Education

2014-2016	Marie Curie Research Fellow in **Biophotonics**
	University of St. Andrews, UK & École Polytechnique de Montréal, Canada
2012-2014	Postdoctoral Fellow in **Nanophotonics,** École Polytechnique de Montréal
2011	PhD in **Applied Physics**
2008	M.Sc. in **Micro-systems and Nano-devices**
2005	B.Sc. in **Applied Physics**
	School of Applied Mathematical and Physical Sciences
	Athens Polytechnic, Greece

Employment

2021-	Associate Professor (Professeur sous octroi agrégé)
2018-2021	Assistant Professor (Professeur sous octroi adjoint)
2016-2018	Research Assistant Professor
	Department of Ophthalmology, University of Montreal (UdeM), Canada

Affiliations

2016-	Maisonneuve-Rosemont Hospital Research Centre
2016-	Biomedical Engineering Institute, UdeM
2018-	Department of Pharmacology and Physiology, UdeM

PI career awards

2022	Chercheurs-boursiers (Junior II), Fonds de recherche du Québec - Santé (FRQS)
2018	Chercheurs-boursiers (Junior I), FRQS

Contributions to the generation of new knowledge

My research program has translational and fundamental components, and spans the fields of eye surgery innovation, and biomaterial/drug delivery. Major contributions of my lab comprise inventions and approaches for improving the safety of eye surgery interventions (*see contributions 1 and 2*) as well as the invention of a laser-assisted bioprinting approach (*see contribution 3*).

My graduate and postdoctoral research yielded 25 publications (12 as first author), including papers in *Nano Letters, Nanoscale, Biosensors and Bioelectronics*. Over the course of my independent research career, I have published 12 papers (11 as senior corresponding author), including papers in *Small, Nanoscale, Biomedical Optics Express, Translational Vision Science & Technology, Scientific Reports*, and filed *1 patent application* (US and PCT) for a translational OCT technology developed in my lab. I present frequently to major conferences in my research field, such as SPIE photonics west.

Google scholar profile: https://scholar.google.ca/citations?user=l8jtzbgAAAAJ&hl=en

I have obtained peer-reviewed funding totaling ~ 2 M$ for my lab, including two salary awards (FRQS Junior I and Junior II; 533k$), one equipment grant (CFI; 690k$), 4 operating grants as PI (NFRF; NSERC; CIHR; VHRN; 665k$) and 2 operating grants as co-PI (CHRP; FRQNT; 169k$)

The most significant contributions of my lab over the last five years:

1. Eye surgery innovation: a system mitigating complications in pars plana vitrectomy

Pars plana vitrectomy (PPV) is a frequent ocular surgery involving removal of the vitreous gel from the eye and repair of the retina. The occurrence of iatrogenic retinal breaks (IRB) in pars plana vitrectomy

(PPV) is a complication that compromises the overall efficacy of the surgery. A subset of IRB occurs when the retina (rather than the vitreous gel) is cut accidentally by the vitrector. My lab developed a smart vitrector that can detect in real-time potential IRB and activate promptly a PPV machine response to prevent them. In-vivo validation of the system (porcine eyes) by two surgeons showed prevention or mitigation of 70.37% (95% CI: 56.4 – 82.0) of intentional attempts at creating retinal breaks. Potential clinical adoption of the smart vitrector can reduce the incidence of IRB in PPV and thus increase the therapeutic outcome of the surgery. In collaboration with Dr Duval (vitreoretinal surgeon), we are in the process of securing an industrial partner to commercialize this technology.

- Abid, R. Duval, F. Rezende, **C. Boutopoulos#,** *"A smart vitrector equipped by a fiber-based OCT sensor mitigates intentional attempts at creating iatrogenic retinal breaks during vitrectomy in pigs"* ***Translational Vision Science & Technology***, 10(13):19 (2021).
- R. Duval, A. Abid, F. Rezende, **C. Boutopoulos**, *"Smart Vitrector"*
  International (PCT) Patent Application No. PCT/CA2021/051559, 03-Nov-2021.
  United States Patent Application No. 17/518,205, 03-Nov-2021.
  United States Provisional Patent Application No. 63/109,040, 03-Nov-2020.

2. Extreme miniaturization of optical coherence tomography OCT probes for robotic-controlled eye surgery

My lab developed a method to miniaturize OCT probes down to 70 μm in diameter. These are the smallest probes with controlled focusing capabilities ever reported, representing ~50% size reduction compared to previous reported studies. We showed that our miniaturized probes present insignificant loss of sensitivity (~1dB) compared to their thicker (125 μm) counterparts. The developed probes can benefit the prototyping of minimally invasive tools for precise surgical manipulations in the eye. Such systems use miniaturized probes to detect/image tissue. Our lab integrates those probes with minimally invasive medical devices (e.g., 41G subretinal injection needles) to enable controlled subretinal injection of drugs.

- Abid, S. Mittal, **C. Boutopoulos#**, *"Etching-enabled extreme miniaturization of graded-index fiber based optical coherence tomography probes"*, ***J. Biomed. Opt.*** 25(3), 032006 (2020), doi: 10.1117/1.JBO.25.3.032006.
- Abid, R. Duval, F. Rezende, **C. Boutopoulos#**, *"Development and ex-vivo validation of 36G polyimide cannulas integrating a guiding miniaturized OCT probe for robotic assisted subretinal injections"* ***Biomedical Optics Express***. 13, 850-861 (2022).

3. A novel laser-assisted approach for multiscale bioprinting

My lab invented a novel laser-assisted drop-on-demand method to print live cells, including primary neurons. The method, named Laser Induced Side Transfer, uses low energy nanosecond laser (wavelength: 532 nm) to print bioink drops in a precise manner. We have developed a modelling framework to model and optimize LIST and studied the underlying printing mechanism (i.e., bubble growth in confined geometry). LIST bioprinting can cover a technological gap in bioprinting technologies, between ink-jet printing and LIFT, as it could not only print bio-inks of high-viscosity but also support 3D printing of artificial tissues with clinically relevant size. The discovery of LIST has been impactful in the field of bioprinting. It has attracted media interviews as well as numerous mentions in news and blogs that focus on the printing and/or bioprinting field. Our key paper on LIST ranks (online attention) in the 95th percentile of the 256,171 tracked articles of a similar age in all journals.

- K. Roversi, H. Ebrahimi Orimi, M. Erfanian, S. Talbot, **C. Boutopoulos#**, *"LIST: a newly developed laser-assisted cell bioprinting technology"*, ***Bio-protocol***, 12(19):e4527 (2022).

- H. Ebrahimi Orimi, E. Hooker, S. Narayanswamy, B. Larrivee, **C. Boutopoulos#**, *"Spatially guided endothelial tubulogenesis by laser-induced side transfer (LIST) bioprinting of HUVECs"*, ***Bioprinting***, 28, e00240 (2022) (2022).
- H. Ebrahimi Orimi, L. Arreaza, S. Narayanswamy, **C. Boutopoulos#**, *"Self-limited nanosecond laser-induced bubble growth in sealed containers"*, ***Appl. Phys. Lett.***, 119, 064101 (2021).
- K. Roversi, H. Ebrahimi Orimi, M. Falchetti, E. Lummertz da Rocha, S. Talbot**, C. Boutopoulos#**, "Bioprinting of Adult Dorsal Root Ganglion (DRG) Neurons Using Laser-Induced Side Transfer (LIST)", ***Micromachines***, 12(8), 265 (2021)
- H. Ebrahimi Orimi, Sivakumar Narayanswamy, **C. Boutopoulos#,** *"Hybrid analytical/numerical modeling of nanosecond laser-induced micro-jets generated by liquid confining devices"*, ***Journal of Fluids and Structures*** 97, 103079 (2020)
- H. Ebrahimi Orimi, S.S. Hosseini Kolkooh, E. Hooker, S. Narayanswamy, B. Larrivee, **C. Boutopoulos#**, "Drop-on-demand cell bioprinting via Laser Induced Side Transfer (LIST)", ***Scientific Reports*** 10, 9730 (2020).

Contributions to training and mentoring

Presently, my team includes 3 PhD students, 2 MSc students, 2 postdocs, and 1 research engineer. Previous HQP supervision includes 2 PhD students, 1 MSc student, 4 BSc students and 1 research assistant. Collectively, my students have published 12 papers as first authors, filed one patent application as co-inventors, received 20 competitive scholarships, participated to 7 international conferences and to 30 local scientific events, and won 6 presentation awards. Presently, all graduate level HQP that received training in my lab hold R&D positions in industry or academic settings. I have directly contributed to their career development by i) offering hands-on training in biomedical and optical technologies, ii) promoting peer learning via interactive group meetings, iii) encouraging and supporting participation to scientific conferences and workshops, iv) providing feedback for improving scientific writing/presentation skills, and v) by ensuring a diverse training experience via co-supervision schemes and collaborations with clinicians and industrial partners. In 2017, I received the UBC Science Co-op Supervisor Recognition Award.

EDI practices in my lab I am committed to provide equal training opportunities for all lab members and to ensure that mentoring activities are balanced, valued, and recognized among our team. To consolidate inclusion, respect and safety feeling among lab members, we have taken the following actions:

- I encourage new members of my lab to improve their EDI knowledge via reading University resources and by completing online modules.
- To prevent non-balanced opportunities (or load «equity tax») of team members, training and dissemination opportunities are identified according to the scientific background, and career stage of each individual and equally distributed.
- By including an EDI commitment statement in recruitment openings and by posting offers to international platforms (i.e., ABG, Linkedin, EURAXESS), we anticipate attracting candidates with diverse backgrounds.
- Family/religion/food needs are considered when scheduling team meetings and social events.
- We have a flexible working schedule, facilitating participation of lab members in ethnical celebrations and religious practices.