# Soutenance de thèse


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## Oxygen effect in medical ion beam radiation combined with nanoparticles


About 50% of the cancer patients who are cured benefit from radiation therapy. Unfortunately, radiation is not tumor selective and damage in healthy tissues is induced. Particle therapy (tumor irradiation by protons or carbon ions) is considered as one of the most promising techniques due to the energy deposition of ions in depth which is maximum at the end of the track. In particular, heavy ions are indicated to treat radio-resistant tumors that contains hypoxic regions (low oxygen levels). However, the use of this modality remains restricted by the lower but significant damage induced to the normal tissue located at the entrance of the ion beam.

To improve the performance of Particle therapy, a new strategy based on the combination of high-Z nanoparticles with ion beam radiation has been developed by the team. The goal of my thesis was to study the effect of oxygen in medical ion radiation combined with nanoparticles. For this purpose, gold NPs (AuNPs) and platinum NPs (PtNPs) has been tested in two radio-resistant human cancer cell lines: HeLa (uterine cervix) and BxPC-3 (pancreas).

In vitro irradiation experiments were performed using two different ions (carbon and helium) and two beam delivery systems (passive scattering and pencil beam scanning) in oxic (20% of $O_2$) and anoxic (0% of $O_2$) conditions.

We observed a radio-enhancement effect of NPs in the presence of oxygen. The amplification effect is reduced with decreasing oxygen concentration. This effect is attributed to an electronic activation processes which generates a strong perturbation in the surrounding nanometer volume. In conclusion, this work evaluates the role of oxygen in the radio-induced cell killing of NPs depending on the radiation quality.


## Lundi 18 décembre 2017 à 14 h

**Bât 520 – Amphithéâtre (3ème étage)**

*Université Paris-Sud, 91405 Orsay Cedex*

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