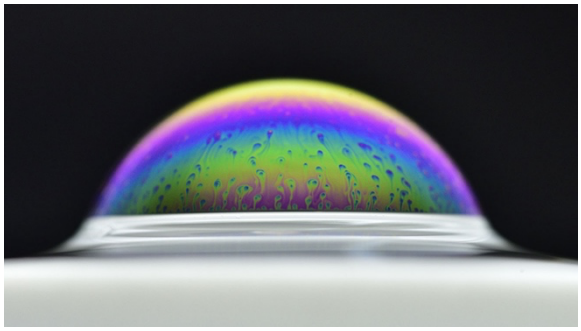
ECOLE
POLYTECHNIQUE
DE BRUXELLES

TIPs-µfluidics

Prof. B. Scheid

Etude numérique de la rhéologie interfaciale de films de savon

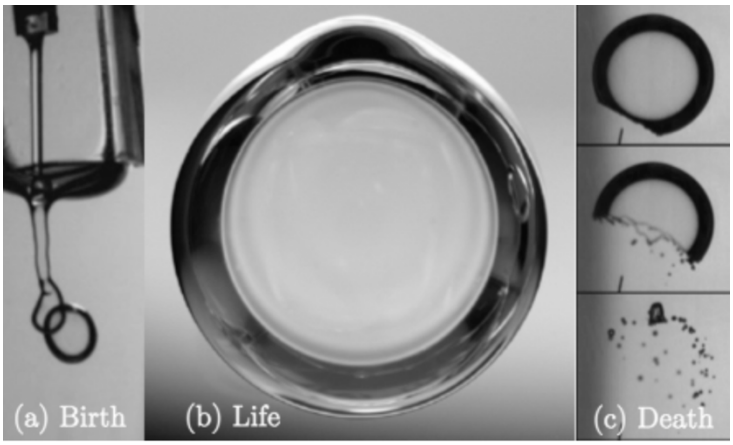


Résumé: Un film de savon est une fine pellicule d'eau maintenue par une monocouche de molécules de savon, les surfactants. La stabilité de ces films de savon est d'une importance primordiale dans la formulation des mousses liquides, qu'elles soient explicitement souhaitées comme mousses de rasage, ou qu'elles se forment sur la vaisselle et le linge. La stabilité des mousses dépend majoritairement de la rhéologie des monocouches de surfactant (forces que les surfactants peuvent encaisser). De nombreuses méthodes de mesures de ces propriétés ont été développées cependant ces techniques sont très limitées en fréquence et sondent la resistance des surfactants seulement sur des temps longs de l'ordre de la seconde.

Dans ce mémoire, nous nous intéresserons à la rupture d'un film de savon dont la rétractation s'opère en quelques millisecondes afin de sonder la rhéologie interfaciale sur des temps très courts. Cette étude s'appuiera sur des simulations numériques directes pour comprendre l'influence de la physico-chimie sur la réorganisation/rhéologie hors équilibre interfaciale d'un film de savon. Ce travail numérique sera confronté aux résultats expérimentaux obtenus en collaboration avec l'Institut Jean Le Rond d'Alembert (Paris) afin de potentiellement développer une nouvelle technique de mesure de la rhéologie interfaciale rapide.

Contacts: Benoit Scheid (Benoit.Scheid@ulb.be) + Omer Atasi (Omer.Atasi@ulb.be)

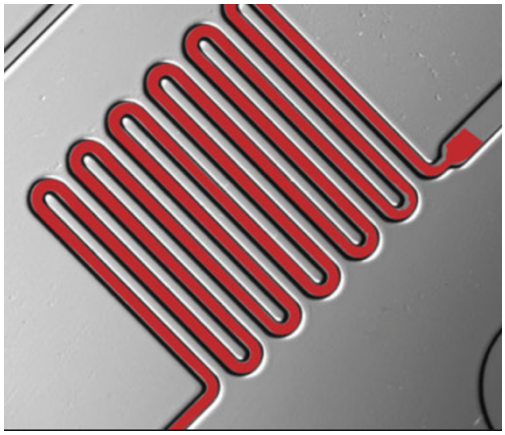
Oil-free encapsulation using microfluidic antibubbles



Summary: An emerging breakthrough in microfluidics is the formation of antibubbles (= a drop inside a bubble in a liquid). Antibubbles turn out to be a potential new elementary component in microfluidics (beside bubbles and droplets) with unequalled properties, combining those of bubbles and droplets, such as "flash" release of a disperse phase into a continuous one or contact-free all-aqueous emulsification (in the context of CO2 sequestration or protein encapsulation). Nevertheless, despite the current knowledge on antibubble dynamics two limitations prevent the antibubble to be used at the scale of a microfluidic process: the limited lifetime and the automated production in microfluidics. The master thesis will contribute to produce and manipulate micro-antibubbles by designing dedicated micronozzles using the nanoscribe 3D printer.

Contact: Benoit Scheid (Benoit.Scheid@ulb.be)

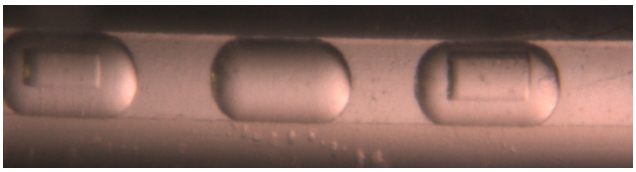
Improvement of an intra-utero rate-of-hemoglobin diagnostic of a fetus during echography using microfluidic technology.



Summary: Measuring the rate of hemoglobin in the blood of a fetus is performed by an intro-utero test during echography. If this rate is too low, the fetus is in danger and a surgical procedure is necessary. The accuracy of the test strongly relies on the underlying theoretical model, based on assumptions that could be invalidated in some conditions. The goal of the master thesis will then consist in contributing to the understanding of the conditions for which the hemoglobin test should be improved. The work will consist in mimicking in-vitro the blood flow of a fetus using microfluidics technology. Once the model adjusted with in-vitro measurements, it will be tested in-vivo and assessments as compared to existing tests will be made with the aim to eventually improve the accuracy of the diagnostic. The in-vitro measurements will be made at the TIPs-microfluidics lab at ULB-Solbosh, while the in-vivo measurements will be performed at the Hemato-oncology department at ULB-Brugmann in collaboration with Prof. F. Corazza.

Contact: Benoit Scheid (Benoit.Scheid@ulb.be)

Microfluidic continuous crystallisation of a pharmaceutical compound: influence of the flow



In the frame of a research effort to continuously produce a pharmaceutical ingredient of interest, we focus in this student project on the crystallization process in flow, and in particular on the influence of the shear stress on the nucleation rate, offering an additional degree of freedom for the fine control of the crystal size and size distribution.

Contact: Benoit Scheid (Benoit.Scheid@ulb.be)

Other subjects available on demand in the field of microfluidics

Contact: Benoit Scheid (Benoit.Scheid@ulb.be)