



# Bio Mechanical Sensing of DNA with Silicon Nanotweezers Reaches Clinical Research and Triggers the SMMIL-E Initiative

**Dominique Collard**

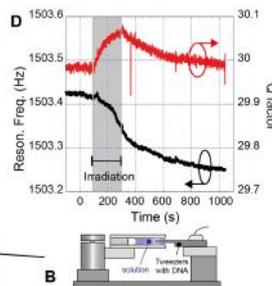
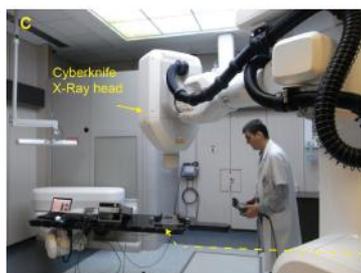
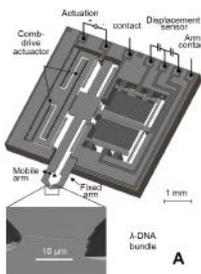
Host Professor: Pr. H. Fujita

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## Context

- Silicon Nano Tweezers (SNT) devices and concepts pushed for 8 years at LIMMS.
- Trap molecular bundle or cells between their 2 opposing tips
- Sense mechanical response when exposed to biochemical reactants and physical stimulation.
- Biomechanical sensing accuracy unaltered even under the harsh environment (X-Ray).
- Measure of DNA stiffness alteration due to the molecular breaks produced by the therapeutic X-ray
- Real time acquisition allows evaluating theoretical DNA breakage model, a better understanding mandatory to improve tumor treatment protocol



*X-ray irradiation of DNA.*  
*A: Nanotweezers device and trapped DNA bundle.*  
*B: MEMS set-up, the DNA bundle is inserted in microfluidic cavity.*  
*C: SNT-microfluidic platform under irradiation head of a 6 MeV Cyberknife.*  
*D: Frequency response of the SNT during irradiation showing DNA stiffness reduction*

## Feasibility

- Project conducted in the radiotherapy department of Centre Oscar Lambret, Lille, the north France reference cancer center.
- Experiments revealed the alteration of DNA bundle stiffness when exposed to X-Ray.
- This feasibility convinced the oncologists that BioMEMS could provide a new approach to investigate scientific and clinical research against cancer.
- Very favorable context with the SIRIC ONCO Lille program for research against cancer pursued in Lille and endorsed by the National Cancer.

## Results

- SMMIL-E research agreement signed in June 2014 and the scientific activities encompass bioMEMS research against Cancer – technology development and bio related experiments.
- Aim to bridge fundamental and clinical research around 4 workpackages:
  - (1) Bio molecular mechanisms of the tumor resistance to treatment,
  - (2) Cellular evaluation and diagnosis,
  - (3) Cells interaction and therapeutic targets and
  - (4) Biological adhesives and neo-tissues.

## Publications

G. Perret et al., Solid-State Electronics, 115(B), pp. 66-73, 2016.

## Contacts

<http://limmshp.iis.u-tokyo.ac.jp/about-the-laboratory/smmil-e>

