

MICRO-VOLUME BILIRUBIN TESTER FOR NEONATES

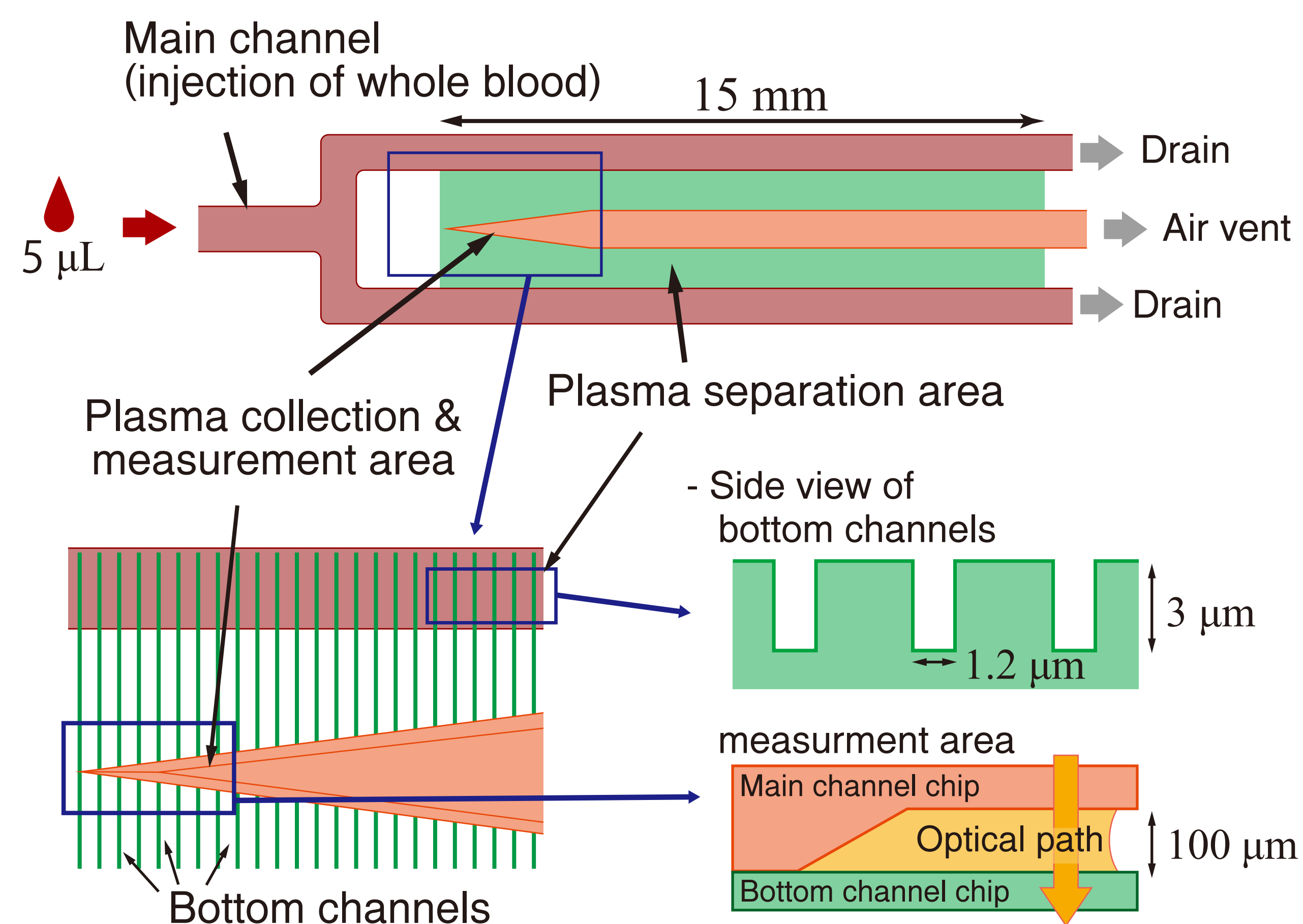
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Motivation

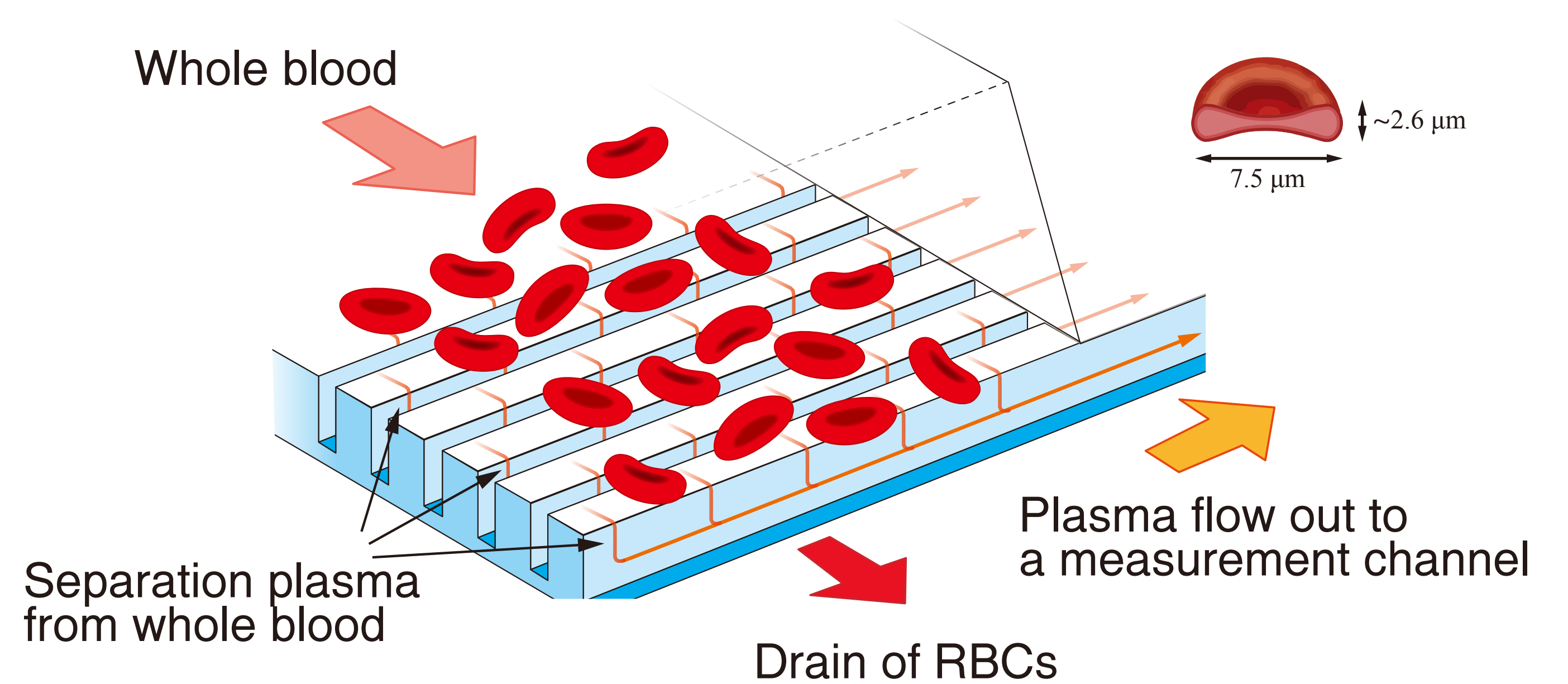
- Neonatal jaundice and hyperbilirubinemia are related with severe illnesses such as hemolytic disease, metabolic and endocrine disorders, and infections. Therefore, the measurement of total bilirubin is one of the most frequently performed tests in neonates, and the bilirubin level is managed to prevent bilirubin neurotoxicity by treatment.

Design and Principle

Schematic of microchannel for plasma extraction.



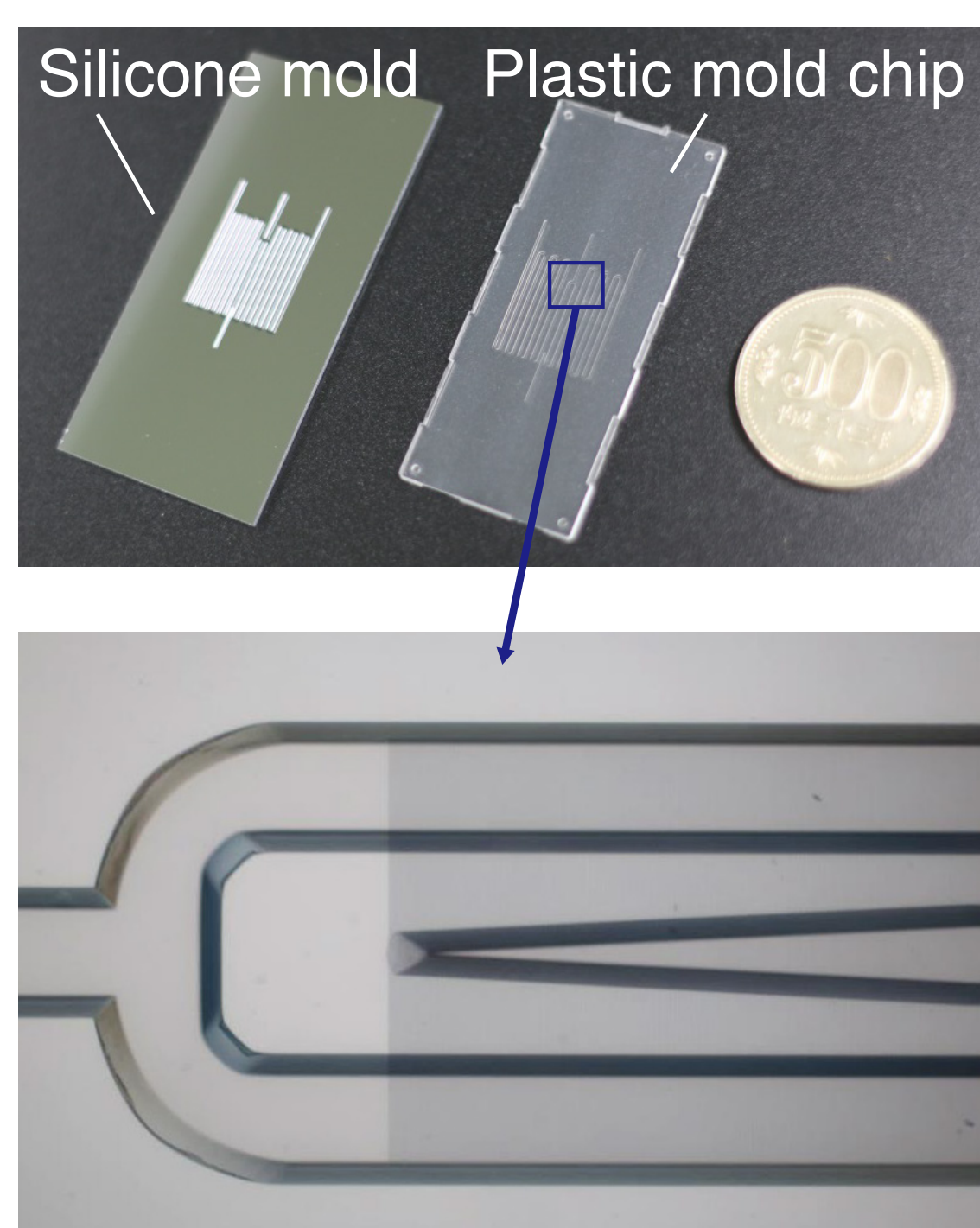
Mechanism of plasma extraction by bottom channels.



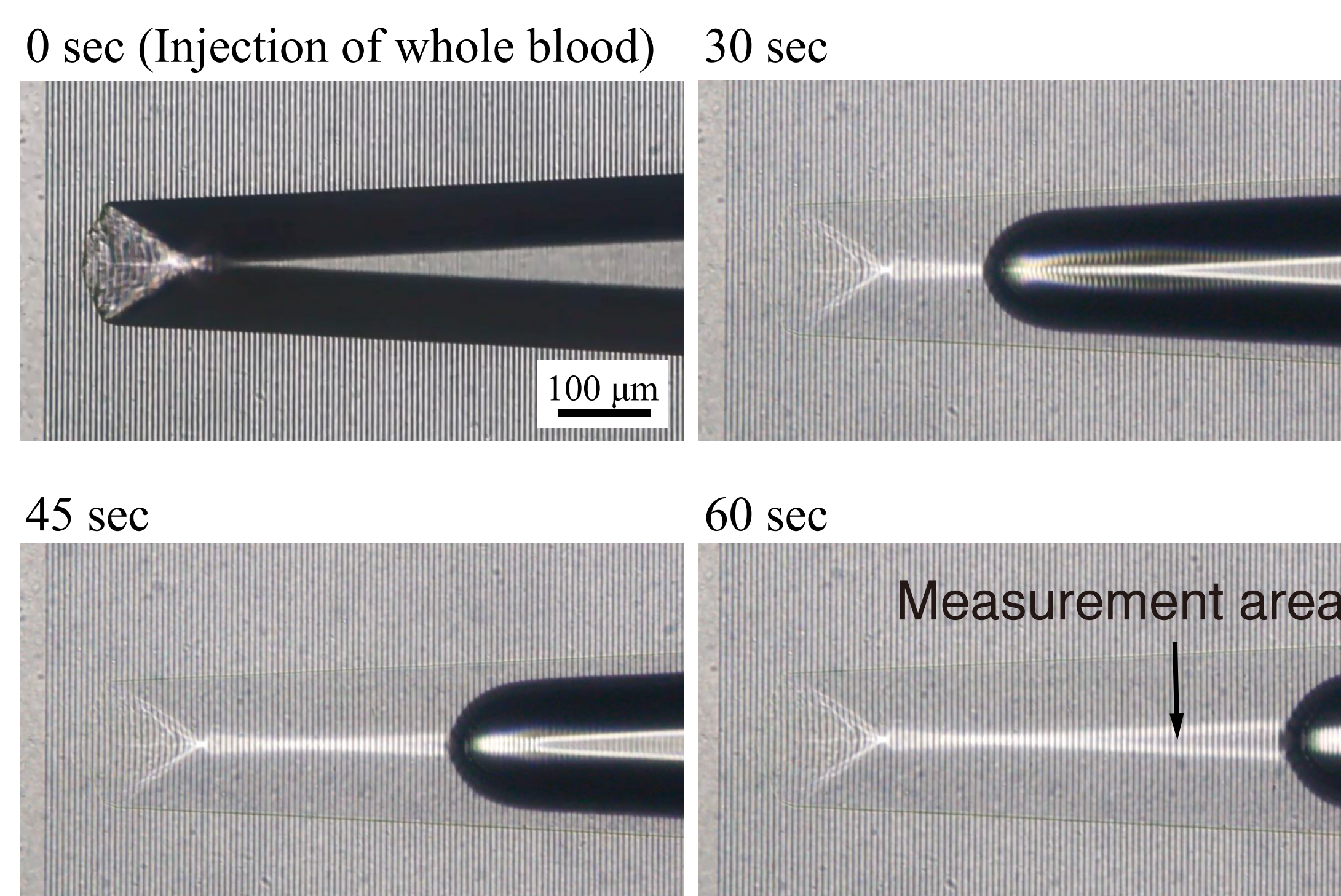
- After a blood sample is injected into a main channel by capillary force and arrives at the area of blood extraction, the plasma is extracted into bottom channels and flow into a measurement channel via side channels; by contrast, separated RBCs are removed by the main blood stream, that reduce clogging of bottom channels.

Extraction and Measurement

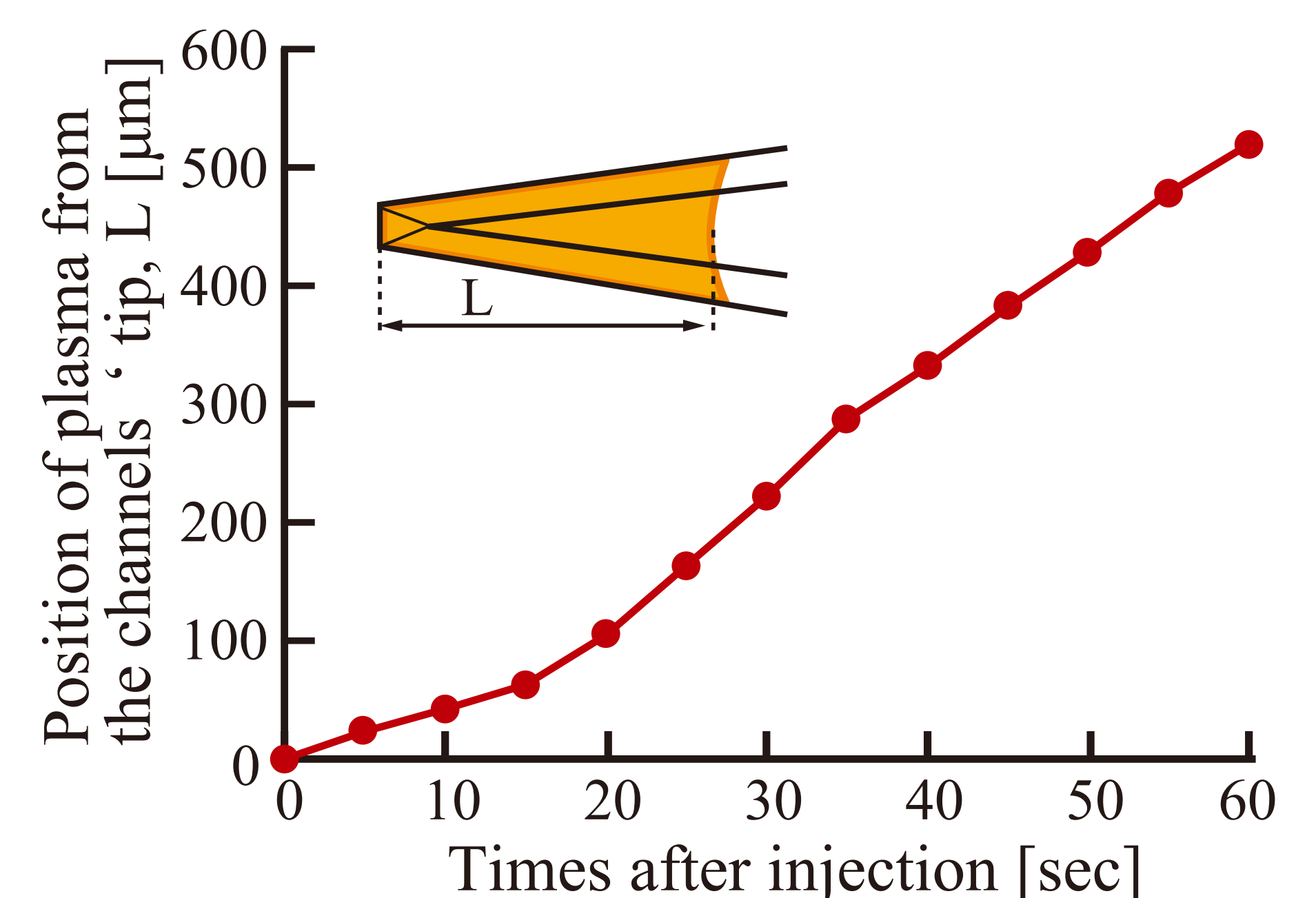
Injection molding using a micropatterned mold.



Collection area filled by extracted plasma.

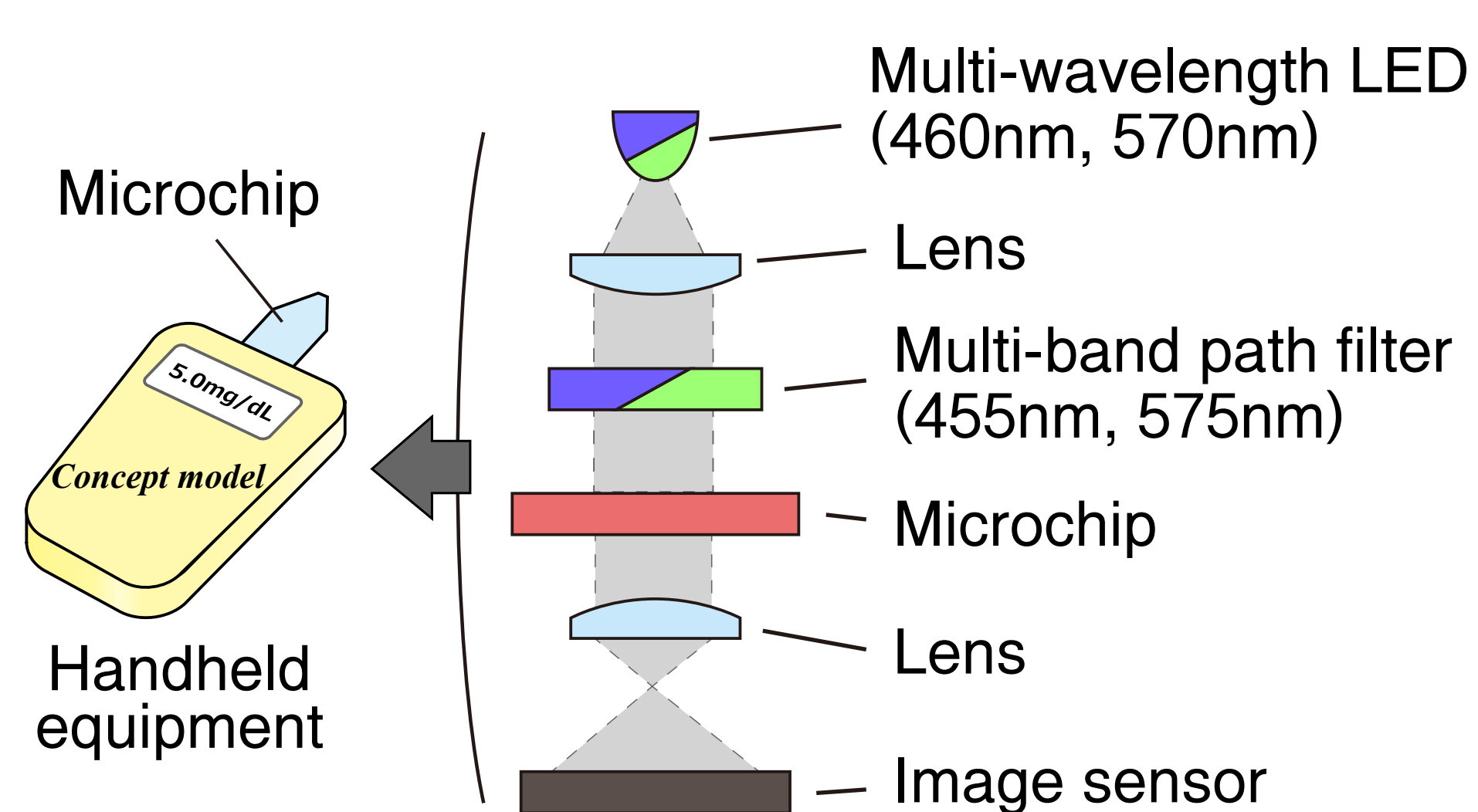


Performance of plasma extraction.

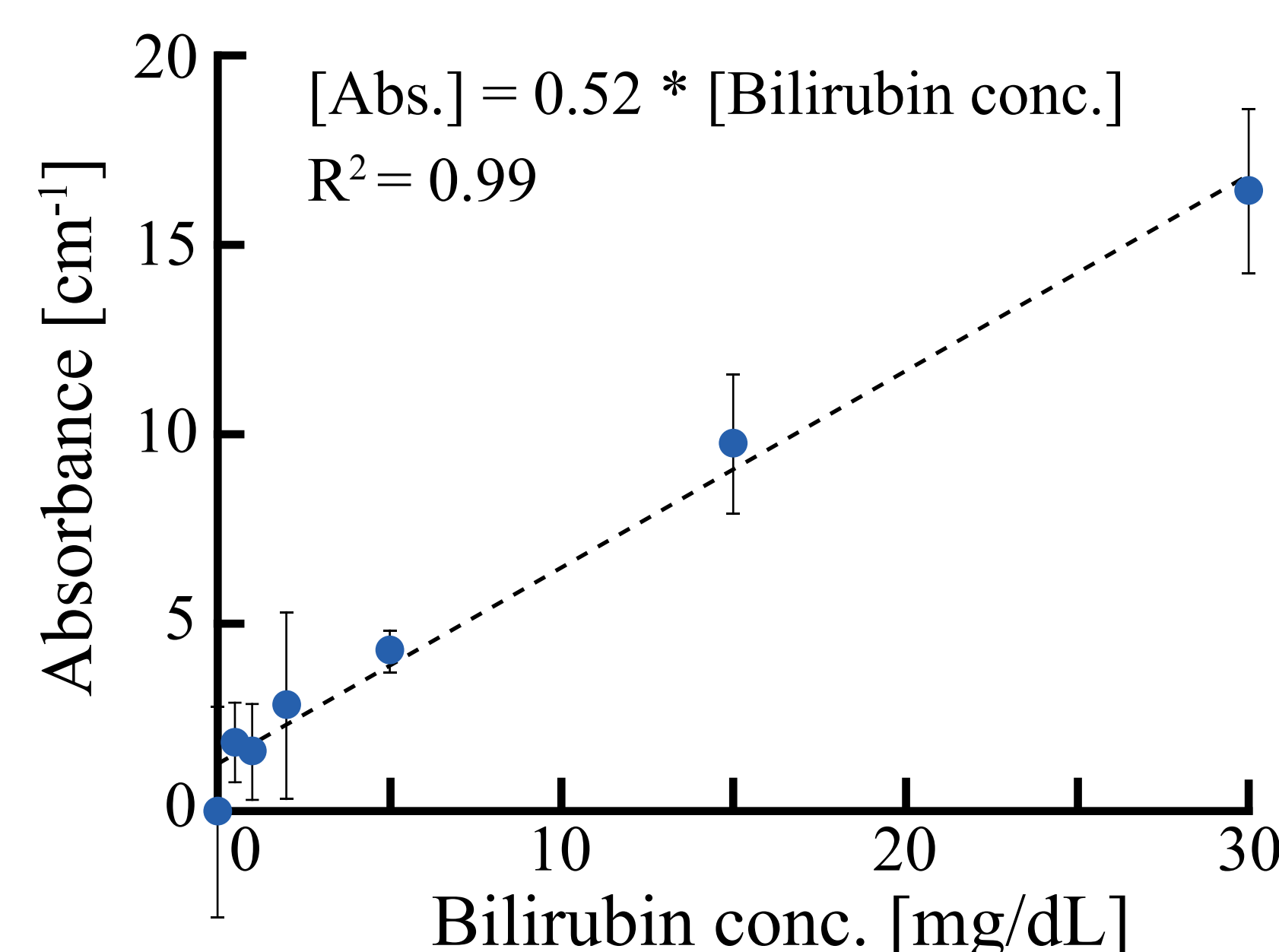


Plasma extraction is completed within 60 sec after blood sample injection

Configuration diagram of Optical measurement system.



Absorption measurements of bilirubin concentrations inside chips.



- A direct spectrophotometric assay for bilirubin is based on the absorbance of bilirubin at 455 nm; by contrast, hemoglobin absorbs equally at both 455 and 575 nm.

- Neonatal jaundice is defined as a total serum bilirubin level above 5 mg/dL, and our device have a sensitivity enough to diagnosis.

- Patent applied for

Conclusions

- We presents a novel one-step blood testing device which extracts plasma from a minute amount of whole blood (<5μL) and measures total bilirubin in the plasma for early diagnosis of neonatal jaundice in a bed side.
- Our microfluidic chip extracte plasma from whole bloods with commercial productivity, and a measurement system without other operation. Obtained plasma also was utilized for various testing by using indicators of target biomarkers.