Iraqi Centre for Cancer and Medical Genetics Research

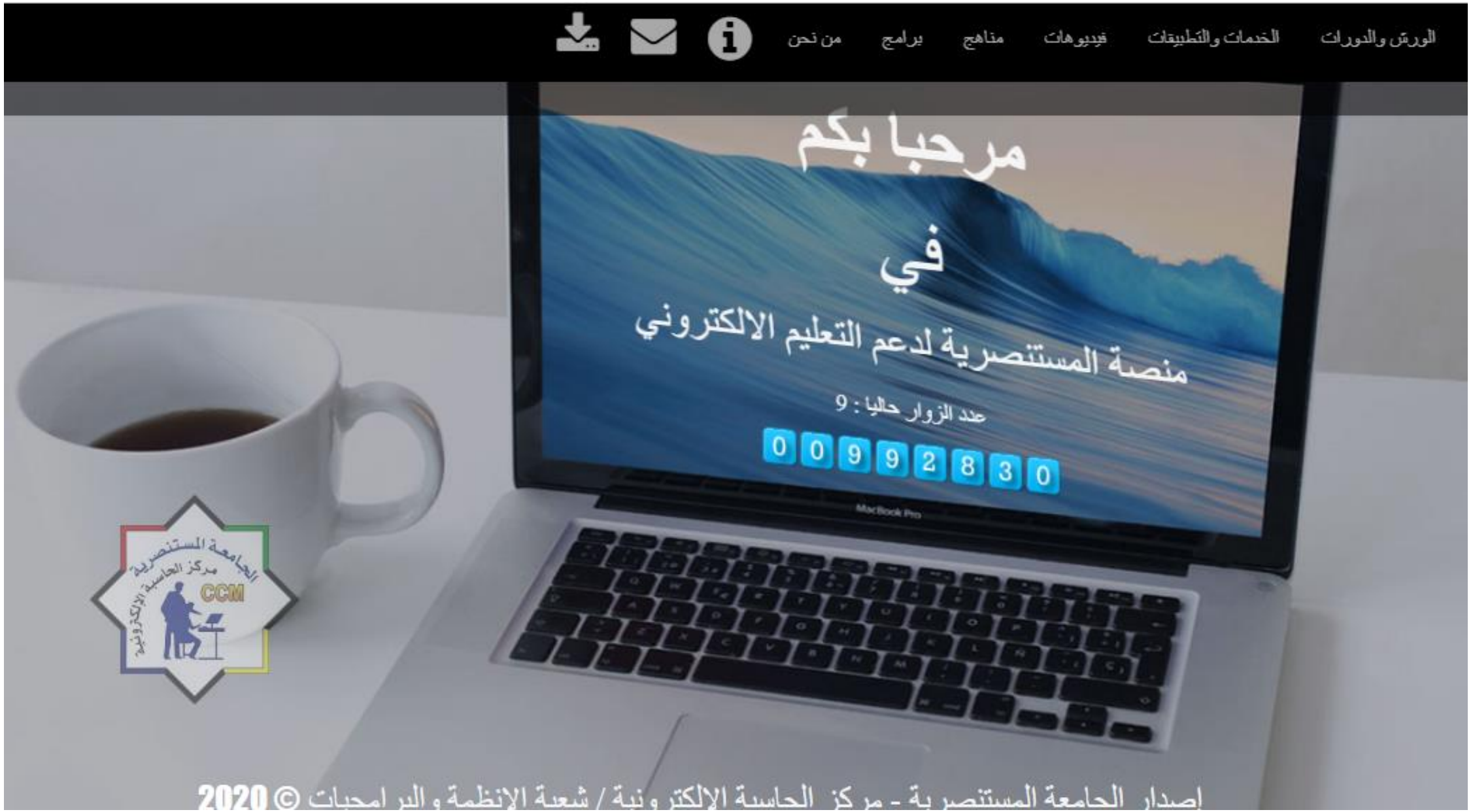
المركز العراقي لبحوث السرطان و الوراثة الطبية

nanoparticles drug FDA

Presented by

Dr. Zaynab Saad

Researcher at molecular biology dep.


الورش والدورات
الخدمات والتطبيقات
فيديوهات
مناهج
برامج
من نحن
مرحبا بكم
في
منصة المستنصرية لدعم التعليم الالكتروني
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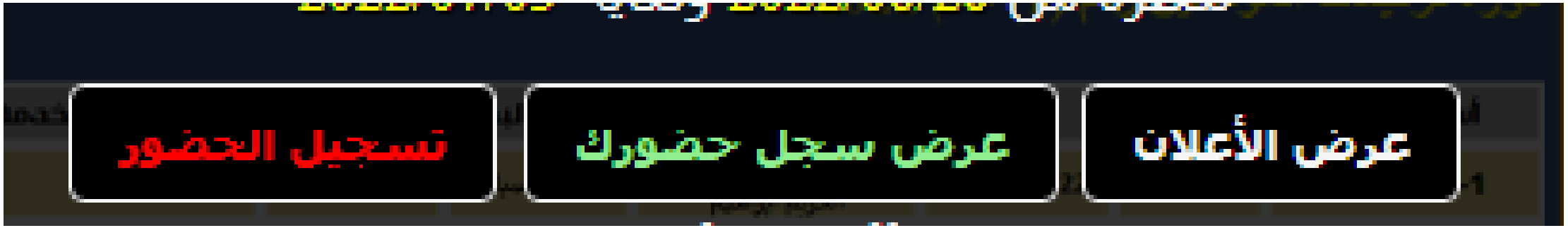

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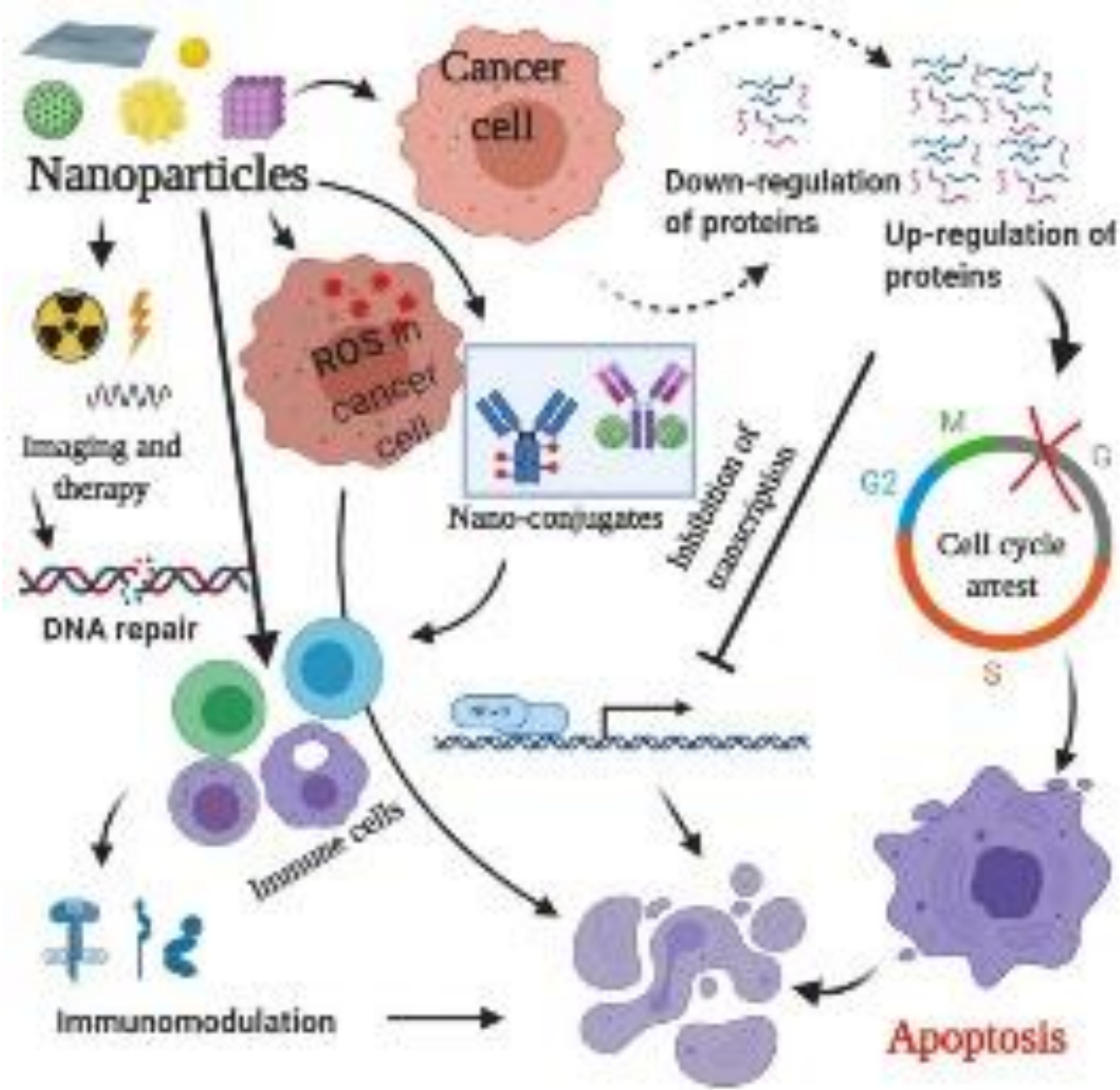
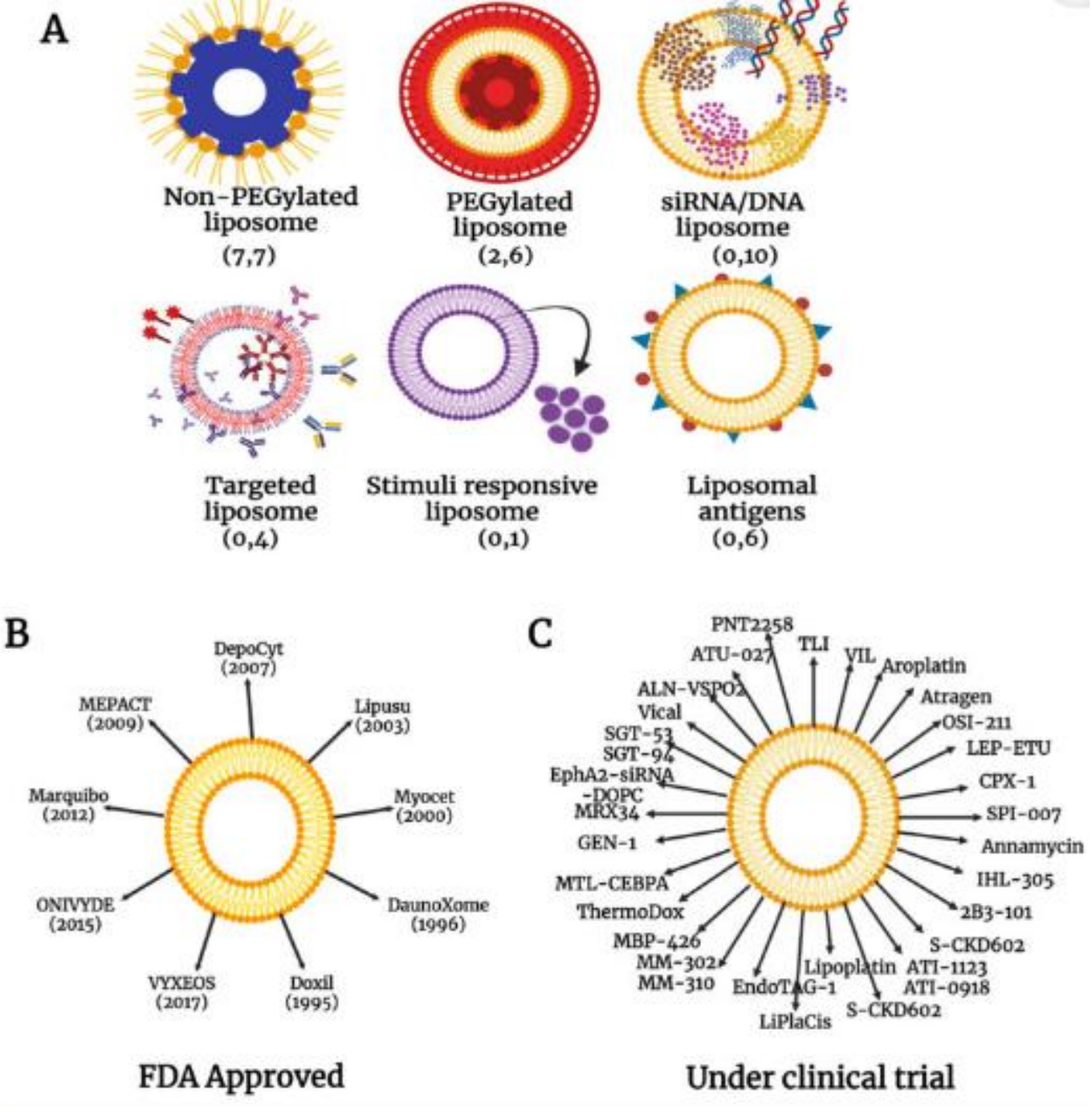
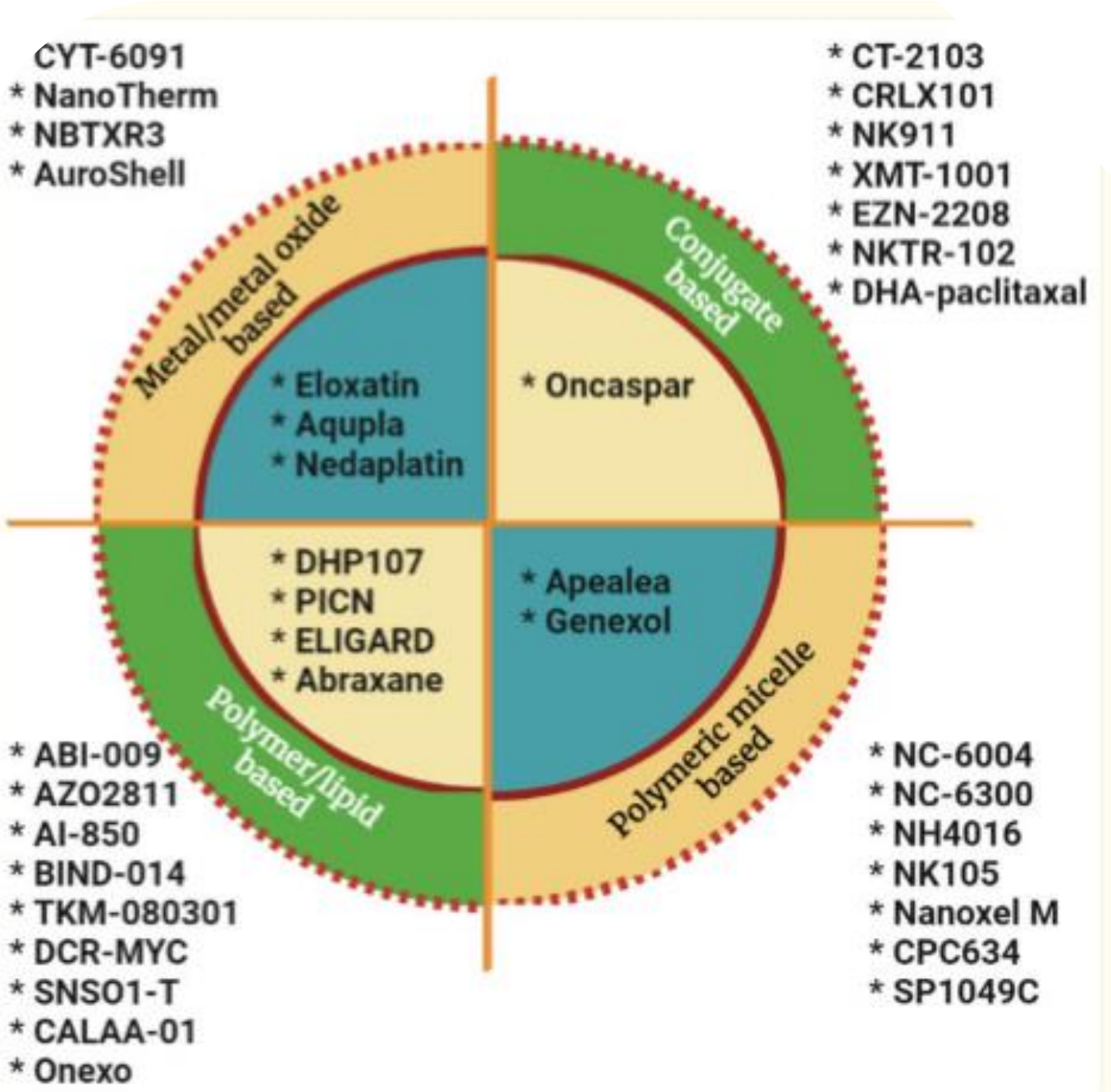

Nanoparticles
Cancer cell
Down-regulation of proteins
Up-regulation of proteins
ROS in cancer cell
Imaging and therapy
Nano-conjugates
Inhibition of transcription
M
G
G2
Cell cycle arrest
S
DNA repair
Immune cells
Immunomodulation
Apoptosis



Mundekkad D, Cho WC. Nanoparticles in Clinical Translation for Cancer Therapy. Int J Mol Sci. 2022 Feb 1;23(3):1685.


CYT-6091
* NanoTherm
* NBTXR3
* AuroShell
* CT-2103
* CRLX101
* NK911
* XMT-1001
* EZN-2208
* NKTR-102
* DHA-paclitaxal
Metal/metal oxide based
Conjugate based
* Eloxatin
* Aqupla
* Nedaplatin
* Oncaspar
* DHP107
* PICN
* ELIGARD
* Abraxane
* Apealea
* Genexol
Polymer/lipid based
Polymeric micelle based
* ABI-009
* AZO2811
* AI-850
* BIND-014
* TKM-080301
* DCR-MYC
* SNSO1-T
* CALAA-01
* Onexo
* NC-6004
* NC-6300
* NH4016
* NK105
* Nanoxel M
* CPC634
* SP1049C

Challenges in the clinical translation of nanoparticles in cancer therapeutics.

Challenges	R
The long process of drug development	
Years required for pre-clinical and clinical research on higher animals and humans	
Hassles in obtaining regulatory approval to release the drug in the market	
Failure to effectively load the drug inside the nanoparticles	
Instability of the formulation	
Issues with biocompatibility and toxicity	
Insufficient residence time in the body	
Failure of the drug formulation to selectively accumulate on the target	
Failure in loading, internalization, and drug release	
Incomplete biodegradation and elimination	
Challenges in cellular uptake	
Failure to translate the in vitro results to in vivo studies	

Particular Method or Technique

There are different methods for synthesizing nanoparticles, ranging from physical techniques using mechanical procedures to chemical or biological protocols using various organic or inorganic chemicals and living organisms.

Each procedure has specific benefits and drawbacks.

However, biological methods for synthesis of nanoparticles use nontoxic and environmentally benign materials in conjunction with green technology and are therefore eco-friendly and more acceptable than traditional methods

pH

pH is an important factor that influences the synthesis of nanoparticles by green technology methods.

Researchers have discovered that pH of the solution medium influences the size and texture of the synthesized nanoparticle.

Therefore, nanoparticle size can be controlled by altering the pH of the solution media.

The effect of pH on the shape and size of the synthesized silver nanoparticle

Temperature

Temperature is another important parameter that affects the synthesis of nanoparticles using all three methods.

The physical method requires the highest temperature (>350°C)

whereas chemical methods require a temperature less than 350°C.

In most cases, the synthesis of nanoparticles using green technology requires temperatures less than 100°C or ambient temperature.

The temperature of the reaction medium determines the nature of the nanoparticle formed

Pressure

Pressure is important for the synthesis of nanoparticles.

The pressure applied to the reaction medium affects the shape and size of the synthesized nanoparticles.

The rate of reduction of metal ions using biological agents has been found to be much faster at ambient pressure conditions

Time

The quality and type of nanoparticle synthesized using green technology are greatly influenced by length of time for which the reaction medium is incubated.

Similarly the characteristics of the synthesized nanoparticles were also altered with time and greatly influenced by the synthesis process, exposure to light, and storage conditions, and so forth.

The variations in the time may occur in many ways:

- aggregation of particles due to long time storage;
- particles may shrink or grow during long storage;
- they may have shelf life, and so forth, that affects their potential

Preparation Cost

To facilitate the potential application of nanoparticles in modern day uses, the costs associated with their synthesis need to be regulated and controlled.

Thus, the cost-effectiveness of the production procedure is an important factor that influences nanoparticle synthesis.

Although the chemical method of synthesis results in a high yield within a short period of time, this technique is not cost-effective.

Therefore, synthesis using chemical and physical methods may be limited,

whereas biological synthesis of nanoparticles involves less cost and can be performed on a large scale.

Particle Shape and Size

Particle size plays an important role in determining the properties of nanoparticles.

For example, the melting point of nanoparticles has been reported to decrease when the size of the nanoparticles reached the nanometer scale.

Nanoparticles with different configurations have similar energy that makes the transformation of their shape easy.

The type of energy commonly used during the analysis of the nanoparticles stimulates the change in the shape of the nanoparticle.

The dynamic nature and shape of the synthesized nanoparticles greatly affect their chemical properties

Pore Size

The quality and application of nanoparticles are greatly influenced by the porosity of the synthesized nanoparticles.

Immobilization of biomolecules onto nanoparticles has been achieved to increase their use in the drug delivery and biomedical field

Environment

The surrounding environment plays an important role in determining the nature of the synthesized nanoparticles.

In many environments, a single nanoparticle becomes core-shell nanoparticles quickly by absorbing materials or reacting with other materials from the environment by the process of oxidation or corrosion.

In a biological system, the synthesized nanoparticles form a coating that makes them thicker and larger-sized.

In addition to this, the environment also affects the physical structure and chemistry of the synthesized nanoparticles.

There are few examples that showed the effect of the environment on the nature of the synthesized nanoparticles:

The crystalline nature of the zinc sulphide nanoparticles changed immediately when its environment was changed from a wet to a dry condition.

The chemical nature of cerium nitrate nanoparticles varies with the presence of the peroxide in the solution in which they are suspended

Proximity

When the individual or isolated nanoparticles come in contact or near to the surface of other nanoparticles, alteration in their properties is observed in most of the cases.

This changing behavior of the nanoparticles can be utilized in making more tuned nanoparticles.

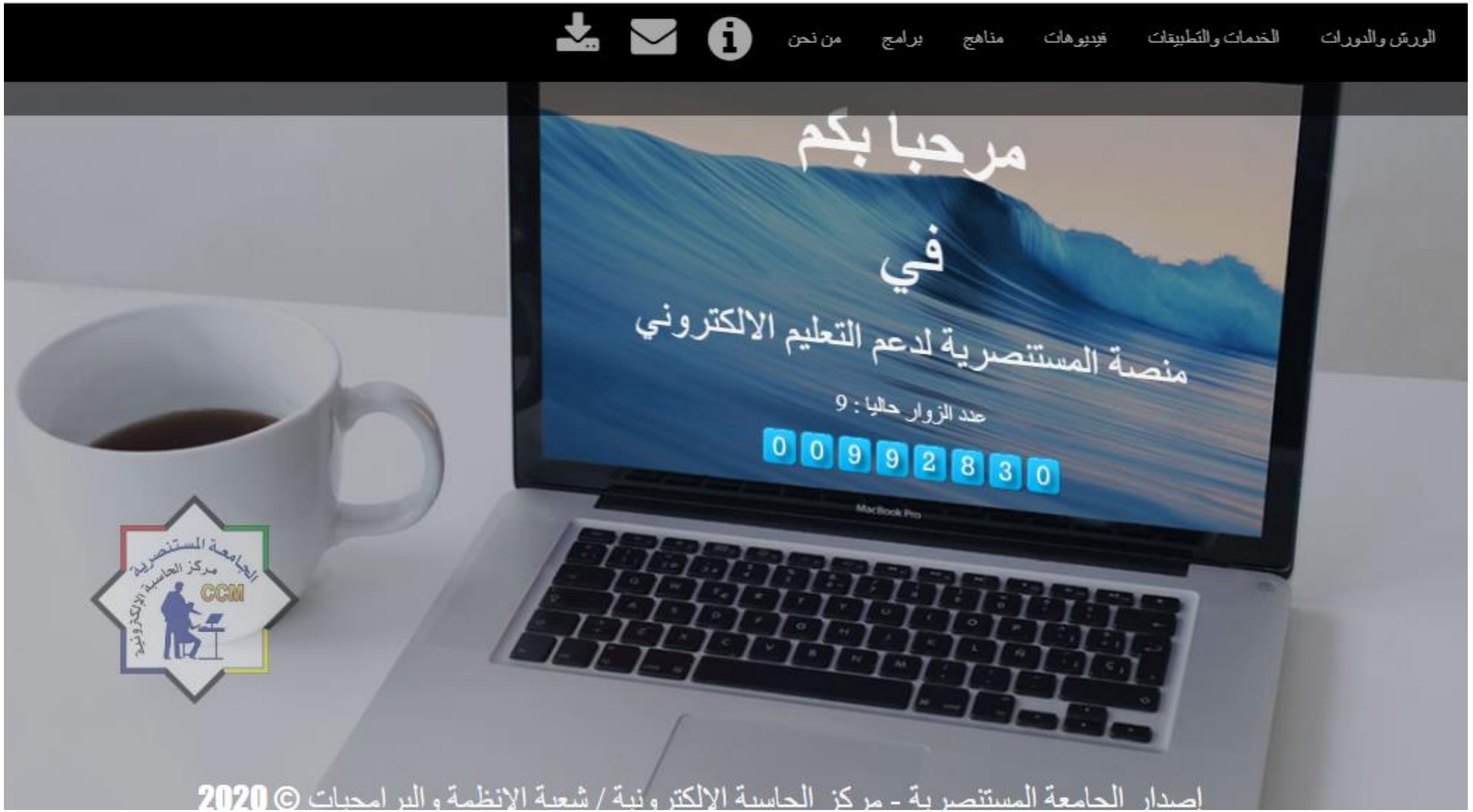
There are many implications of the proximity effect of nanoparticles:

- the particle charging,
- the substrate interactions,
- magnetic properties of the nanoparticles

Future observation of ICCMGR

- Develop
- Understand
- Target

Title of study	Journal and Year of publication
Iron oxide nanoparticles synthesized using plant (Beta vulgaris and Punica granatum) extracts for a breast cancer cell line (MCF-7) cytotoxic assay	Materials Technology / 2022
Quercetin against MCF7 and CAL51 breast cancer cell lines: apoptosis, gene expression and cytotoxicity of nano-quercetin	Nanomedicine / 2021
Layer-by-Layer Nanoparticles of Tamoxifen and Resveratrol for Dual Drug Delivery System and Potential Triple-Negative Breast Cancer Treatment	Pharmaceutics / 2021
Biogenic synthesis of copper oxide nanoparticles using olea europaea leaf extract and evaluation of their toxicity activities: An in vivo and in vitro study	American institute of chemical engineers biotechnology progress 2018
Biosynthesis, characterization of magnetic iron oxide nanoparticles and evaluations of the cytotoxicity and DNA damage of human breast carcinoma cell lines	Artificial cells, nanomedicine, and biotechnology / 2018
Efficiency of nanoliposomes loaded with chloroformic extract of Jasminum sambac or Jasminin on the growth inhibition of some cell lines, a preliminary study	Iraqi Journal of Cancer and Medical Genetics / 2016
Genotoxicity of silver nanoparticles synthesized by laser ablation method in vivo	Iraqi Journal of Cancer and Medical Genetics / 2015
Targeting Mice Mammary Adenocarcenoma Cells with Zinc Oxide Nanoparticles	Journal of biotechnology research center / 2015
Pulsed laser ablation synthesized silver nanoparticles induce apoptosis in human glioblastoma cell line and possess minimal defect in mice brains	Iraqi Journal of Biotechnology / 2013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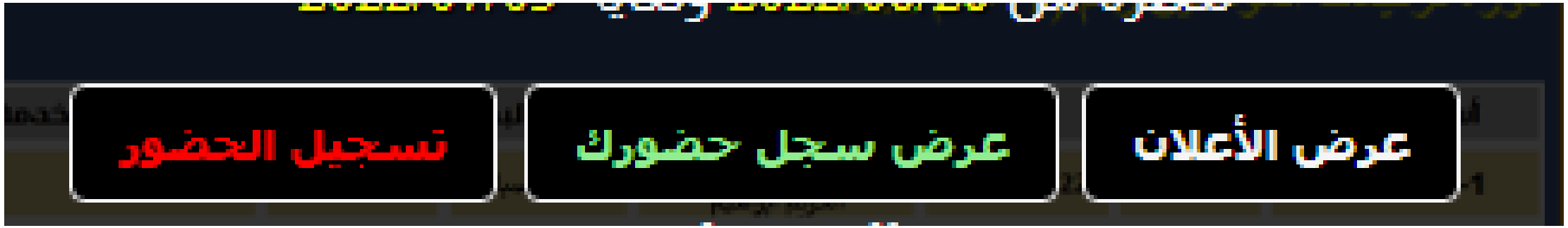

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