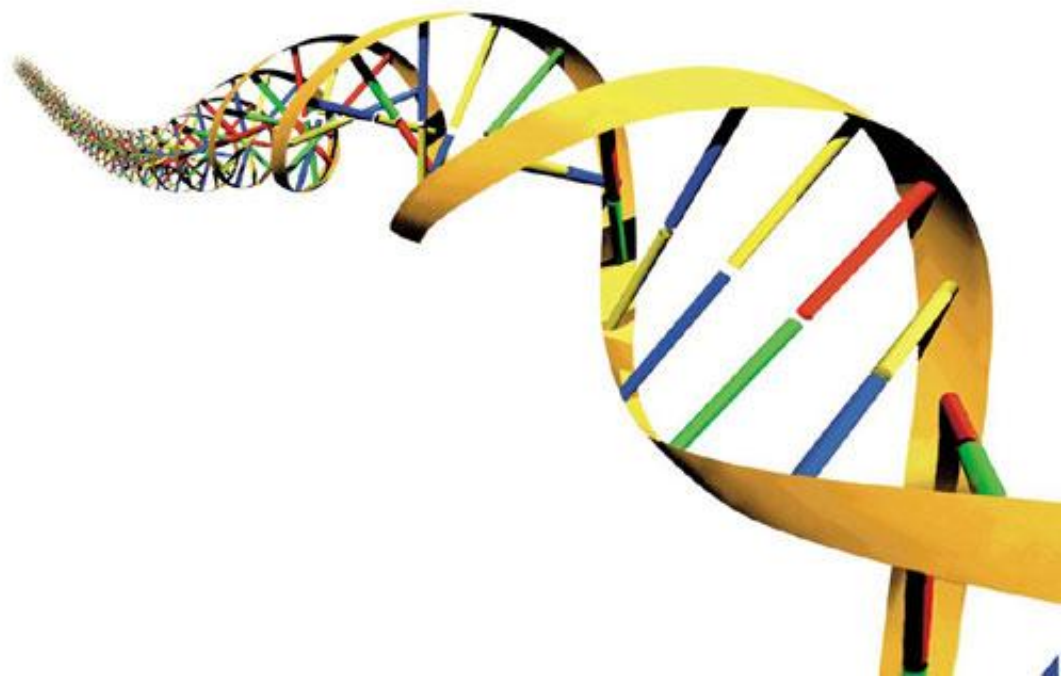

生醫工程實驗期中報告

第四組
李徹重 陳隆彥 朱君元

基因定序

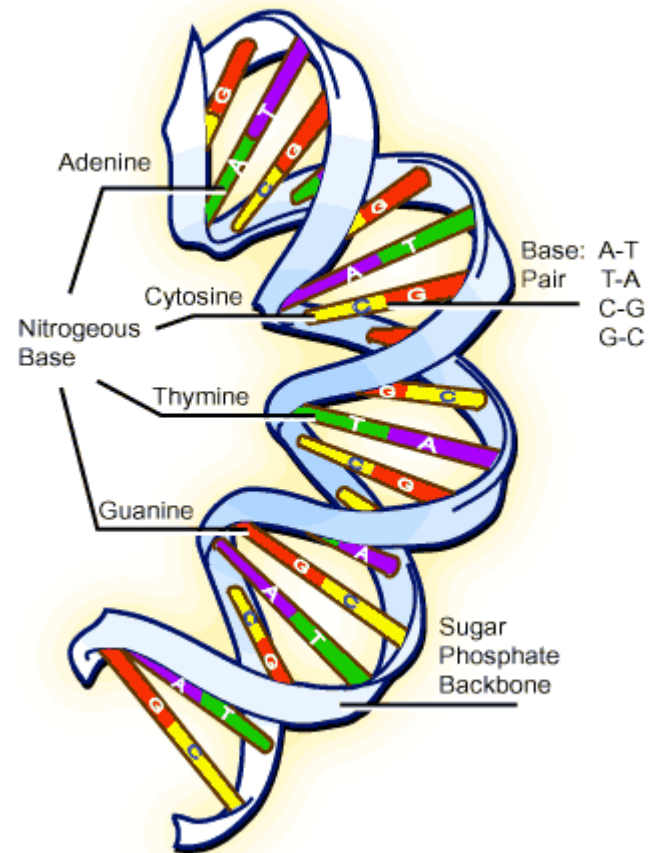
- 什麼是基因定序
- 基因定序的用途
- 基因定序的三步驟

- Cracker



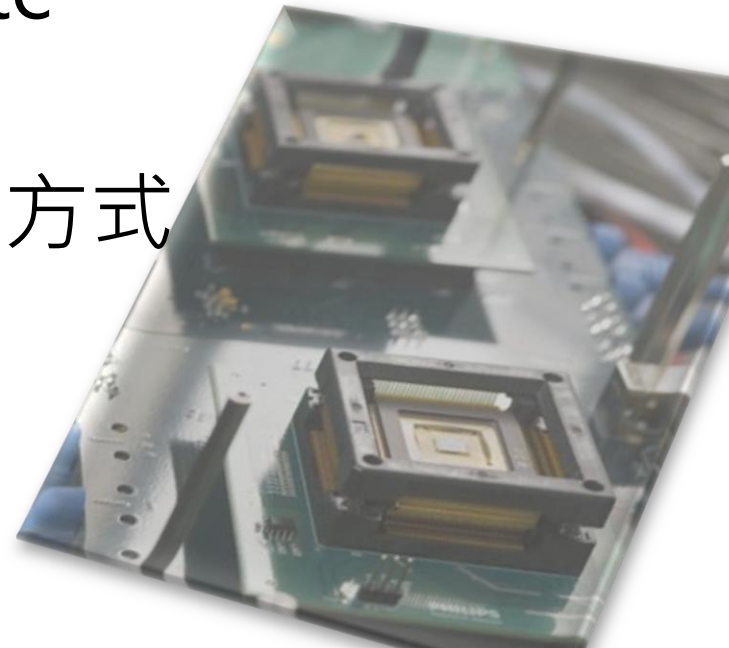
什麼是基因定序？

- 染色體 → DNA → 鹼基對
- 基因
- 基因定序



基因定序的用途？

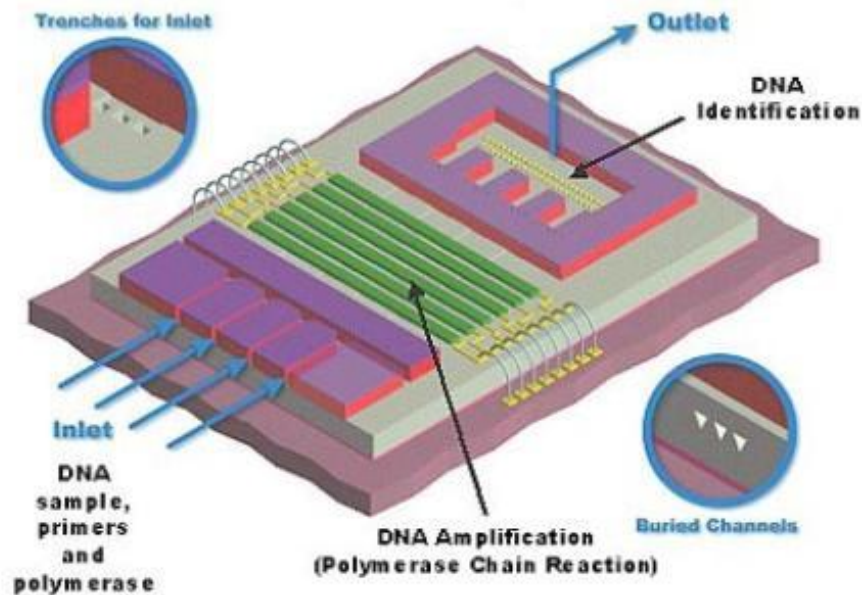
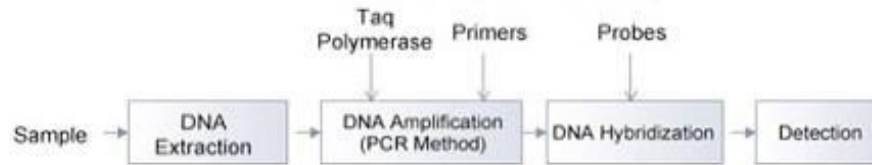
- 了解生命藍圖
- 鑑別可能發生的疾病
- 找出重大疾病的基因
心臟病,糖尿病...etc
- 標靶藥物的研發
- 以基因觀點的治療方式



基因定序的步驟

Lab-on-a-chip and PCR

Lab-on-chip Concept



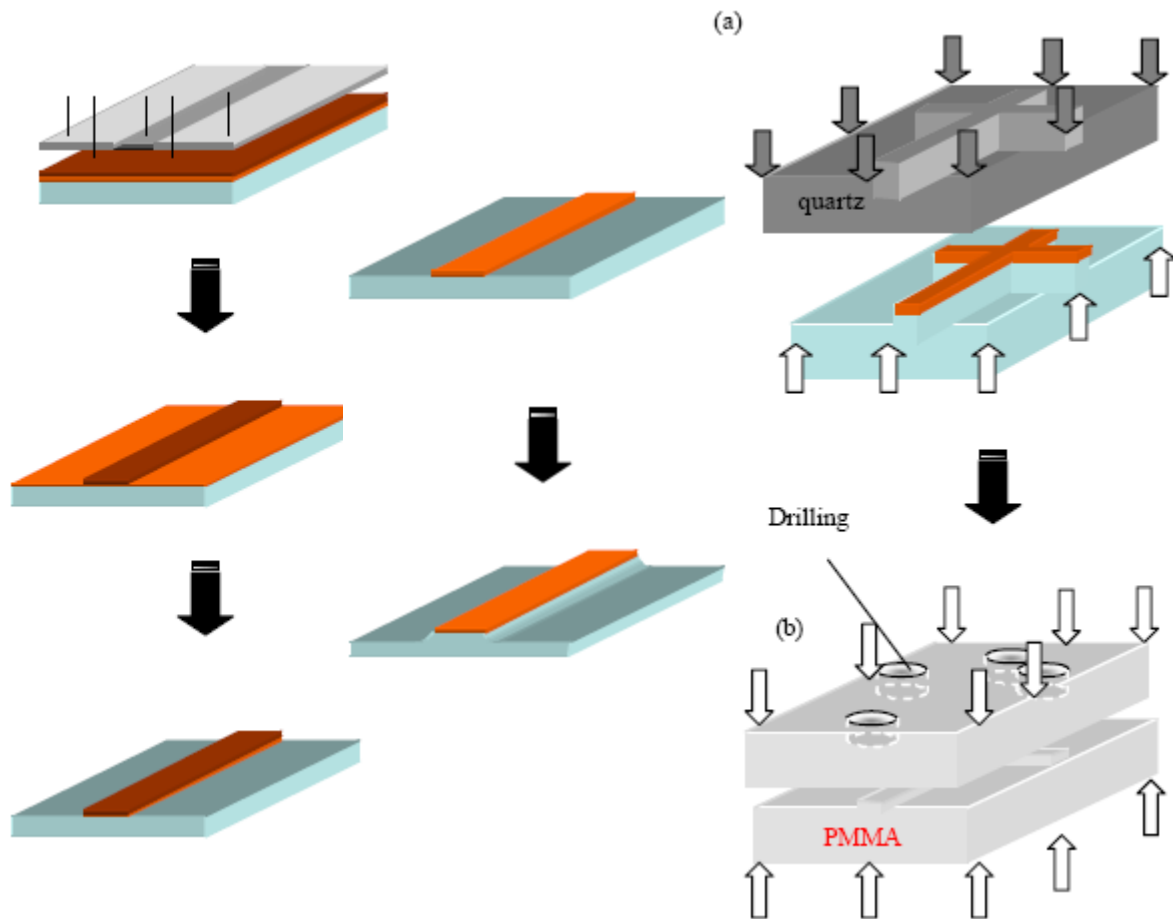
- **Continuously flowing sample**
 - well-defined temperature controlled zones
- **Pattern of chip**
 - determines the relative time sample is exposed to each temperature zone
- **Multiple channel**

膠體電泳

- 電場大小
- 電性多寡VS遷移速度
- DNA的質量/電量比
- 膠體 (多孔)
- 速度問題

毛細管電泳 電泳晶片

- 十字型
- 聚合物材質
PMMA
- 微機電
- 單一光罩

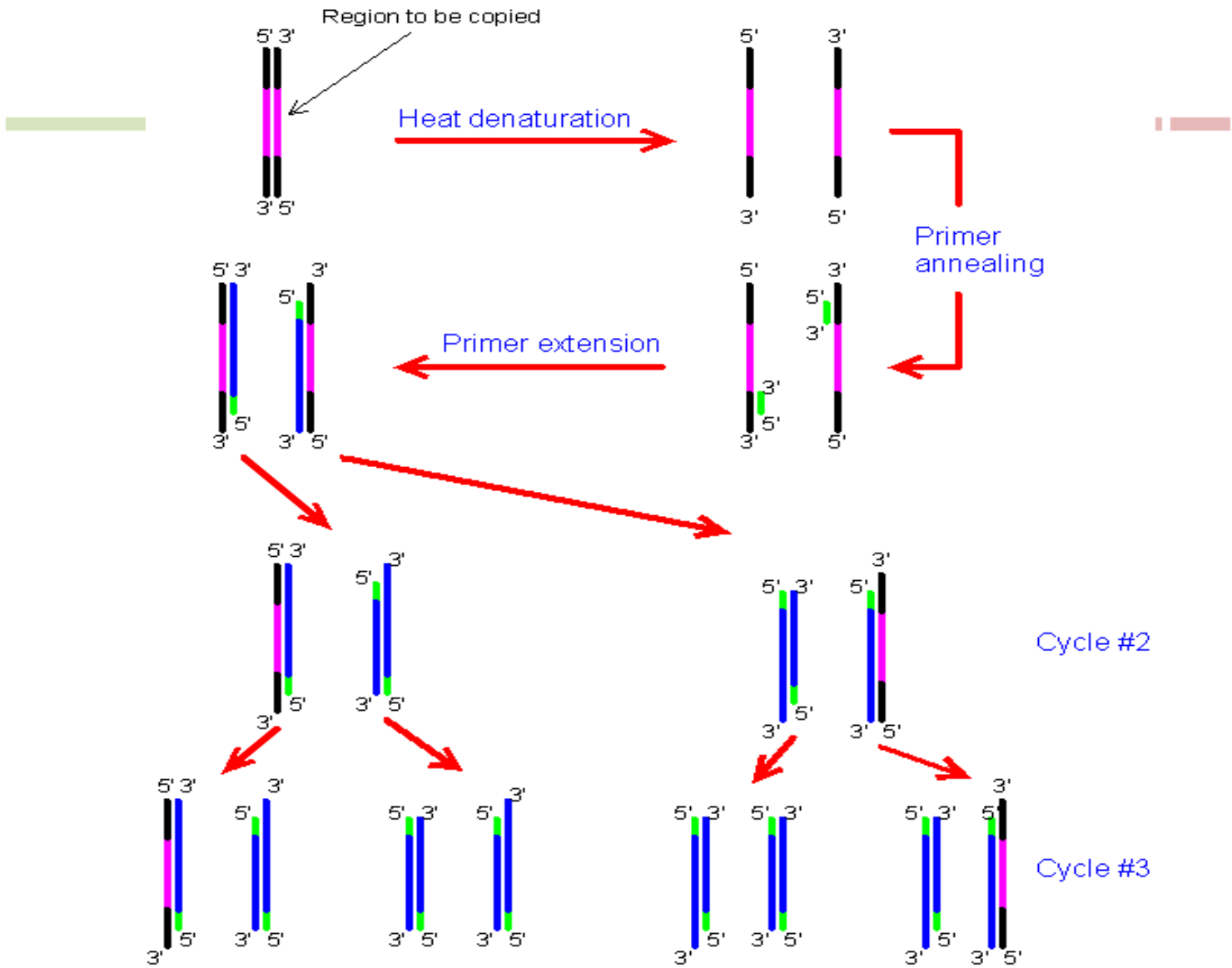




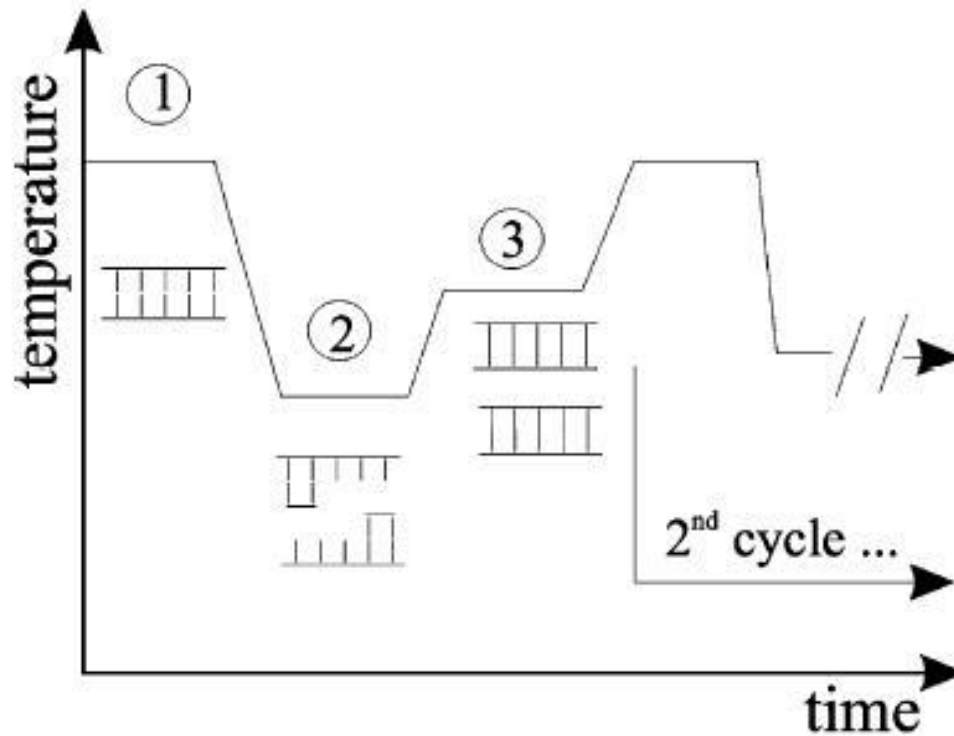
PCR

PCR Chip

- Polymerase chain reaction
- 1. Heat denaturation
- 2. Primer annealing(引子鍊合)
- (Primer 爲一對寡核甘酸小片)
- 3. Primer extension(引子延伸作用)

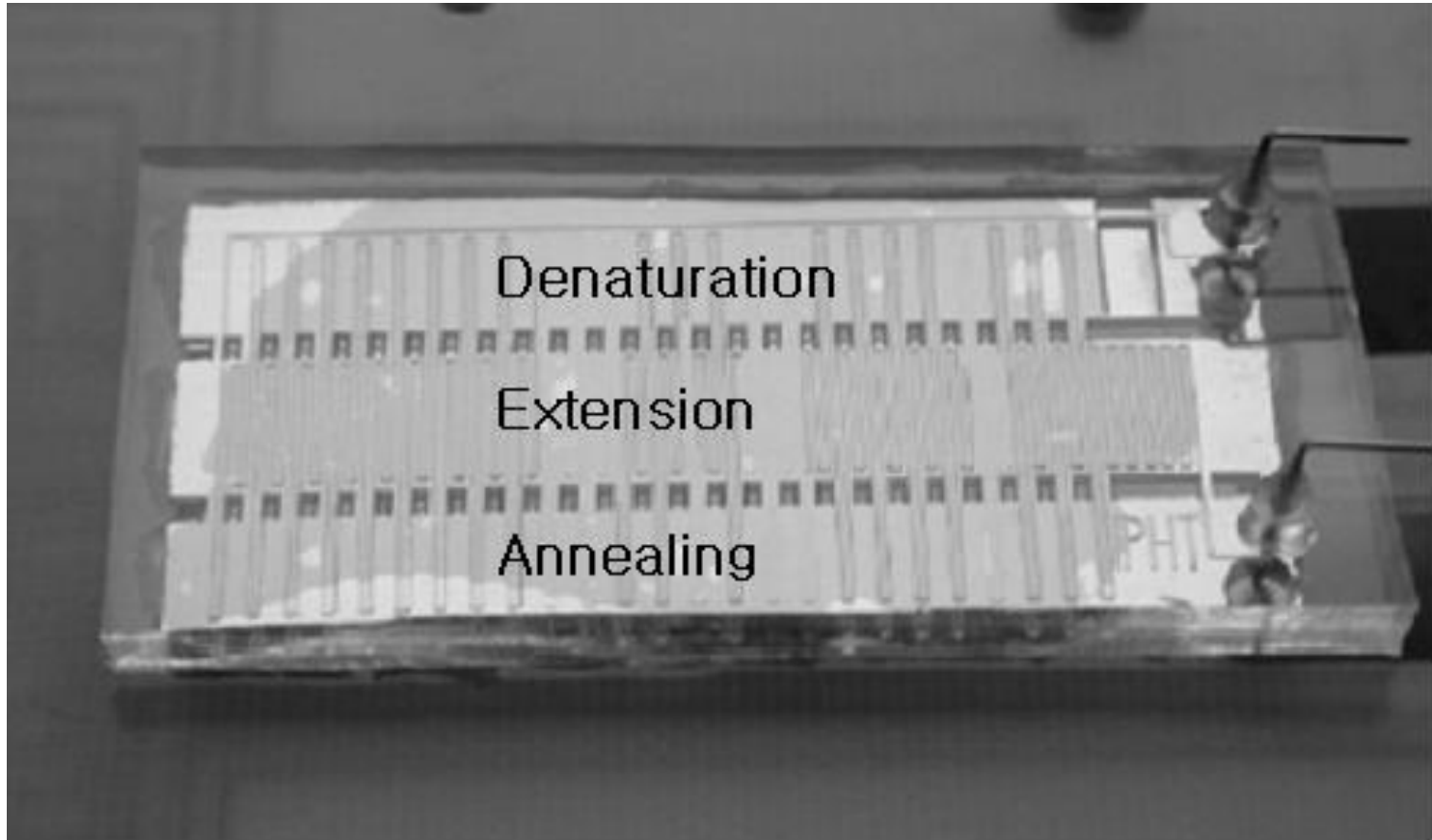


PCR Chip



- 1 - denaturation
- 2 - primer annealing
- 3 - primer extension

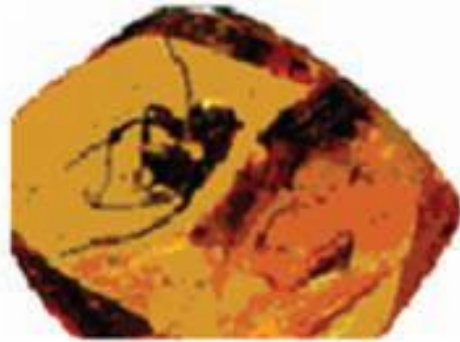
PCR Chip



PCR Chip

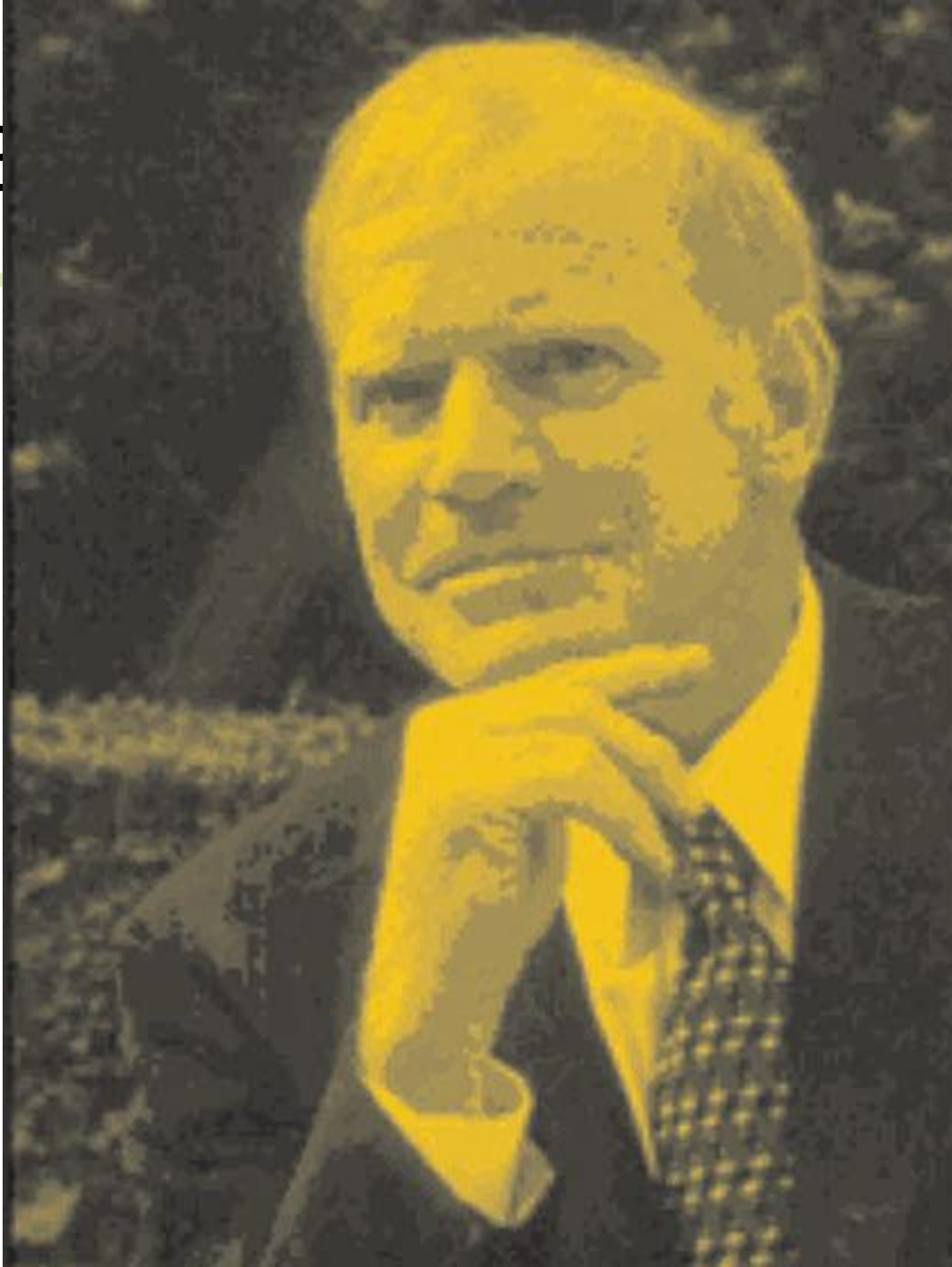
- PCR在生物科技上的用途相當廣泛，如應用在醫學、遺傳學、藥物設計上等，許多病毒和細菌的傳染是靠PCR 方法診斷出來的。

PCR Chip

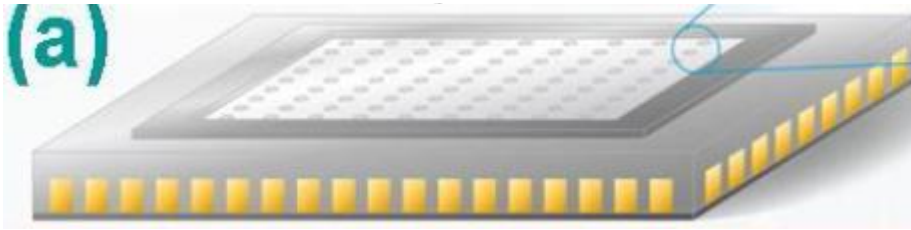


Kary E

Mullis



Cracker's TECHNOLOGY : sTOP

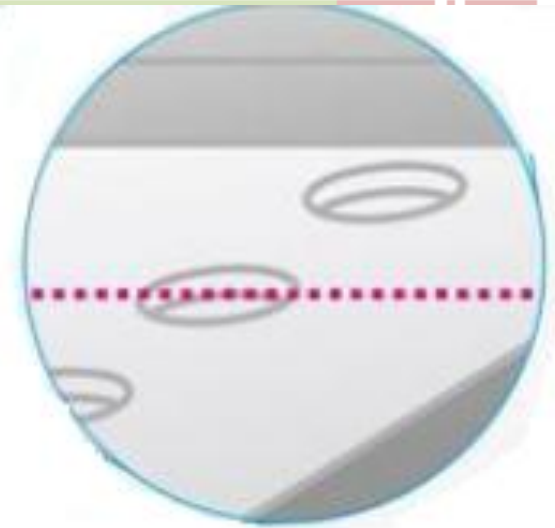


Genomic DNA will be sequenced by a fluorescent method in tiny wells on a composite chip, each chip spanning up to a million of reaction sites.

每個Chip的大小大概是 one square inch
A three-tiered chip.

Nanowell

1. The diameter at bottom is one hundred nanometers or less.
2. The total volume excitable by the surrounding light source is below 0.001 cubic micrometers.
3. The very confined space is subject to a light of very high intensity ($1\text{kW}/\text{cm}^2$).

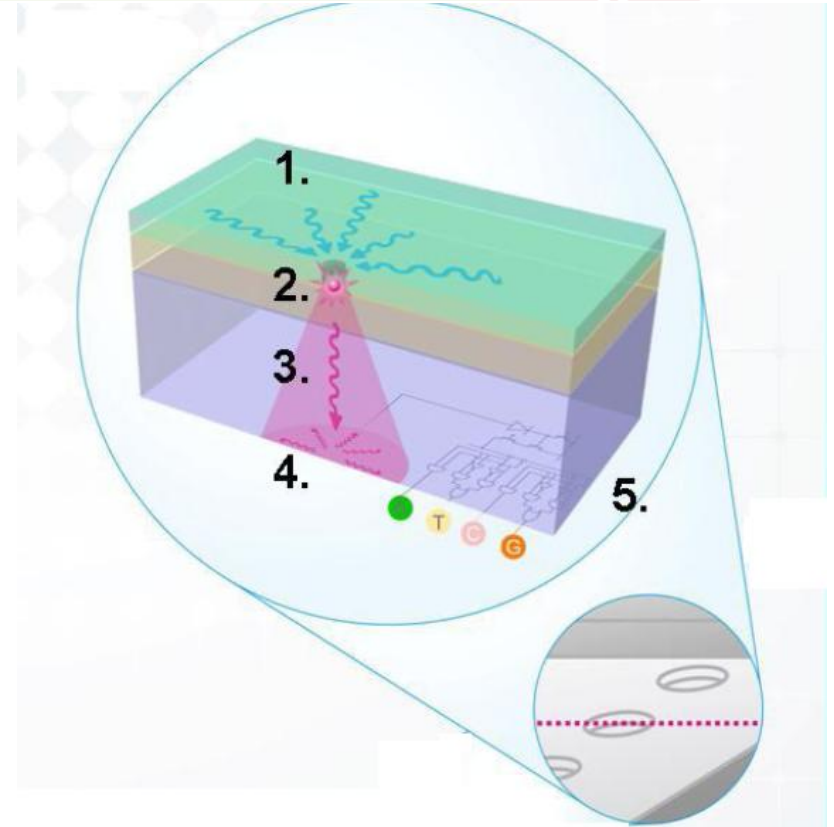


sTOP

Three tiers:

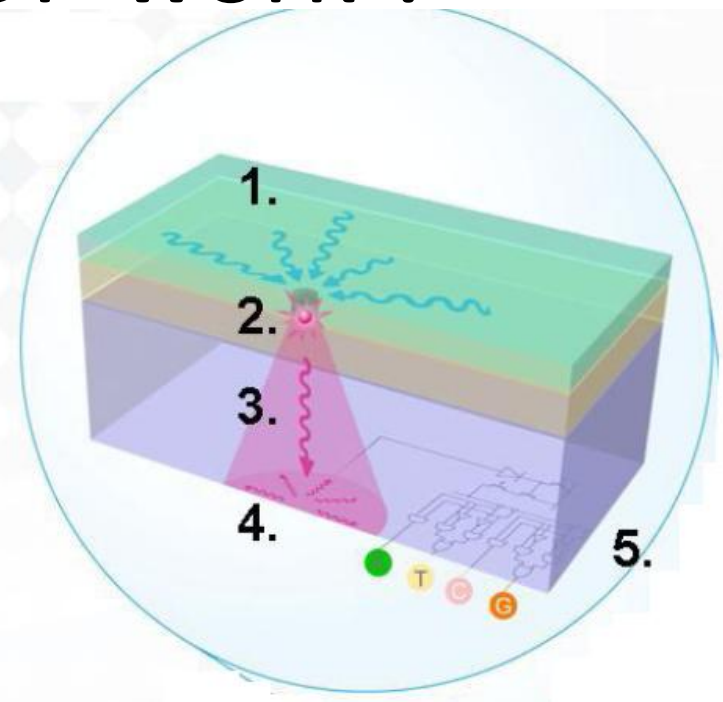
1. The light-emitting tier (green)
2. The filtering tier (orange)
3. The photo-sensing one (blue)

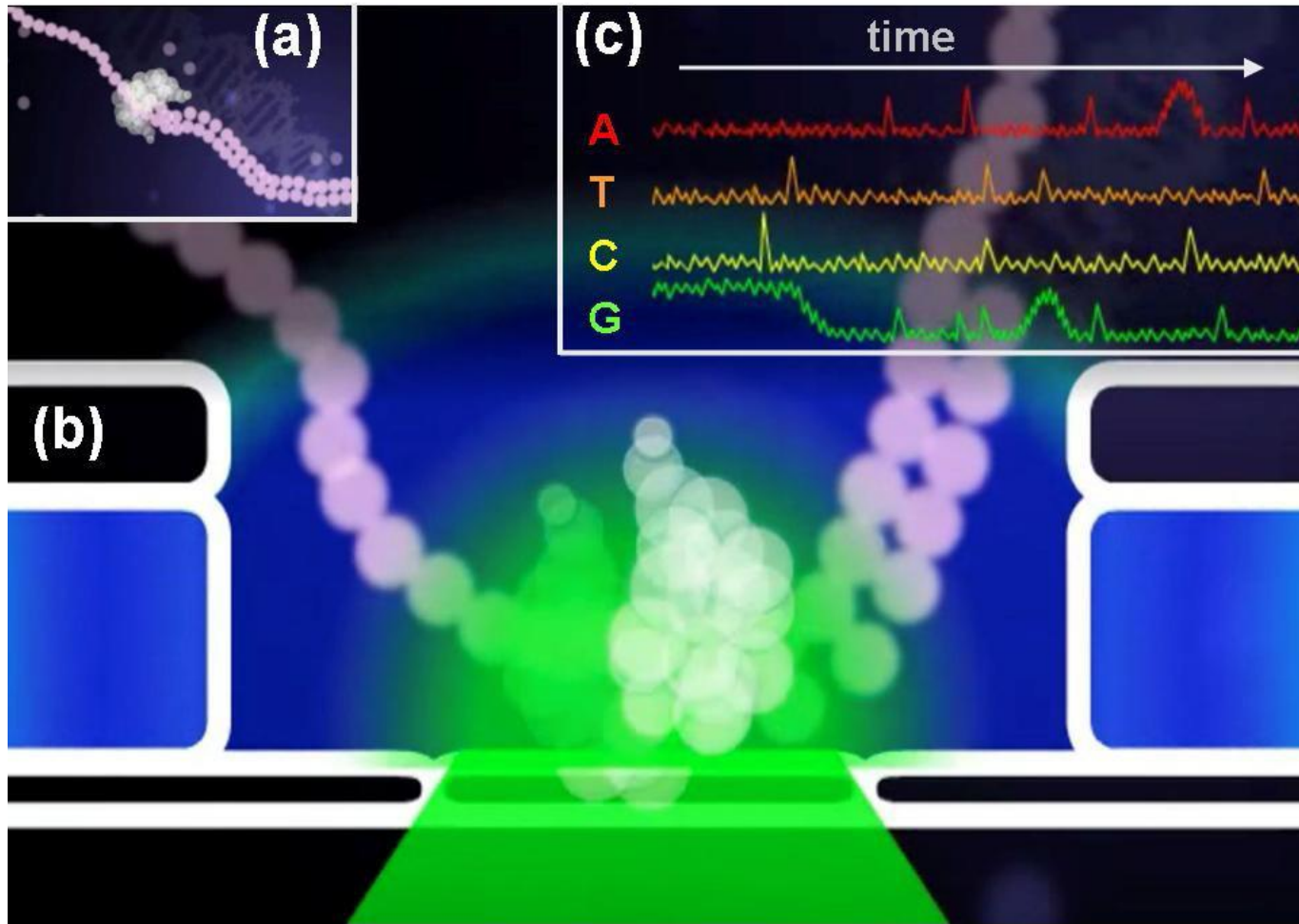
A nanowell is embedded in the top tier surrounded by a light source.



How does sTOP work ?

- Five steps
- 1. and 2. the sides of the nanowell emanates light at particular wavelength, which excites fluorescently labeled reagents present in the well
- 3. The emitted light is transmitted and filtered through the ca. 2-micrometer-thick filter tier.
- 4. Converting into electric signal
- by a specially designed photodiode underneath.
- 5. The electric signal is in turn
- handled by integrated circuits adjacent to each diode, and transformed into a digital format suitable for further informatics analyses





Each nucleotide carrying a different fluorescent tag.

DNA 序列分析

- 兩種主要的演算法
- 1. Blast (**B**asic **L**ocal **A**lignment **S**earch **T**ool)
- 有做些許的估計 較有效率
- 2. Smith waterman
- 一個一個比對，準確性高但效率較低

$$H = \begin{pmatrix} - & A & C & A & C & A & C & T & A \\ - & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 \\ A & 0 & 2 & 1 & 2 & 1 & 2 & 1 & 0 & 2 \\ G & 0 & 1 & 1 & 1 & 1 & 1 & 1 & 0 & 1 \\ C & 0 & 0 & 3 & 2 & 3 & 2 & 3 & 2 & 1 \\ A & 0 & 2 & 2 & 5 & 4 & 5 & 4 & 3 & 4 \\ C & 0 & 1 & 4 & 4 & 7 & 6 & 7 & 6 & 5 \\ A & 0 & 2 & 3 & 6 & 6 & 9 & 8 & 7 & 8 \\ C & 0 & 1 & 4 & 5 & 8 & 8 & 11 & 10 & 9 \\ A & 0 & 2 & 3 & 6 & 7 & 10 & 10 & 10 & 12 \end{pmatrix}$$

Q & A

