A 4 to 8 month research assistant position is available in the Zandstra Stem Cell Bioengineering laboratory, which is in the School of Biomedical Engineering located within the Biomedical Research Centre, and is affiliated with the Michael Smith Laboratories, at the University of British Columbia's Vancouver campus. The successful candidates will join our world-class research team to **build an automatic fluidic flow cell on a fluorescent microscope for continuous imaging and chemical treatments on cells/tissues.** Our highly successful multidisciplinary program integrates researchers in stem cell biology, biological computation, synthetic biology, system biology, microfabrication, developmental biology, and regenerative medicine, with the goal of developing *in vitro* and *in silico* representations of complex tissue and organ development. Our research program is based on understanding how individual cells form complex functional tissues and organs by studying multiscale interactions between cells, their molecular regulatory networks, and the external microenvironments, and then mobilizing our findings to generate therapeutically relevant blood cells from stem cells.

Details on the project and position:

Title: Building an automatic flow cell system for Fluorescent *In Situ* Sequencing (FISSEQ)

The ability to characterize gene regulatory network (GRNs) at the 'omic' level *in situ* is the key to link molecular machineries to their functional output at the cellular, tissue, and organism level. It is crucial for studying many biological systems and pathways including embryogenesis and blood development. Fluorescent In situ Sequencing (FISSEQ) is the very first genome-wide *in situ* sequencing technology that was developed in the laboratory of Dr. George Church at Harvard Medical School. In the Zandstra lab, we aim to introduce a variation of the FISSEQ technology called targeted FISSEQ and combine it with our established *in vitro* models that we use to study the GRNs controlling early gastrulation and blood development events during human embryogenesis. Targeted FISSEQ allows us to monitor a large number of both RNA and protein species simultaneously in the samples, which enables us to monitor/detect GRNs at different stages critical to making developmental decisions.

To fully exploit the potential of this technology, the candidate will independently set up an automated flow cell system for both sample preparation and sequencing-on-microscope steps, especially the sequencing steps. During each round of sequencing (sequencing-by synthesis), a sample (i.e. tissue section on a glass slide) goes through: single fluorescent nucleotide attachment on templates via polymerase →imaging → fluorophore removal →wash. Sequencing a 20-base target requires repeating 20 rounds of these chemical steps between imaging rounds. Therefore, the candidate will be building a fluidic device that includes the following main design features/components:

- A computer-controlled peristaltic pump to control the flow rate of different buffers through the flow system, with the capacity of at least 0-30ml/min at 0 backpressure such as Rainin Dynamax RP-1.

- Two to three computer-controlled 8-way valves that can host up to 24 buffers and control which buffer is being pulled across the sample at any given time.

- A flow chamber that can host standard glass-slide size coverslip and 0.1-1mm gasket for varying flow volumes and sample thickness, is a temperature controlled closed system, and has the capacity of high-volume laminar flow, Koehler Illumination and

electronically conductive coating for temperature control. Reference example: FCS2 chamber from Bioptechs.

- Microscope platform adaptor for the flow chamber.

The candidate will have the opportunity to build some parts of the system from the ground up to suit our sample types and experimental setup, such as the design of the flow cell chamber. Besides building the hardware, the candidate will also be writing in-house scripts to control the system with some help from the computational experts in the lab. The system will help to greatly reduce the time taken for sequencing steps and human labor, as well as to improve sample consistency and data quality. Training on fluorescent confocal imaging will be provided as needed. If time permits, the candidate will also learn the FISSEQ technique and apply it to samples provided, using the flow cell they have built.

Relevant literature and useful websites:

- https://www.ncbi.nlm.nih.gov/pubmed/25675209
- https://www.ncbi.nlm.nih.gov/pubmed/25858977
- https://www.ncbi.nlm.nih.gov/pubmed/27625426
- https://www.ncbi.nlm.nih.gov/pubmed/27241748
- https://bioptechs.com/product/fcs2-chamber/

1) This position is suitable for an independent, resourceful, highly self-motivated candidate with experience in mechanical and electrical engineering, computer programming, and also ideally in fluorescent imaging however training on imaging techniques will be provided as needed.

2) Position will be 4 – 8 months duration starting on May 1st, 2020. Ideally we are looking for an 8 month research assistant or co-op student.

3) No vacation time is provided as vacation pay is provided in lieu; however if the candidate wishes to minimally alter the start or end dates, please discuss with us.

4) We encourage successful applicants to also apply for external award funding as appropriate e.g. an NSERC undergraduate research award (https://students.ubc.ca/career/campus-experiences/nserc-undergraduate-student-research-awards) and/or a Centre for Blood Research-School of Biomedical Engineering award (https://www.bme.ubc.ca/research/funding-opportunities/); either one of these awards can be held at one time concurrent with a co-op position. Note that the NSERC program requires a minimum 16 week continuous duration of work.

5) The salary will be $2500/month full-time (based on 40 hours work/week), pro-rated if any partial months worked; inclusive of any award funding received.

Ideal candidates would have experience in some or all of the below:

- Mechanical and electrical engineering (required)
- Knowledge of fluid dynamics and flow cell construction (required)

- Computer programming skills (preferred)
- Fluorescent/confocal microscopy (desirable)
- Knowledge of nucleic acid sequencing chemistry (desirable)

Individuals must also:

- Work well in a goal-oriented team environment;
- Be highly self-motivated and engaged in research
- Possess excellent communication skills – both verbal and written;
- be open to instruction and constructive criticism on the project and their capabilities
- Have the ability to work semi-independently and organize own workload under supervision
- keep meticulous records of experiments and data, report on research progress and outcomes openly
- Demonstrate an ability to design and analyze experiments, review experimental methodologies in response to feedback
- Have the ability to acquire and update knowledge in their specialized area and implement relevant technologies to advance the project

For further information about these projects and to apply, please also send us your application package ***as one PDF file*** via email at **zandstra.lab@ubc.ca** to include

- Email subject line: "Building an automatic flow cell system for FISSEQ" 2020 research assistant/co-op application
- cover letter
- dates of your availability
- CV
- copy of all university transcripts (require English translations where applicable; originals must sent prior to acceptance of offer)
- contact information for 3 references

For further information on our research and team, please visit our website and Twitter account:

https://www.stemcellbioengineering.ca/

https://twitter.com/StemCellBioEng

We will consider applications on a rolling basis until the position is filled, at which time we will note this on the job posting on our lab website here - https://www.stemcellbioengineering.ca/careers/

We regret that we can only contact those applicants who are selected for further consideration.