



2021「中技社科技獎學金」

2021 CTCI Foundation Science and Technology Scholarship

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Combination of Bilirubin Chip and Smartphone for Neonatal Hyperbilirubinemia Diagnosis

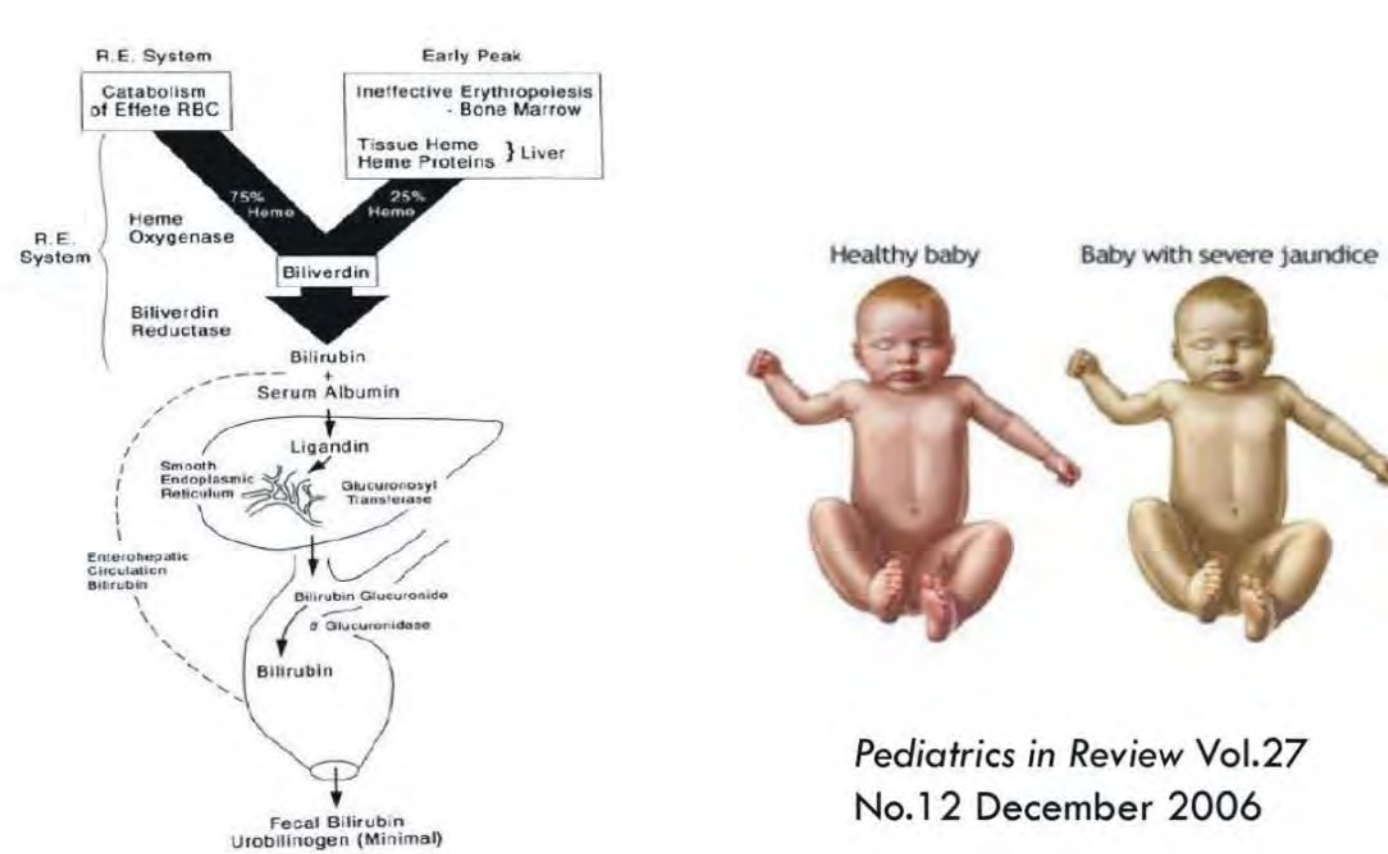
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Introduction

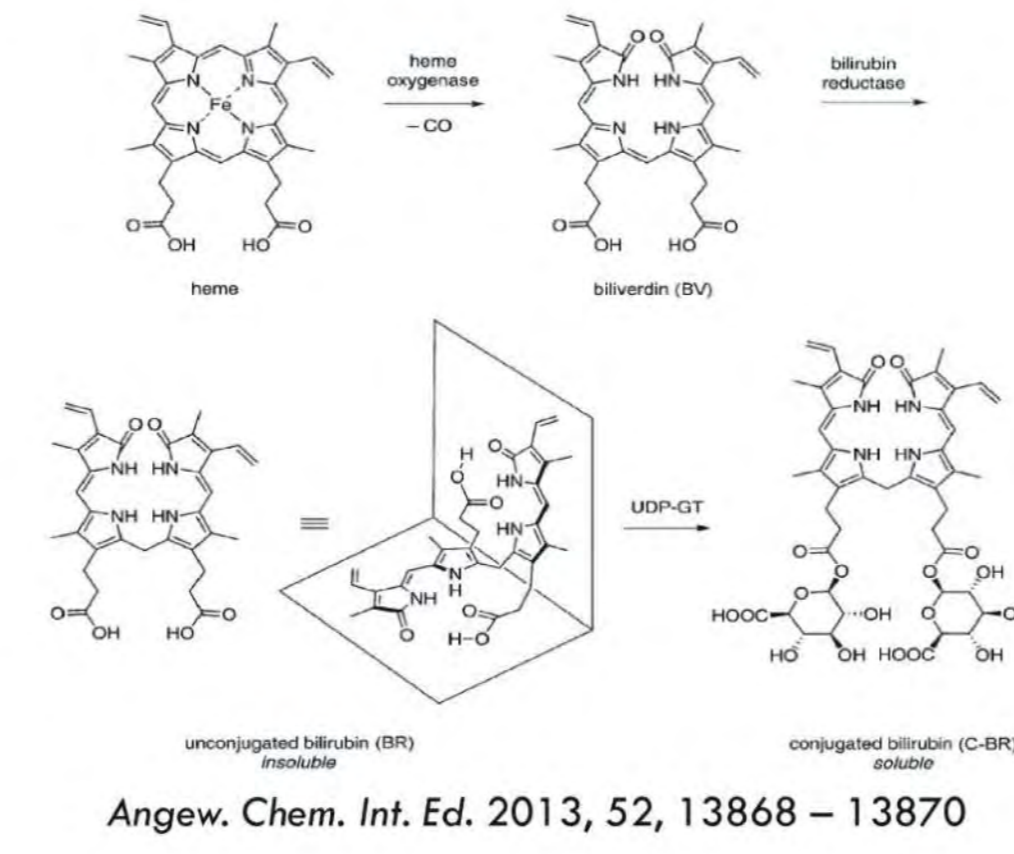
Neonatal Jaundice



Pediatrics in Review Vol.27 No.12 December 2006

- ◆ Commonly seen in the newborn
- ◆ May cause permanent brain damage
- ◆ Require regular monitoring
- ◆ Analyzed by using automated clinical chemistry analyzer

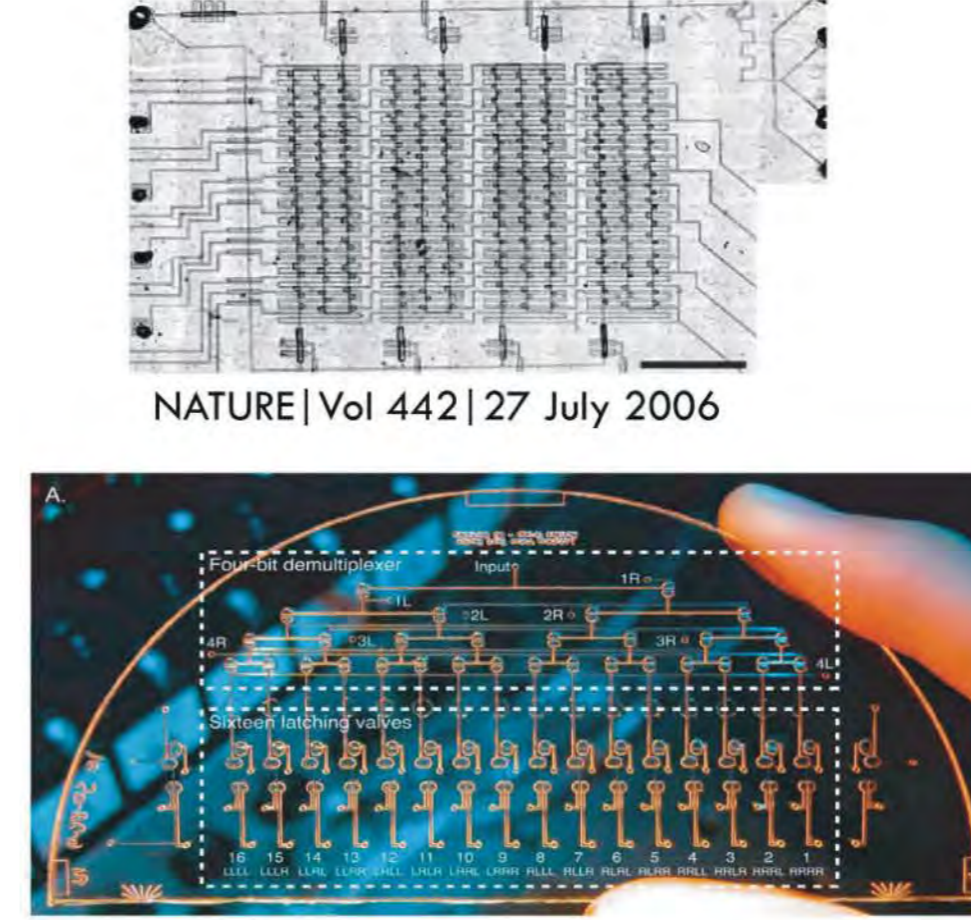
Determination of Bilirubin



Angew. Chem. Int. Ed. 2013, 52, 13868 – 13870

- ◆ Conjugation & Unconjugation
- ◆ Diazotization
- ◆ HPLC, Fluorescence
- ◆ Noninvasive method

Microfluidic Device



NATURE | Vol 442 | 27 July 2006

- ◆ Rapid prototype
- ◆ Easily assembled
- ◆ Cost-effective
- ◆ Analytical Device

Point of Care



JACC : BASIC TO TRANSLATIONAL SCIENCE VOL. 1, NO. 1-2, 2016

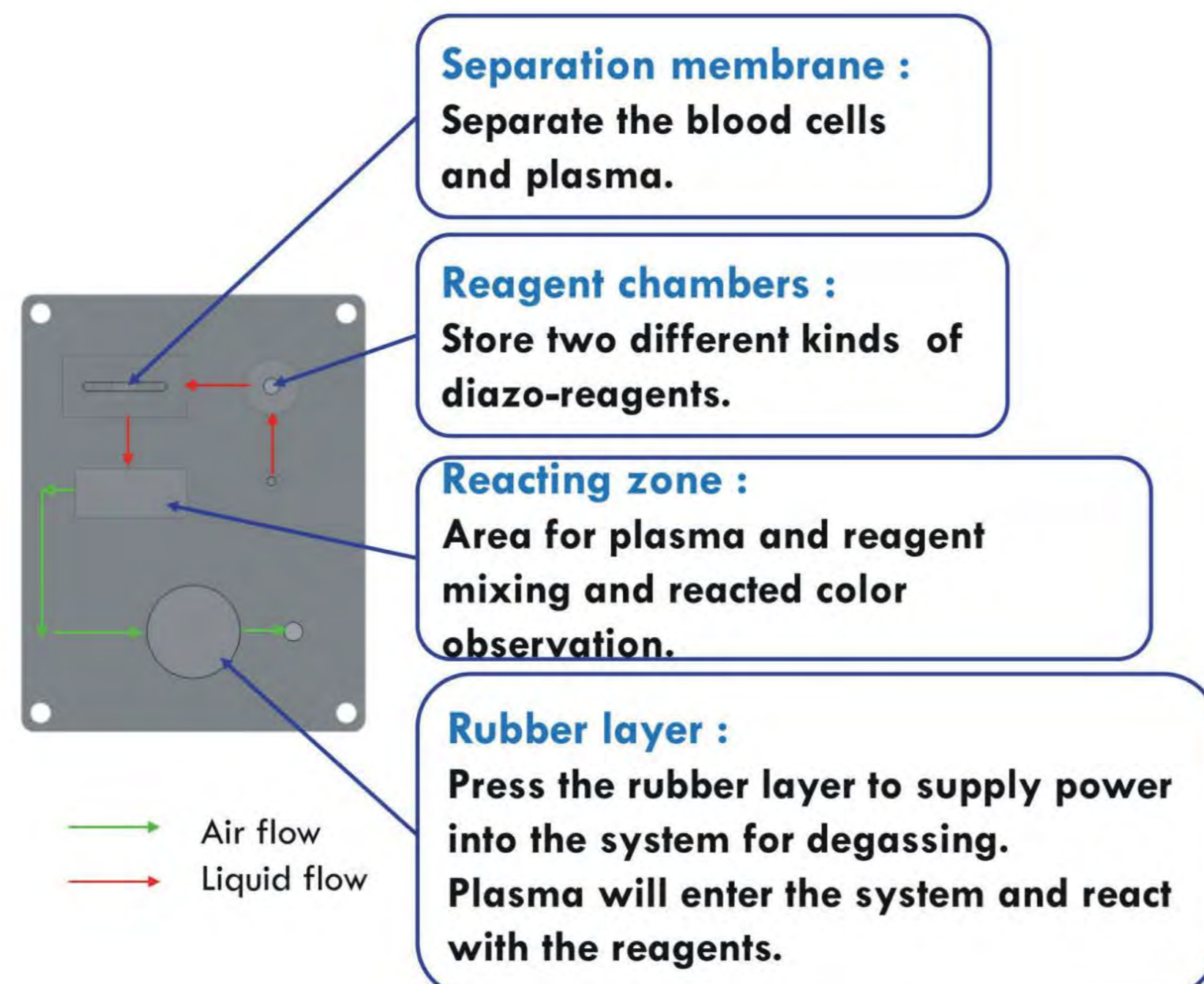
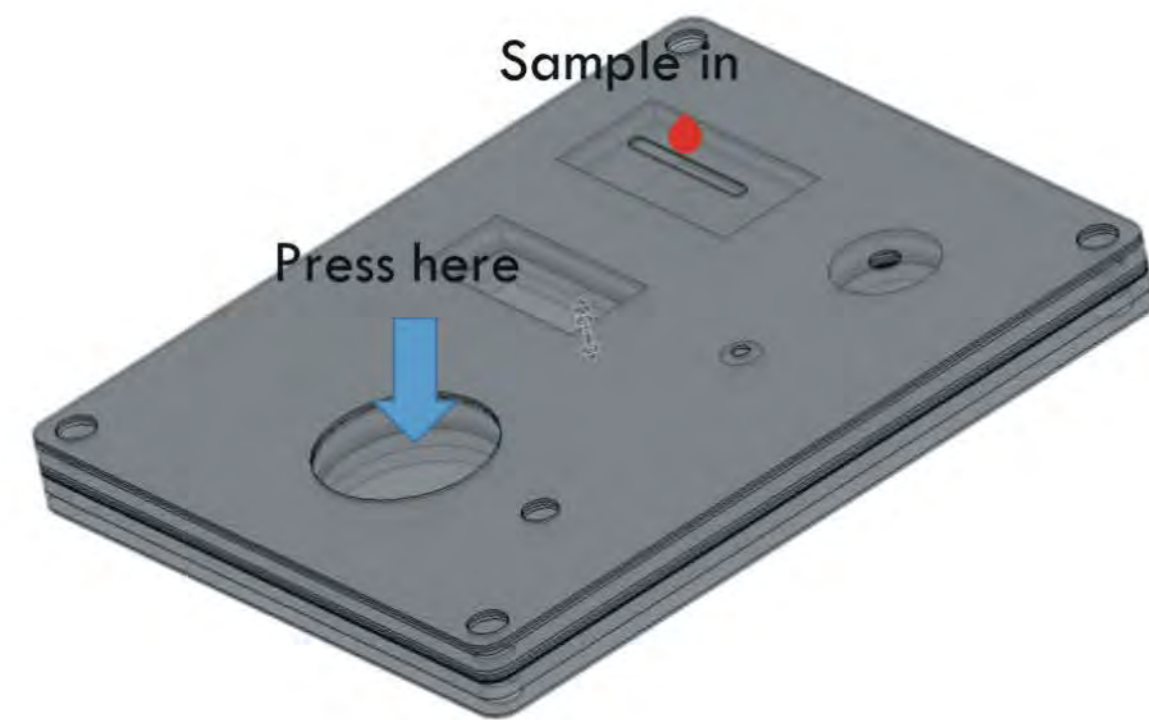
Trends in Biotechnology, November 2015, Vol. 33, No. 11

- ◆ Portable
- ◆ Real-time detection
- ◆ Reduced operating times

Approach

Bilirubin Test Chip

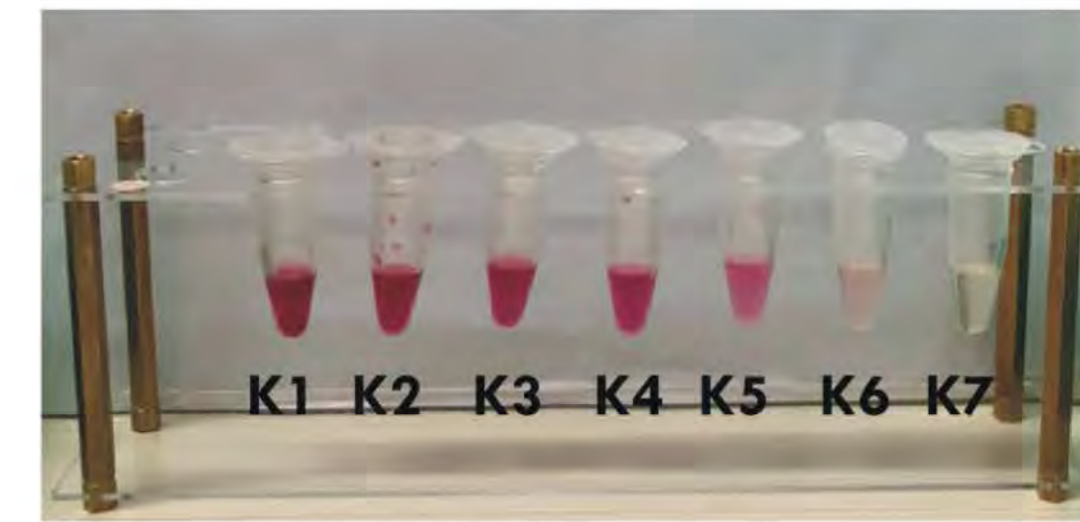
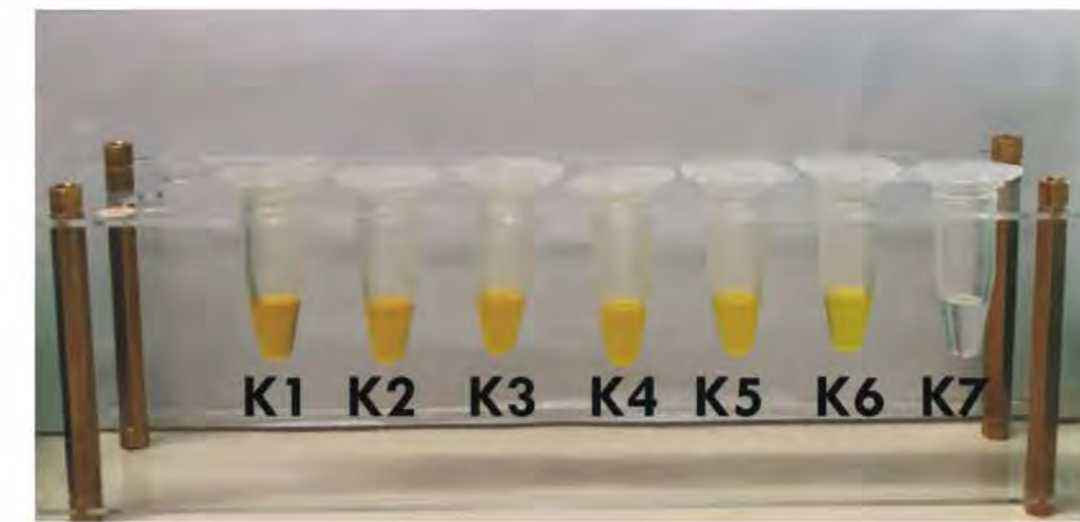
Principle : Performs both plasma separation from whole blood and total bilirubin determination by colorimetric method.



Bilirubin Solution

Dissolve bilirubin powder in 0.1M NaOH to prepare 7 different concentration solutions.

After loading the bilirubin in the bilirubin test kit, we can observe the color change.



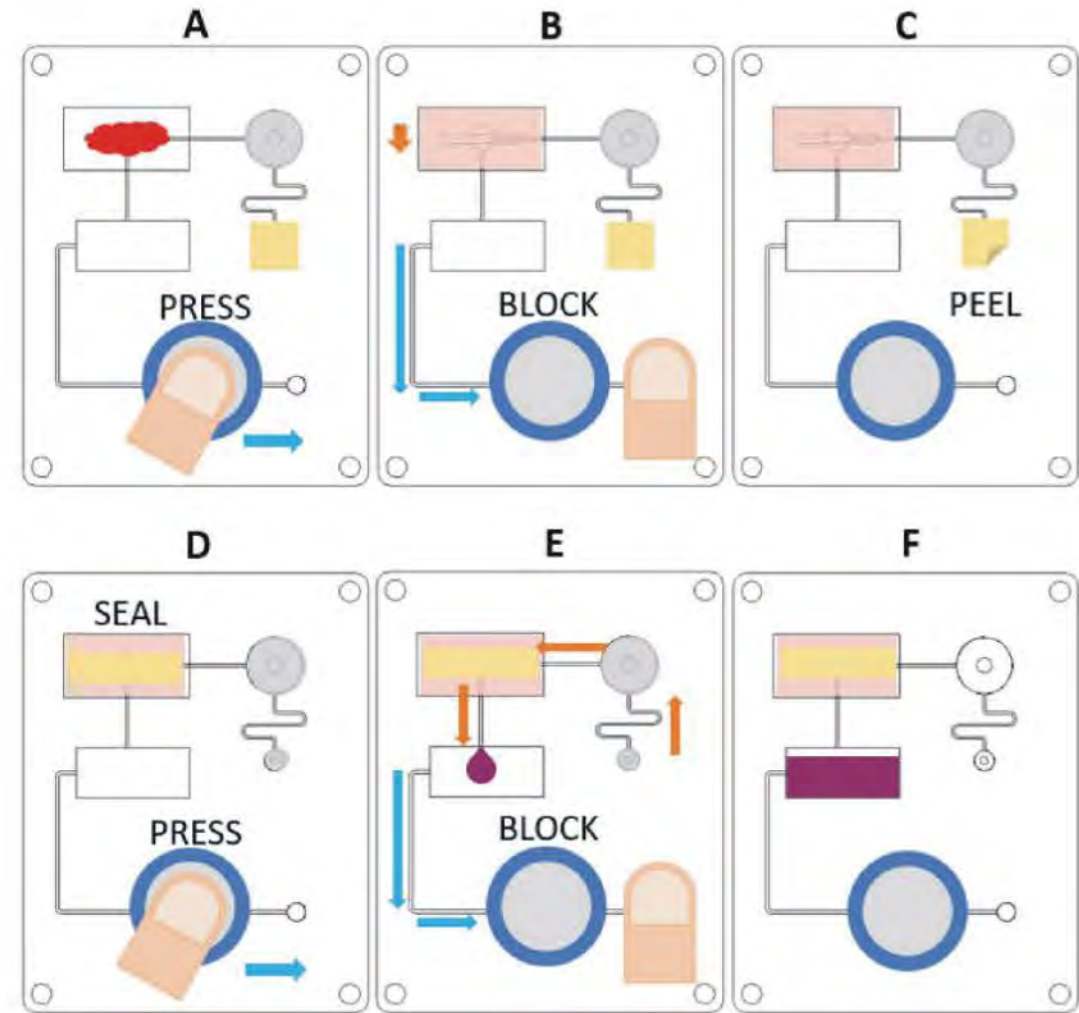
Concentration of bilirubin solutions

	K1	K2	K3	K4	K5	K6	K7
Concentration (mg/dL)	25	20	15	10	5	1	0

Results

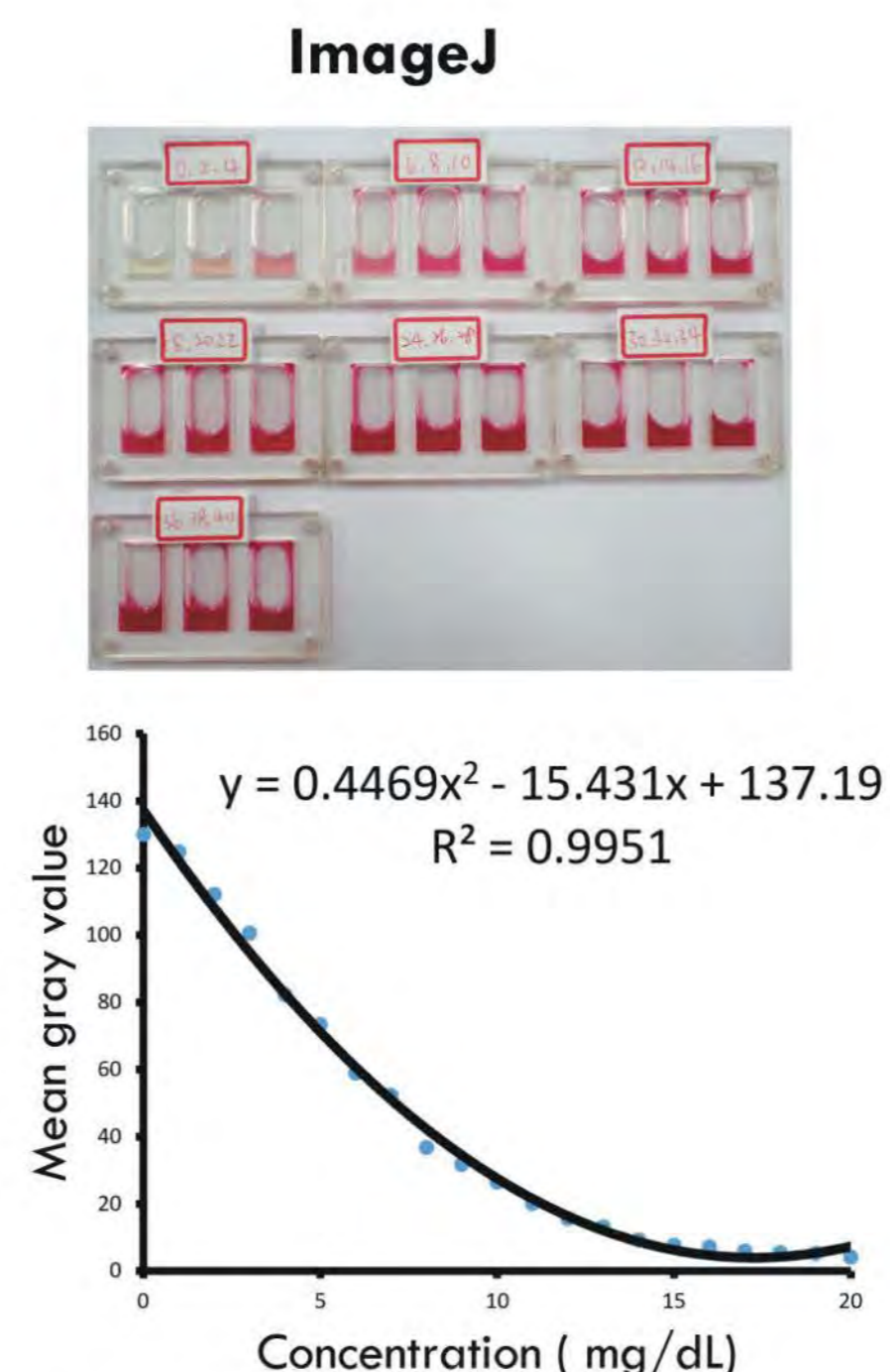
Bilirubin Chip Test

Process of the bilirubin test chip



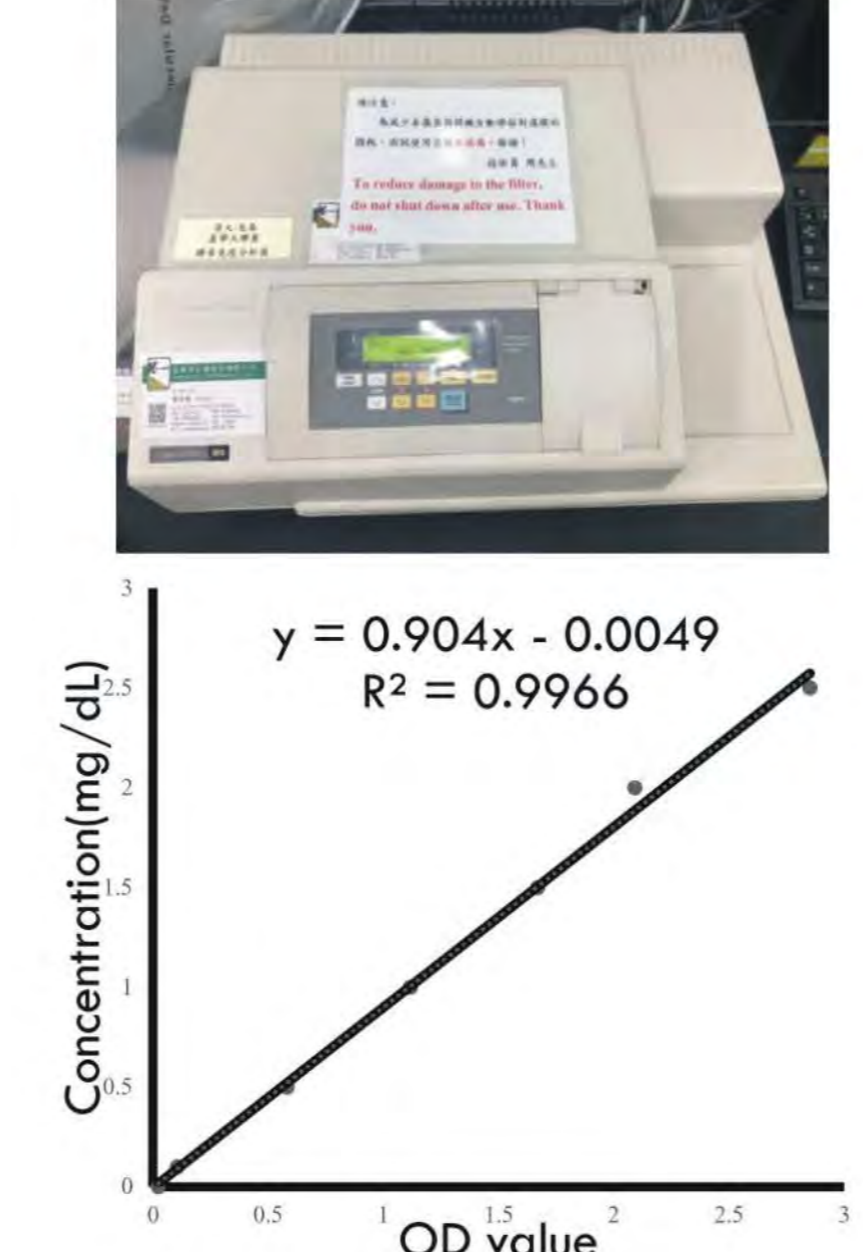
- Two steps operation:
- Separation of blood sample
 - Reaction of plasma and bilirubin reagent

Colorimetric Analysis



- Take picture of the reacted solution under the same condition
- Use Image J software to obtain the mean gray value
- Calibrate the gray value and the concentration

Absorbance Microplate Reader



- Calibrate the absorbance and the concentration
- Test the 540 nm absorbance

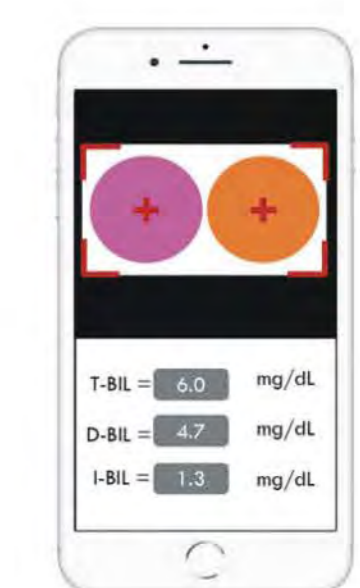
Conclusion

- Colorimetric method can be used in the bilirubin detection
- We can use the microfluidic chip to develop a better way for detecting neonatal jaundice.
- Point-of-care concept can be applied on neonatal testing.



Future work

- Replace total bilirubin with direct bilirubin.
- Establish the standard operating procedure to perform the bilirubin diagnosis.
- Apply to another rapid diagnosis mechanism.
- Obtain bilirubin value from smartphone.



Acknowledgement

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