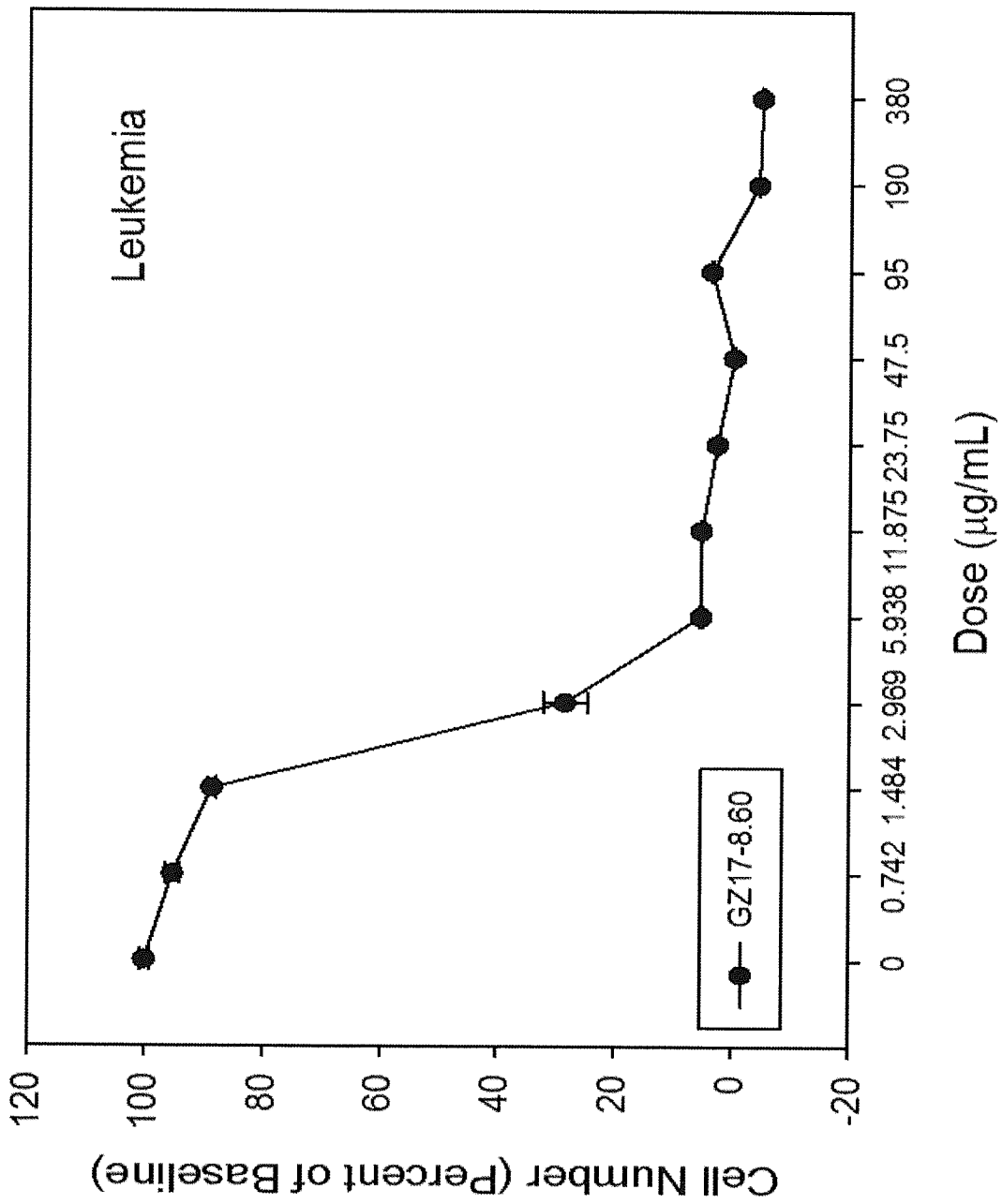

Leukemia
Cell Number (Percent of Baseline)
120
100
80
60
40
20
0
-20
GZ17-8.60
0
0.742
1.484
2.969
5.938
11.875
23.75
47.5
95
190
380
Dose (µg/mL)

Fig. 78D

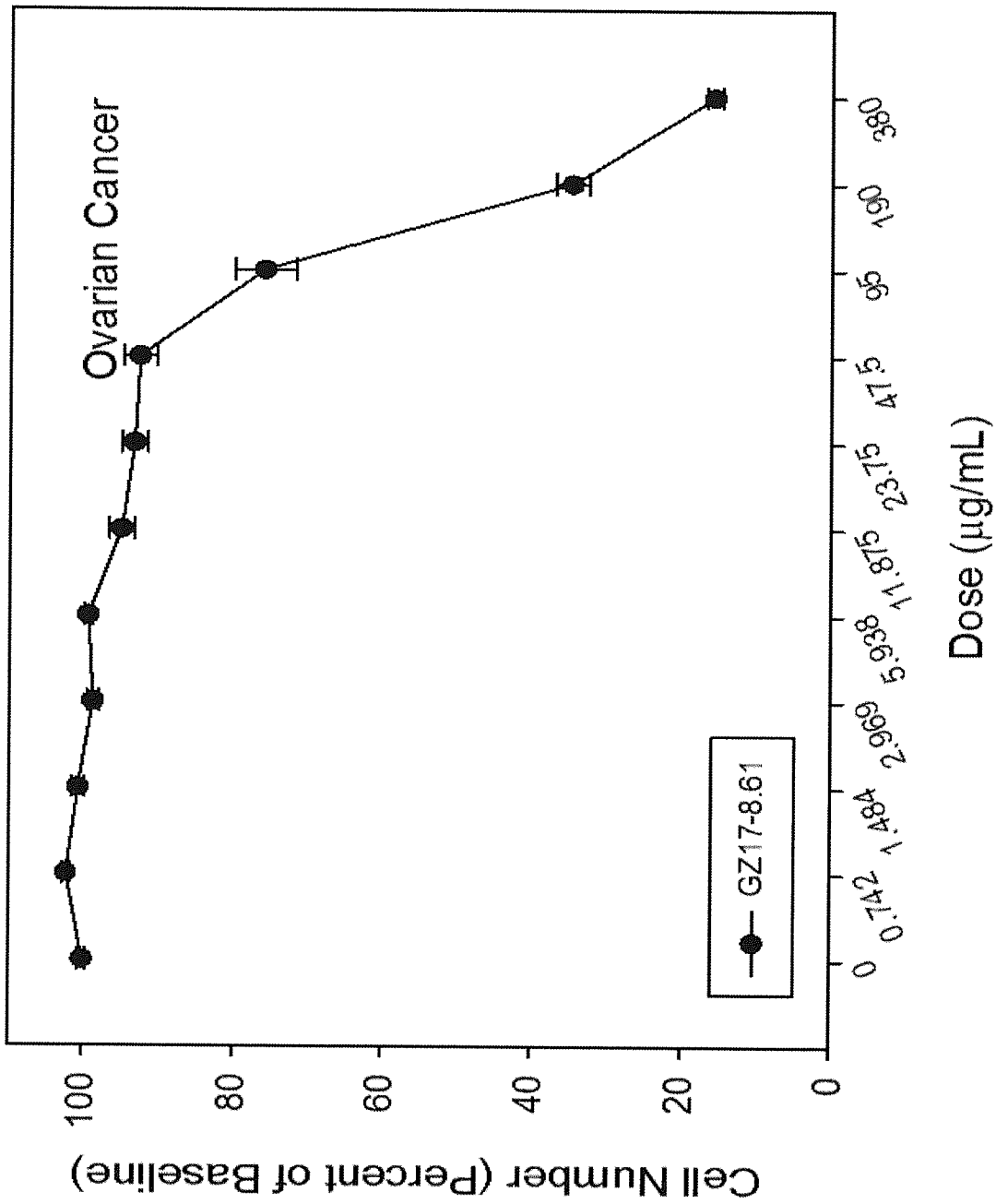

Ovarian Cancer
Cell Number (Percent of Baseline)
0
20
40
60
80
100
GZ17-8.61
0
0.742
1.484
2.969
5.938
11.875
23.75
47.5
95
190
380
Dose (µg/mL)

Fig. 79A

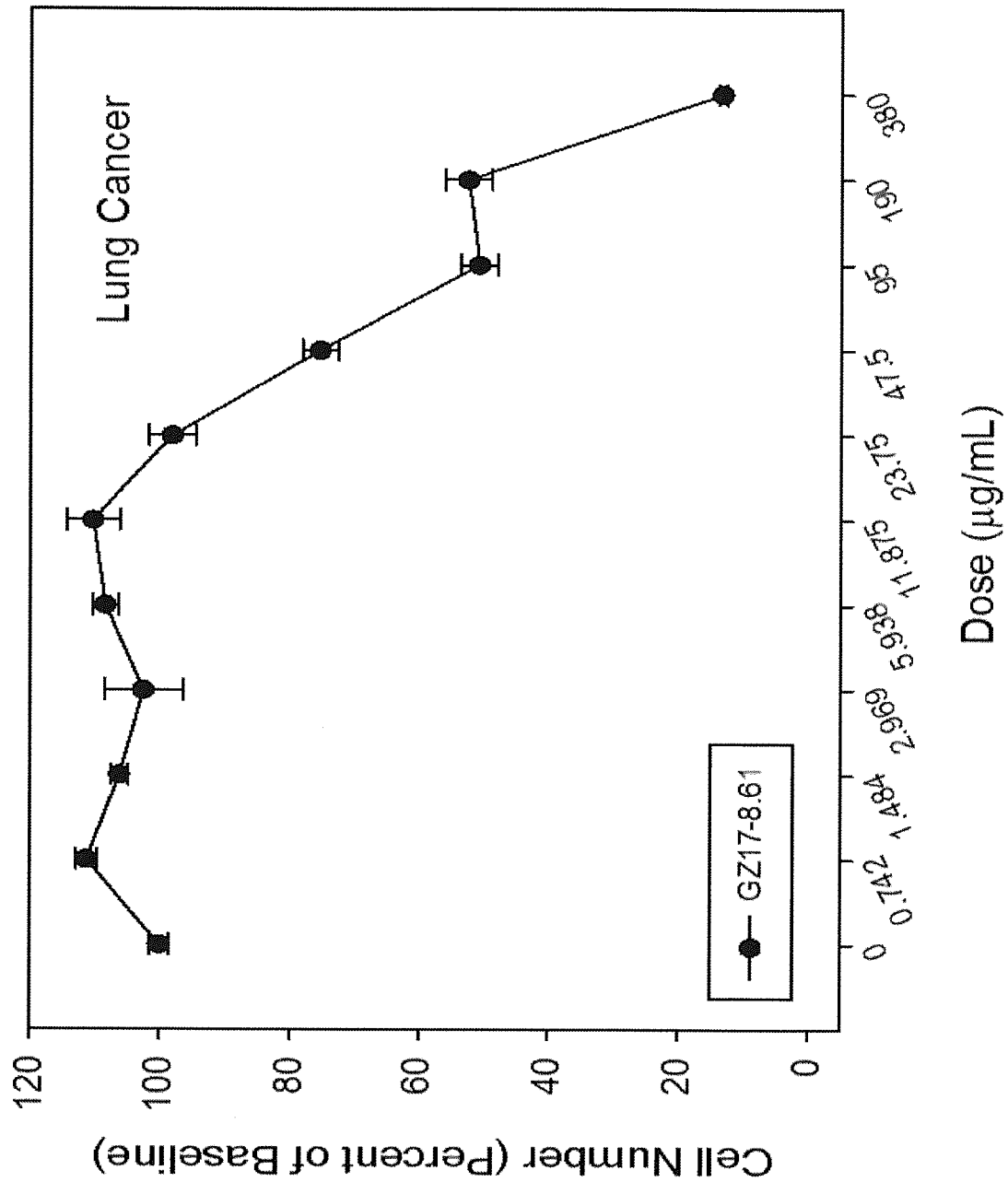

Lung Cancer
Cell Number (Percent of Baseline)
120
100
80
60
40
20
0
GZ17-8.61
0
0.742
1.484
2.969
5.938
11.875
23.75
47.5
95
190
380
Dose (µg/mL)

Fig. 79B

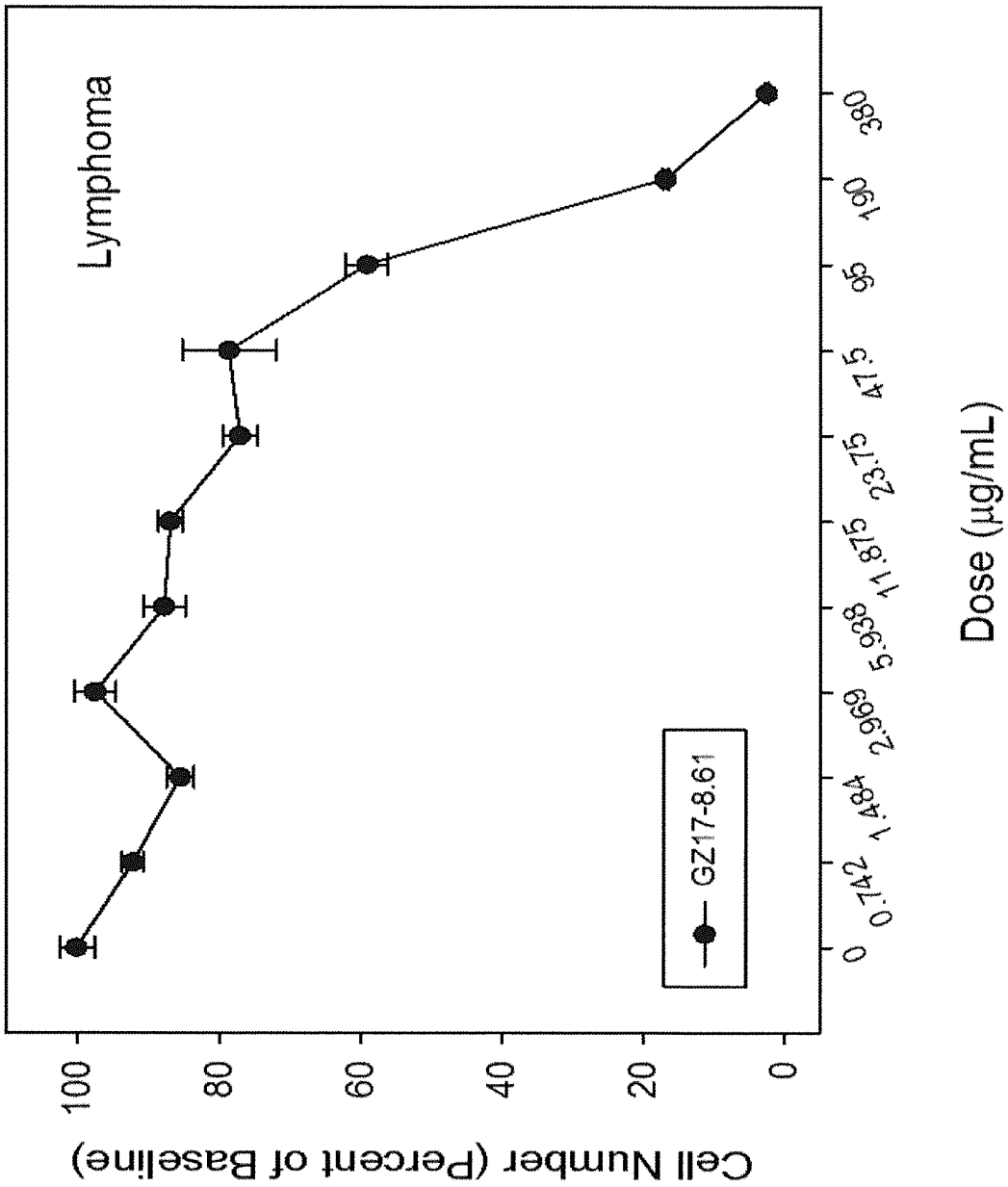

Lymphoma
Cell Number (Percent of Baseline)
0
20
40
60
80
100
GZ17-8.61
0
0.742
1.484
2.969
5.938
11.875
23.75
47.5
95
190
380
Dose (µg/mL)

Fig. 79C

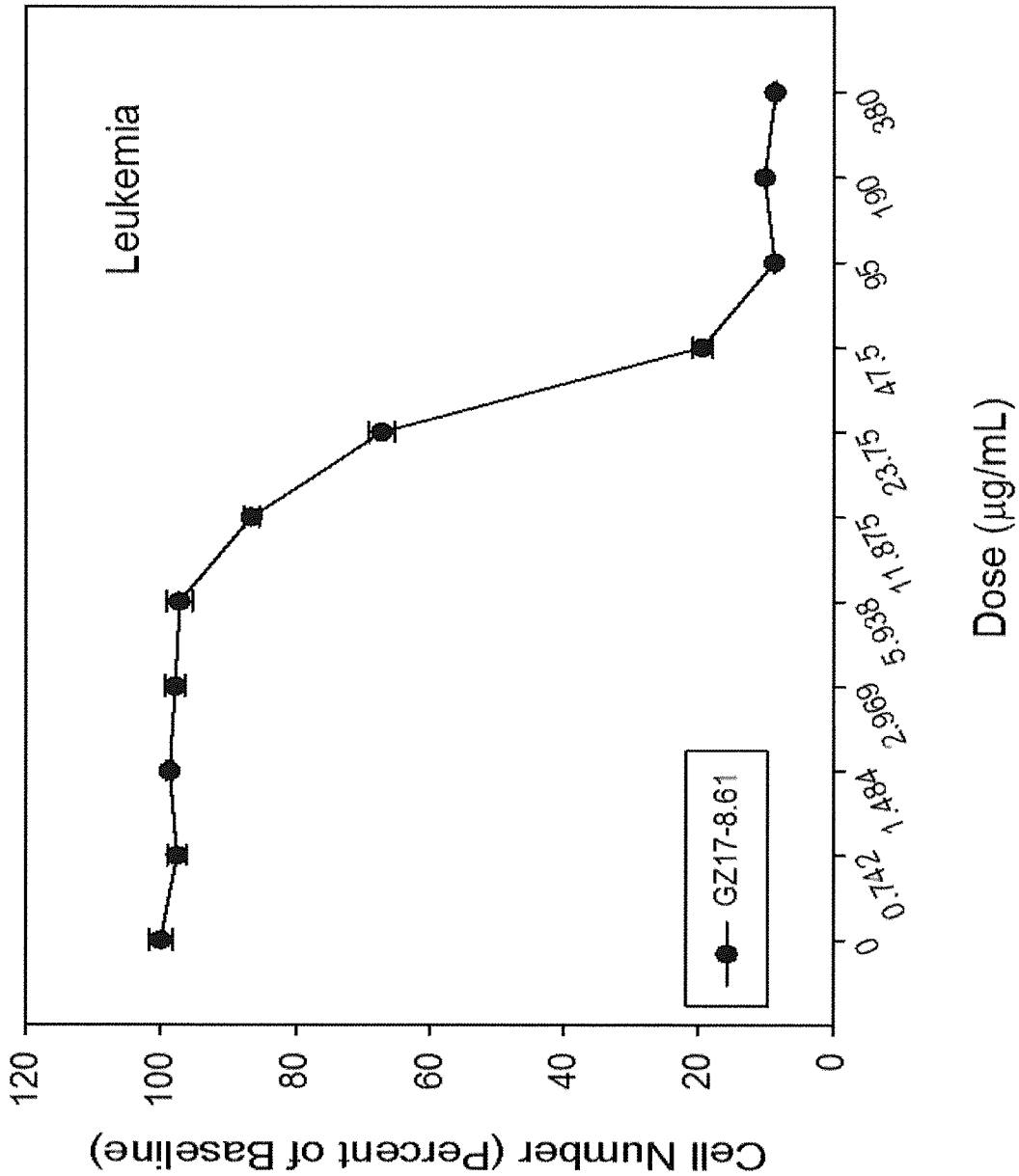

Leukemia
Cell Number (Percent of Baseline)
120
100
80
60
40
20
0
GZ17-8.61
0
0.742
1.484
2.969
5.938
11.875
23.75
47.5
95
190
380
Dose (µg/mL)

Fig. 79D

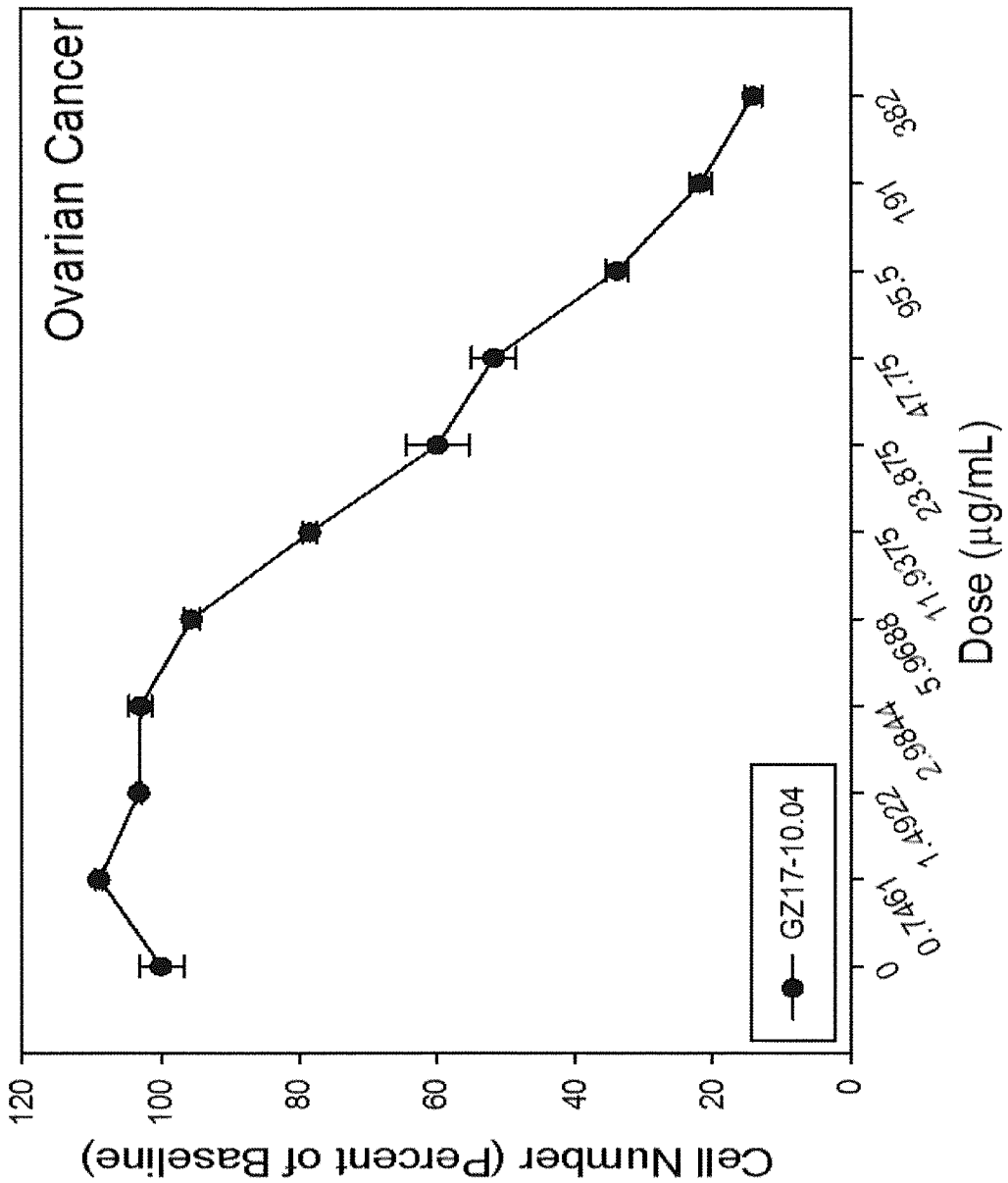

Ovarian Cancer
Cell Number (Percent of Baseline)
120
100
80
60
40
20
0
GZ17-10.04
0
0.7461
1.4922
2.9844
5.9688
11.9375
23.875
47.75
95.5
191
382
Dose (µg/mL)

Fig. 80A

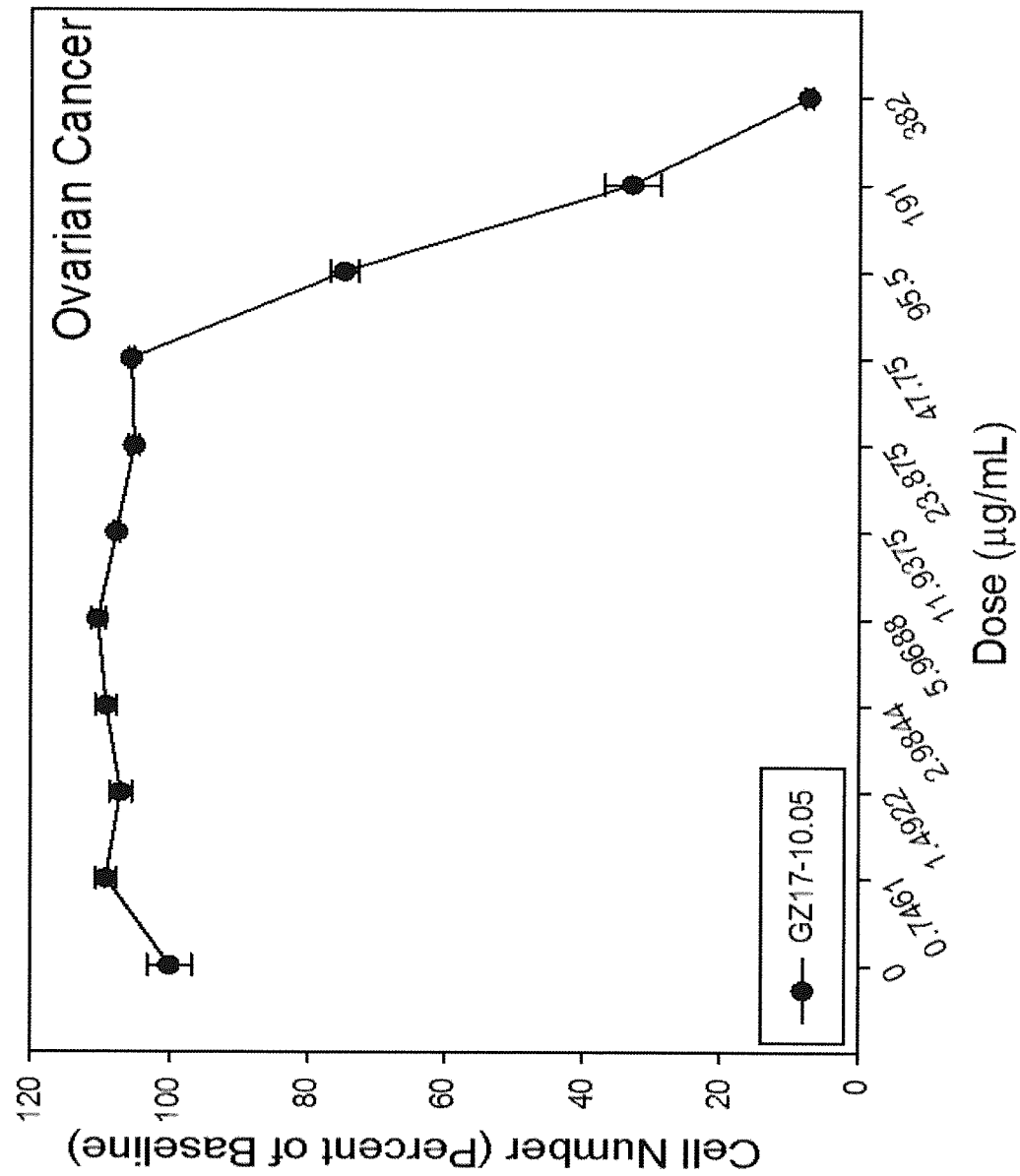

Ovarian Cancer
Cell Number (Percent of Baseline)
120
100
80
60
40
20
0
GZ17-10.05
0
0.7461
1.4922
2.9844
5.9688
11.9375
23.875
47.75
95.5
191
382
Dose (µg/mL)

Fig. 80B

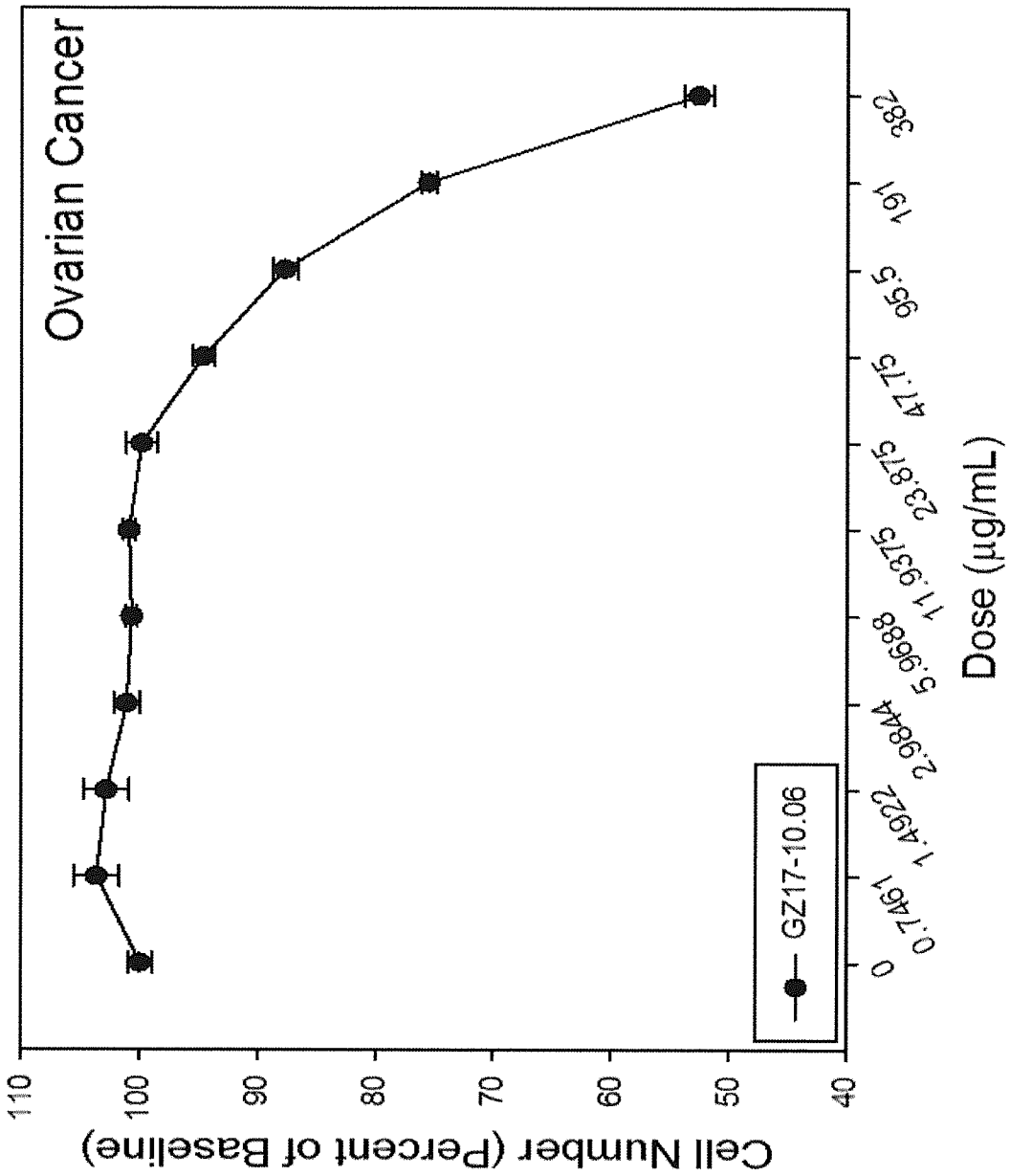

Ovarian Cancer
Cell Number (Percent of Baseline)
110
100
90
80
70
60
50
40
GZ17-10.06
0
0.7461
1.4922
2.9844
5.9688
11.9375
23.875
47.75
95.5
191
382
Dose (µg/mL)

Fig. 80C

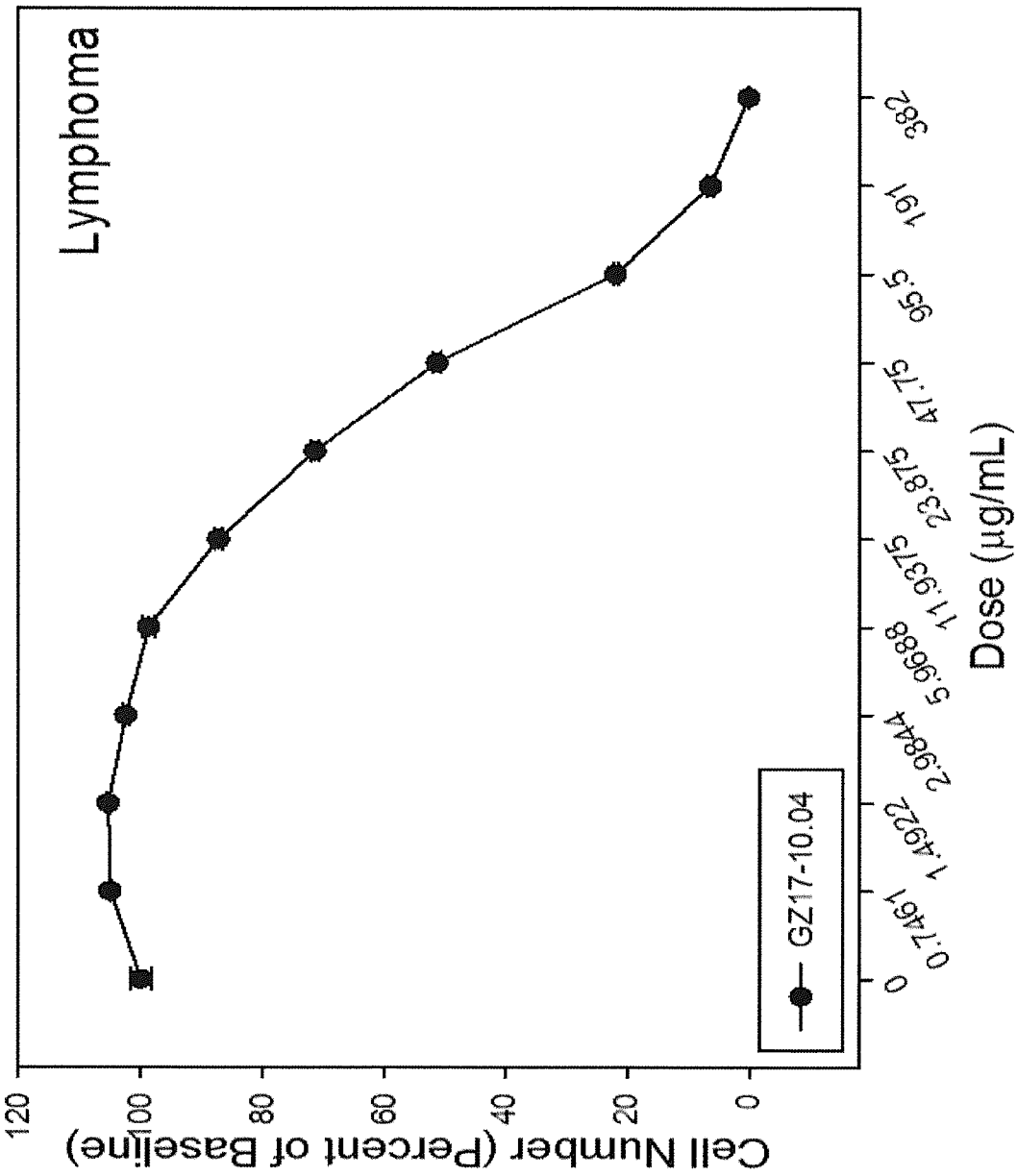

Lymphoma
Cell Number (Percent of Baseline)
120
100
80
60
40
20
0
GZ17-10.04
0
0.7461
1.4922
2.9844
5.9688
11.9375
23.875
47.75
95.5
191
382
Dose (µg/mL)

Fig. 80D

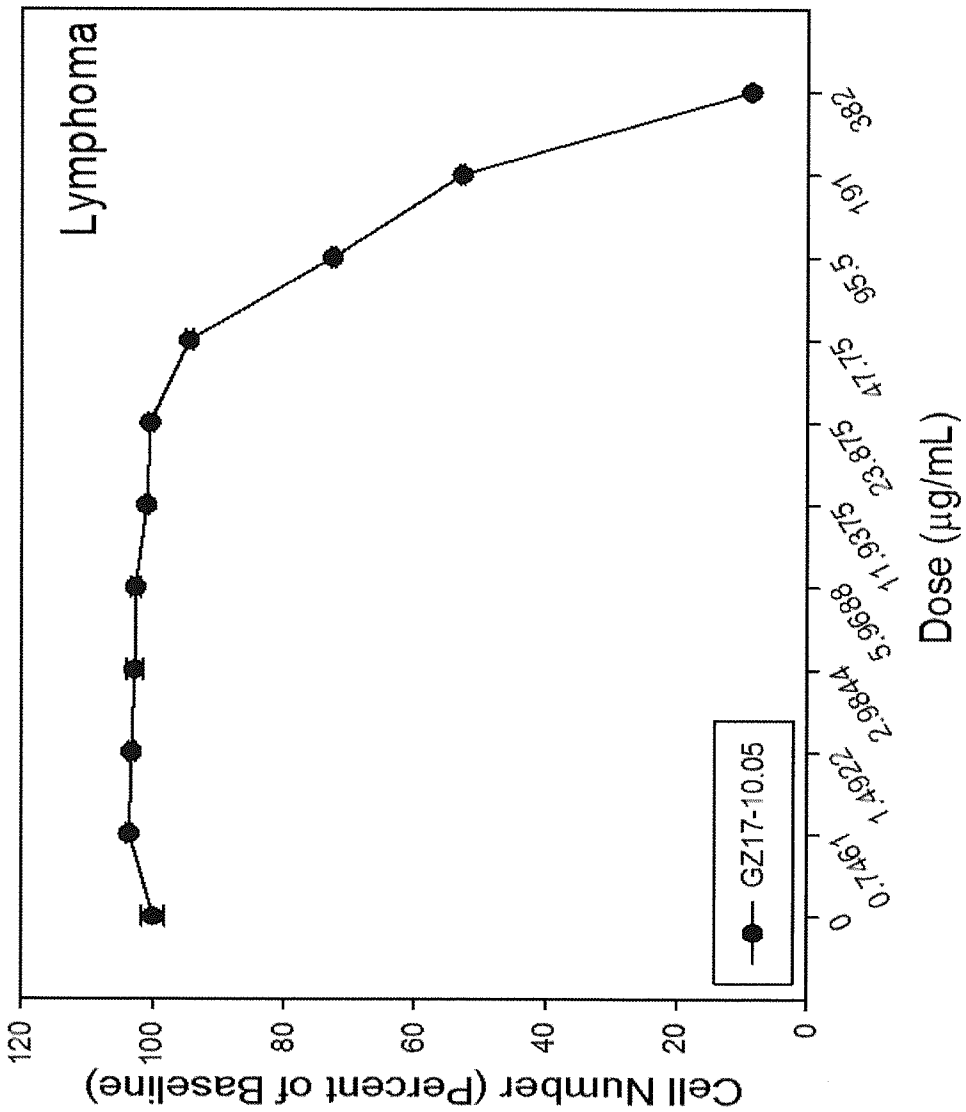

Lymphoma
Cell Number (Percent of Baseline)
120
100
80
60
40
20
0
GZ17-10.05
0
0.7461
1.4922
2.9844
5.9688
11.9375
23.875
47.75
95.5
191
382
Dose (µg/mL)

Fig. 80E

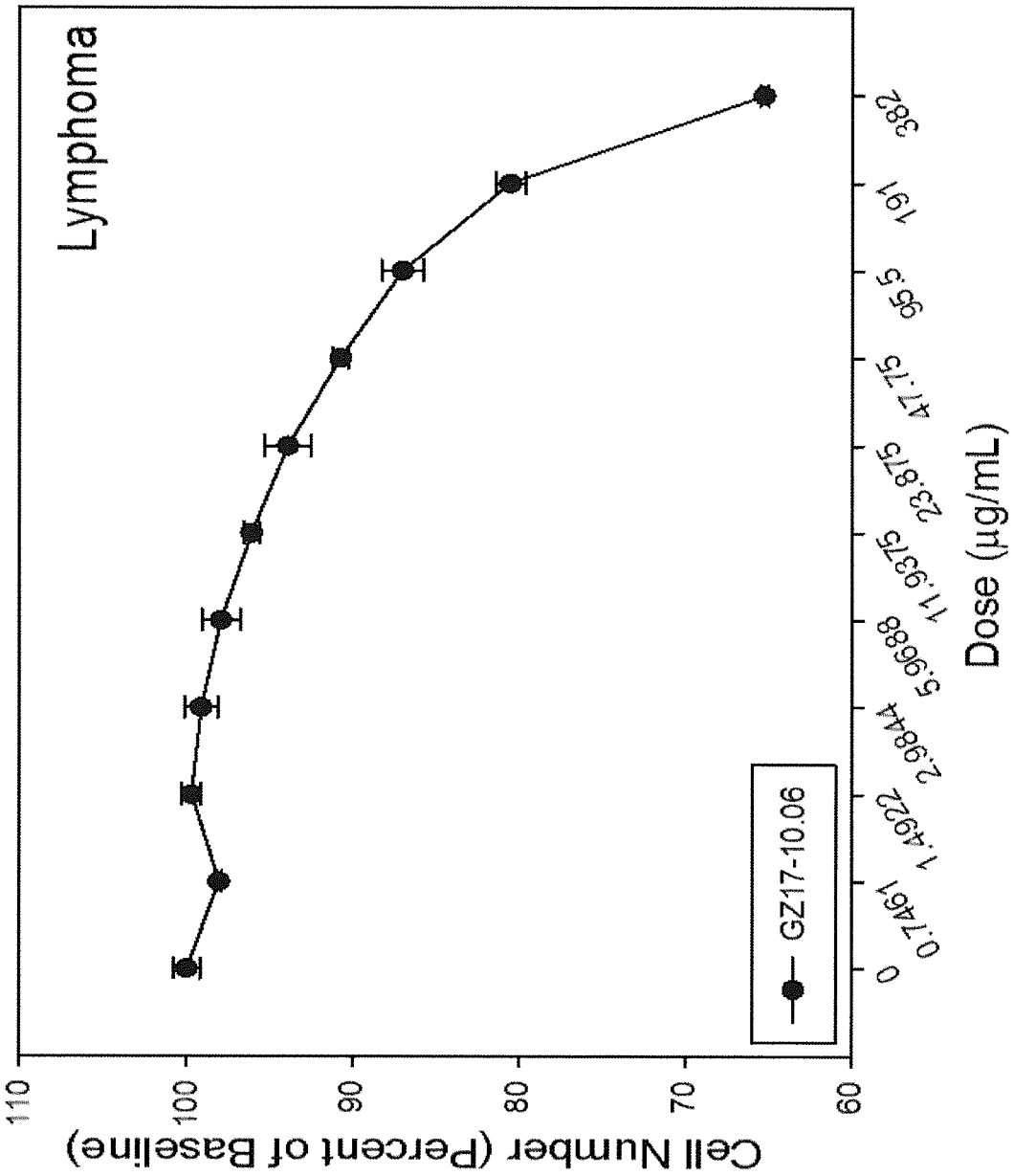

Lymphoma
Cell Number (Percent of Baseline)
110
100
90
80
70
60
GZ17-10.06
0
0.7461
1.4922
2.9844
5.9688
11.9375
23.875
47.75
95.5
191
382
Dose (µg/mL)

Fig. 80F

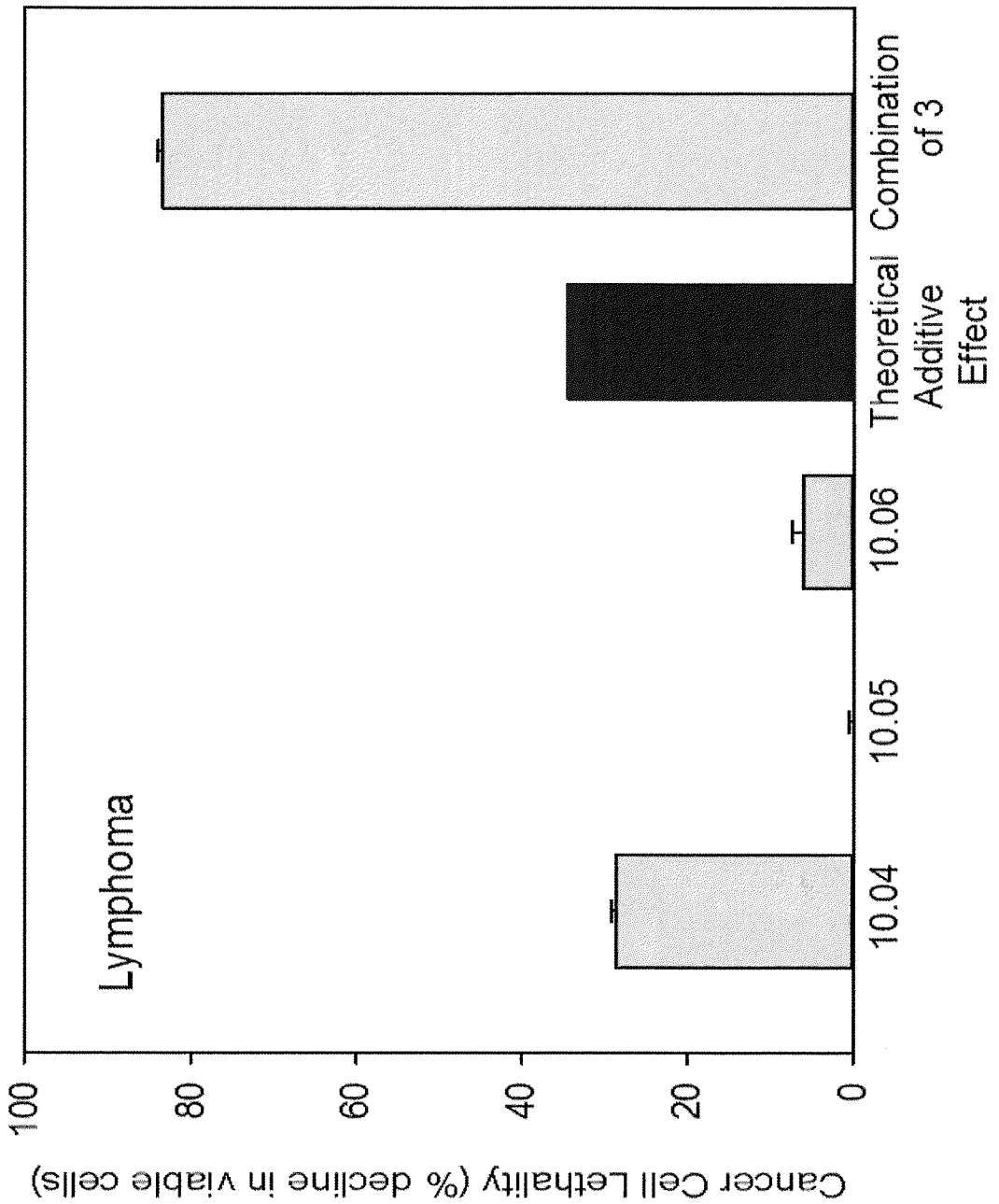

Lymphoma
Cancer Cell Lethality (% decline in viable cells)
100
80
60
40
20
0
10.04
10.05
10.06
Theoretical Additive Effect
Combination of 3

Fig. 80G

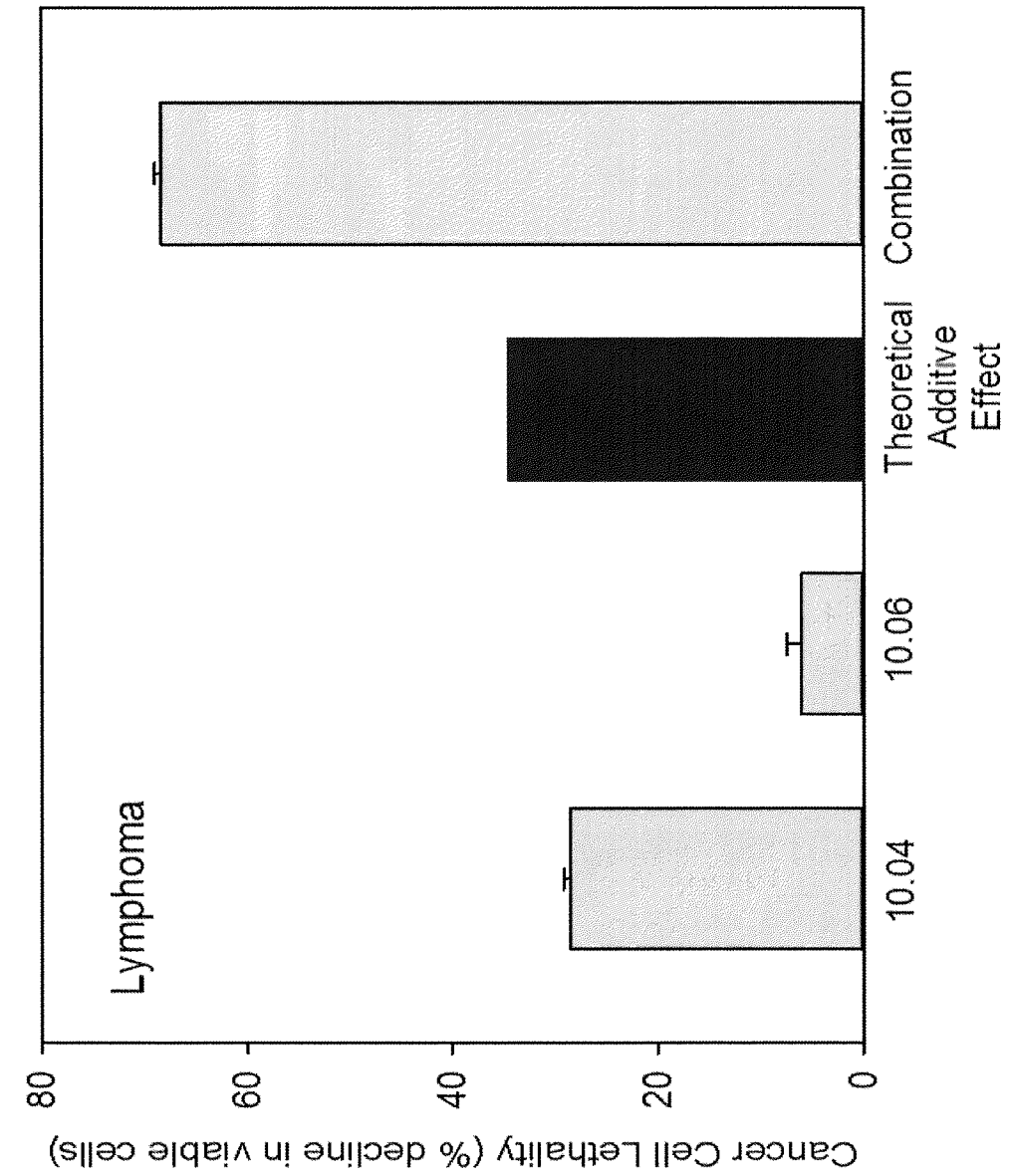

Lymphoma
Cancer Cell Lethality (% decline in viable cells)
0
20
40
60
80
10.04
10.06
Theoretical Additive Effect
Combination

Fig. 80H

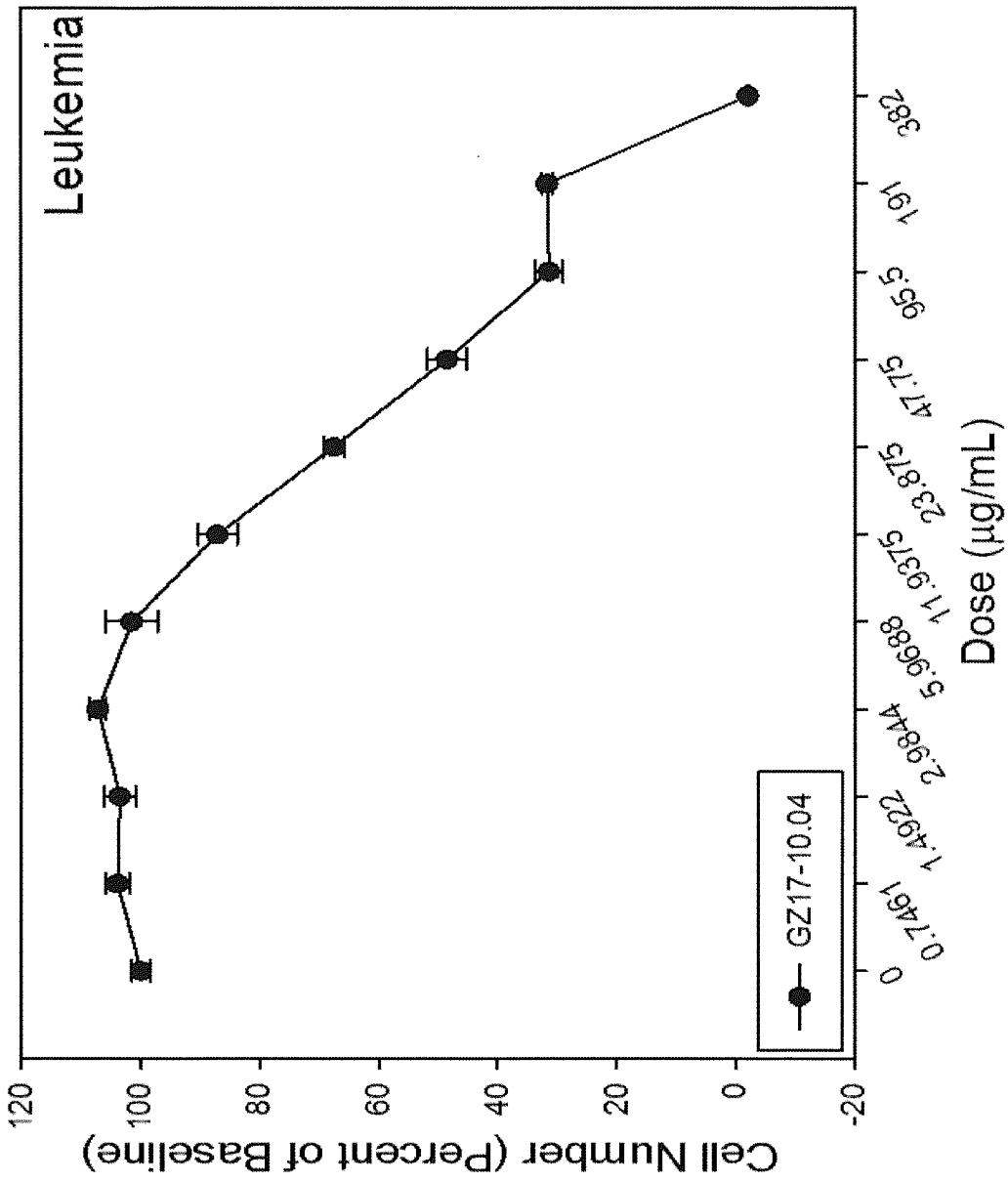

Leukemia
Cell Number (Percent of Baseline)
120
100
80
60
40
20
0
-20
GZ17-10.04
0
0.7461
1.4922
2.9844
5.9688
11.9375
23.875
47.75
95.5
191
382
Dose (µg/mL)

Fig. 80I

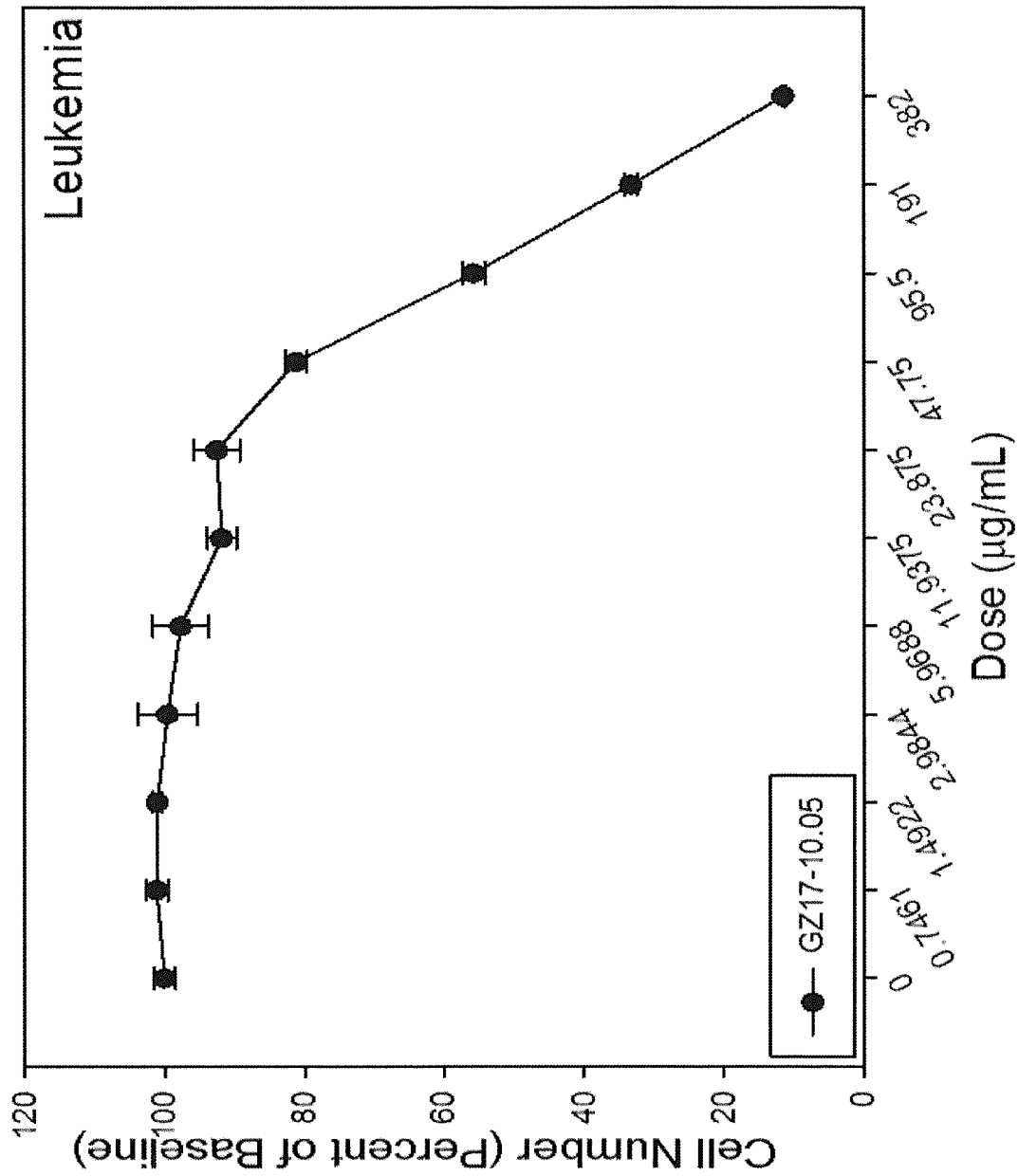

Leukemia
Cell Number (Percent of Baseline)
120
100
80
60
40
20
0
GZ17-10.05
0
0.7461
1.4922
2.9844
5.9688
11.9375
23.875
47.75
95.5
191
382
Dose (µg/mL)

Fig. 80J

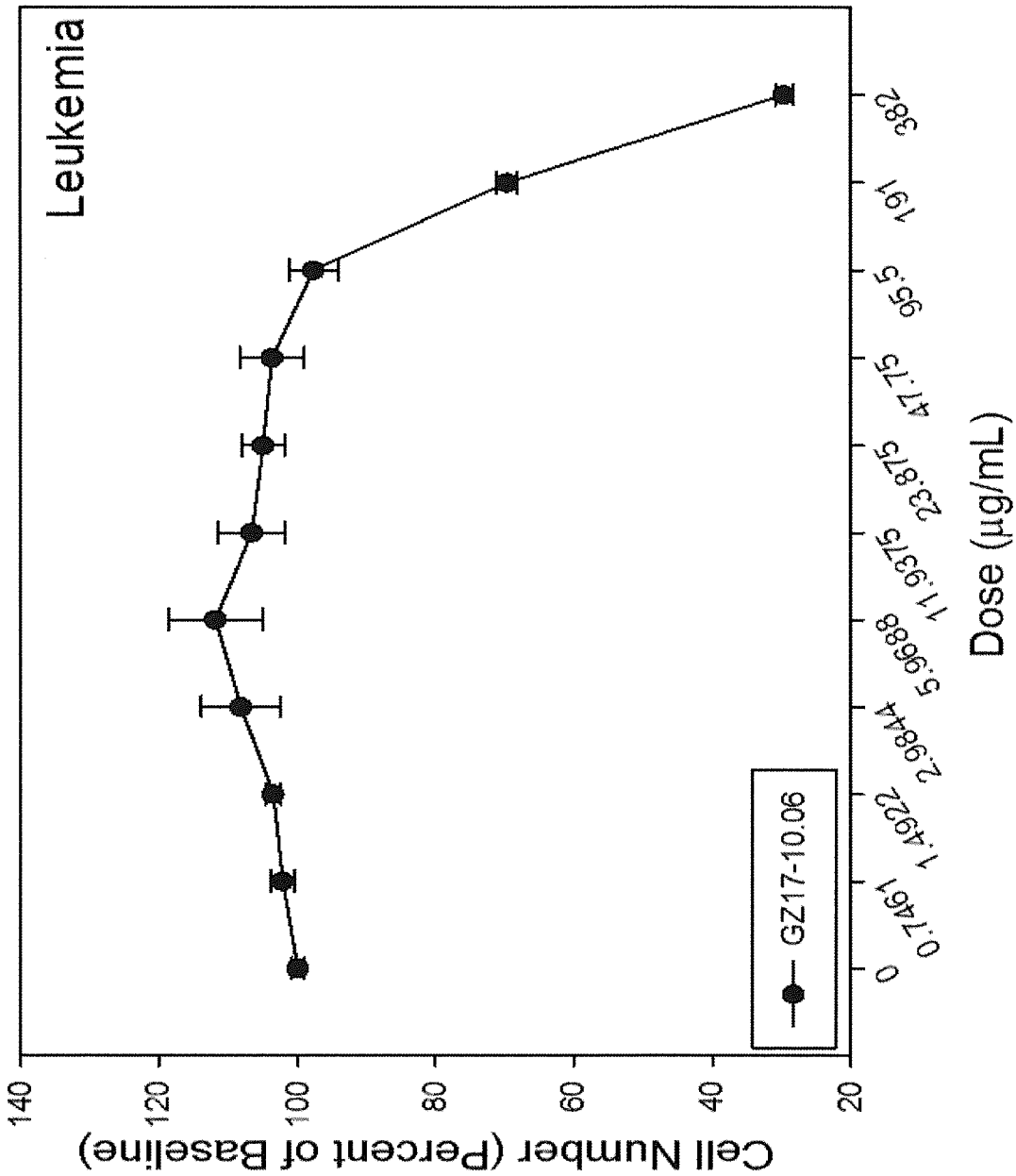

Leukemia
Cell Number (Percent of Baseline)
140
120
100
80
60
40
20
GZ17-10.06
0
0.7461
1.4922
2.9844
5.9688
11.9375
23.875
47.75
95.5
191
382
Dose (µg/mL)

Fig. 80K

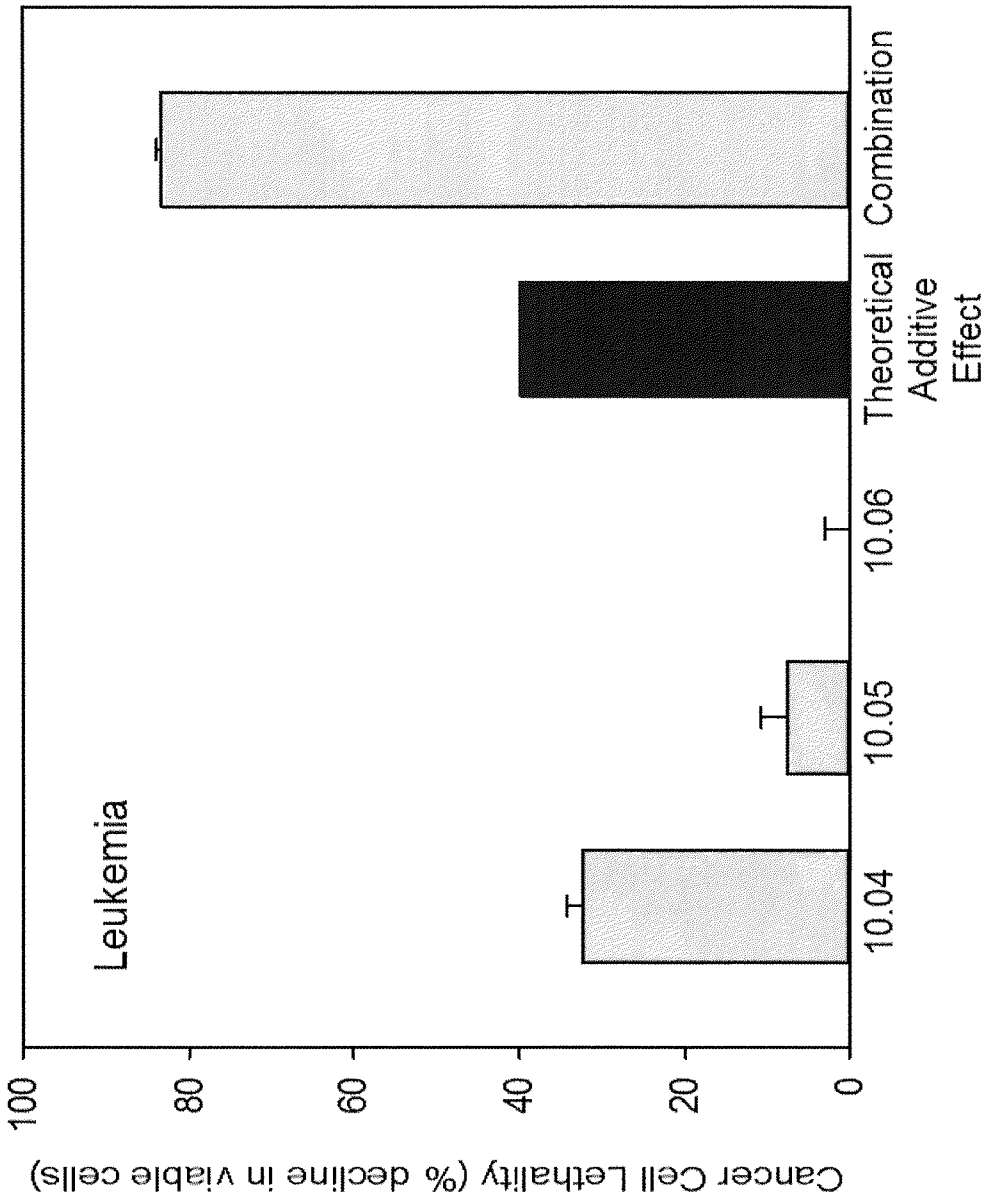

Leukemia
Cancer Cell Lethality (% decline in viable cells)
0
20
40
60
80
100
10.04
10.05
10.06
Theoretical Additive Effect
Combination

Fig. 80L

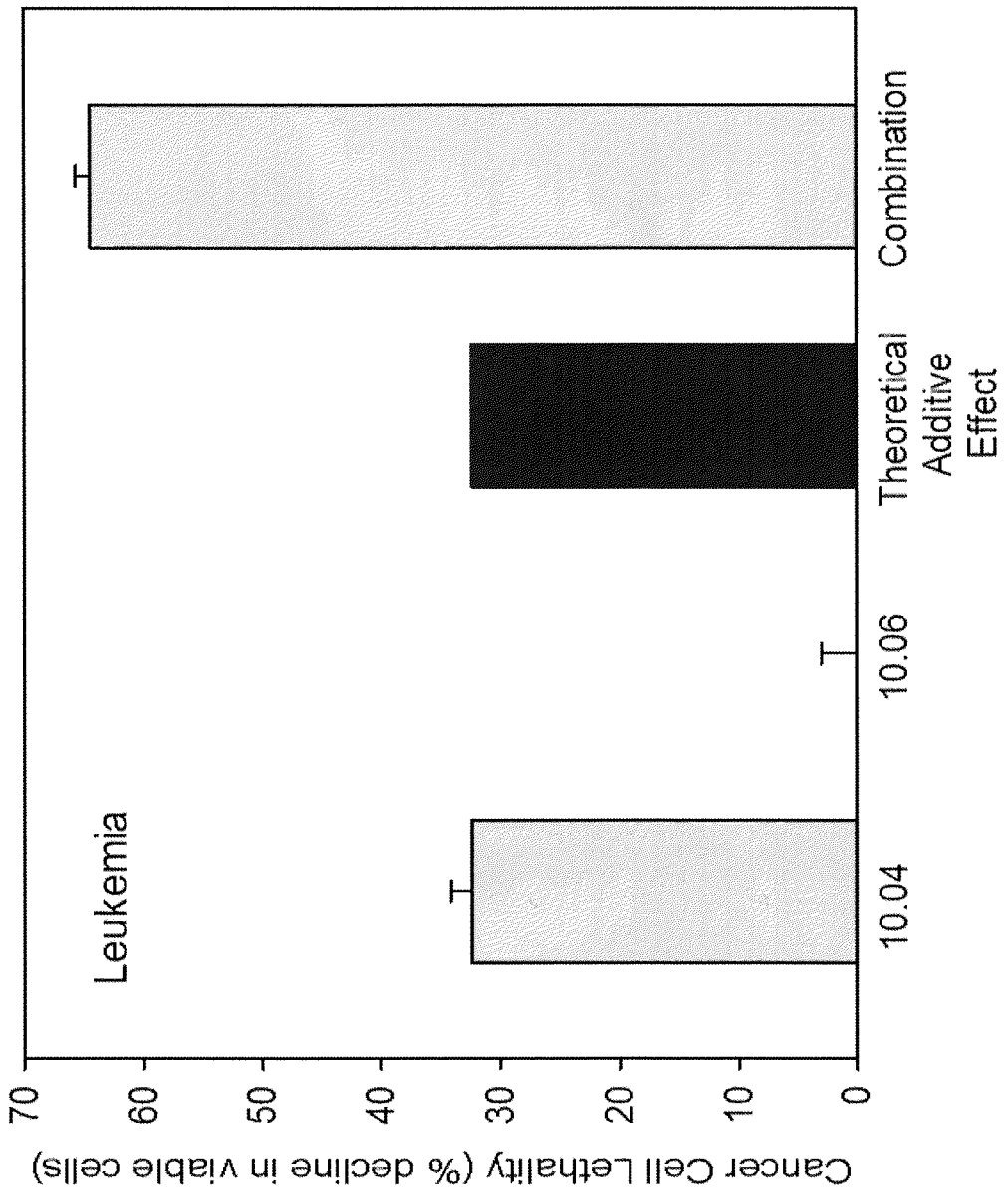

Cancer Cell Lethality (% decline in viable cells)
0
10
20
30
40
50
60
70
Leukemia
10.04
10.06
Theoretical Additive Effect
Combination

Fig. 80M

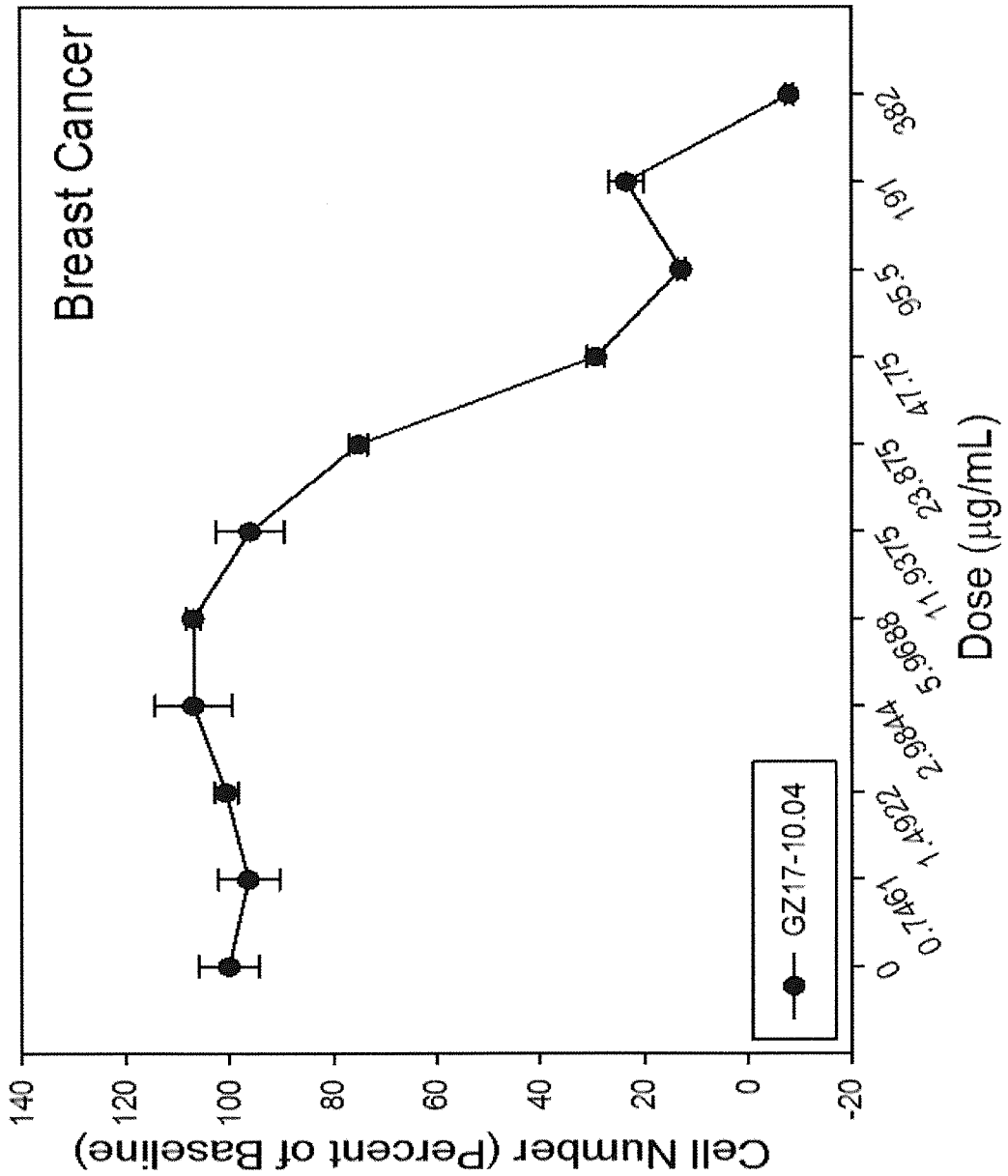

Breast Cancer
Cell Number (Percent of Baseline)
140
120
100
80
60
40
20
0
-20
GZ17-10.04
0
0.7461
1.4922
2.9844
5.9688
11.9375
23.875
47.75
95.5
191
382
Dose (µg/mL)

Fig. 80N

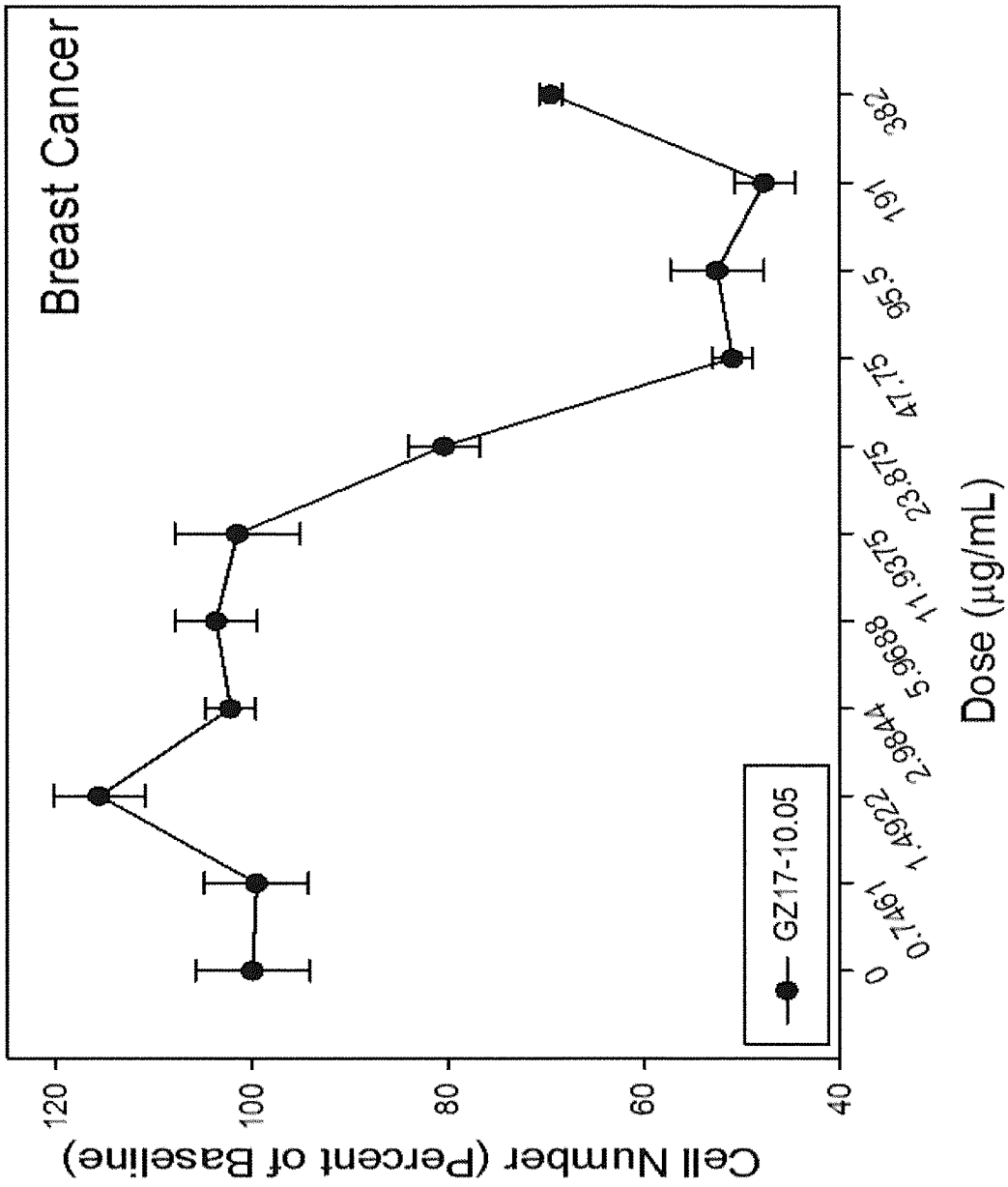

Breast Cancer
Cell Number (Percent of Baseline)
120
100
80
60
40
GZ17-10.05
0
0.7461
1.4922
2.9844
5.9688
11.9375
23.875
47.75
95.5
191
382
Dose (µg/mL)

Fig. 80O

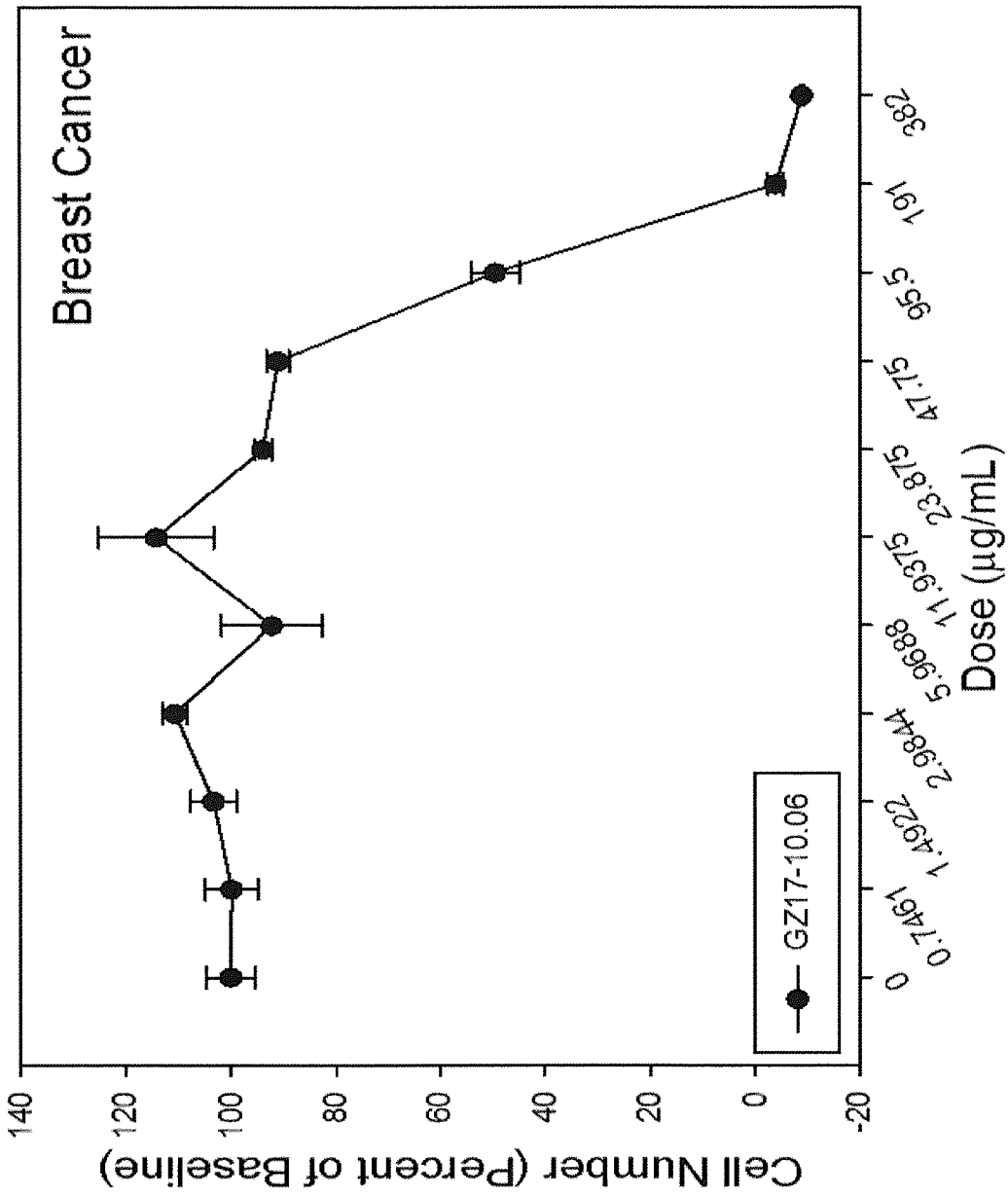

Breast Cancer
Cell Number (Percent of Baseline)
140
120
100
80
60
40
20
0
-20
GZ17-10.06
0
0.1461
1.4922
2.984
5.9688
11.9375
23.875
47.75
95.5
191
382
Dose (µg/mL)

Fig. 80P

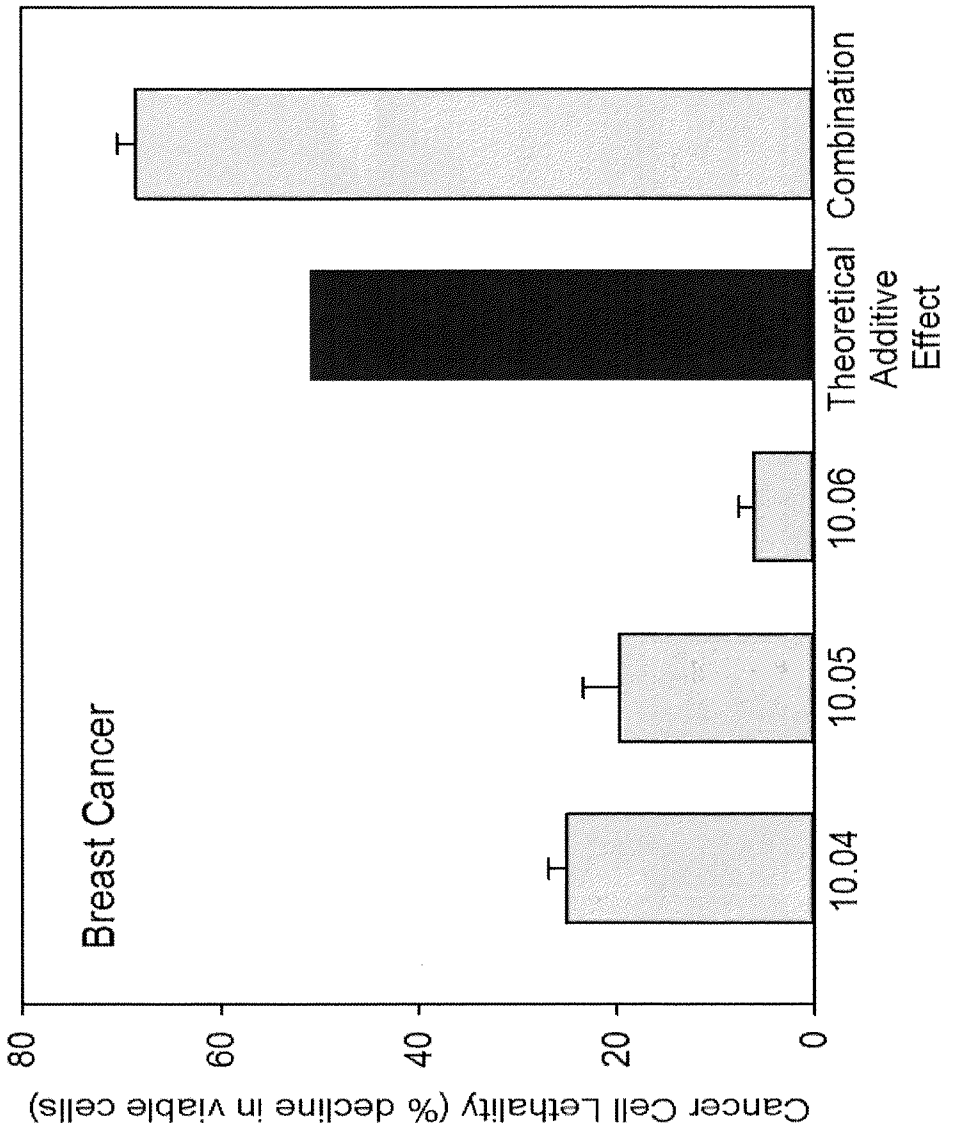

Cancer Cell Lethality (% decline in viable cells)
0
20
40
60
80
Breast Cancer
10.04
10.05
10.06
Theoretical Additive Effect
Combination

Fig. 80Q

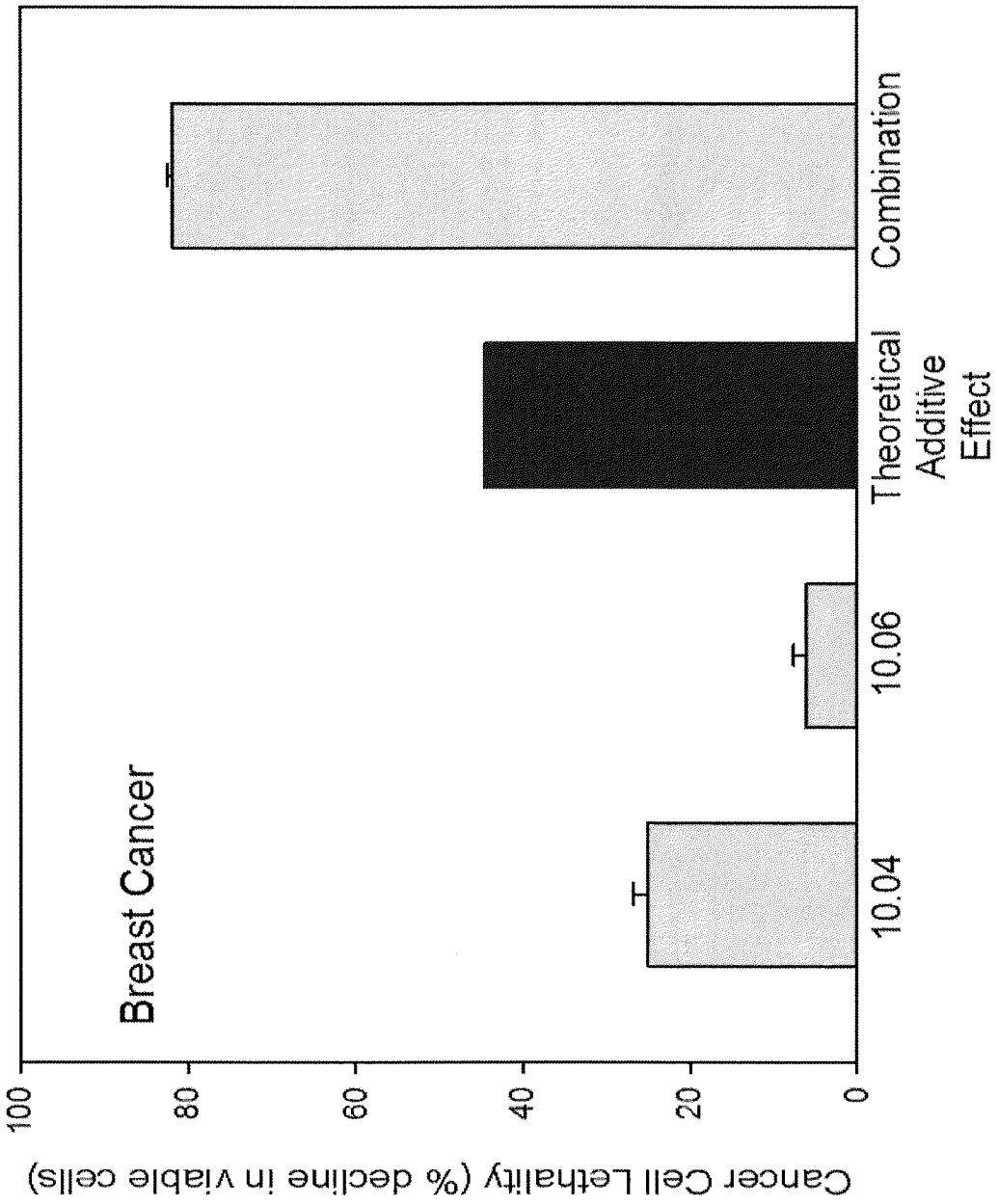

Cancer Cell Lethality (% decline in viable cells)
100
80
60
40
20
0
Breast Cancer
10.04
10.06
Theoretical Additive Effect
Combination

Fig. 80R

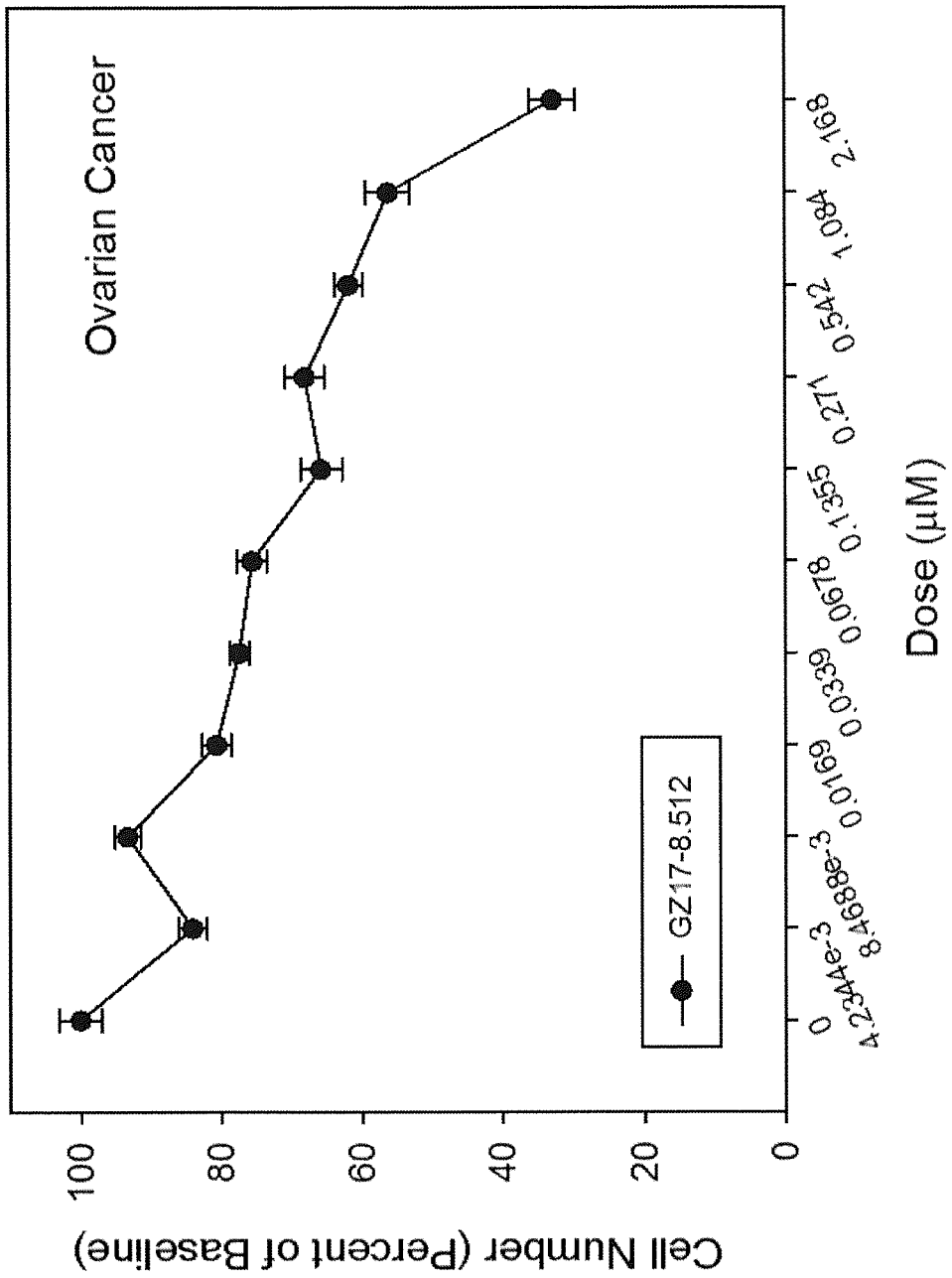

Ovarian Cancer
Cell Number (Percent of Baseline)
0
20
40
60
80
100
GZ17-8.512
0
4.2344e-3
8.4688e-3
0.0169
0.0339
0.0678
0.135
0.271
0.542
1.084
2.168
Dose (μM)

Fig. 81A

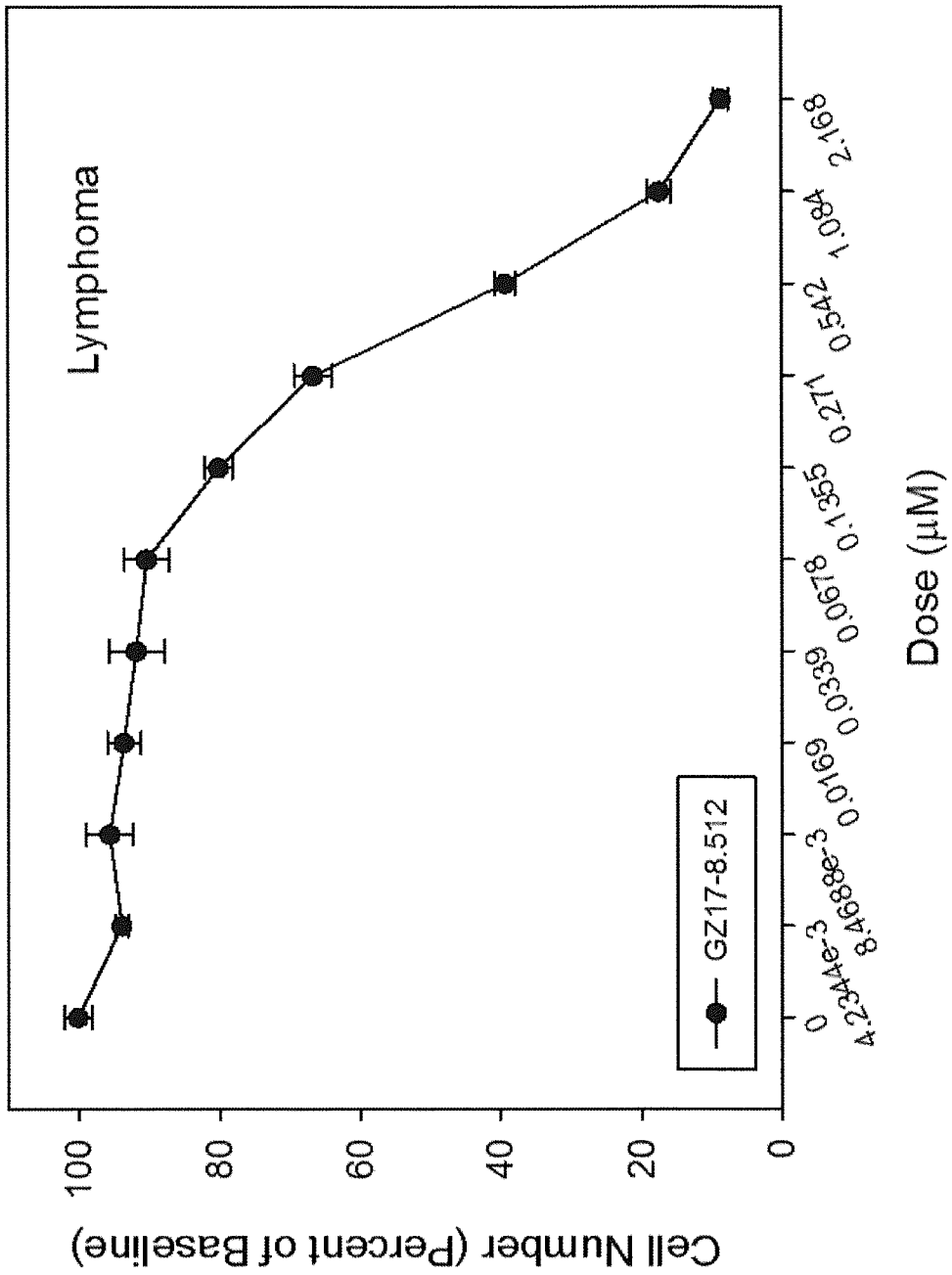

Lymphoma
Cell Number (Percent of Baseline)
100
80
60
40
20
0
GZ17-8.512
0
4.2344e-3
8.4688e-3
0.0169
0.0339
0.0678
0.135
0.271
0.542
1.084
2.168
Dose (μM)

Fig. 81B

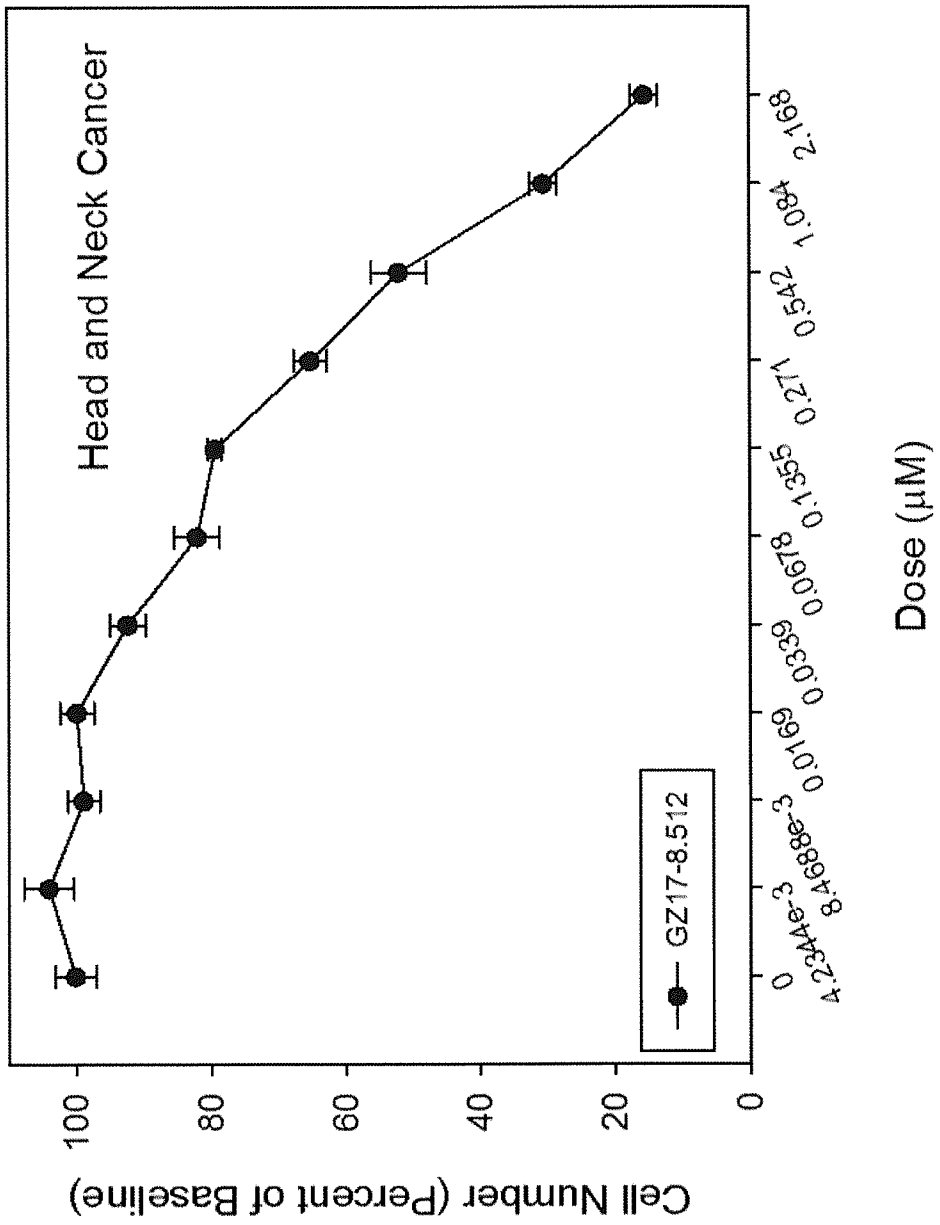

Head and Neck Cancer
Cell Number (Percent of Baseline)
100
80
60
40
20
0
GZ17-8.512
0
4.234e-3
8.468e-3
0.0169
0.0339
0.0678
0.135
0.271
0.542
1.084
2.168
Dose (μM)

Fig. 81C

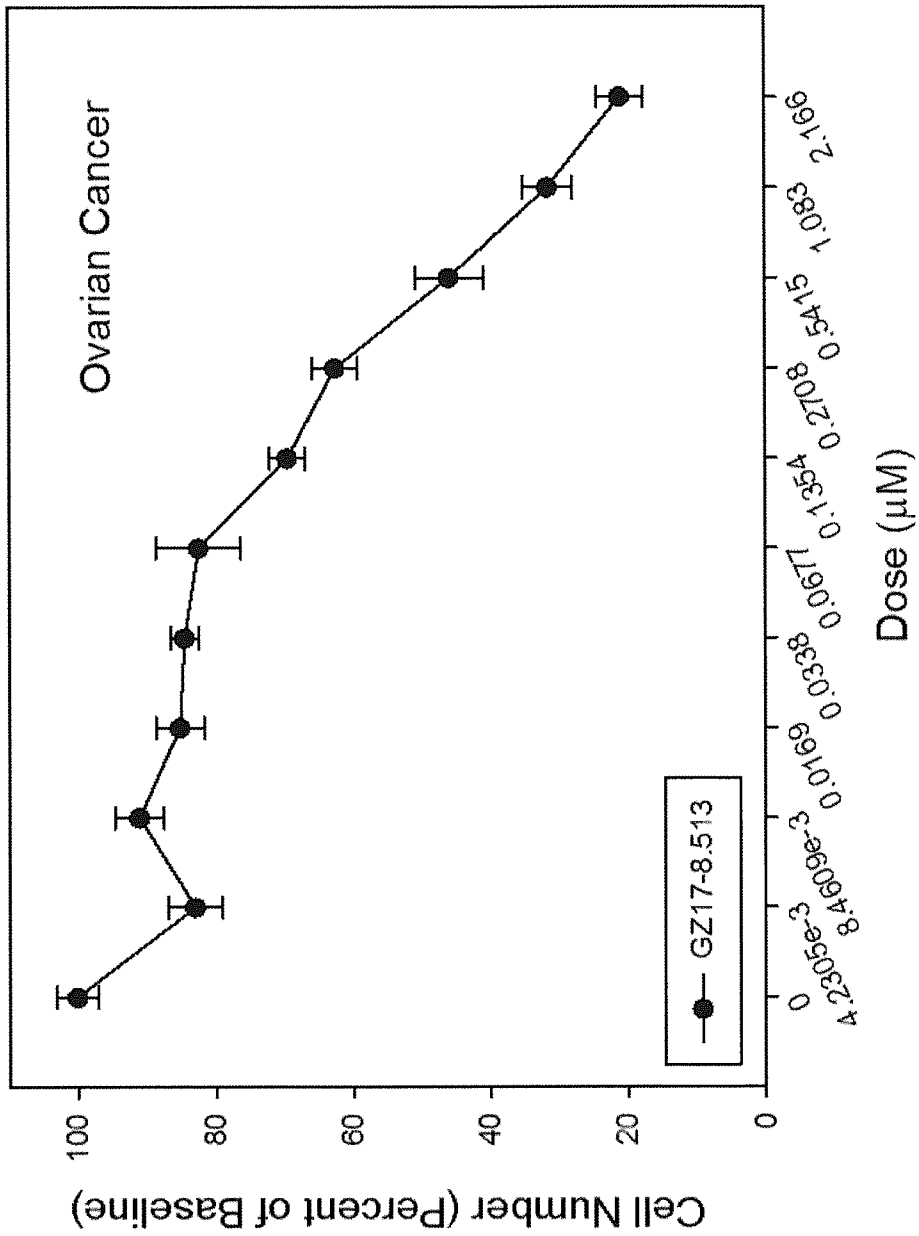

Ovarian Cancer
Cell Number (Percent of Baseline)
0
20
40
60
80
100
GZ17-8.513
0
4.230e-3
8.460e-3
0.0169
0.0338
0.0677
0.135
0.270
0.541
1.083
2.166
Dose (μM)

Fig. 81D

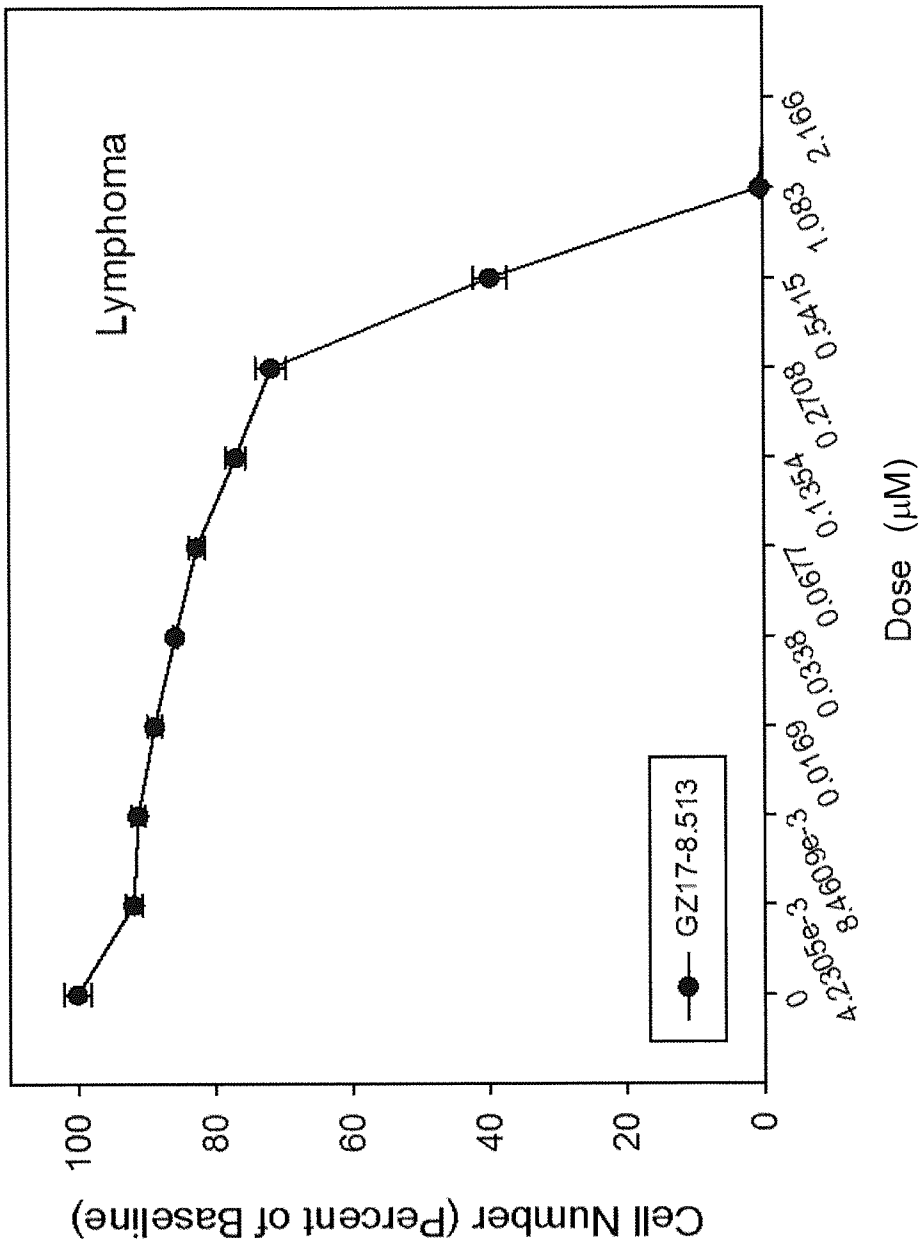

Lymphoma
Cell Number (Percent of Baseline)
100
80
60
40
20
0
GZ17-8.513
0
4.2305e-3
8.4609e-3
0.0169
0.0338
0.0677
0.1354
0.2708
0.5415
1.083
2.166
Dose (μM)

Fig. 81E

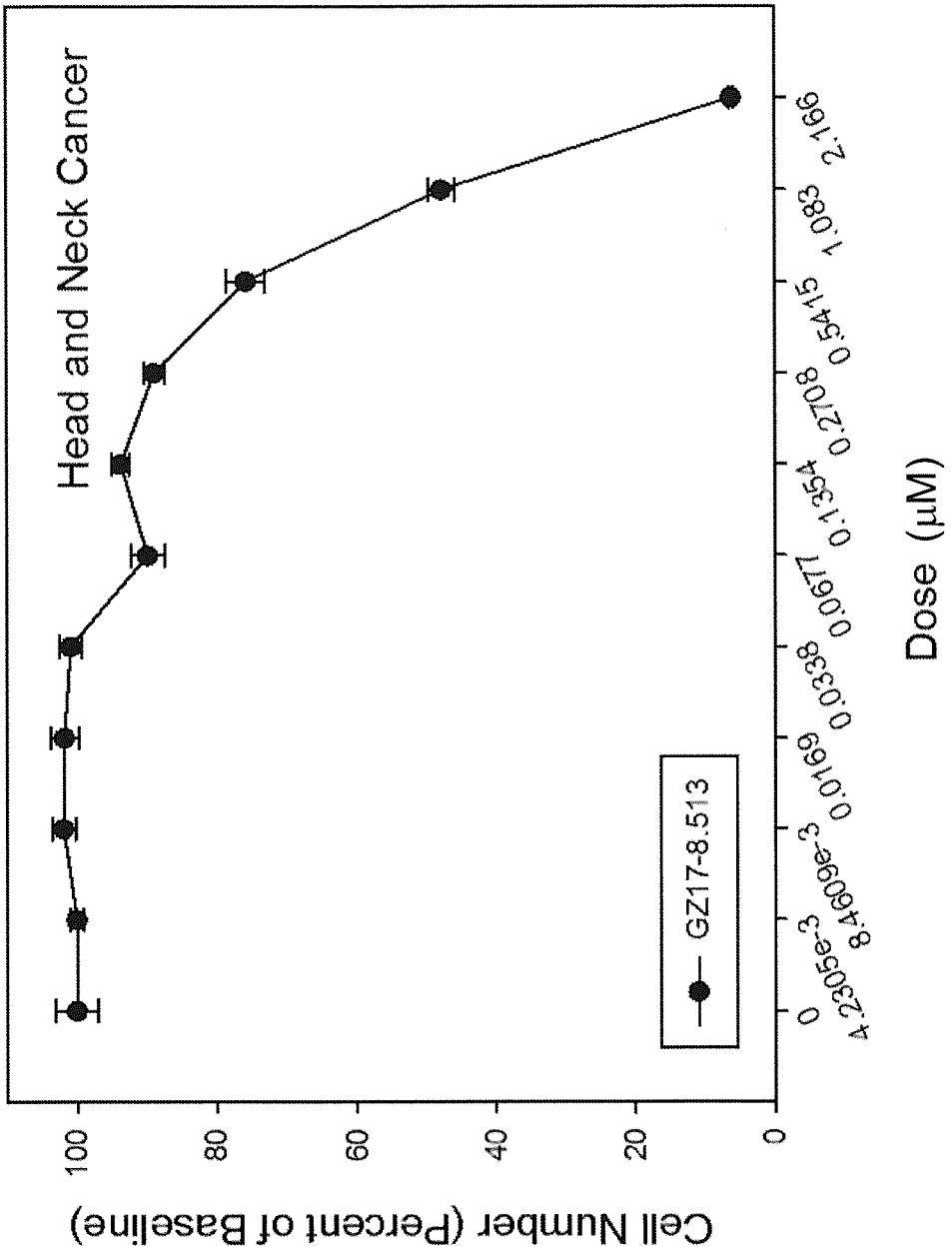

Head and Neck Cancer
Cell Number (Percent of Baseline)
0
20
40
60
80
100
GZ17-8.513
0
4.2305e-3
8.4606e-3
0.0169
0.0338
0.0677
0.1354
0.2708
0.5415
1.083
2.166
Dose (μM)

Fig. 81F

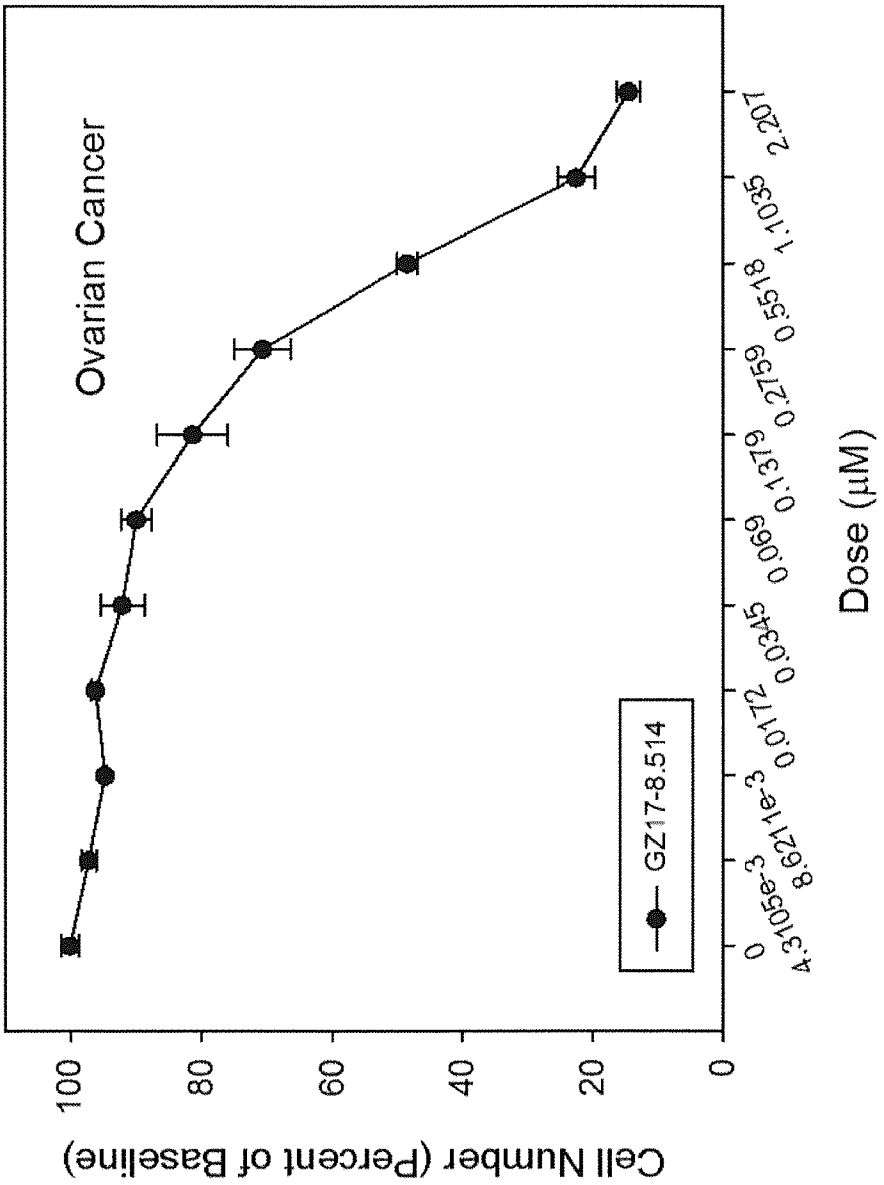

Ovarian Cancer
Cell Number (Percent of Baseline)
0
20
40
60
80
100
GZ17-8.514
0
4.3105e-3
8.9211e-3
0.0172
0.0345
0.069
0.1379
0.2759
0.5518
1.1035
2.207
Dose (μM)

Fig. 81G

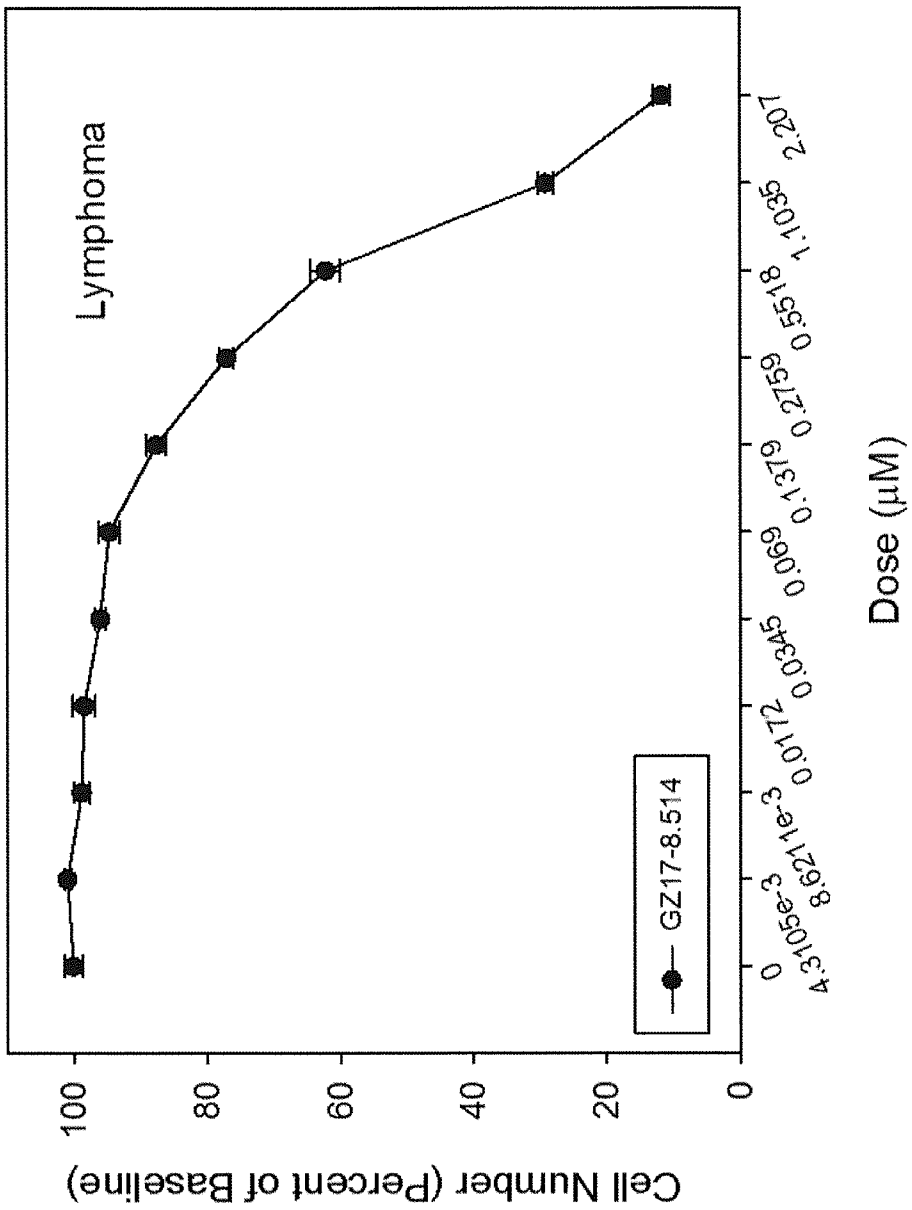

Lymphoma
Cell Number (Percent of Baseline)
0
20
40
60
80
100
GZ17-8.514
0
4.3105e-3
8.6211e-3
0.0172
0.0345
0.069
0.1379
0.2759
0.5518
1.1035
2.207
Dose (μM)

Fig. 81H

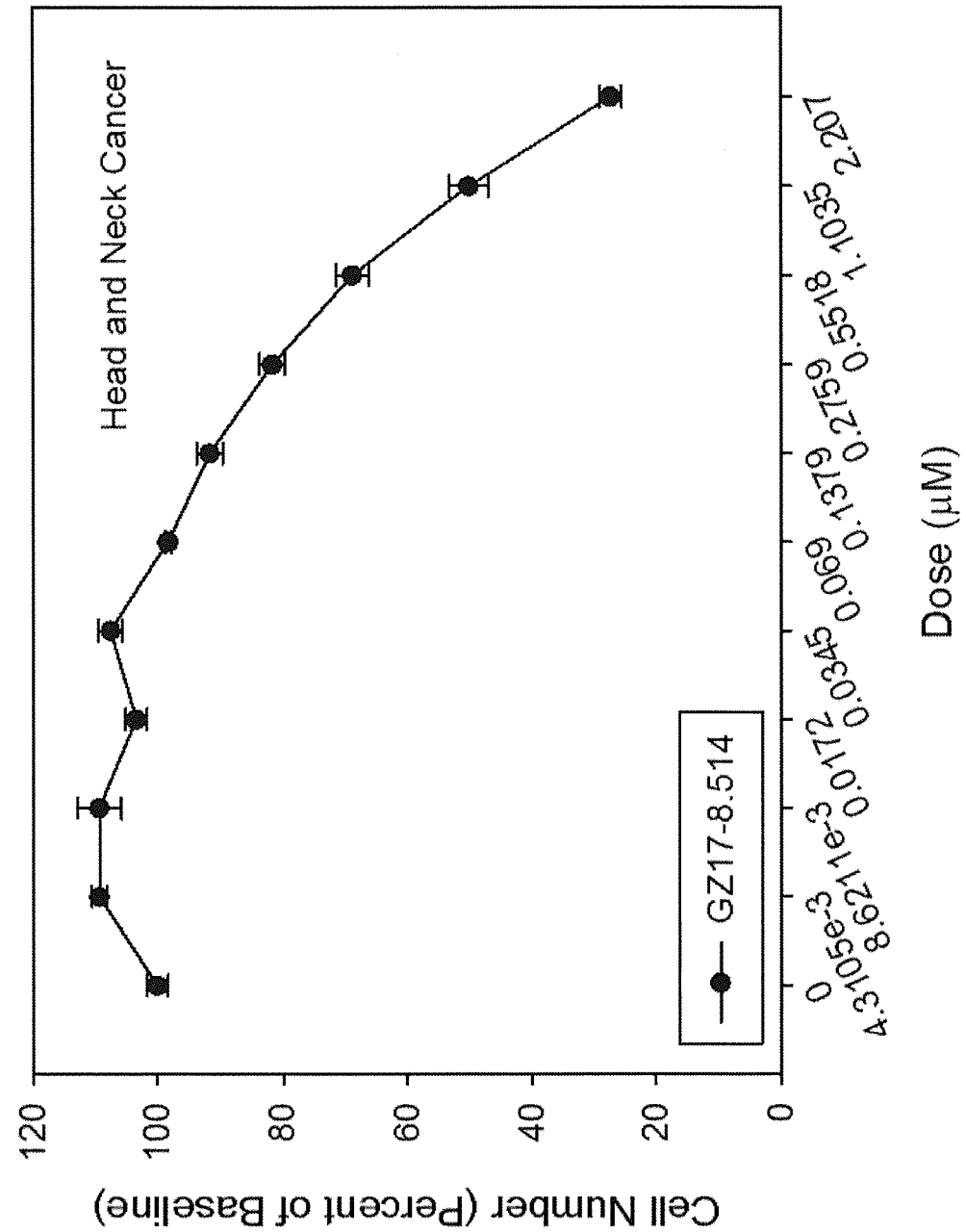

Head and Neck Cancer
Cell Number (Percent of Baseline)
120
100
80
60
40
20
0
GZ17-8.514
0
4.3105e-3
8.6211e-3
0.0172
0.0345
0.069
0.1379
0.2759
0.5518
1.1035
2.207
Dose (μM)

Fig. 81I

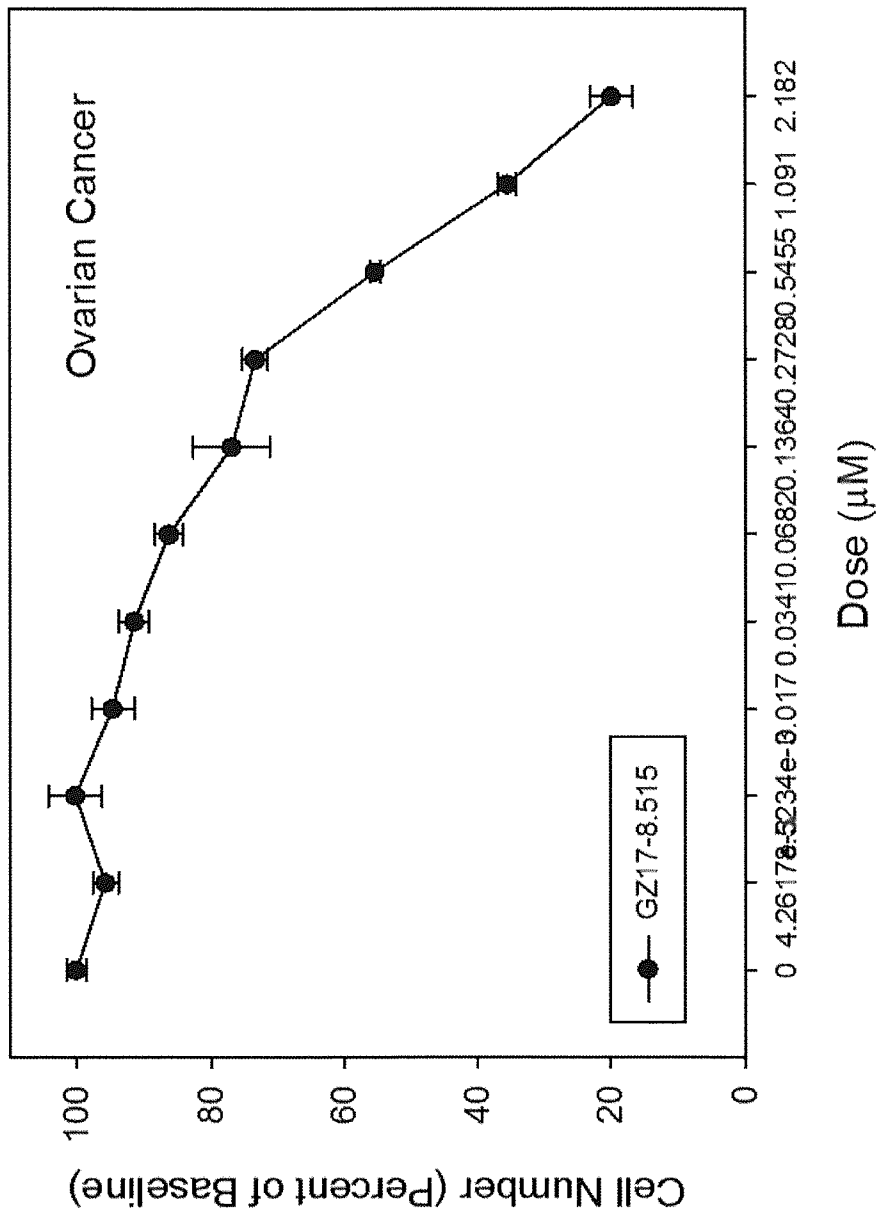

Ovarian Cancer
Cell Number (Percent of Baseline)
100
80
60
40
20
0
GZ17-8.515
0 4.261 8.523e-3 0.017 0.034 0.068 0.136 0.272 0.545 1.091 2.182
Dose (µM)

Fig. 81J

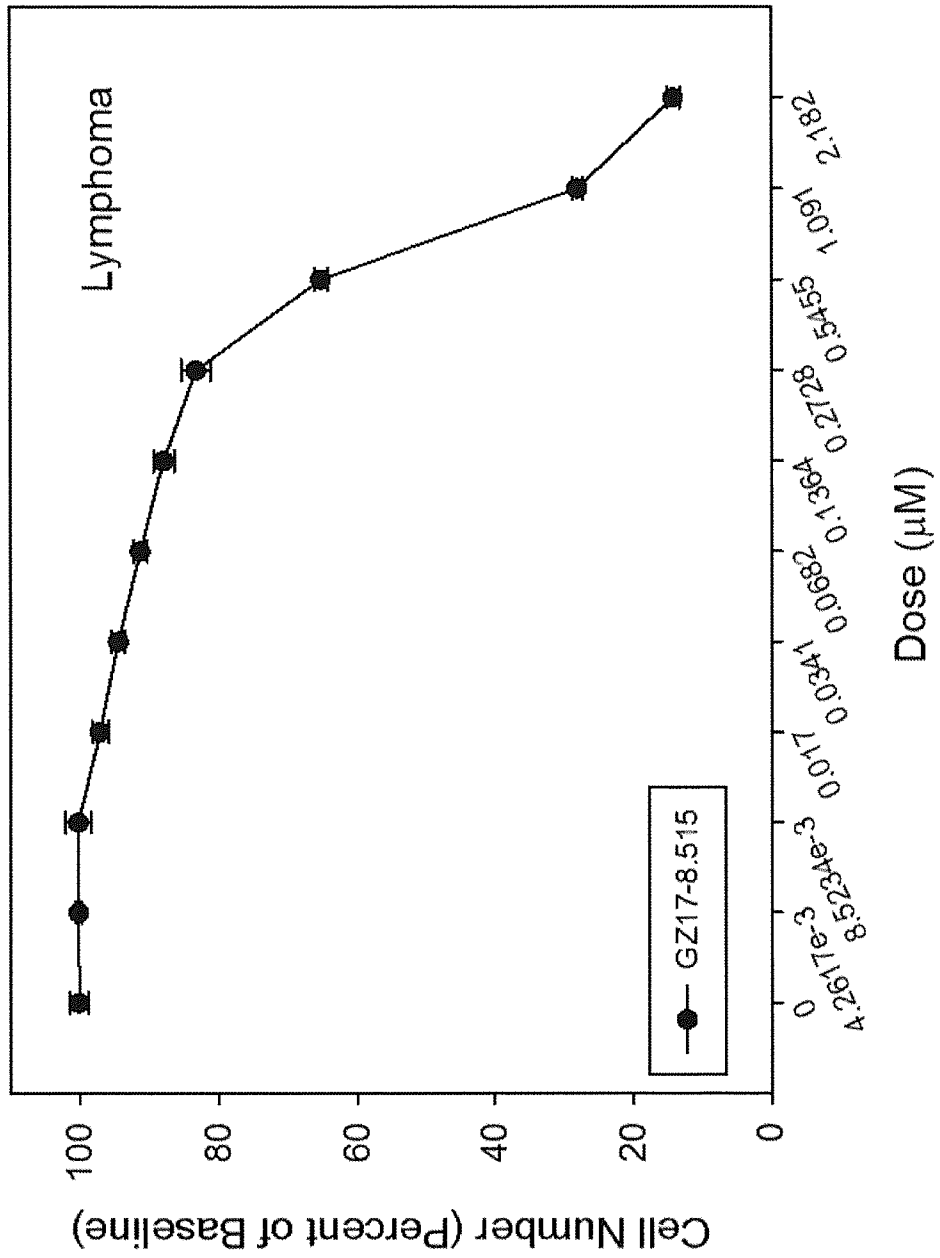

Lymphoma
Cell Number (Percent of Baseline)
0
20
40
60
80
100
GZ17-8.515
0
4.2617e-3
8.5234e-3
0.017
0.0341
0.0682
0.1364
0.2728
0.5455
1.091
2.182
Dose (μM)

Fig. 81K

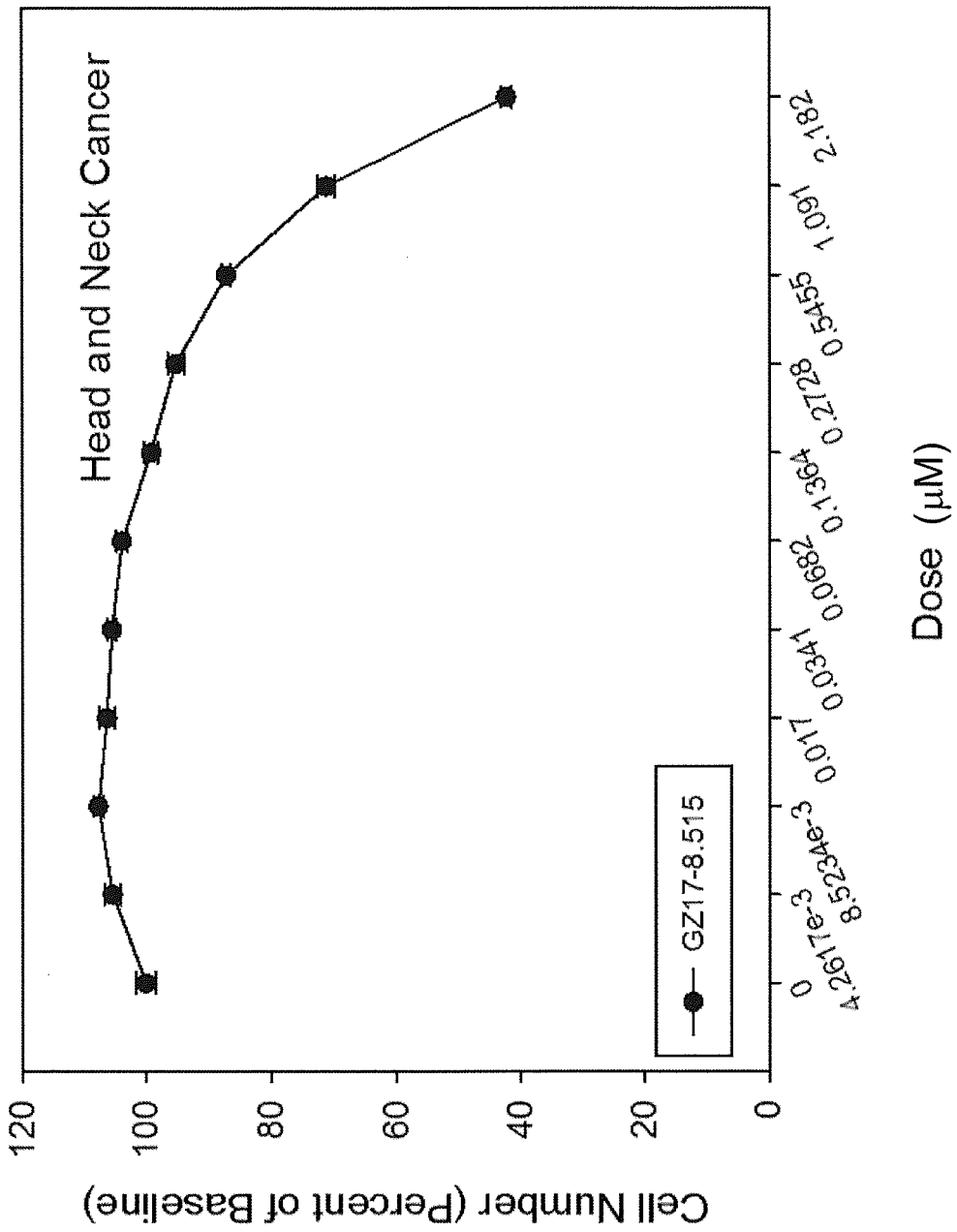

Head and Neck Cancer
Cell Number (Percent of Baseline)
120
100
80
60
40
20
0
GZ17-8.515
0
4.2617e-3
8.5234e-3
0.017
0.0341
0.0682
0.1364
0.2728
0.5455
1.091
2.182
Dose (μM)

Fig. 81L

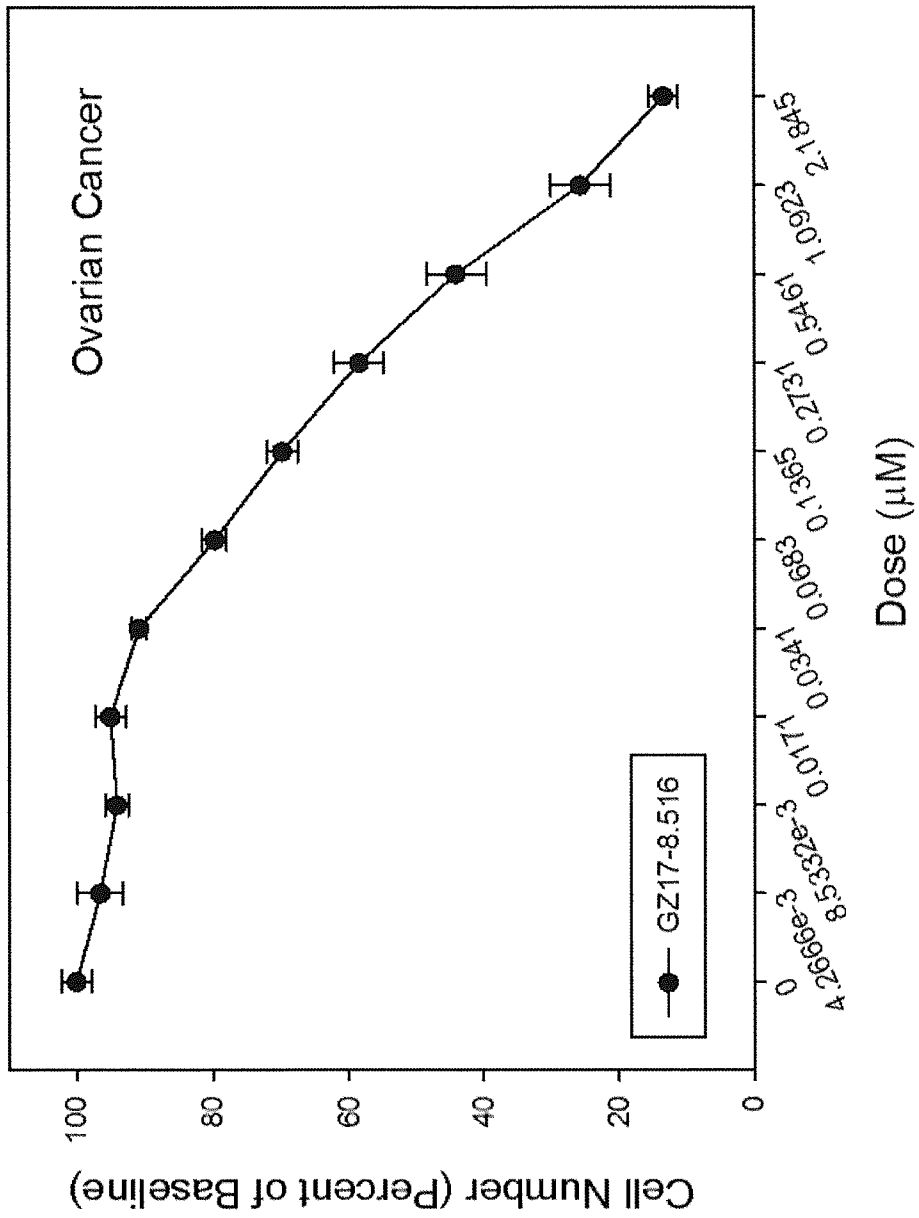

Ovarian Cancer
Cell Number (Percent of Baseline)
100
80
60
40
20
0
GZ17-8.516
0
4.2969e-3
8.5352e-3
0.0171
0.0341
0.0683
0.1365
0.2731
0.5461
1.0923
2.1845
Dose (μM)

Fig. 81M

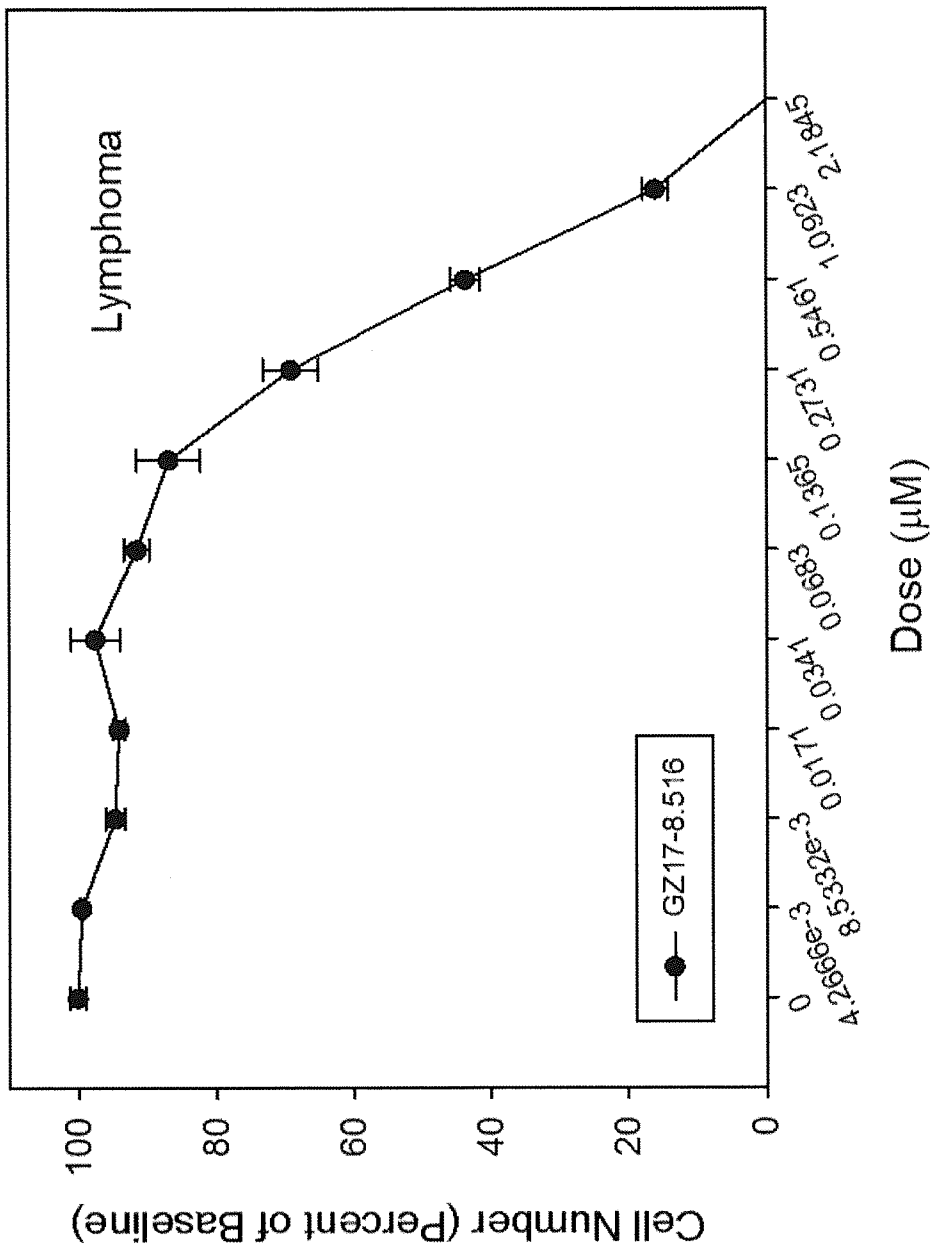

Lymphoma
GZ17-8.516
Cell Number (Percent of Baseline)
0
20
40
60
80
100
Dose (μM)
0
4.2696e-3
8.5332e-3
0.0171
0.0341
0.0683
0.1365
0.2731
0.5461
1.0923
2.1845

Fig. 81N

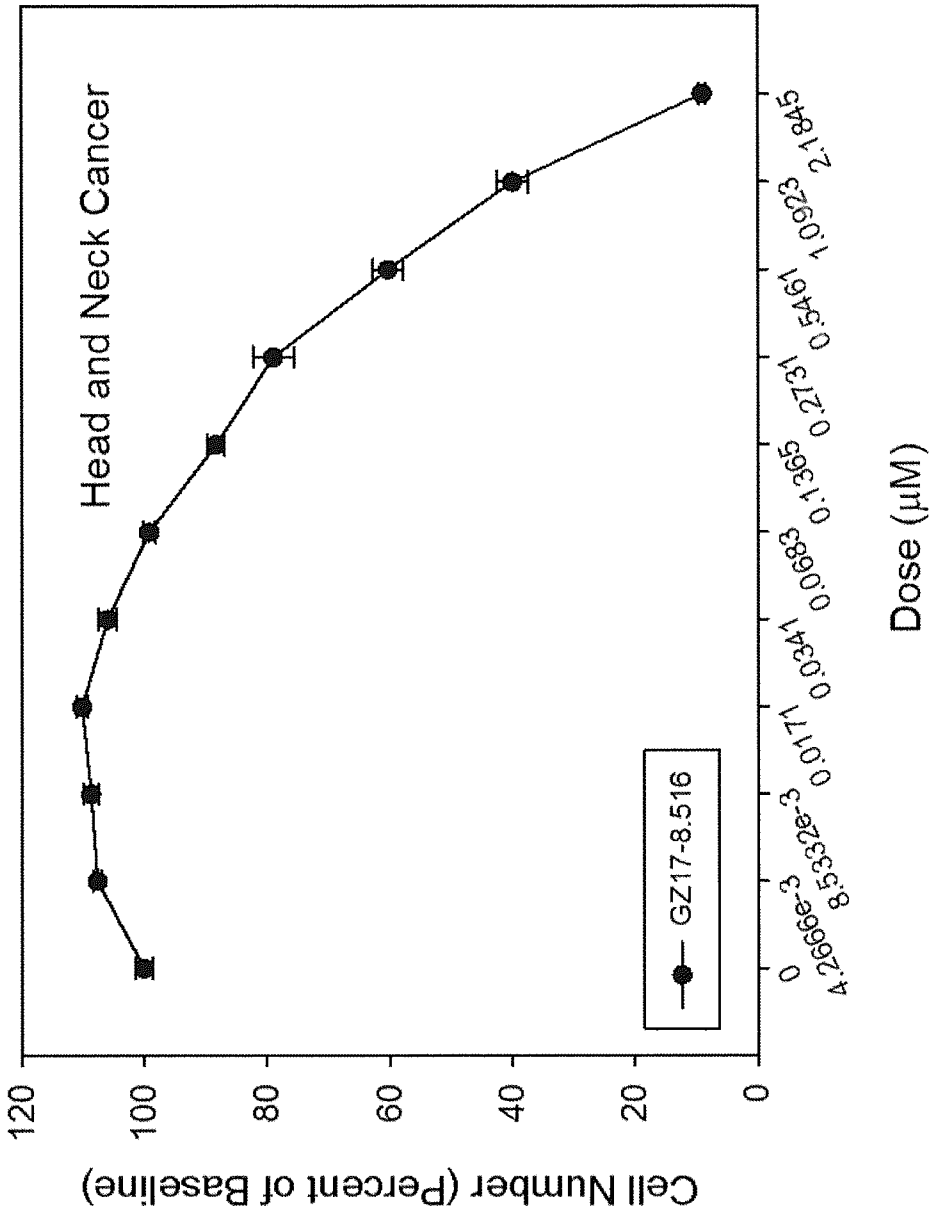

Head and Neck Cancer
GZ17-8.516
Cell Number (Percent of Baseline)
0
20
40
60
80
100
120
0
4.2696e-3
8.5332e-3
0.0171
0.0341
0.0683
0.1365
0.2731
0.5461
1.0923
2.1845
Dose (μM)

Fig. 81O

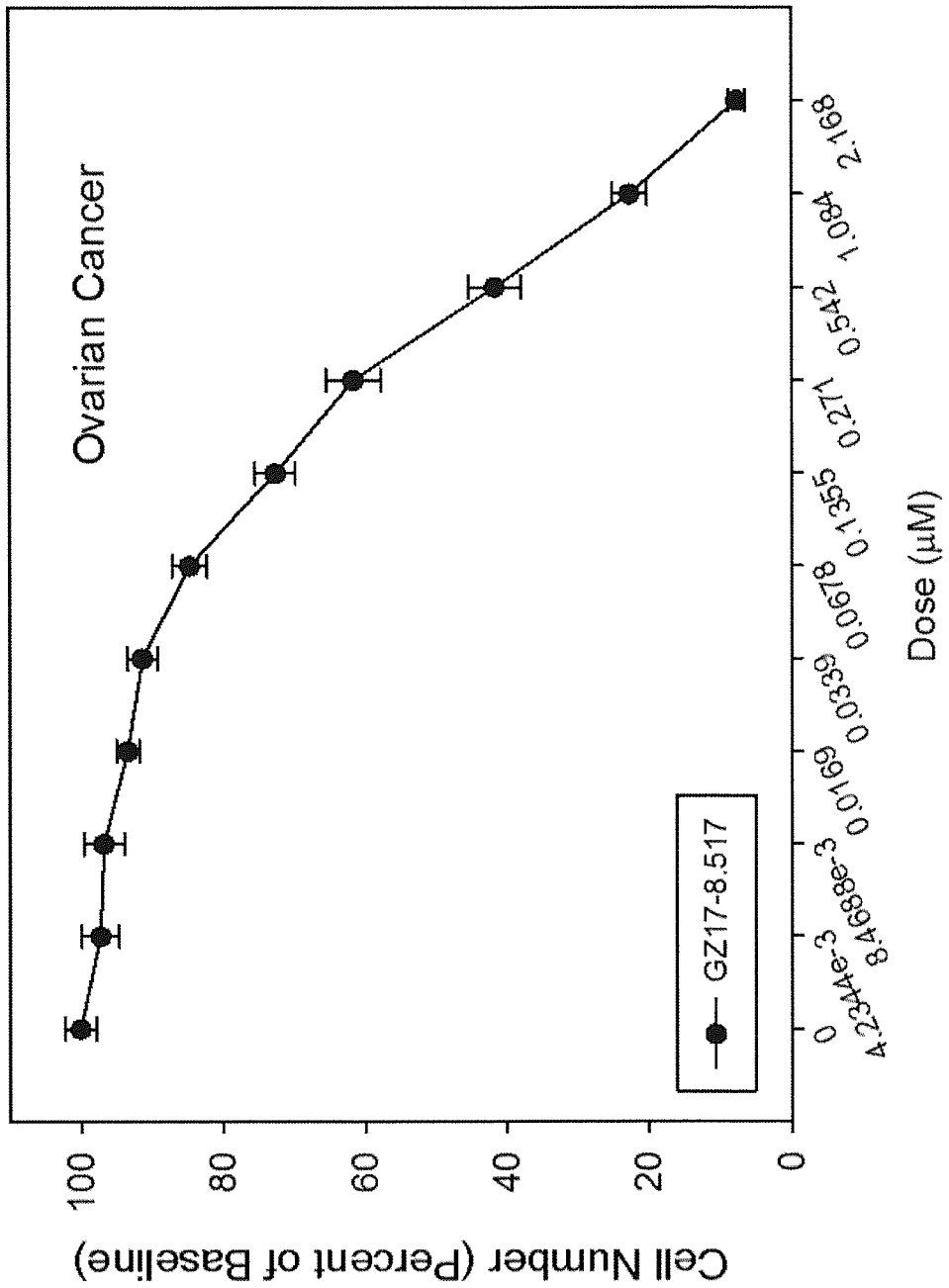

Ovarian Cancer
Cell Number (Percent of Baseline)
0
20
40
60
80
100
GZ17-8.517
0
4.234e-3
8.468e-3
0.0169
0.0339
0.0678
0.135
0.271
0.542
1.084
2.168
Dose (μM)

Fig. 81P

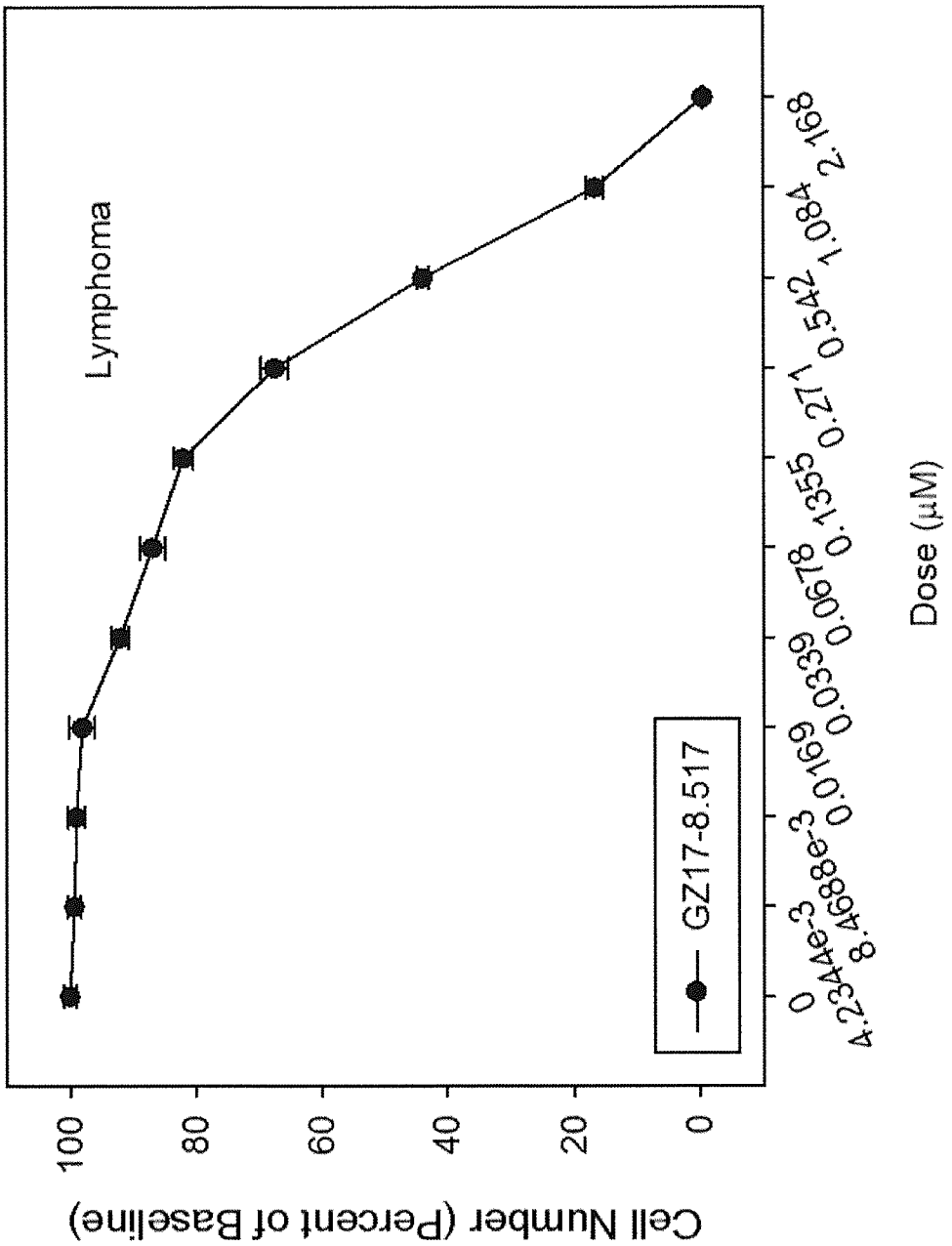

Lymphoma
Cell Number (Percent of Baseline)
100
80
60
40
20
0
GZ17-8.517
0
4.234e-3
8.468e-3
0.0169
0.0339
0.0678
0.135
0.271
0.542
1.084
2.168
Dose (μM)

Fig. 81Q

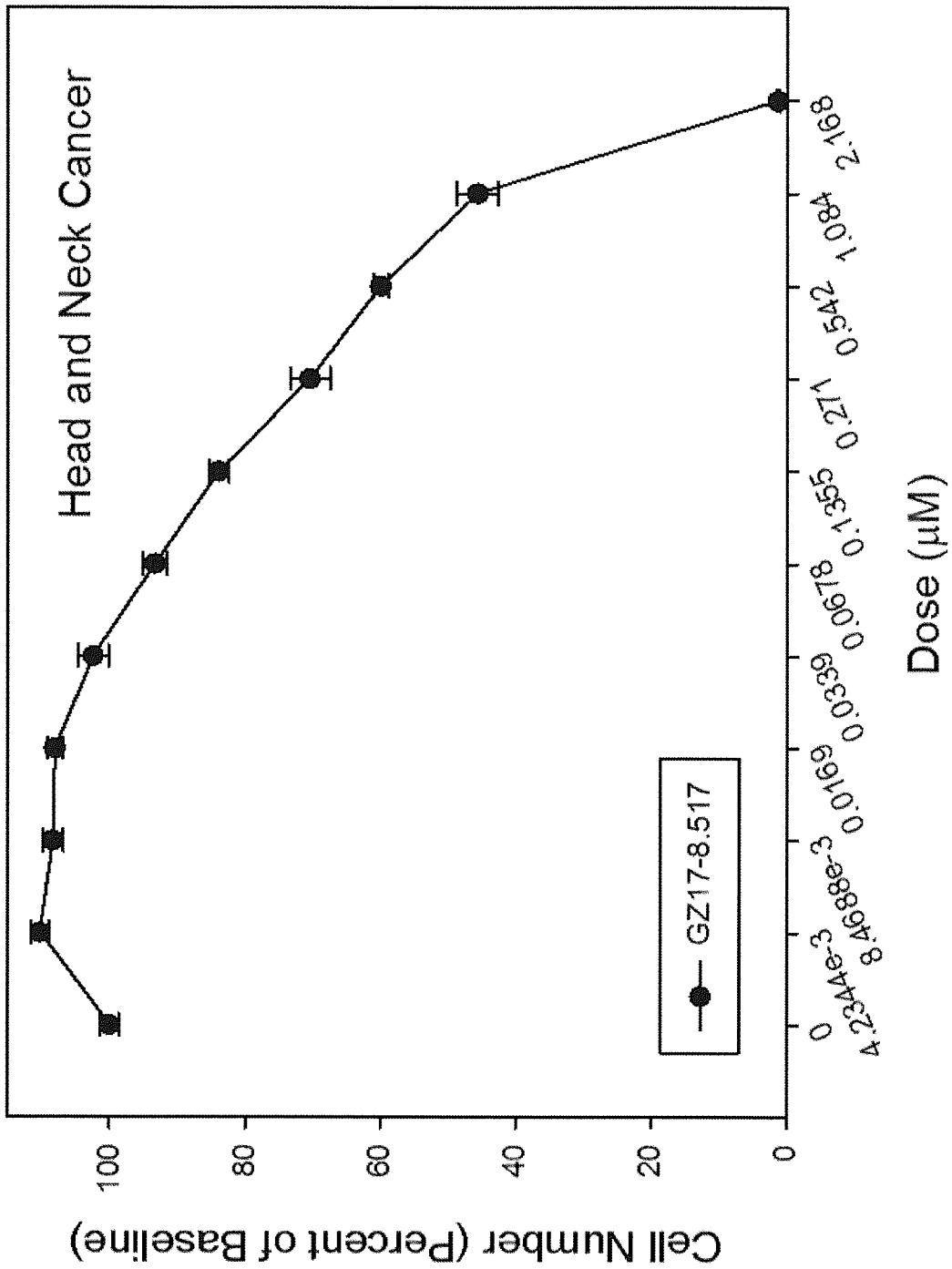

Head and Neck Cancer
Cell Number (Percent of Baseline)
0
20
40
60
80
100
GZ17-8.517
0
4.2344e-3
8.4688e-3
0.0169
0.0339
0.0678
0.1355
0.271
0.542
1.084
2.168
Dose (μM)

Fig. 81R

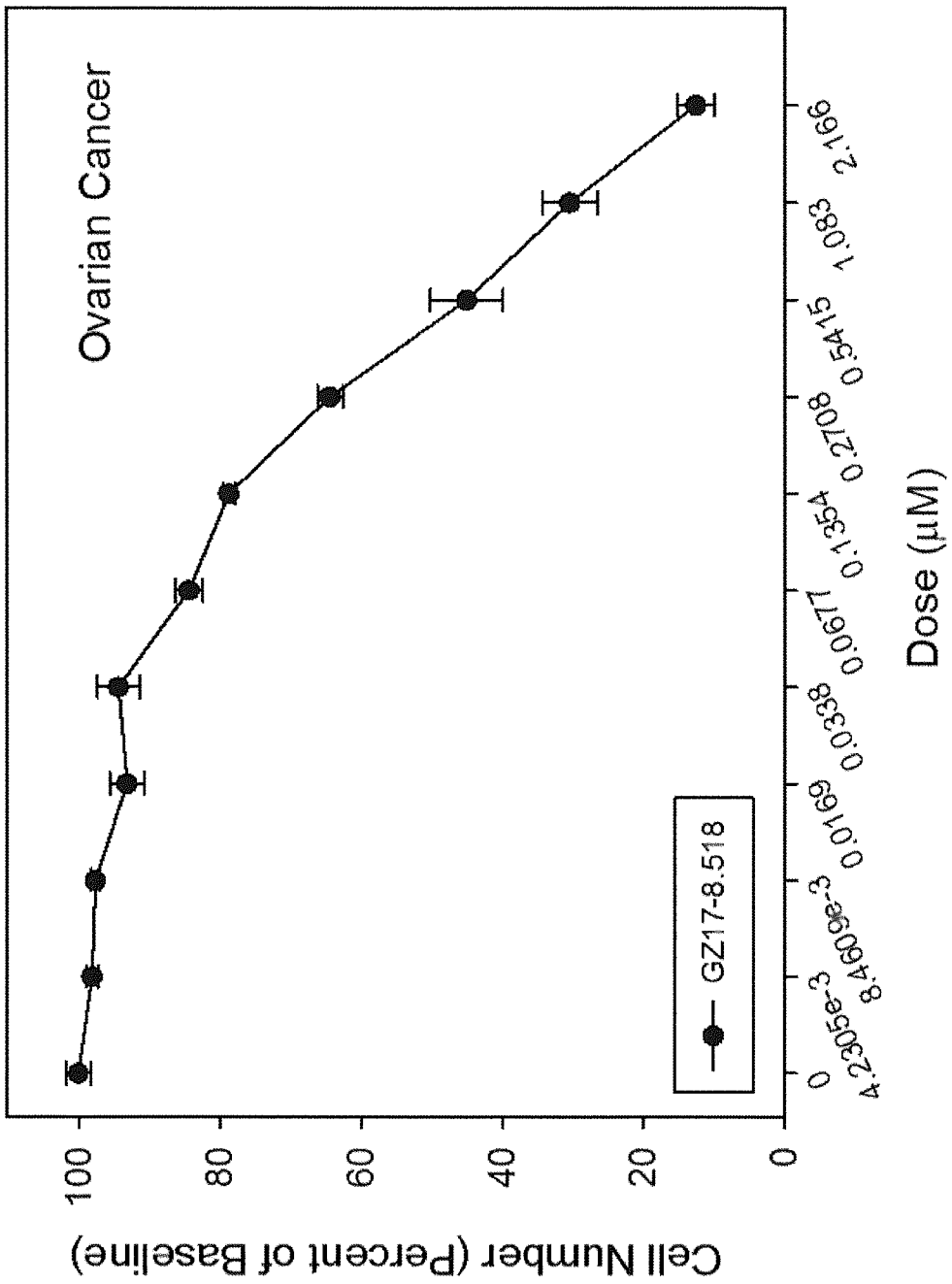

Ovarian Cancer
Cell Number (Percent of Baseline)
0
20
40
60
80
100
GZ17-8.518
0
4.2305e-3
8.4609e-3
0.0169
0.0338
0.0677
0.1354
0.2708
0.5415
1.083
2.166
Dose (µM)

Fig. 81S

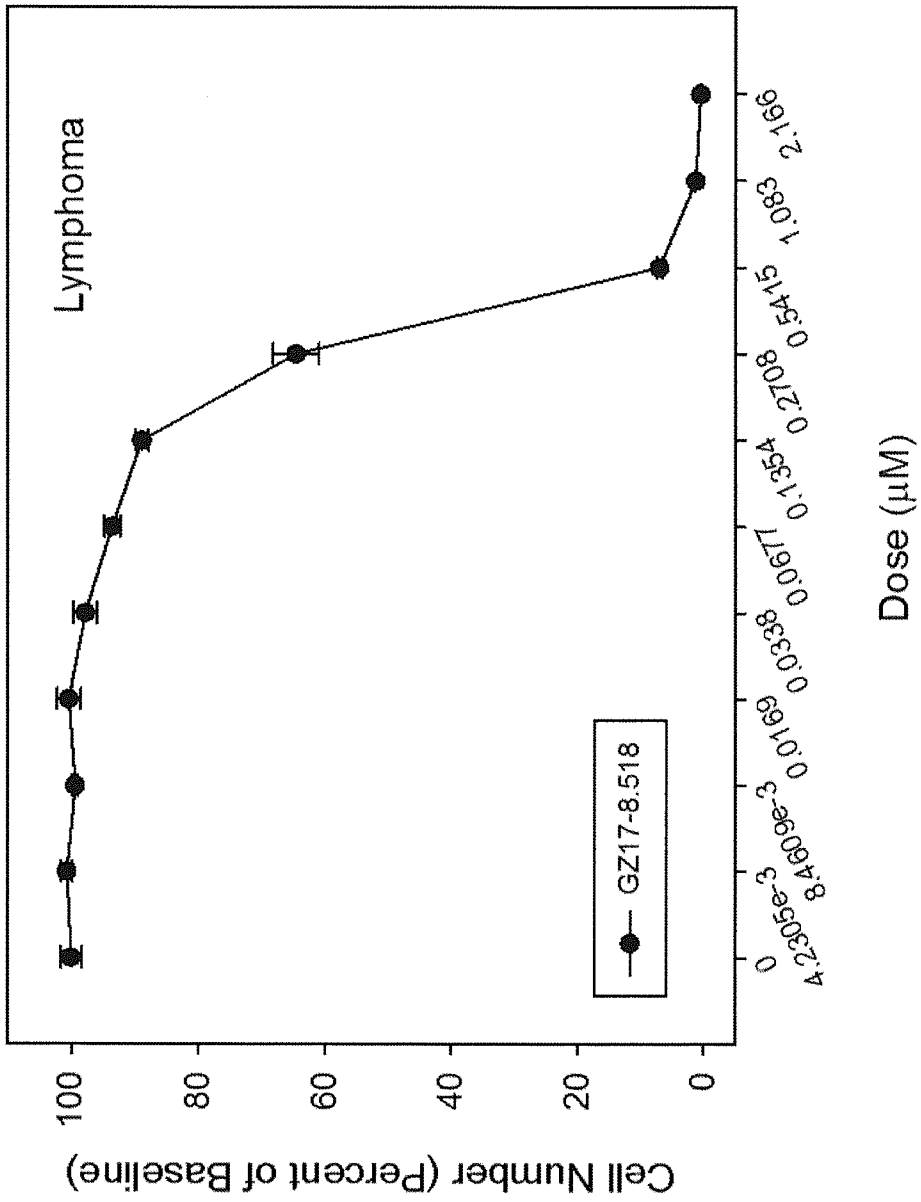

Lymphoma
GZ17-8.518
Cell Number (Percent of Baseline)
0
20
40
60
80
100
0
4.2305e-3
8.4609e-3
0.0169
0.0338
0.0677
0.1354
0.2708
0.5415
1.083
2.166
Dose (μM)

Fig. 81T

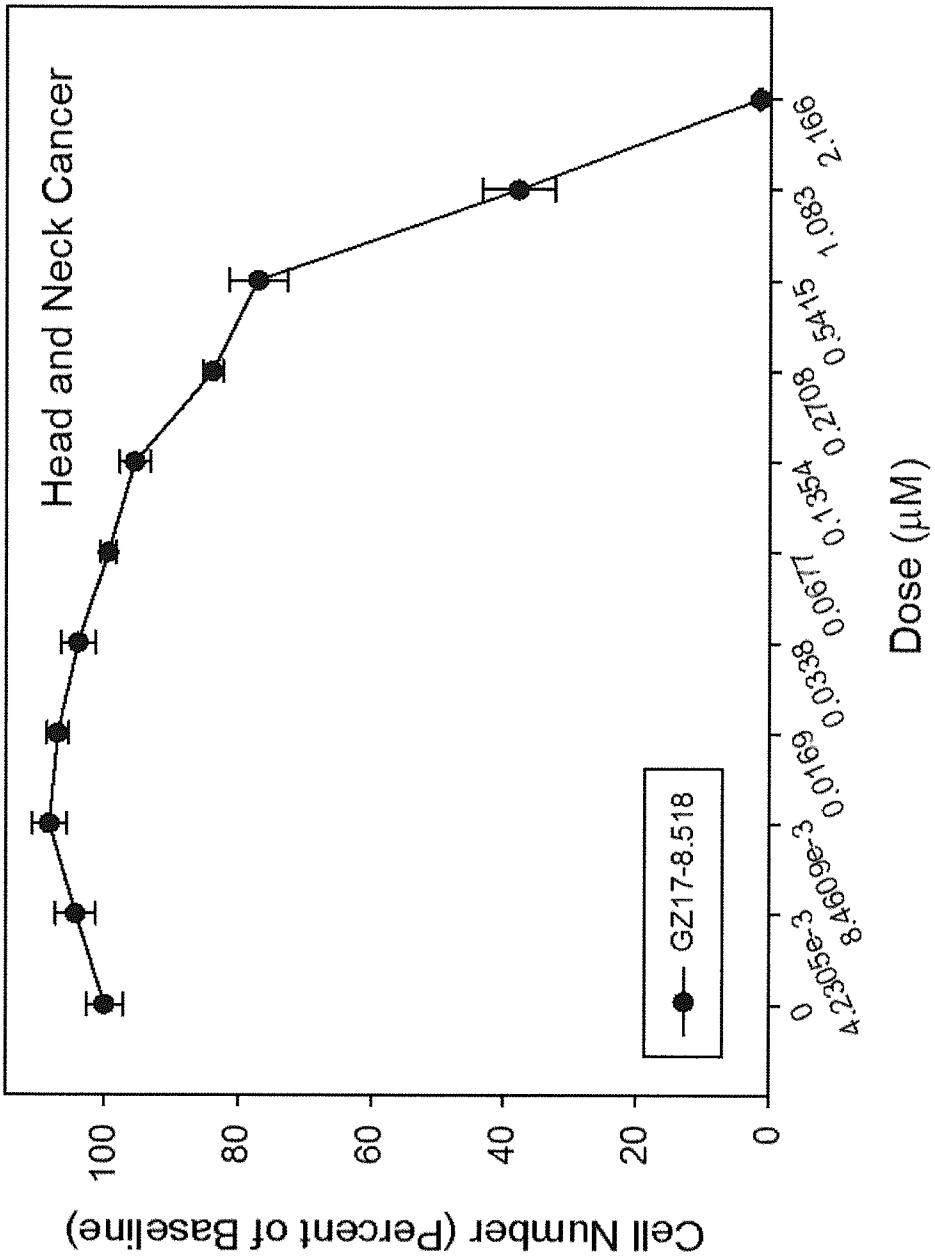

Head and Neck Cancer
Cell Number (Percent of Baseline)
0
20
40
60
80
100
GZ17-8.518
0
4.230e-3
8.460e-3
0.0169
0.0338
0.0677
0.135
0.270
0.541
1.083
2.166
Dose (μM)

Fig. 81U

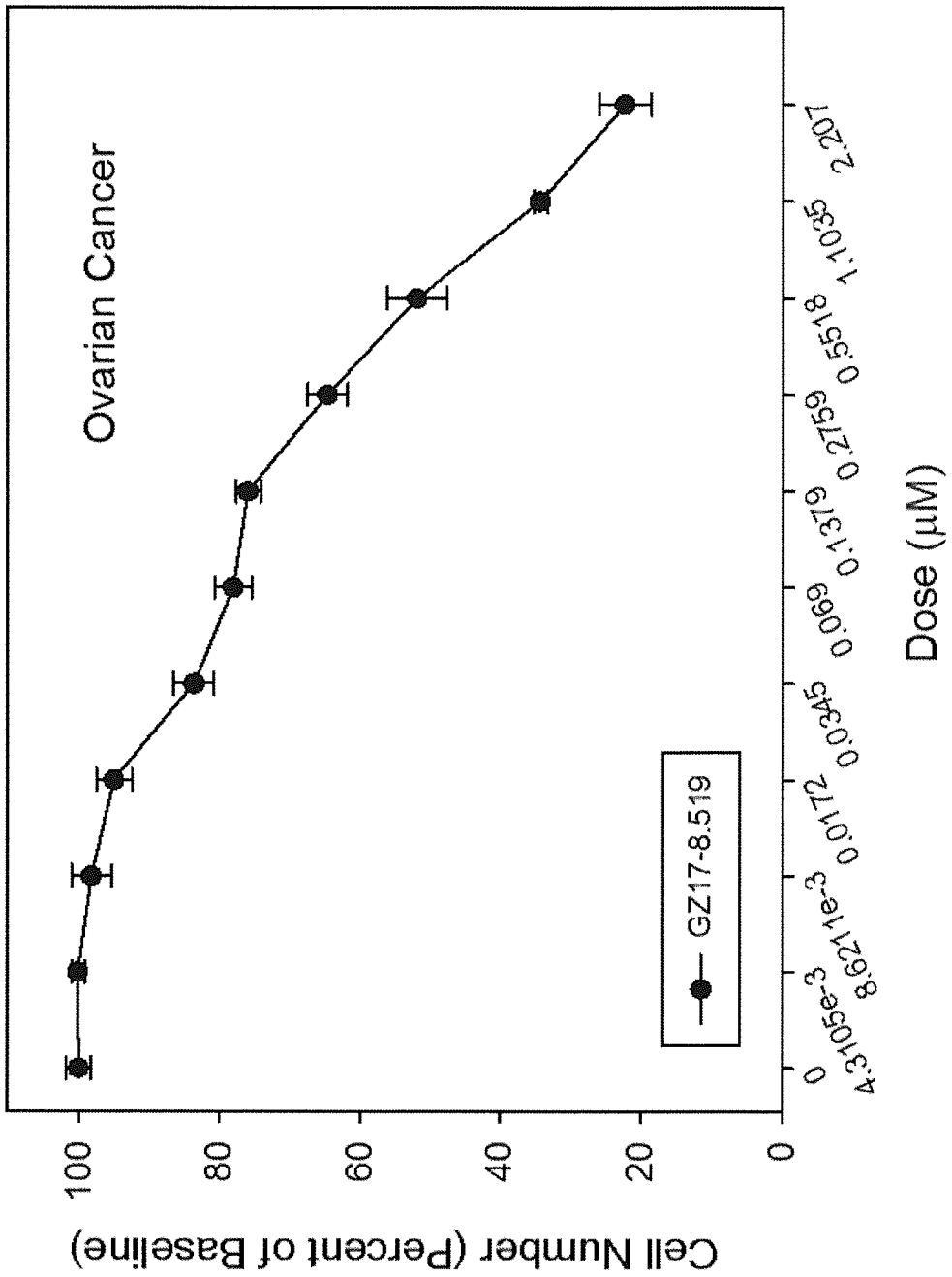

Ovarian Cancer
Cell Number (Percent of Baseline)
0
20
40
60
80
100
GZ17-8.519
0
4.3105e-3
8.6211e-3
0.0172
0.0345
0.069
0.1379
0.2759
0.5518
1.1035
2.207
Dose (µM)

Fig. 81V

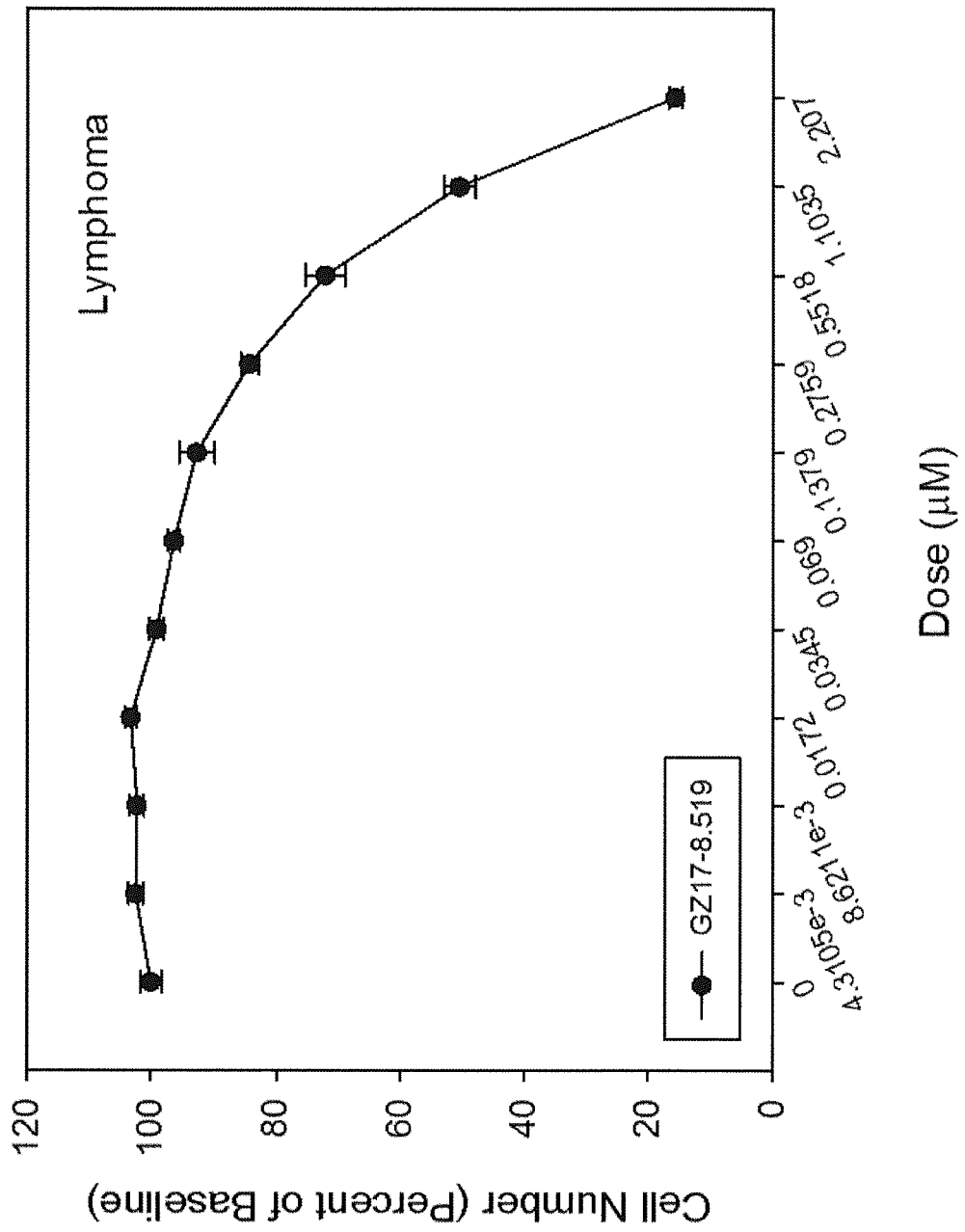

Lymphoma
GZ17-8.519
Cell Number (Percent of Baseline)
120
100
80
60
40
20
0
0
4.3105e-3
8.9211e-3
0.0172
0.0345
0.069
0.1379
0.2759
0.5518
1.1035
2.207
Dose (µM)

Fig. 81W

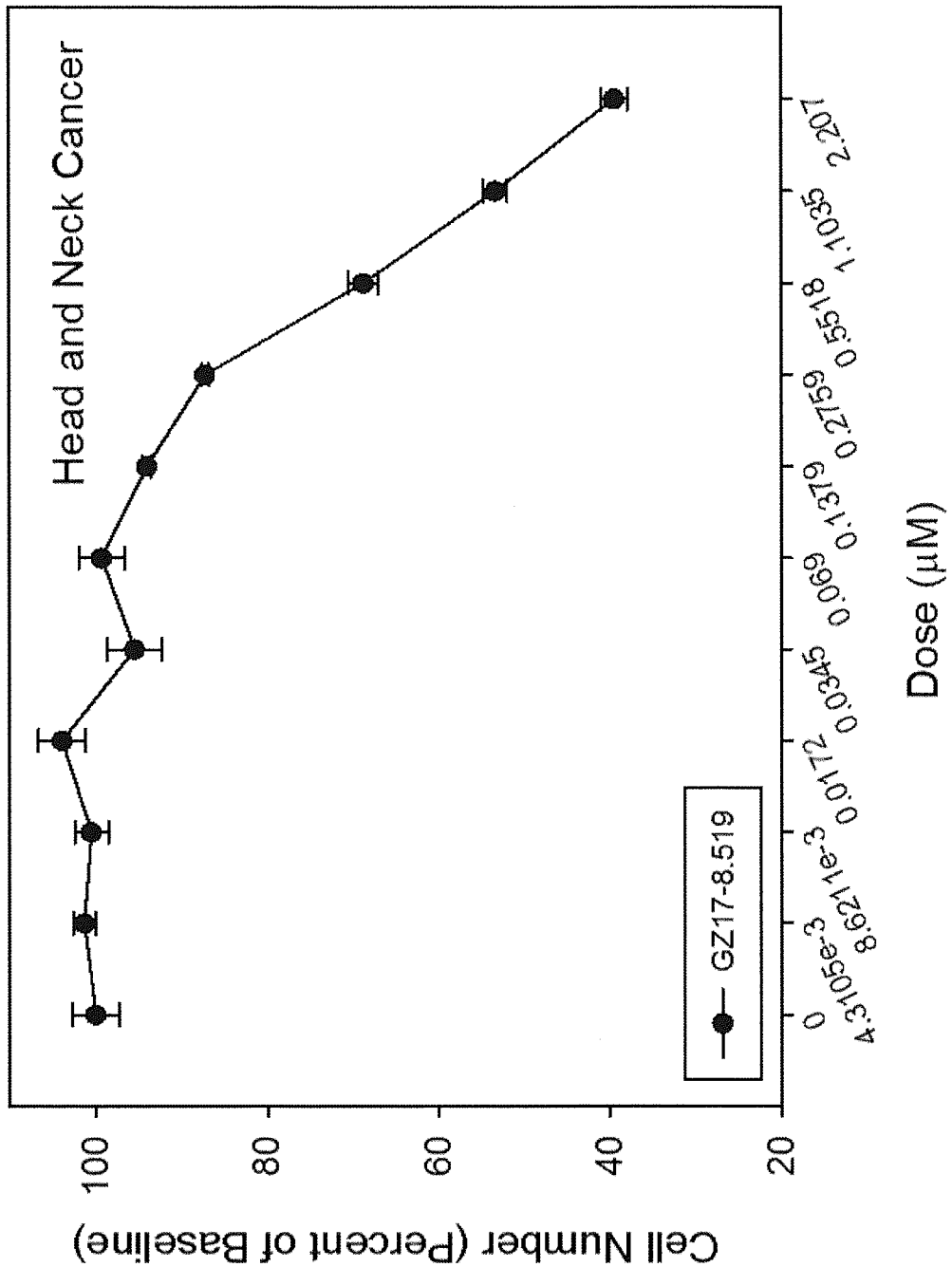

Head and Neck Cancer
Cell Number (Percent of Baseline)
100
80
60
40
20
GZ17-8.519
0
4.3105e-3
8.6211e-3
0.0172
0.0345
0.069
0.1379
0.2759
0.5518
1.1035
2.207
Dose (μM)

Fig. 81X

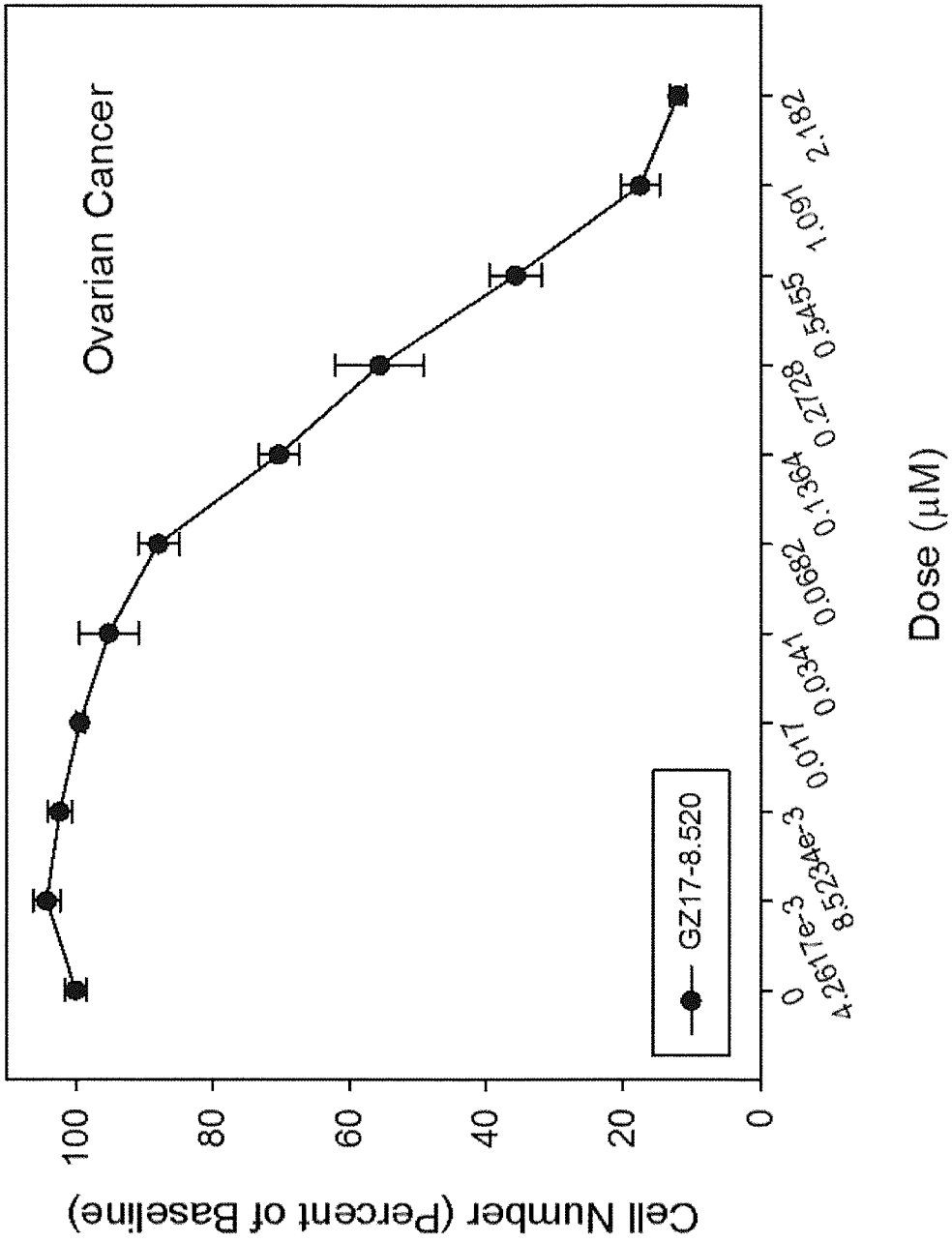

Ovarian Cancer
Cell Number (Percent of Baseline)
0
20
40
60
80
100
GZ17-8.520
0
4.2617e-3
8.5234e-3
0.017
0.0341
0.0682
0.1364
0.2728
0.5455
1.091
2.182
Dose (µM)

Fig. 81Y

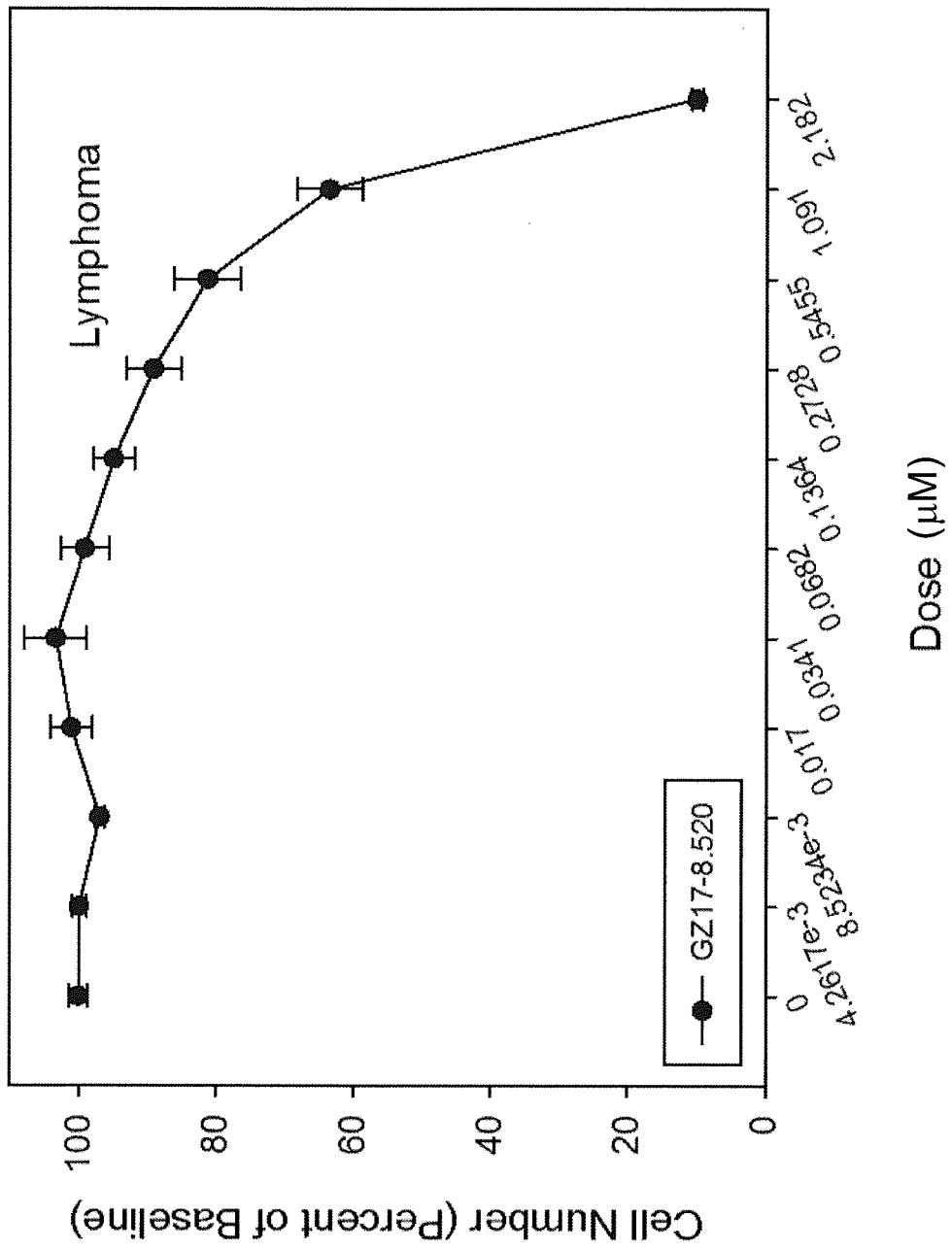

Lymphoma
Cell Number (Percent of Baseline)
0
20
40
60
80
100
GZ17-8.520
0
4.2617e-3
8.5234e-3
0.017
0.0341
0.0682
0.1364
0.2728
0.5455
1.091
2.182
Dose (μM)

Fig. 81Z

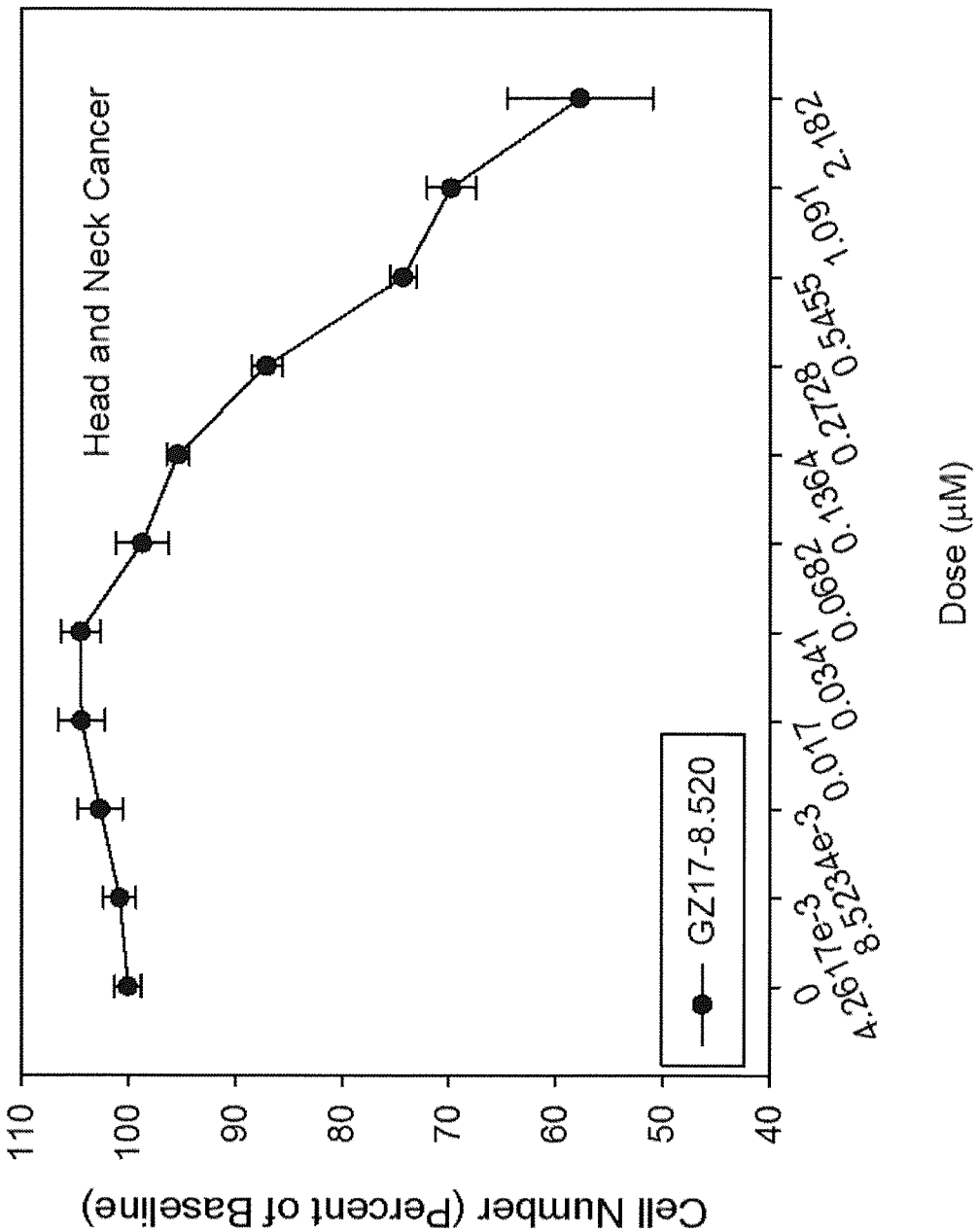

Head and Neck Cancer
GZ17-8.520
Cell Number (Percent of Baseline)
110
100
90
80
70
60
50
40
0
4.2617e-3
8.5234e-3
0.017
0.0341
0.0682
0.1364
0.2728
0.5455
1.091
2.182
Dose (μM)

Fig. 81AA

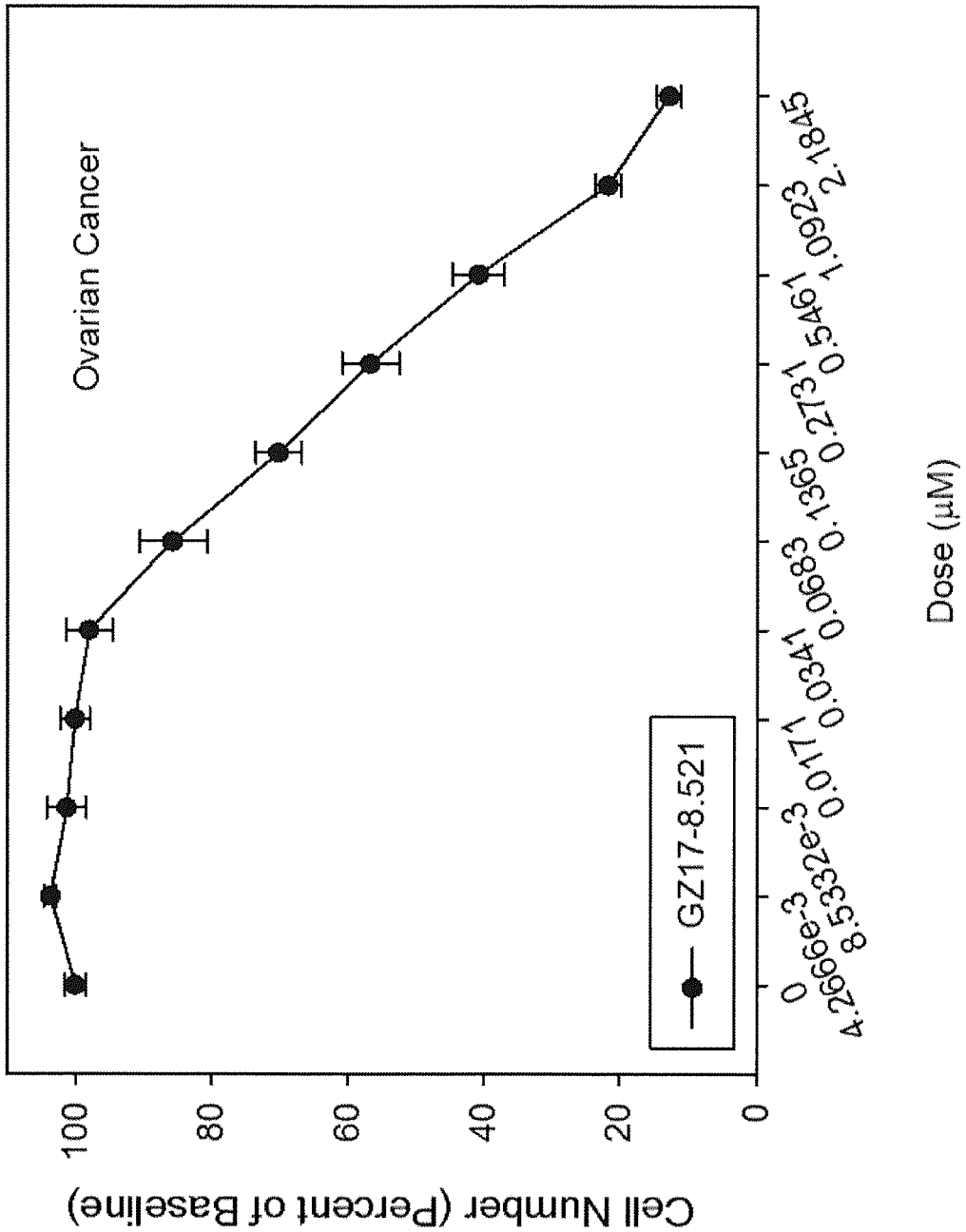

Ovarian Cancer
GZ17-8.521
Cell Number (Percent of Baseline)
0
20
40
60
80
100
0
4.2666e-3
8.5332e-3
0.017
0.034
0.068
0.136
0.273
0.546
1.092
2.184
Dose (μM)

Fig. 81BB

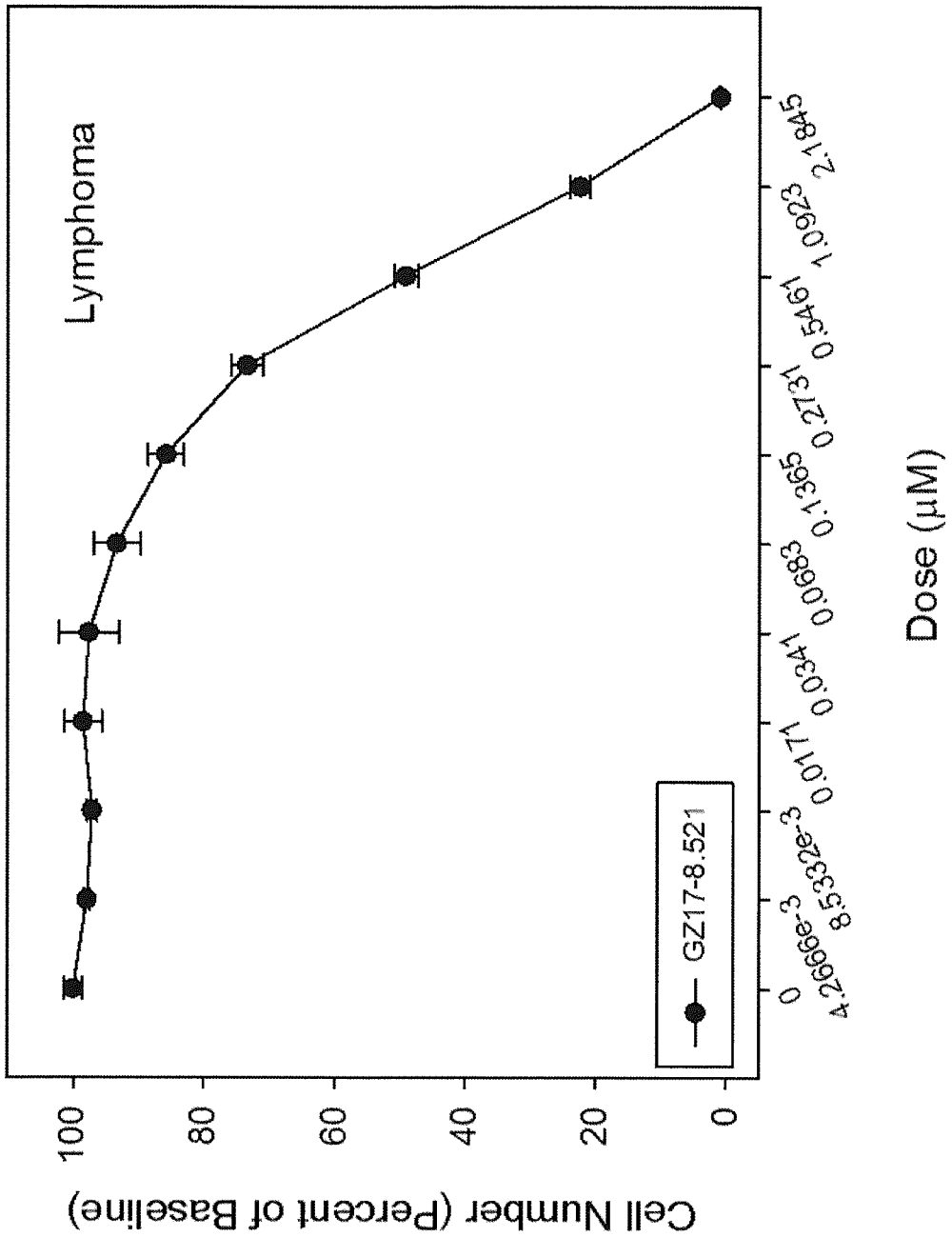

Lymphoma
GZ17-8.521
Cell Number (Percent of Baseline)
0
20
40
60
80
100
0
4.2666e-3
8.5332e-3
0.0171
0.0341
0.0683
0.1365
0.2731
0.5461
1.0923
2.1845
Dose (μM)

Fig. 81CC

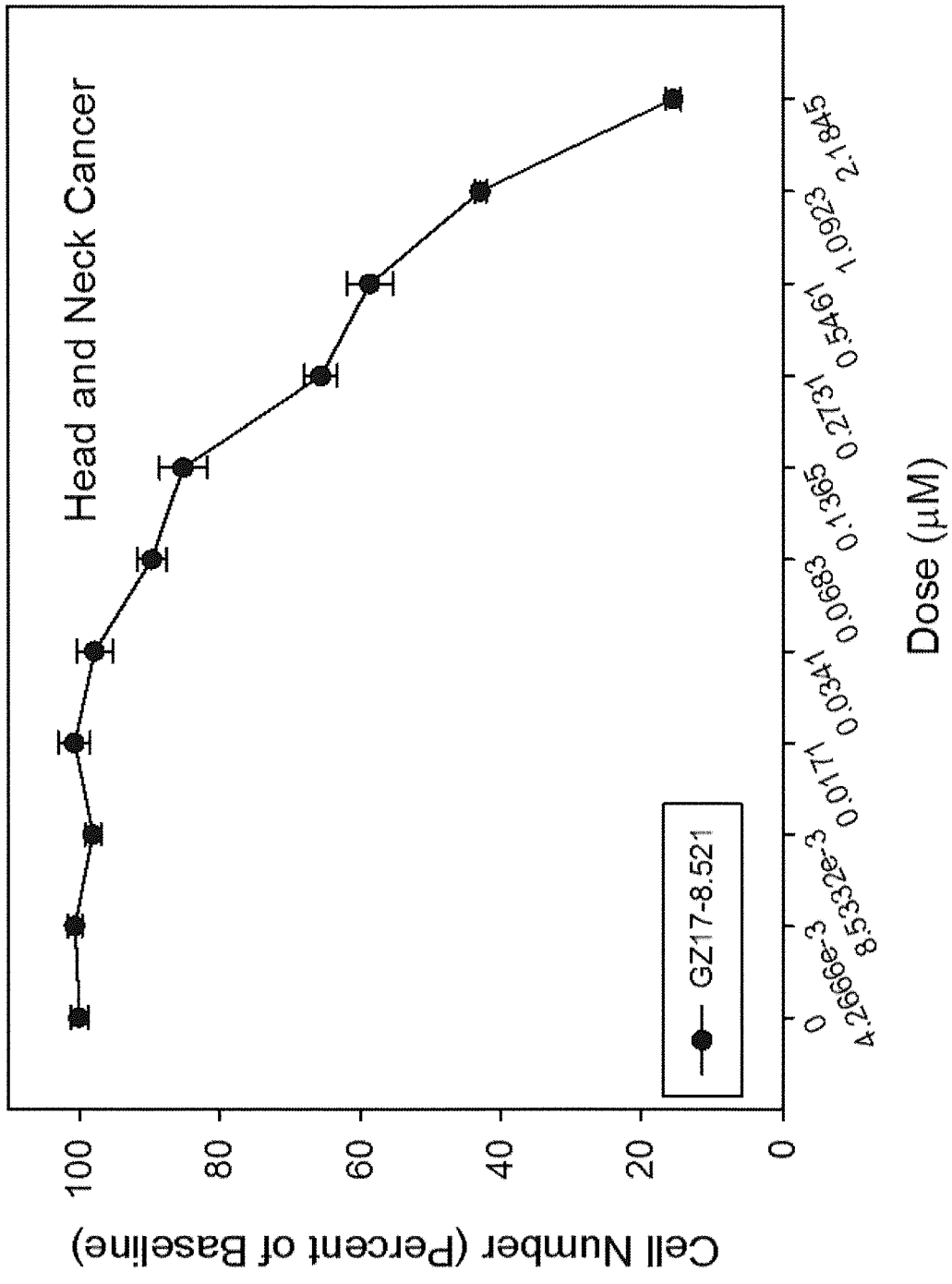

Head and Neck Cancer
Cell Number (Percent of Baseline)
100
80
60
40
20
0
GZ17-8.521
0
4.2696e-3
8.5332e-3
0.0171
0.0341
0.0683
0.1365
0.2731
0.5461
1.0923
2.1845
Dose (μM)

Fig. 81DD

INTERNATIONAL SEARCH REPORT

International application No.
PCT/US 15/55968

A. CLASSIFICATION OF SUBJECT MATTER
IPC(8) - A61K 31/12; 31/11; 31/437; A61P 35/00 (2015.01)
CPC - A61K 31/12; A61K 31/11; C07D 487/04; C07D 471/04
According to International Patent Classification (IPC) or to both national classification and IPC

B. FIELDS SEARCHED

Minimum documentation searched (classification system followed by classification symbols)
IPC(8): A61K 31/12; 31/11; 31/437; A61P 35/00 (2015.01)
CPC: A61K 31/12; A61K 31/11; C07D 487/04; C07D 471/04

Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched
USPC: 514/679; 514/699

Electronic data base consulted during the international search (name of data base and, where practicable, search terms used)
PatBase; Keyword limited: curcumin; harmine; isovanillin; therapeutic combination; cancer; treat cancer; phenol/harmaline/anisol/methoxybenz/curcumin/harmine/isovanillin treat cancer/combination/synergistic

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
X -- Y	US 2012/0108500 A1 (SAKANE et al.) 3 May 2012 (03.05.2012), entire document, especially: para [0028]; para [0032]; para [0097]; para [0256]; para [0422].	70-72,78-82,92-93 --- 1-69,73-77,83-91,94-183,189 184-188,190-191,197-212
X ---- Y	US 2012/0053208 A1 (LI et al.) 1 March 2012 (01.03.2012), entire document, especially: Figure 27b, Scheme 6, compound 41.	--- 1-69,138-183,189, 192-196
Y	SOTIROPOULOU et al. "Chemical approaches to targeting drug resistance in cancer stem cells", Drug Discovery Today. 2014. Vol. 19(10), pp 1547-1562; entire document, especially: pg 1552, col 1, para 2; pg 1559, col 1, para 3; pg 1555-1556, Figure 2-3; Table 2; pg 1559, col 1, para 3.	4,10-19,22-69,73-77,83-91,94-137,139-147,151-153,156-183, 192-196
A	BUCAR et al. "Natural product isolation - how to get from biological material to pure compounds", Nat. Prod. Rep. 2013. Vol. 30, pp 525-545; entire document, especially: pg 533, col 1, para 3; pg 534, col 1, para 1.	1-212

☐ Further documents are listed in the continuation of Box C. ☐

* Special categories of cited documents:
"A" document defining the general state of the art which is not considered to be of particular relevance
"E" earlier application or patent but published on or after the international filing date
"L" document which may throw doubts on priority claim(s) or which is cited to establish the publication date of another citation or other special reason (as specified)
"O" document referring to an oral disclosure, use, exhibition or other means
"P" document published prior to the international filing date but later than the priority date claimed
"T" later document published after the international filing date or priority date and not in conflict with the application but cited to understand the principle or theory underlying the invention
"X" document of particular relevance; the claimed invention cannot be considered novel or cannot be considered to involve an inventive step when the document is taken alone
"Y" document of particular relevance; the claimed invention cannot be considered to involve an inventive step when the document is combined with one or more other such documents, such combination being obvious to a person skilled in the art
"&" document member of the same patent family

Date of the actual completion of the international search	Date of mailing of the international search report
18 December 2015 (18.12.2015)	08 JAN 2016
Name and mailing address of the ISA/US Mail Stop PCT, Attn: ISA/US, Commissioner for Patents P.O. Box 1450, Alexandria, Virginia 22313-1450 Facsimile No. 571-273-8300	Authorized officer: Lee W. Young PCT Helpdesk: 571-272-4300 PCT OSP: 571-272-7774

Form PCT/ISA/210 (second sheet) (January 2015)