**ORIGIN OF CANCER CELLS**

The cell cycle is a series of multiple steps which lead to the growth, division, and replication of every cell. Proto-oncogenes and tumor suppressor work together to maintain this cycle to balance the speed and accuracy of division.

A gene mutation occurs when an unintentional change that occurs in the DNA sequence of the gene. Mutations in the tumor suppressor and proto-oncogene genes makes it possible create duplicates of potentially harmful cells, and unable to slow the rate at which this happens.

A tumor is a collection of cells created by the mutated genes in the body with no function. Often times tumors are benign, but in other situations, these tumors can become harmful, blocking vital organ function, destroying surrounding tissues, and spreading to other parts of the body.

**STRUCTURE OF GOLD NANOPARTICLES**

Gold nanoparticles for functional cancer treatment are on the scale of 20-100 nanometers. The varying size and shape of each particle allows for different functions.

The shape of each nanoparticle can vary as well. The most common shapes are the sphere, rod, and star, but other shapes can be synthesized. Each shape has its advantages and disadvantages. For example, tests recorded that the sphere saw slow the most uptake by cancerous cells, over that of the rod and star in medicine delivery.

At the core of each particle is the gold. The gold acts as a non-organic vehicle to attach organic molecules to. Metals are used as transport vehicles because they are not biodegradable, allowing them to not decompose in the body. Gold is most commonly as it remains non-toxic to the body until extreme volumes, and will not react with any organic material inside the body.

**APPLICATION OF NANOPARTICLES**

The previous nanotechnology used to screen cancer cells incorporated iron oxide particles. These particles were iron oxide in the core and were coated with a sugar like substance called dextran, which is taken in by healthy cells. Iron oxide concentration in healthy cells would be abundantly clear when comparing before and after MRI scans.

The healthy cells will change to a black color from the concentration of iron oxide particles they have taken in. This leaves cancerous cells to be unchanged and easier to identify and locate. However, this process brings health risks and limited accuracy.

For example, if there is a healthy cell that does not absorb a nanoparticle, it will be seen as cancerous on the screening, and a false diagnosis will be given. This means that doctors will be attacking healthy cells with a chemotherapy treatment that is even more harmful to the patient. A much more precise diagnostic tool is needed to ensure the health of the patient.

**INTRODUCTION TO NANOPARTICLES**

A nanoparticle is a functional element that has been sized down to the nanoscale. In cancer treatment, these particles are gathered, reacted, and equipped with organic compounds in order to deliver pharmaceutical drugs to treatment locations. The nanoparticle acts as a non-biodegradable transport vehicle for these medicines, that navigates its way through the body of the patient. This new form of technology is a much more efficient way to deliver medications, and is a reduction in both the side effects and costs of other cancer treatment options.

**VERSATILITY OF THE GOLD nanoparticle**

There are three major stages in the fight against cancer. The first step is diagnosis, followed by therapy, and treatment. The versatility of the gold nanoparticles allows them to function effectively at each stage as necessary.

**Precision**

Through characteristics specific to the gold nanoparticle, researchers can identify cancer cells using gold nanoparticles. Concentrations of the gold particles that are attached to cancerous cells will be very apparent in imaging screens, as they often become a red color due to the heat change. Doctors can provide a much more accurate diagnosis with precise location.

**Tracking**

Unable to enter normal blood vessels, gold nanoparticles are able to enter broken blood vessels which lead to the cancerous cells. In addition to only having access to cancerous cells from the blood stream, the gold nanoparticles can also be equipped to be attracted to a cancer cell. On the outside of the gold nanoparticle is the biocompatible layer which holds the appropriate ligand to be accepted into a cancer cell. This allows the vehicle to find the specific receptor site and connect itself.

**Drug Delivery**

Gold nanoparticle can be used as a transport vehicle. The properties of gold allow it to make strong covalent bonds with the medicines that are being delivered. This very compatible structure allows researchers to disguise the vehicle and medicine under a biocompatible outer layer upon which they can attach appropriate ligands to enter the cancer cell.

**Photothermal Therapy**

The versatility of gold nanoparticle treatment does not stop there. The same process that is used to find the cancer cells though imaging can be used to kill the cells as well. A highly-concentrated light wave at a specific wavelength is sent to the targeted area. This is very similar to the imaging process but on a much higher concentration. The electrons in the gold particle begin to oscillate at a uniform frequency. This movement of electrons can generate an extreme increase of heat in the particle, making it possible to kill the cancerous cell. This process is known as Photothermal Therapy.

**GOLD NANOPARTICLES: AN EFFECTIVE FORM OF CANCER TREATMENT AND DETECTION**

Arvind Venkatraman & Matt O’Connor
ORIGIN OF CANCER CELLS

The cell cycle is a series of multiple steps which lead to the growth, division, and replication of every cell. Proto-oncogenes and tumor suppressor work together to in this cycle to balance the speed and accuracy of division.

A gene mutation occurs when an unintentional change that occurs in the DNA sequence of the gene. Mutations in the tumor suppressor and proto-oncogene genes makes it possible create duplicates of potentially harmful cells, and unable to slow the rate at which this happens.

A tumor is a collection of cells created by the mutated genes in the body with no function. Often times tumors are benign, but in other situations, these tumors can become harmful, blocking vital organ function, destroying surrounding tissues, and spreading to other parts of the body.

STRUCTURE OF GOLD NANOPARTICLES

Gold nanoparticles for functional cancer treatment are on the scale of 20-100 nanometers. The varying size and shape of each particle allows for different functions.

The shape of each nanoparticle can vary as well. The most common shapes are the sphere, rod, and star, but other shapes can be synthesized. Each shape has its advantages and disadvantages. For example, tests recorded that the sphere saw the most uptake by cancerous cells, over that of the rod and star in medicine delivery.

At the core of each particle is the gold. The gold acts as a non-organic vehicle to attach organic molecules to. Metals are used as transport vehicles because they are not biodegradable, allowing them to not decompose in the body. Gold is most commonly as it remains non-toxic to the body until extreme volumes, and will not react with any organic material inside the body.

APPLICATION OF NANOPARTICLES

The previous nanotechnology used to screen cancer cells incorporated iron oxide particles. These particles were iron oxide in the core and were coated with a sugar like substance called dextran, which is taken in by healthy cells. Iron oxide concentration in healthy cells would be abundantly clear when comparing before and after MRI scans.

The healthy cells will change to a black color from the concentration of iron oxide particles they have taken in. This leaves cancerous cells to be unchanged and easier to identify and locate. However, this process brings health risks and limited accuracy.

For example, if there is a healthy cell that does not absorb a nanoparticle, it will be seen as cancerous on the screening, and a false diagnosis will be given. This means that doctors will be attacking healthy cells with a chemotherapy treatment that is even more harmful to the patient. A much more precise diagnostic tool is needed to ensure the health of the patient.

INTRODUCTION TO NANOPARTICLES

A nanoparticle is a functional element that has been sized down to the nanoscale. In cancer treatment, these particles are gathered, reacted, and equipped with organic compounds in order to deliver pharmaceutical drugs to treatment locations. The nanoparticle acts as a non-biodegradable transport vehicle for these medicines, that navigates its way through the body of the patient. This new form of technology is a much more efficient way to deliver medications, and is a reduction in both the side effects and costs of other cancer treatment options.

VERSATILITY OF THE GOLD NANOPARTICLE

There are three major stages in the fight against cancer. The first step is diagnosis, followed by therapy, and treatment. The versatility of the gold nanoparticles allows them to function effectively at each stage as necessary.

Precision: Through characteristics specific to the gold nanoparticle, researchers can identify cancer cells using gold nanoparticles. Concentrations of the gold particles that are attached to cancerous cells to be very apparent in imaging screens, as they often become a red color due to the heat change. Doctors can provide a much more accurate diagnosis with precise location.

Although unable

Tracking: Unable to enter normal blood vessels, gold nanoparticles are able to enter broken blood vessels which lead to the cancerous cells. In addition to only having access to cancerous cells from the blood stream, the gold particles can also be equipped to be attracted to a cancer cell. On the outside of the gold nanoparticle is the biocompatible layer which holds the appropriate ligand to be accepted into a cancer cell. This allows the vehicle to find the specific receptor site and connect itself.

Drug Delivery: Gold nanoparticle can be used as a transport vehicle. The properties of gold allow it to make strong covalent bonds with the medicines that are being delivered. This very compatible structure allows researchers to disguise the vehicle and medicine under a biocompatible outer layer upon which they can attach appropriate ligands to enter the cancer cell.

Photothermal Therapy: The versatility of gold nanoparticle treatment does not stop there. The same process that is used to find the cancer cells though imaging can be used to kill the cells as well. A highly-concentrated light wave at a specific wavelength is sent to the targeted area. This is very similar to the imaging process but on a much higher concentration. The electrons in the gold particle begin to oscillate at a uniform frequency. This movement of electrons can generate an extreme increase of heat in the particle, making it possible to kill the cancerous cell. This process is known as Photothermal Therapy.