

種豬基因選種

黃木秋教授

104年度種豬品質提升研討會暨 表揚績優種豬場頒獎典禮

種豬基因選種

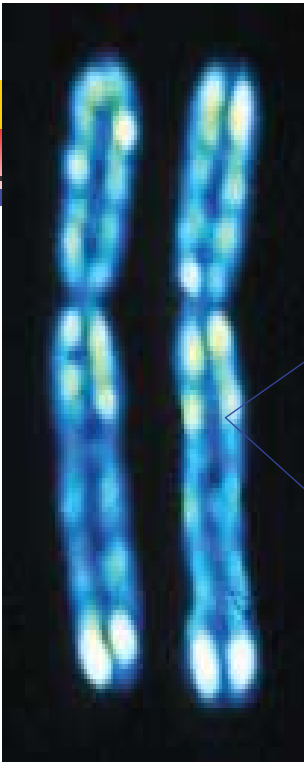
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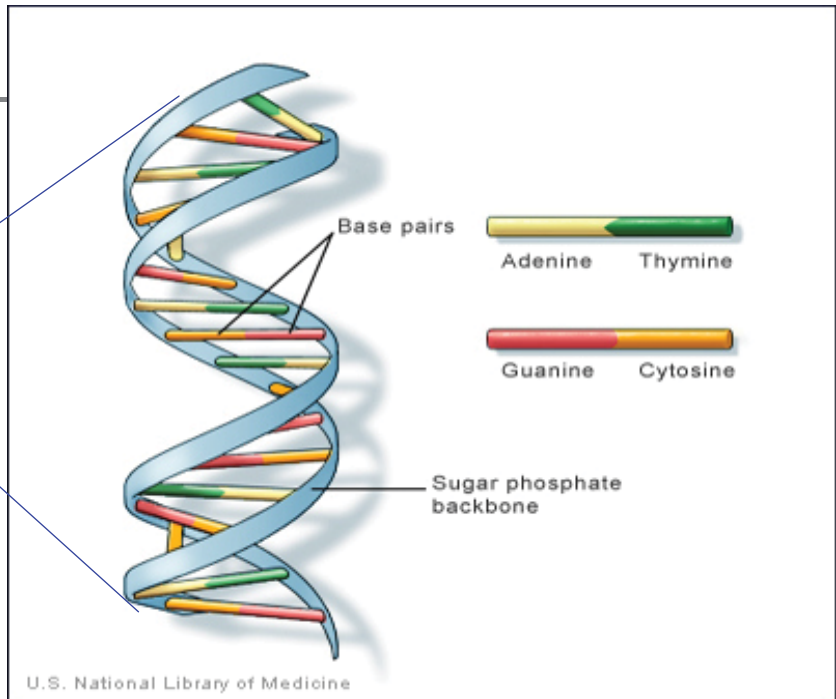
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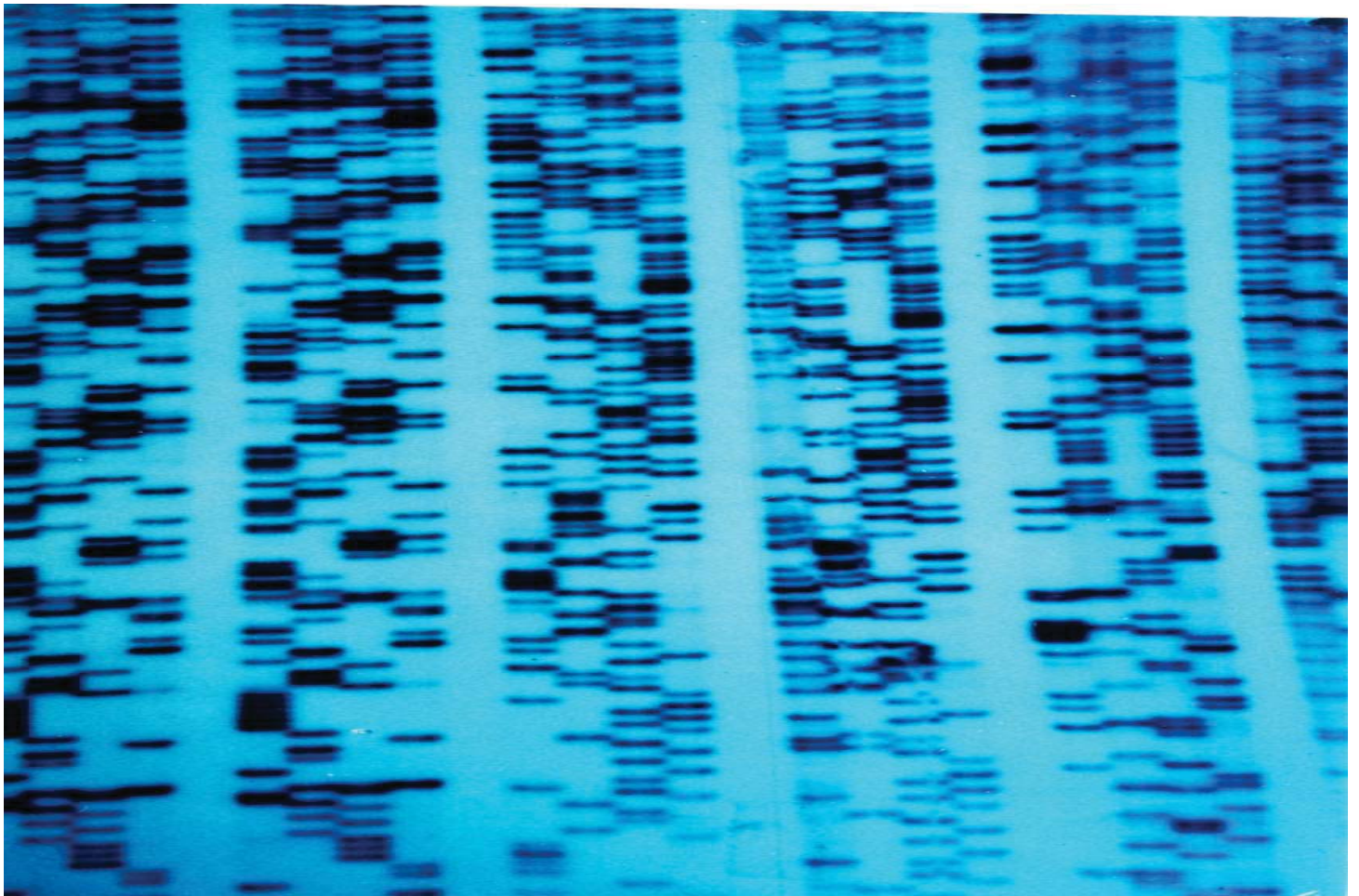
DNA



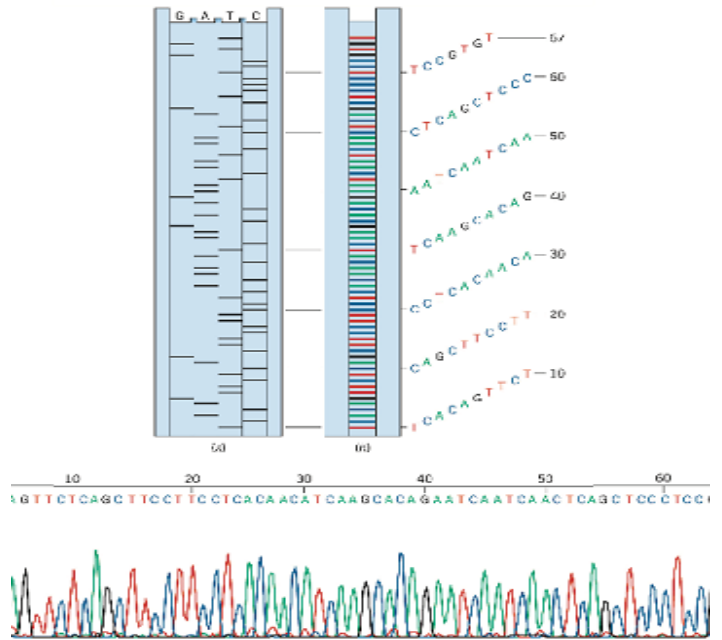
染色體



http://www.core.org.cn/NR/rdonlyres/Biology/7-A12Fall-2005/D4134A30-F348-4615-8B0A-DOCB5ED86081/0/chp_dna.jpg



DNA序列分析



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基因標記



■ 「標記」Marker?
少年仔放尿會過山
老人放尿滴腳盤
是少年仔與老人之「年歲標記」

■ 身長腰落一骨拉夾 班段做

■ 高挑致癌—以100cm為基準，每增10cm，男增10%，女增18% (試樣:550萬人)
(E. Benyi, 瑞典 Karolinska Institute. 2015-10-1. 歐洲兒科內分泌學會)

■ 應用: DNA標記 → 基因選種

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老年的標記

坐咧就哈戲
倒咧困抹去
見講講過去
現講現忘記

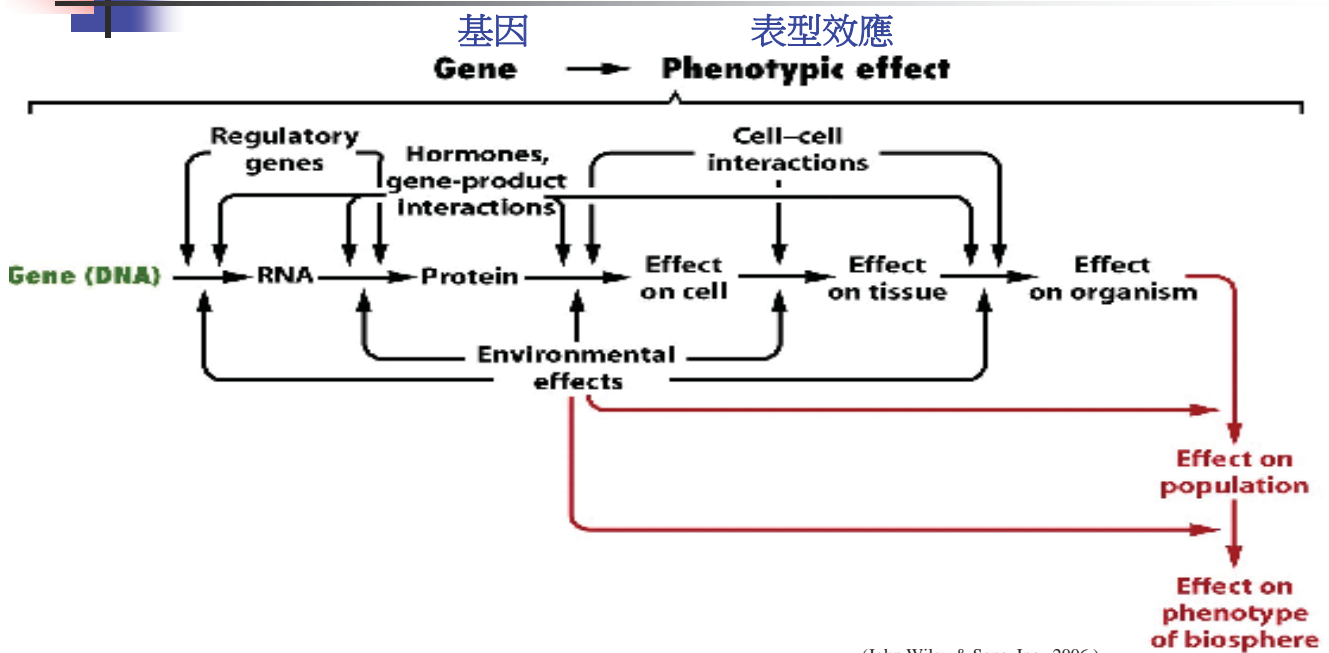
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太也安呢？

基因在操控

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基因控制表型



(John Wiley & Sons, Inc., 2006)

The central dogma

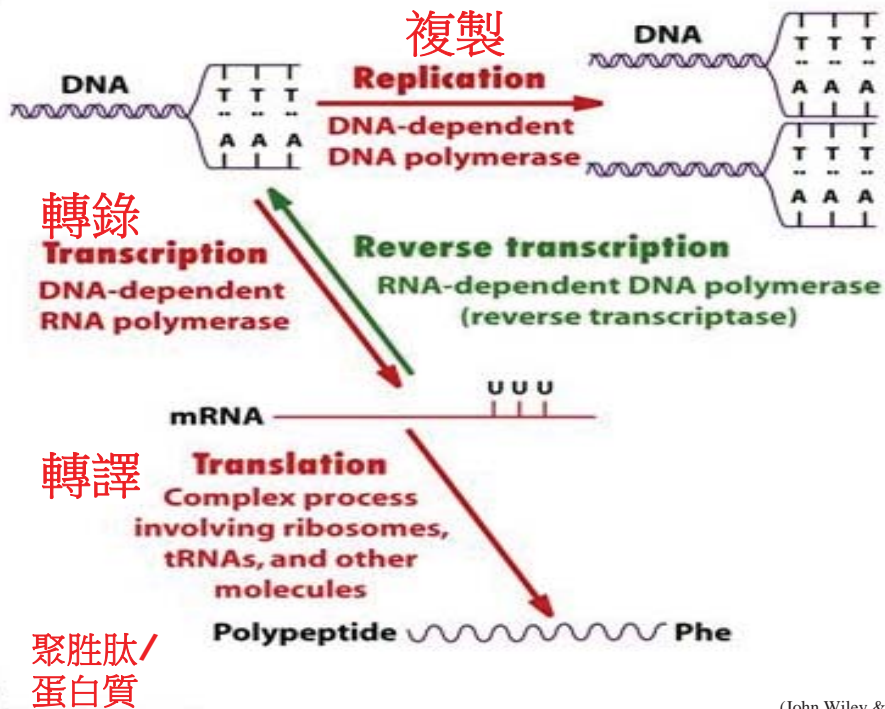
Flow of genetic information:

1. Perpetuation of genetic information from generation to generation

基因表現
控制表型

2. Control of the phenotype:

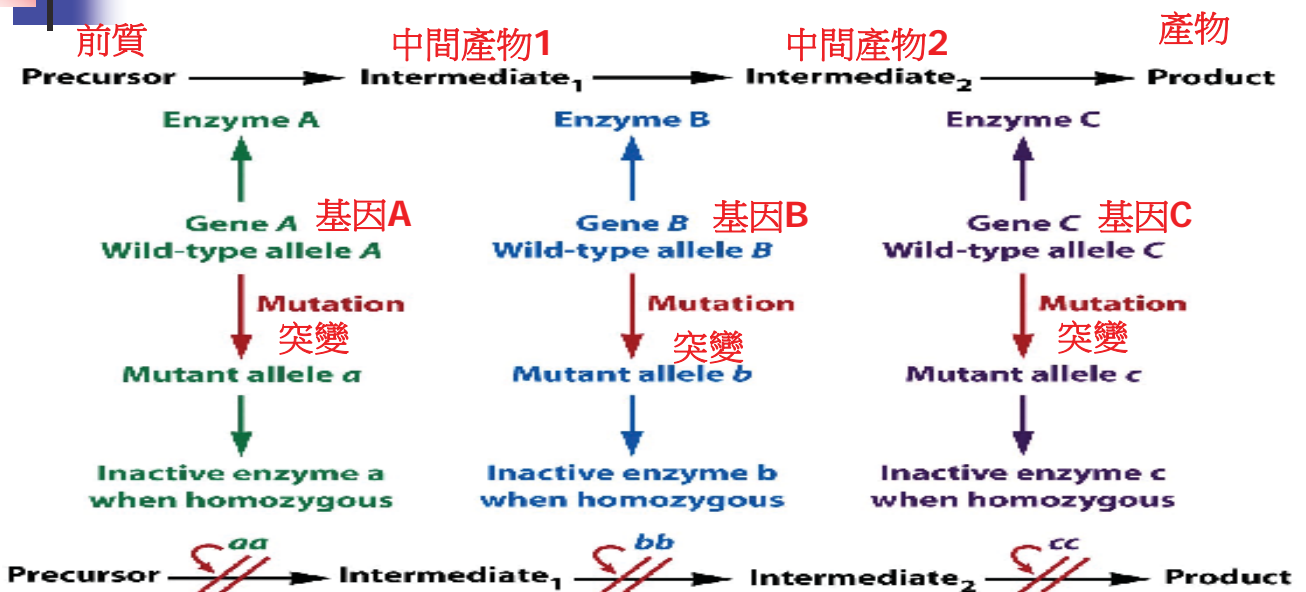
Gene expression



(John Wiley & Sons, Inc., 2006)

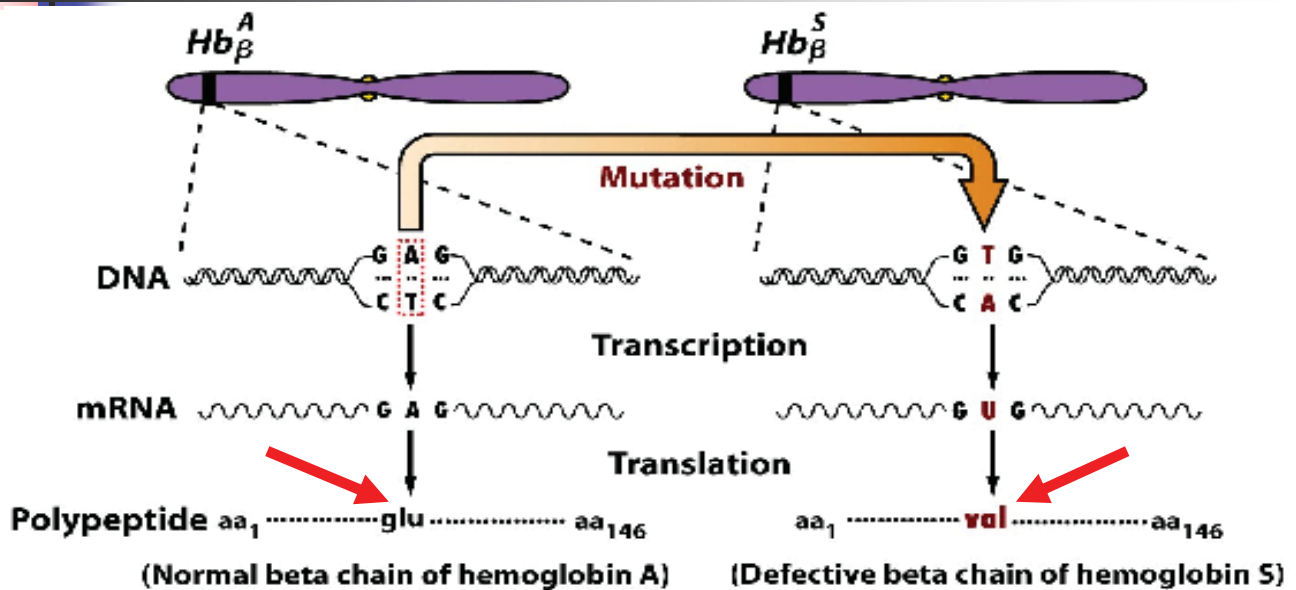
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多對基因控制同一表型



(John Wiley & Sons, Inc., 2006)

突變造成基因產物之改變



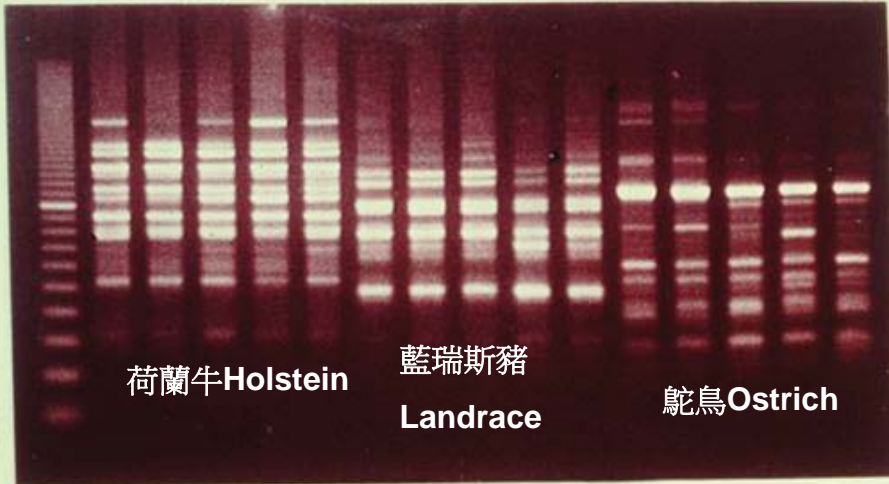
(John Wiley & Sons, Inc., 2006)

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與DNA共舞數十載

- DNA指紋技術
- 遺傳工程技術
- 基因改造技術
- 基因選種技術

1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16



1. 100 bp ladder marker 2. H1 3. H2 4. H3
5. H4 6. H5 7. L1 8. L2 9. L3 10. L4
11. L5 12. O1 13. O2 14. O3 15. O4 16.
O5 H: Holstein cattle L: Landrace O: Ostrich

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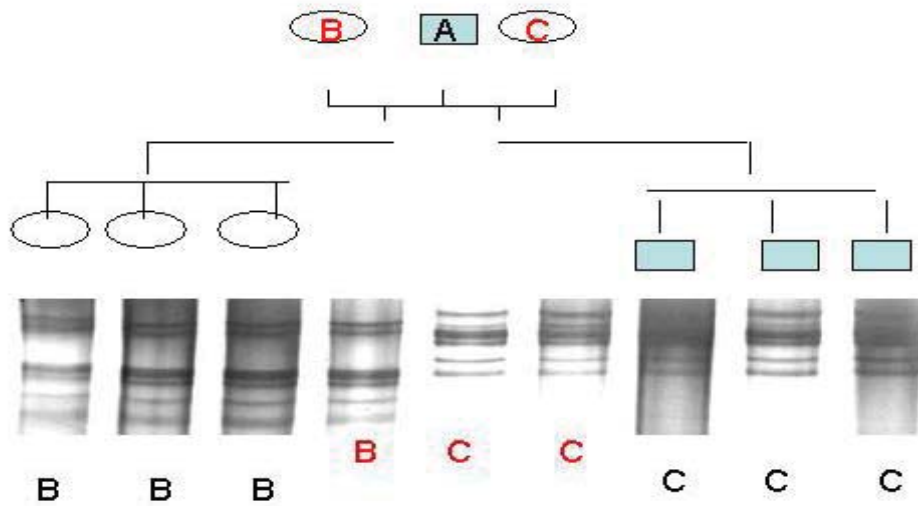
一個優良之鑑定方法

An excellent method for detection

一 操作簡易 **Simplicity**

二 快速 **Up to speed**

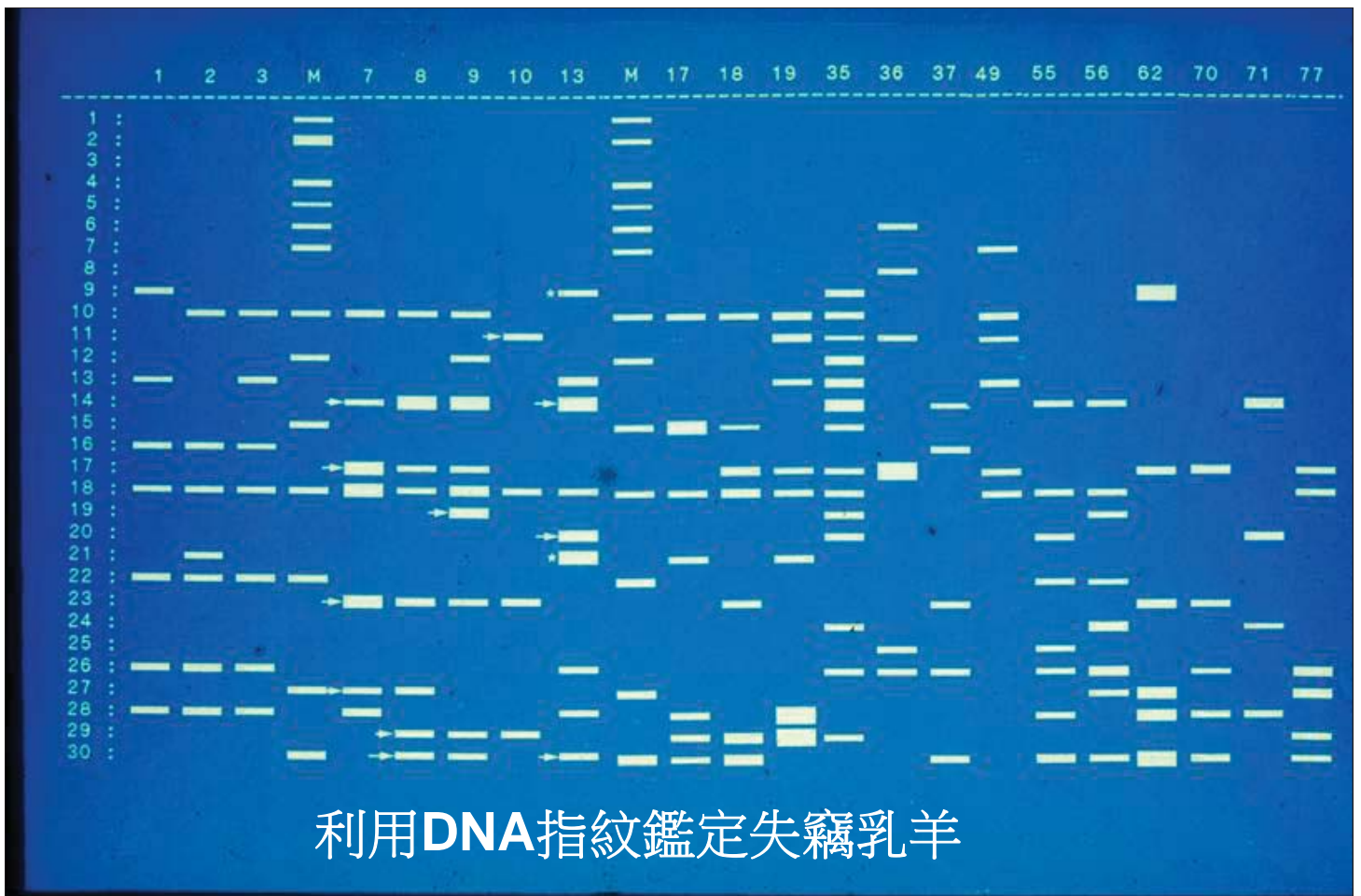
三 準確 **Accuracy**



用SSCP指紋進行豬之親子鑑定

Paternity testing by SSCP fingerprinting in pigs

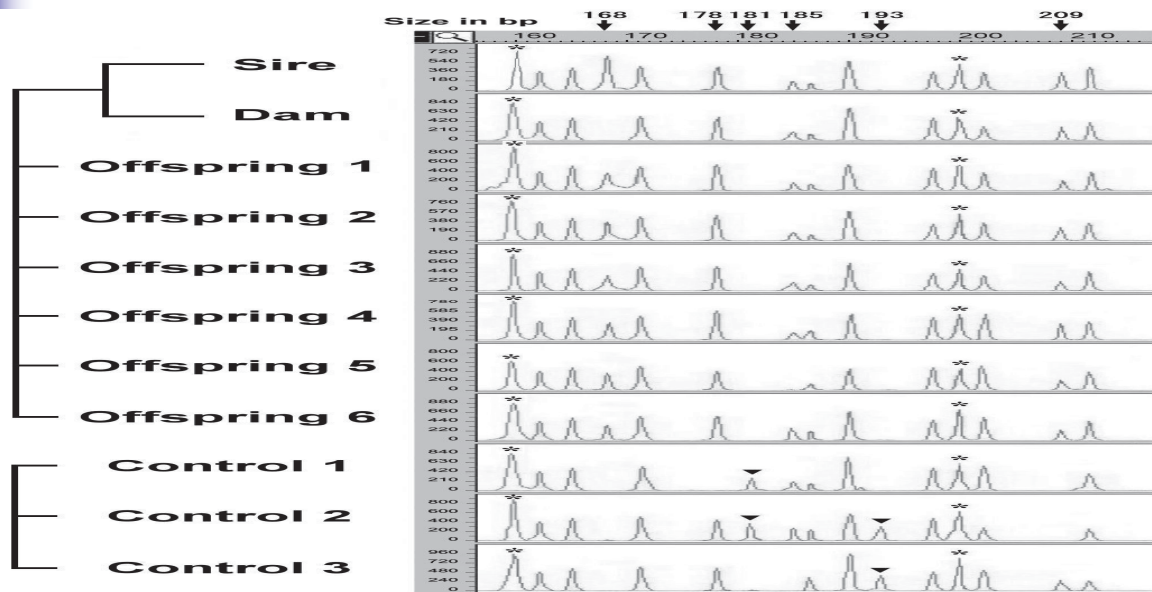
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利用DNA指紋鑑定失竊乳羊

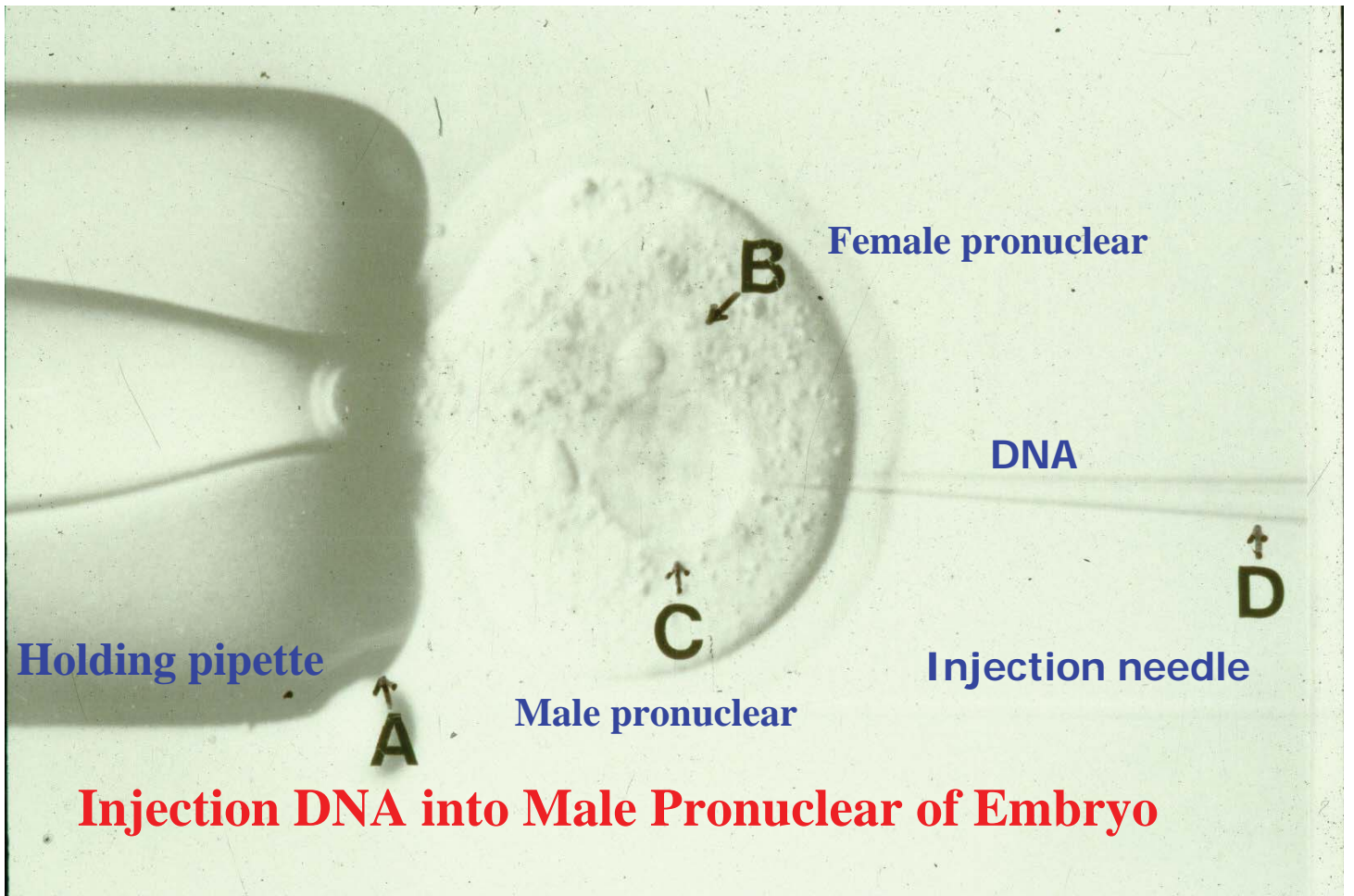
AFLP指紋用於親子鑑定

AFLP for paternity testing

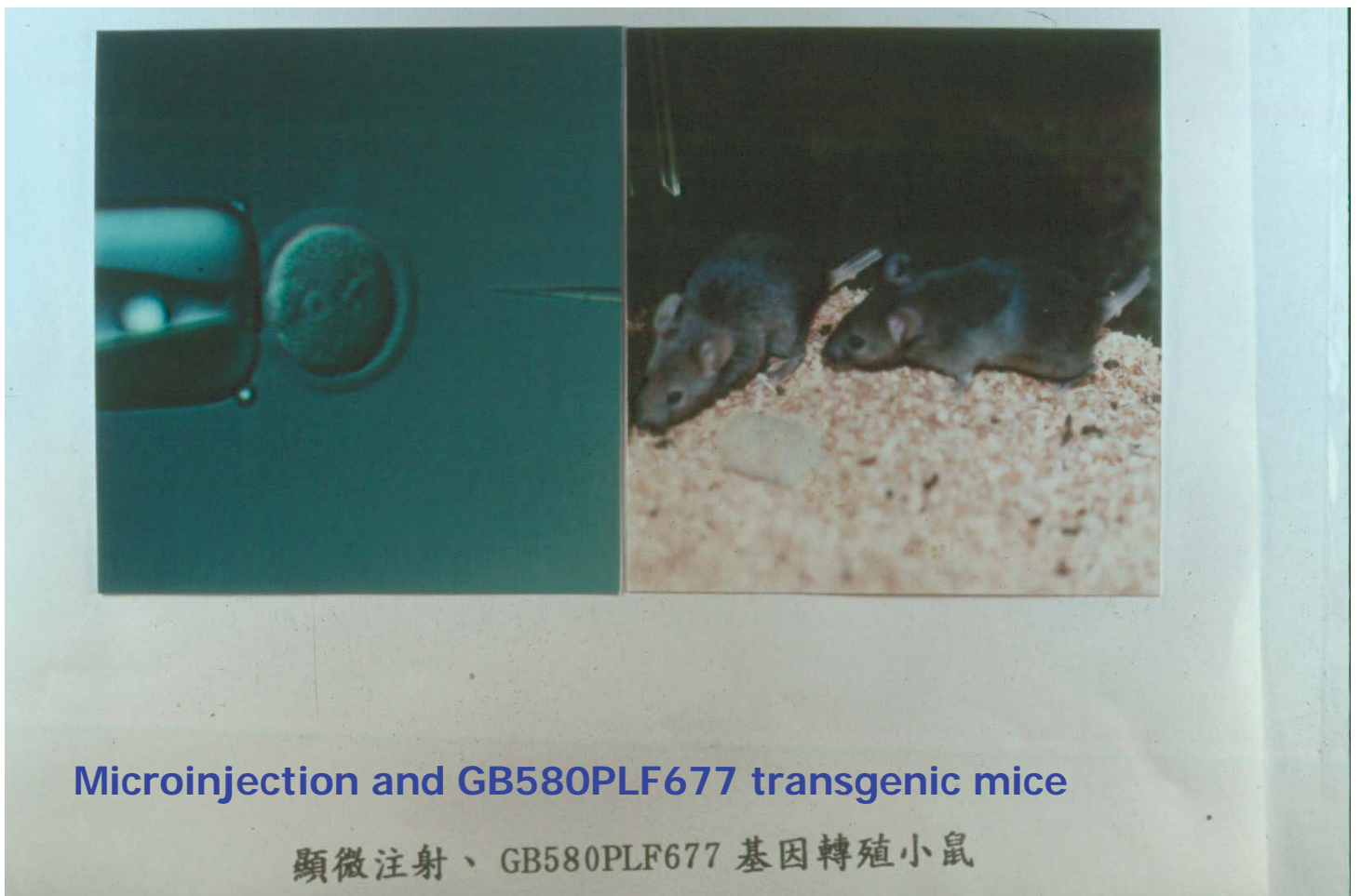


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基因選種
非基因改造



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GMO corn causes cancer study (Seralini et al., 2012)

Study linking GM maize to rat tumours was withdrawn by the publisher



1. In November 2013, Food and Chemical Toxicology (FCT), **retracted Seralini's paper** after the authors refused to withdraw it. [https://en.wikipedia.org/wiki/S%C3%A9ralini_affair]
2. **Republished study** : Environmental Sciences Europe 2014, 26:14 doi:10.1186/s12302-014-0014-5

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育種是畜產的火車頭

種畜講究的是種原，擁有優良的種原，就好像擁有源源不絕的金脈。

表型由遺傳與環境共同決定

◆ 動物的遺傳改良

遺傳因子 (G)

環境因子 (E)

表型 (P)

$$P = G + E$$

$$\sigma^2_P = \sigma^2_G + \sigma^2_E + 2 \text{Cov GE}$$

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種豬選拔三字經

A. 外貌

B. 能力

C. 血統



種豬改良四維

- A. 種豬登錄
- B. 種豬檢定
- C. 核心豬場
- D. 豬場評鑑

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基因標記輔助
選種

基因鑑定 培育運動高手



■ 英國倫敦大學發現運動基因

UK---Discovery of the Genes in sports

■ 澳洲鑑定運動員肌肉與心臟心臟強弱
篩選培育運動高手

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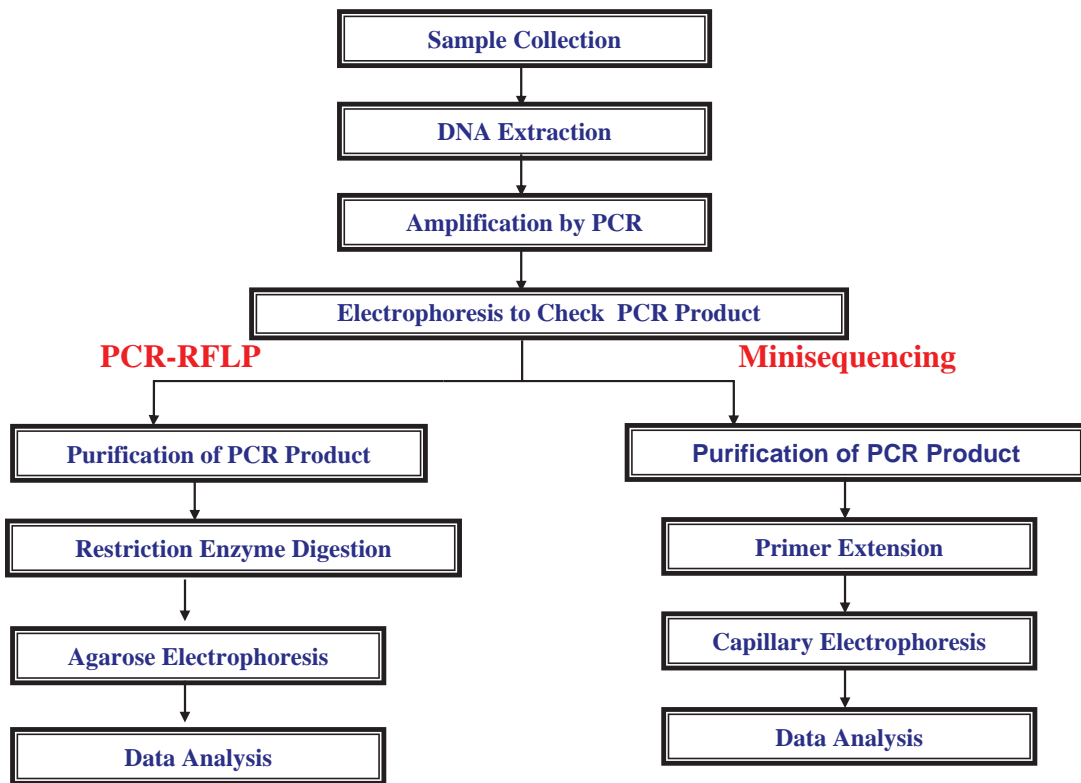
★ 豬隻重要經濟性狀

■ 肉質性狀

■ 繁殖性狀

■ 生長性狀

■ 抗病性狀



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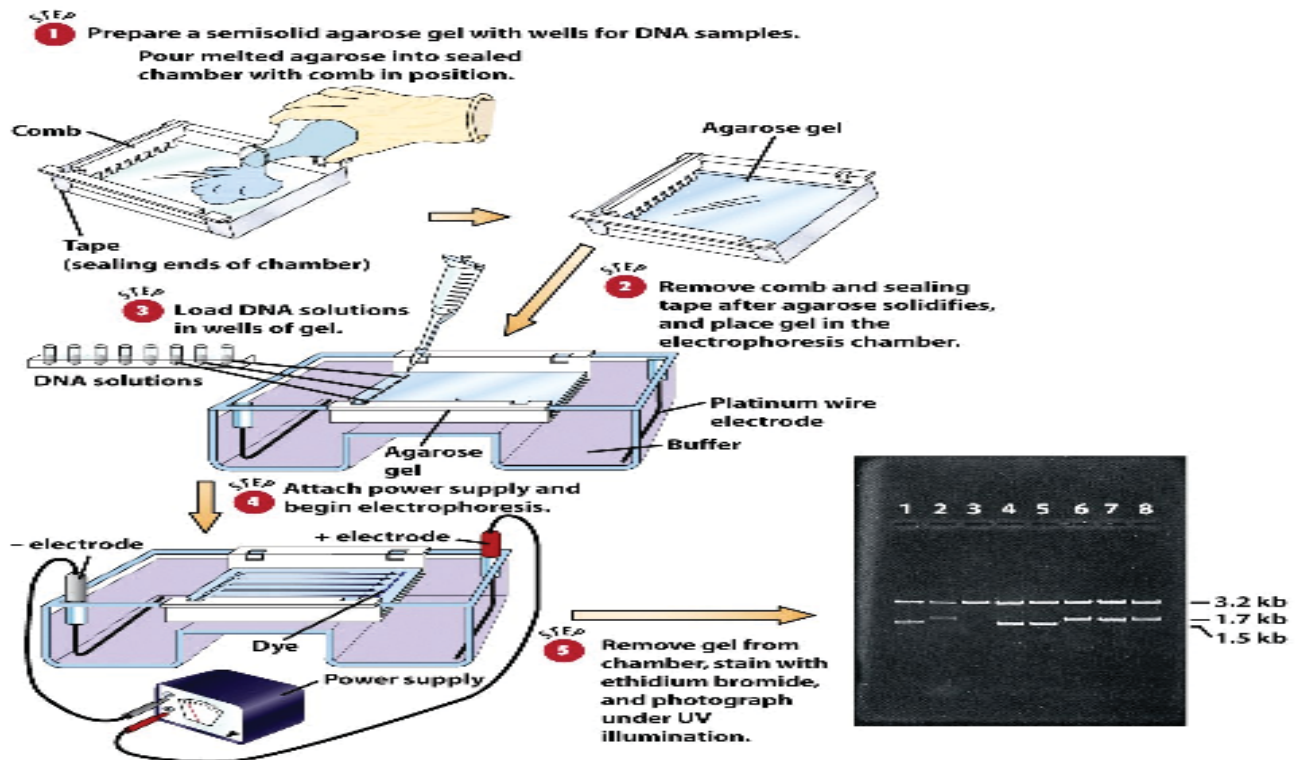


利用高速磨碎機將組織磨碎供DNA萃取用

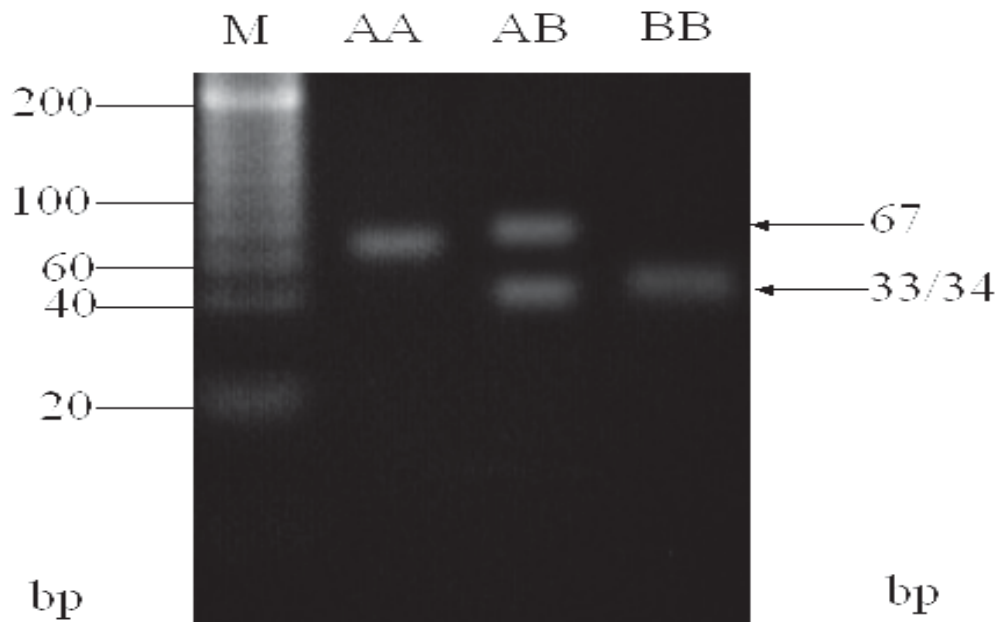


利用聚合酶連鎖反應大量擴增DNA分子

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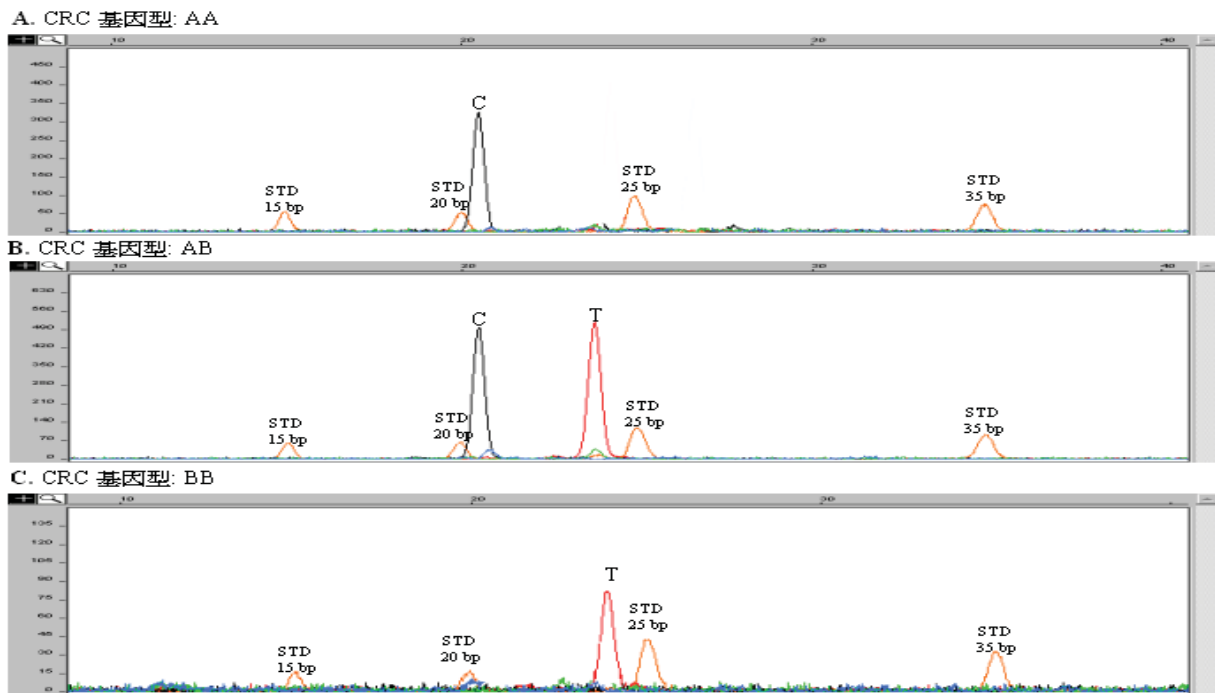


DNA電泳



以PCR-RFLP分析豬CRC基因型

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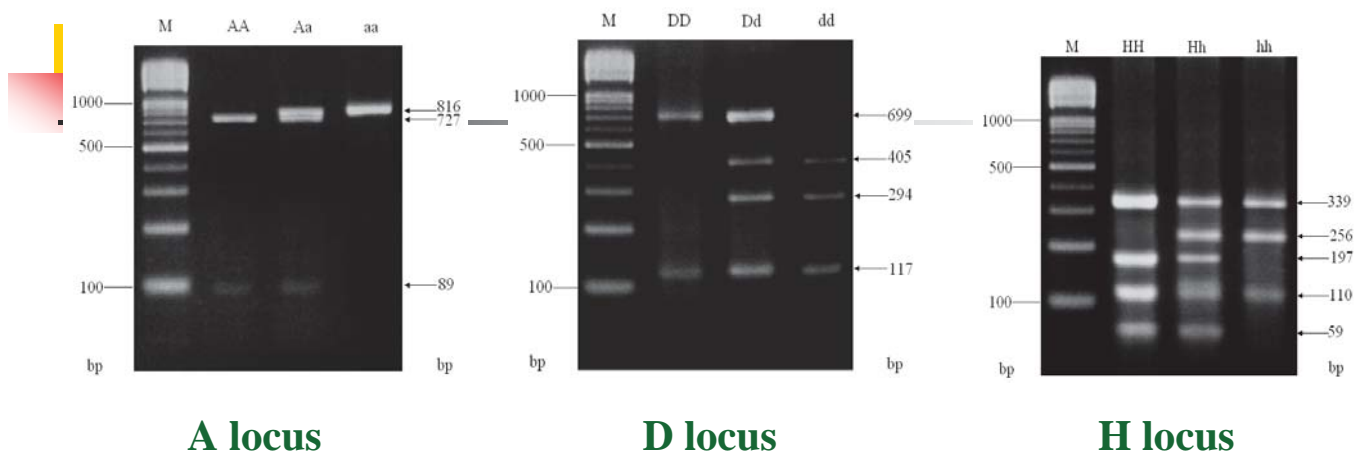
以微定序法分析豬CRC基因型

豬HFABP

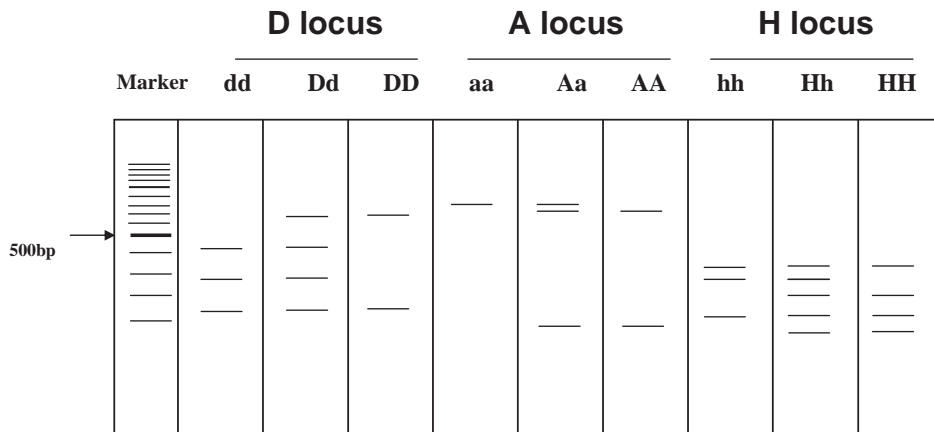
Heart fatty acid binding protein

基因型歸類	基因型
HH-6	ddaaHH
HL-5	ddaaHh , ddAaHH , DdaaHH
HL-4	ddaa hh , ddAAHH , DDaaHH , DdAaHH , DdaaHh , ddAaHh
HL-3	ddAa hh , Ddaa hh , ddAAHh , DdAAHH , DDaaHh , DDAaHH , DdAaHh
LL-2	ddAAhh , DDaahh , DDAaHH , DdAa hh , DdAAHh , DDAaHh
LL-1	DdAAhh , DDAa hh , DDAaHh
LL-0	DDAAhh

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PCR-RFLP分析豬H-FABP基因型

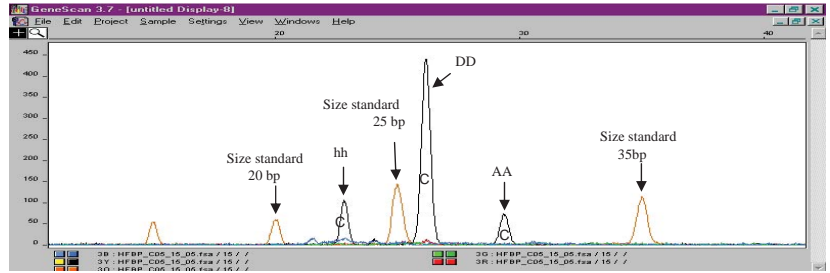


PCR-RFLP分析豬H-FABP基因型示意圖

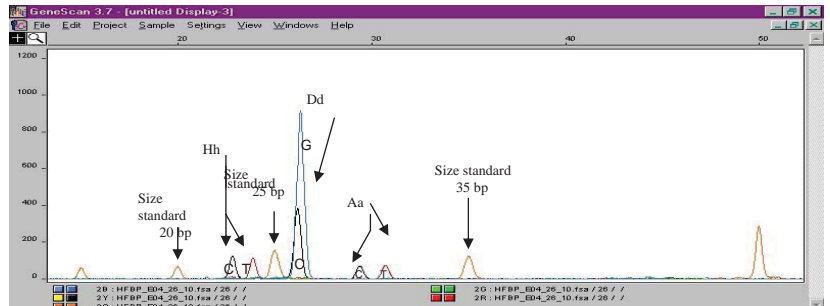
39



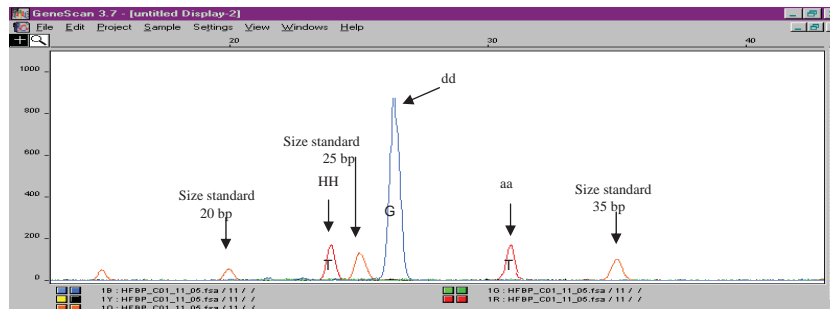
基因型組合為
hhDDAA



基因型組合為
HhDdAa



基因型組合為
HHddaa

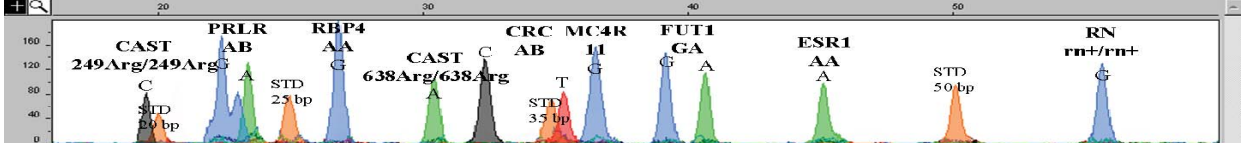


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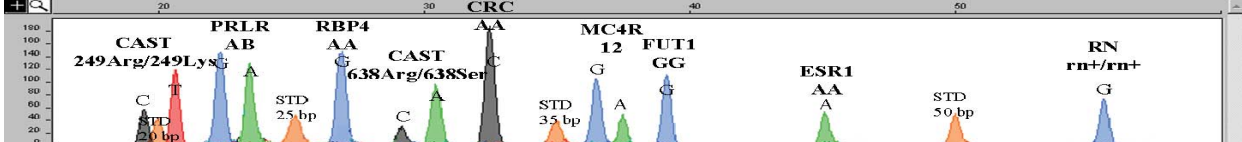
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Genotyping of CAST249, PRLR, RBP4, CAST638, CRC, MC4R, FUT1, ESR1, and RN genes in pigs

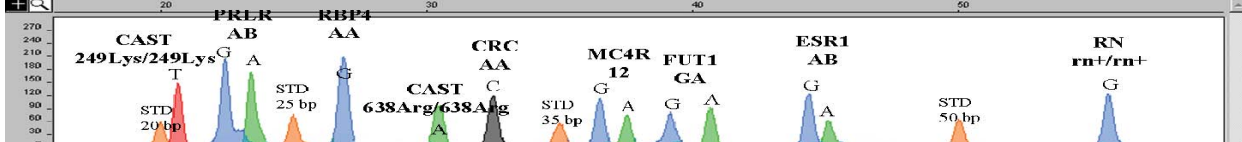
(1) Genotype : CAST-249Arg/249Arg, PRLR-AB, RBP4-AA, CAST-638Arg/638Arg, CRC-AB, MC4R-11, FUT1-GA, ESR1-AA, RN-rn+/rn+



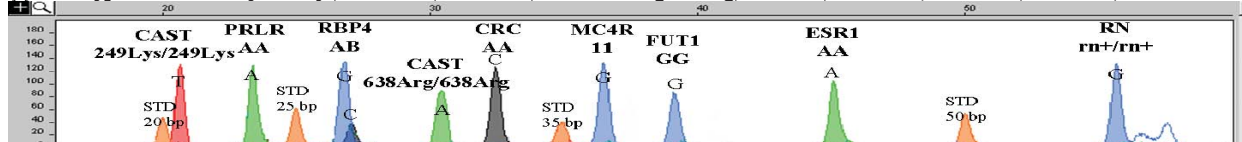
(2) Genotype : CAST-249Arg/249Lys, PRLR-AB, RBP4-AA, CAST-638Arg/638Ser, CRC-AA, MC4R-12, FUT1-GG, ESR1-AA, RN-rn+/rn+



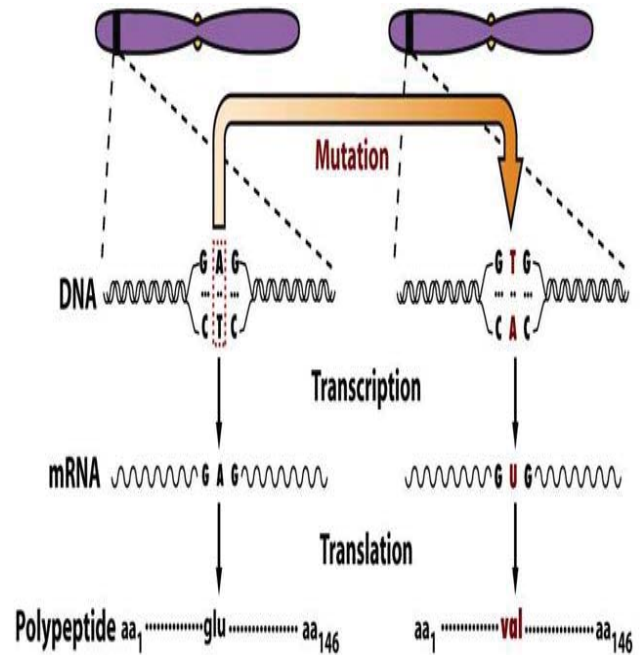
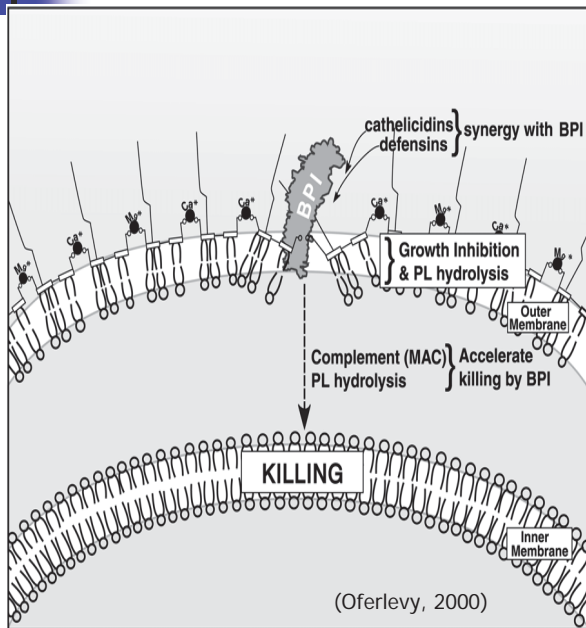
(3) Genotype : CAST-249Lys/249Lys, PRLR-AB, RBP4-AA, CAST-638Arg/638Arg, CRC-AA, MC4R-12, FUT1-GA, ESR1-AB, RN-rn+/rn+



(4) Genotype : CAST-249Lys/249Lys, PRLR-AA, RBP4-AB, CAST-638Arg/638Arg, CRC-AA, MC4R-11, FUT1-GG, ESR1-AA, RN-rn+/rn+



抗病育種的原理



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仔豬餵食感染大腸桿菌後下痢與FUT1基因型的關聯性

基因型	下痢檢查		合計
	+	-	
GG/GA	10	4	14
AA	1	16	17
Total	11	20	31

(Frydendahl *et al.*, 2003)

仔豬飼養至斷乳時生病或死亡頭數與FUT1基因型的關聯性

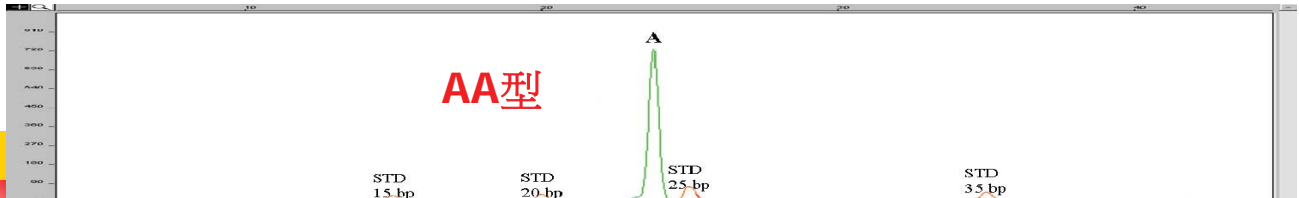
基因型	生病或死亡頭數	百分比 (%)
GG	178	71
GA	67	26
AA	7	3
Total	252	100

*FUT1 (alpha-1-fucosyltransferase)

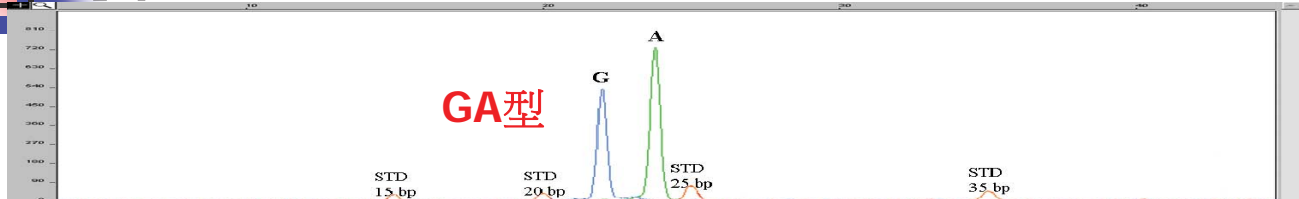
(Kim *et al.*, 2013)

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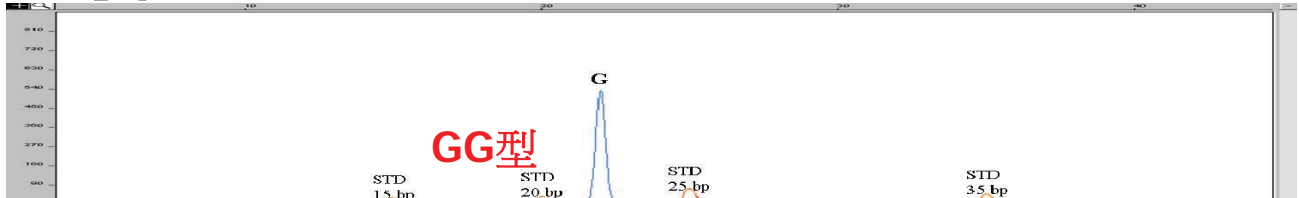
A. FUT1基因型:AA



B. FUT1基因型:GA



C. FUT1基因型:GG



台灣豬隻FUT1基因型檢測

(Huang *et al.*, 2007)

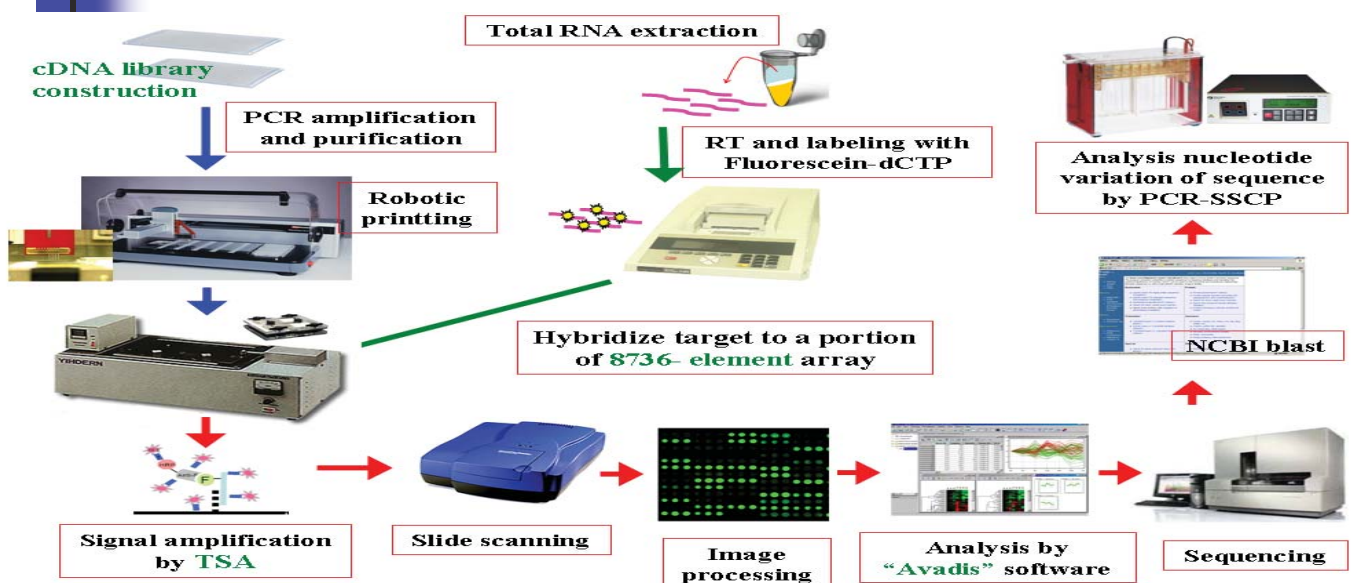
台灣豬隻FUT1基因型分布

品 種	檢測頭數	基因型及分布(%)		
		AA	GA	GG
杜洛克	151	2.0	29.8	68.2
藍瑞斯	67	1.5	32.8	65.7
黑豬	334	1.5	16.8	81.7

(Huang et al., 2007)

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新基因選種標記之開發



Single Nucleotide Polymorphisms

1. Non-coding region

2. Coding region

- Doesn't result in an amino acid change
- Results in an amino acid change

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單核苷酸多態性

SNP (Single nucleotide polymorphisms)

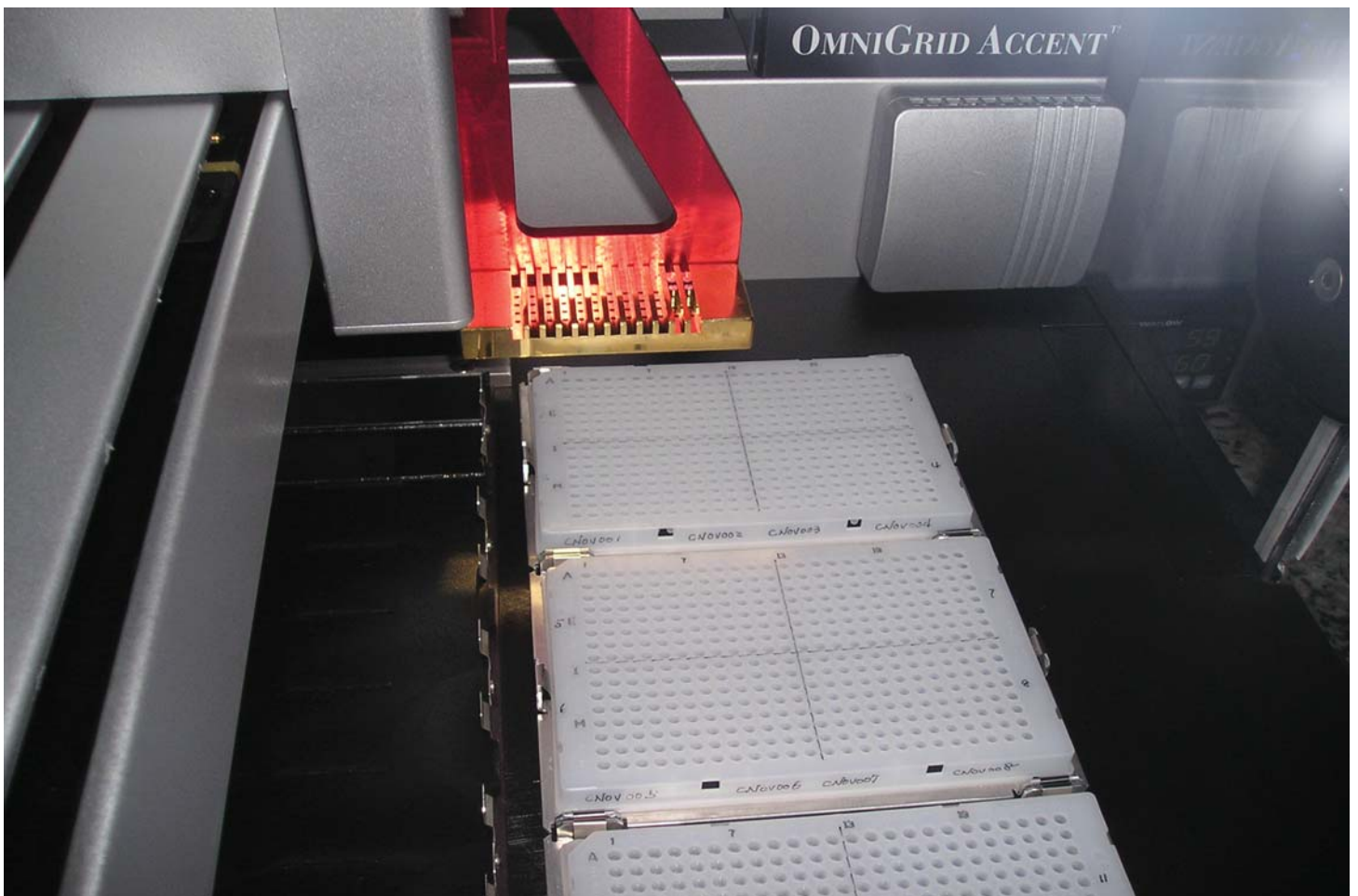
- ◆ SNP為基因碼上單一鹼基對變異。在人類基因組裡，大約每1000個鹼基中會有一個鹼基發生變異 (Cooper *et al.*, 1985)。
- ◆ SNPs出現在編碼基因上，可改變蛋白質的結構與功能；若出現在非編碼區，則可操控基因的表現。
- ◆ 依據鹼基變異的形式可分為transition和transversion，前者是指一個嘌呤改變成另一個嘌呤 (A \longleftrightarrow G) 或是一個嘧啶改變成另一個嘧啶 (C \longleftrightarrow T)，後者是指嘌呤改變成嘧啶 (A或G \longleftrightarrow C或T)，但單一鹼基的插入或缺失也亦歸類為SNP。

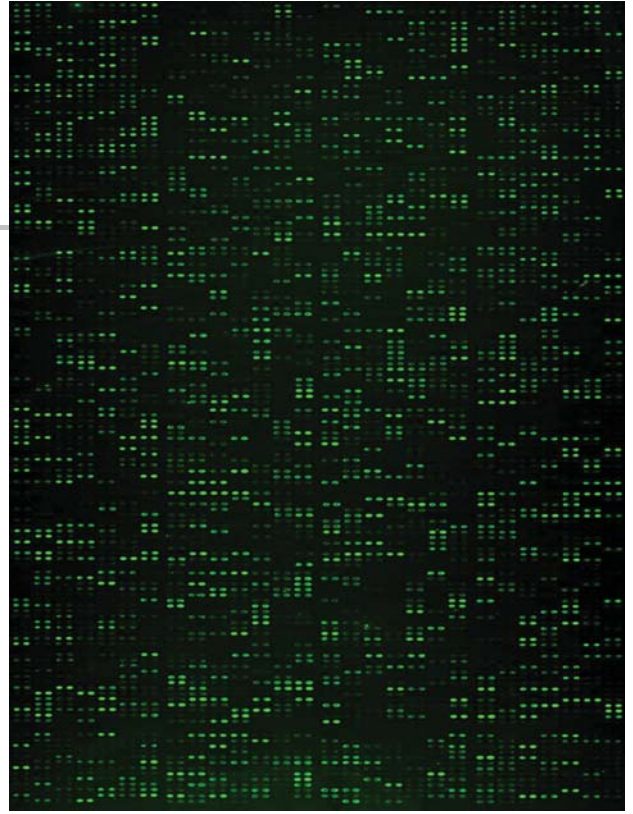
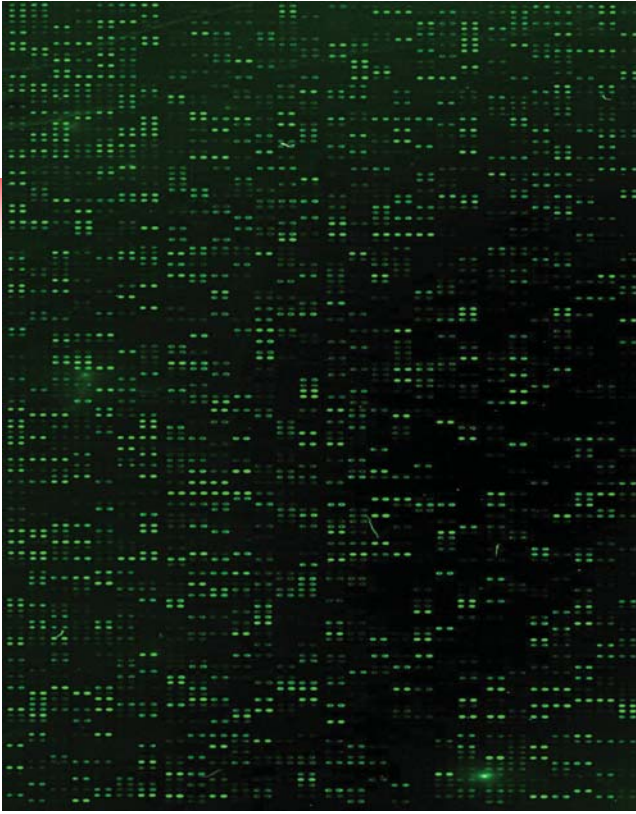


微陣列點漬儀 Microarrayer

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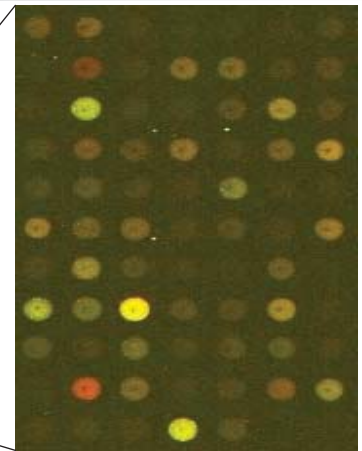
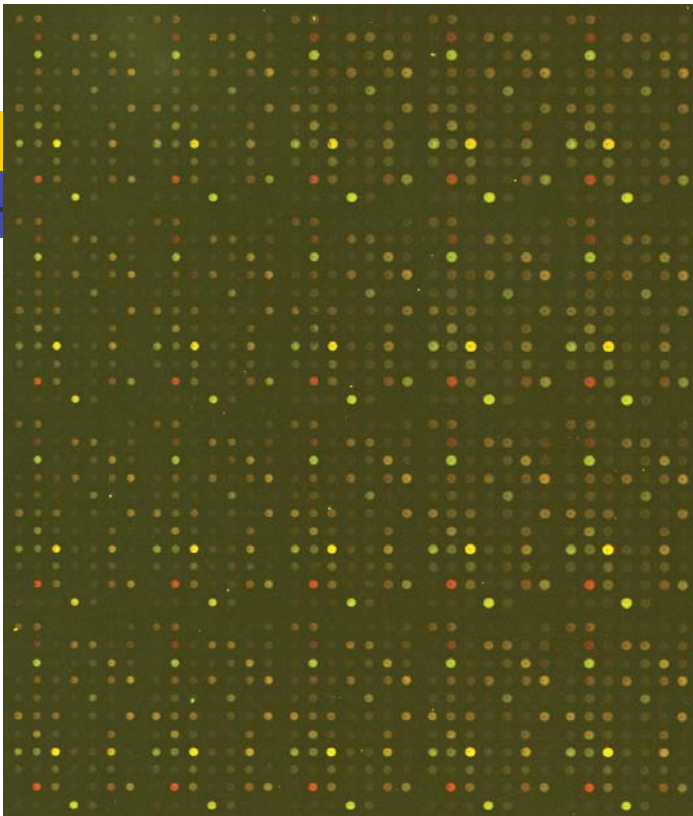




cDNA microarrays

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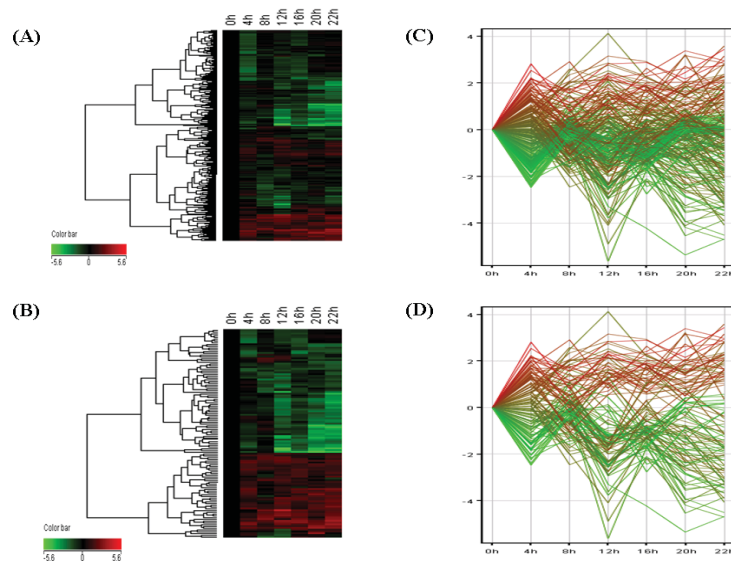
53





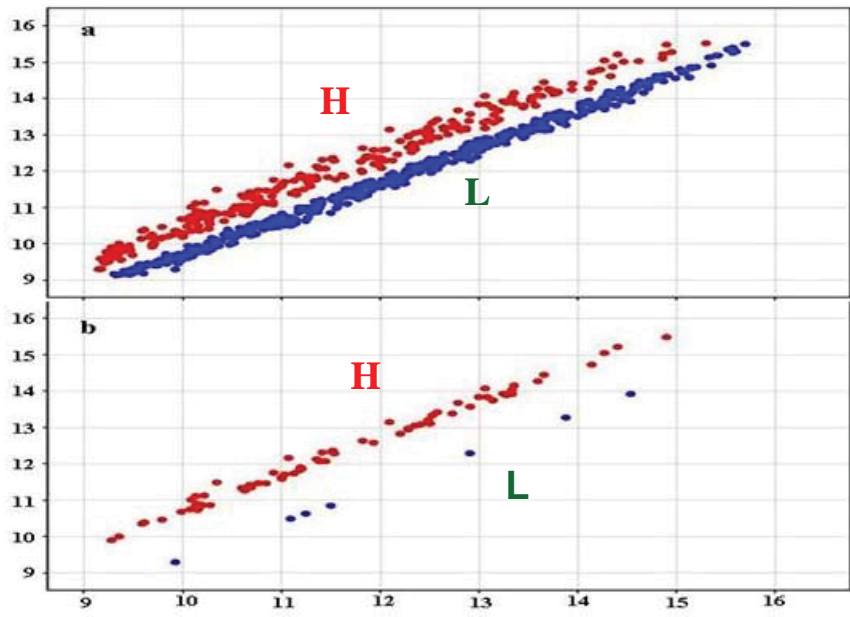
生物資訊分析

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Hierarchical clustering analysis performed with based on the pituitary gland gene expression data

表現量 Levels of expression

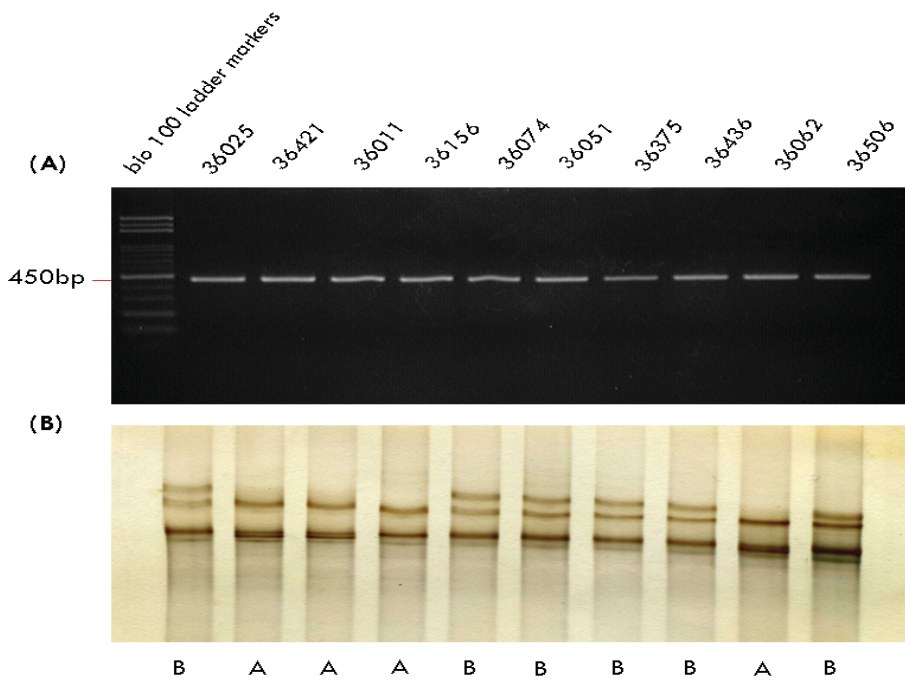


時間 (Hours)

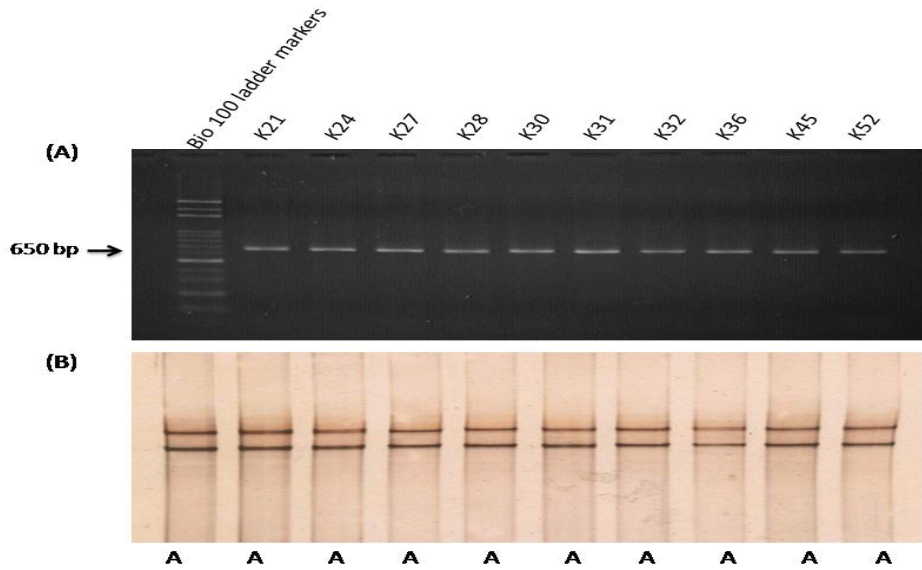
差異表現基因之散佈圖 Scatter plots of differential expression

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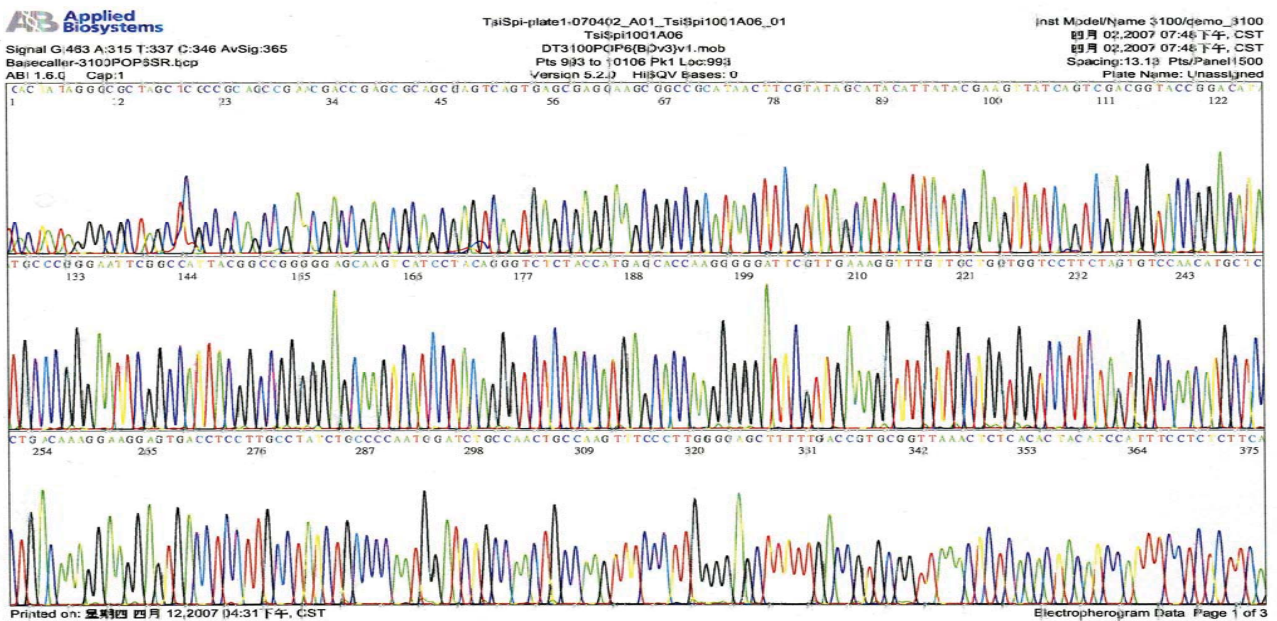


SSCP analysis



SSCP analysis

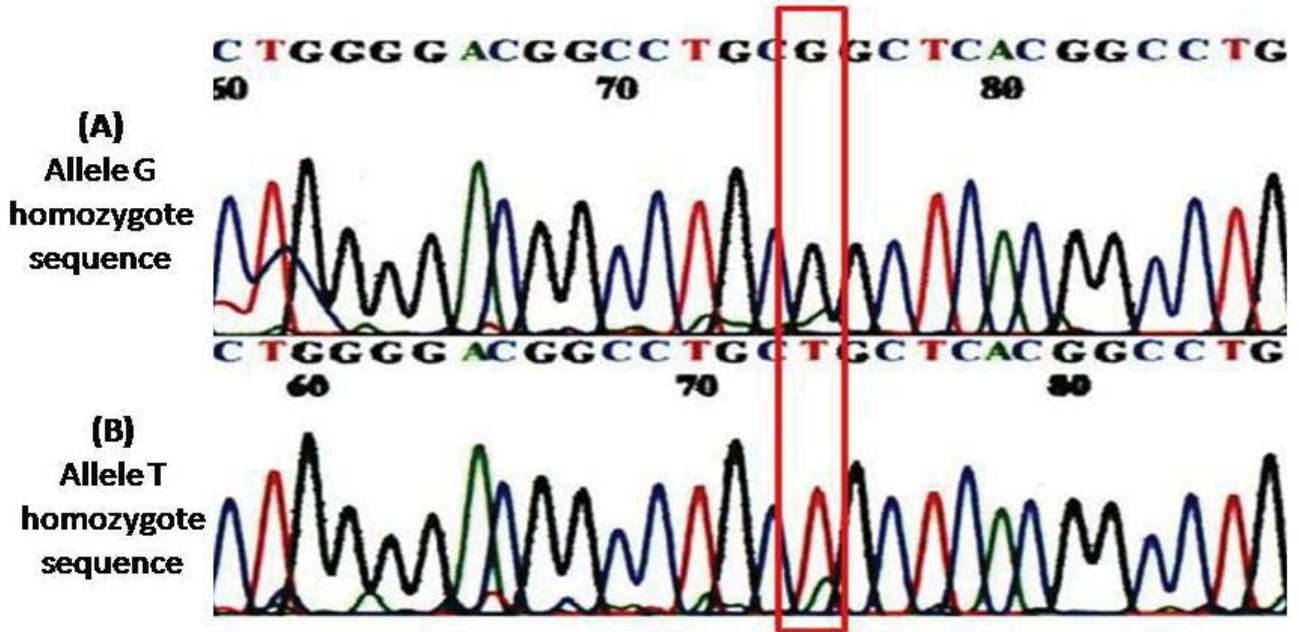
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差異表現基因定序

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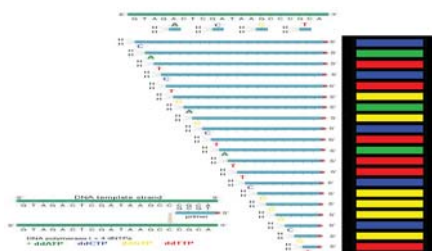
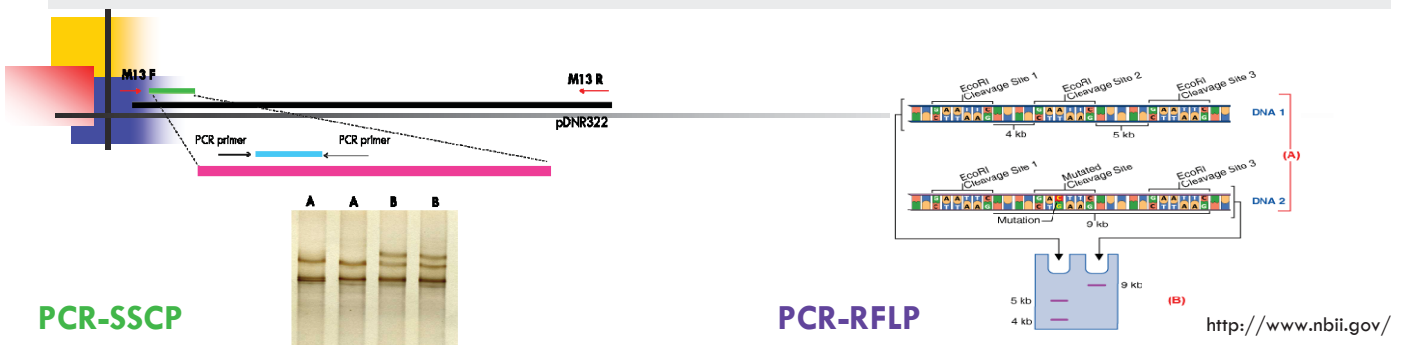
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差異表現基因CST3-G97T變異點

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PCR-SSCP/RFLP for SNP Detection



DNA sequencing

基因型鑑定



性能與基因型間 相關性分析



基因選種

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THE END

請指教

3Q 4UR Attention