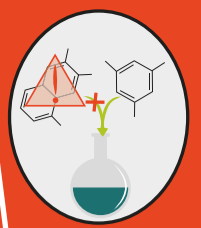


Safe(r) quantum dots



WHAT ARE QUANTUM DOTS (QDs)?

They are small **semiconductor nanoparticles**, less than 10 nanometers, which emit light. According to their size and composition, they emit different light color, for instance:



orange color

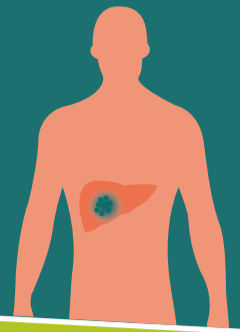


green color

WHY ARE THEY USEFUL?

□ In TV screens, the presence of quantum dots **improves the color quality of screens**.

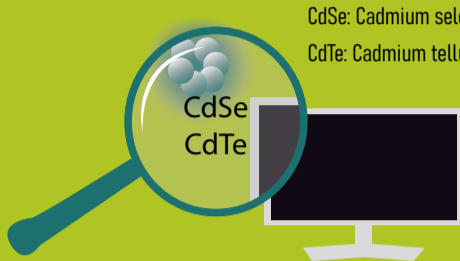
□ As **targeted tools** in biomedical diagnosis.



ATTRACTIVE BUT POTENTIALLY TOXIC

Nowadays, QDs used are composed by a **cadmium based (Cd)** core.

These cadmium based quantum dots may be **toxic** during use, if they are released.



CdSe: Cadmium selenide
CdTe: Cadmium telluride

BUT

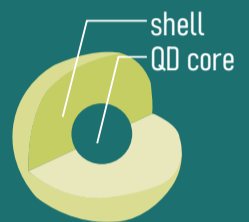


OBJECTIVES

Developing new, **safe(r) by design** formulations of QDs which should have the **same optical properties** as the Cd-based ones.

Two combined strategies have been experimented:

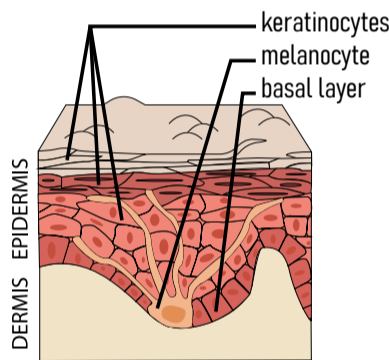
- **for the QD core, replace cadmium (Cd) by an alternative chemical element** : Indium (In),
- **avoid the release of potential toxic ions by enhancing the protection provided by optimal shell(s).**



EVALUATE THE TOXICITY

The toxicity has been characterized on **human keratinocytes**.

They are the **major components of the epidermis**, they multiply near the basal layer, then differentiate and migrate to the surface of the skin.

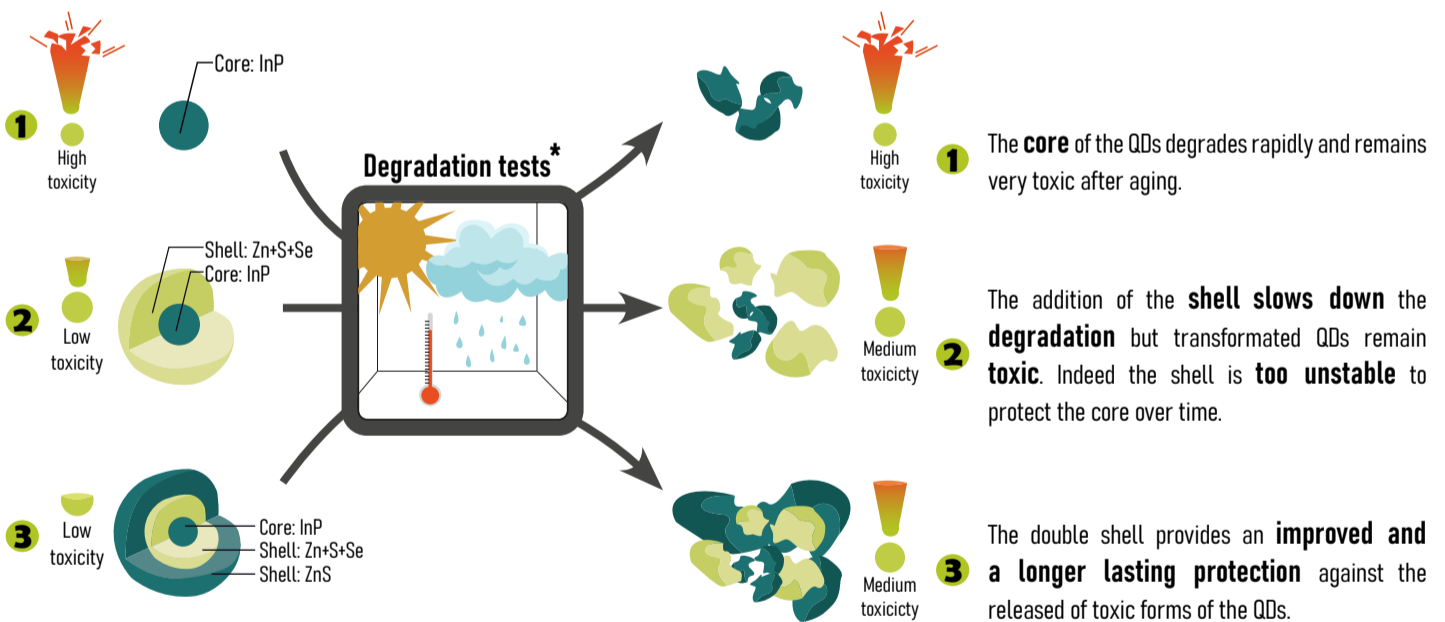


The **toxicity of QDs** is characterized through:

- ◆ **CYTOTOXICITY**
Cell viability
- ◆ **GENOTOXICITY**
DNA alteration
- ◆ **OXIDATIVE STRESS**
Damage to the cell redox balance

SOME RESULTS OF THE PROJECT

Different QDs were developed using phosphated indium (InP) core, **the toxicity of these QDs has been examined through several tests:**



* QDs were aged in a climatic chamber simulating **environmental conditions** (UV light, humidity and temperature).



Replace cadmium by indium and enhance the protection provided by the shell are two efficient strategies to limit the toxicity and the exposure to quantum dots.

LIFE CYCLE STAGES STUDIED

