乳牛基因體檢測服務

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鉉肽阮生物科技有限公司

報告人：蘇少儀

乳牛選拔
龍生九子個個不同

仔代　　　親代　　　祖代

Bob Weaber, Ph.D.

乳牛的表現潛力都建檔在染色體上的基因組之中

Chromosome duplication
Centromere
Separation of sister chromatids
Distribution of new chromosomes to daughter cells
Sister chromatids
0.5 μm
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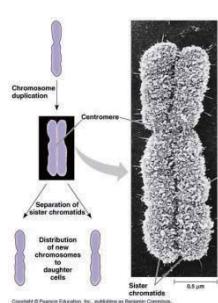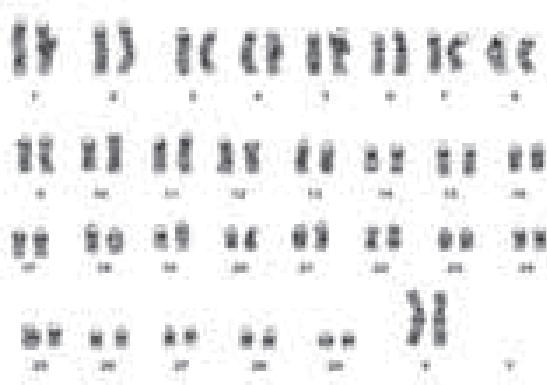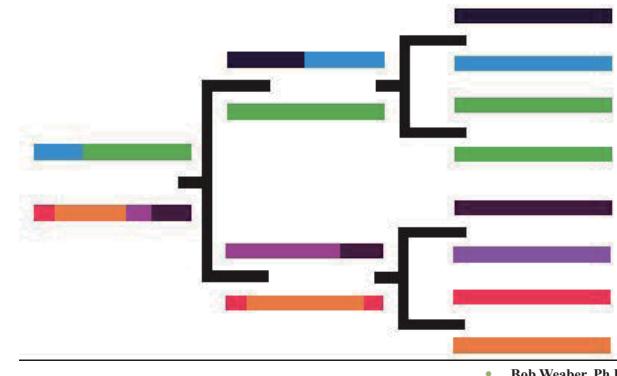
畜群遺傳改進基本觀念

遺傳改進速度＝(選拔強度 X 選拔信度 X 族群變異度)／(世代間距)

Rate of genetic gain ΔG

$\Delta G = (i_m\, r_m + i_f\, r_f)/ (L_m + L_f)$ genetic standard deviation/year

$= (2*0.8 + 0)/ (6+2)$ = 0.2 s.d./year (progeny test)

$= (2*0.6 + 0.8*0.6)/ (2+2)$ = 0.42 (genomic selection)

i = intensity of selection
r = accuracy of selection
L = generation interval

Modified from Goddard. (2009) BIF Meeting

Animal Biotechnology and Genomics Education

現行乳用種公牛選拔模式
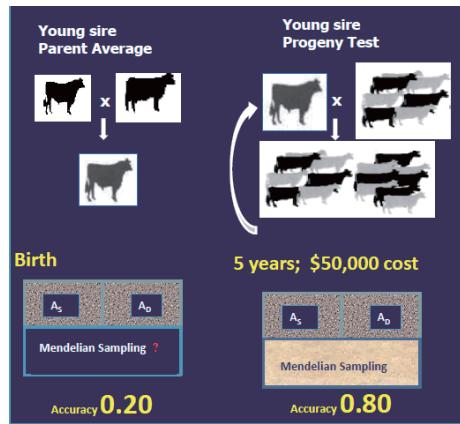
2009年牛基因體序列完全解碼

分子育種科技演進

QTL Mapping → **MAS** → **Genomic Selection**

數量性狀基因座定位　　　基因標記輔助選種　　　基因體選種

四個鹼基譜出每一頭牛獨特的生命篇章

基因座Locus
數量性狀基因座QTL

牛29對體染色體及1對性染色體
30億對鹼基（3Gb）約22.000
個基因

單核苷酸多型性（Single Nucleotide Polymophism）

# 牛第十四對染色體上上乳脂百分率具顯著關聯的單核苷酸多型性（SNP）基因標記分佈
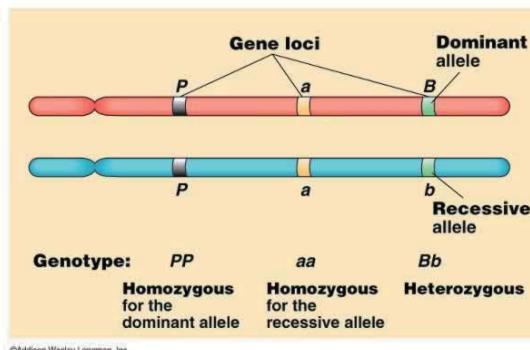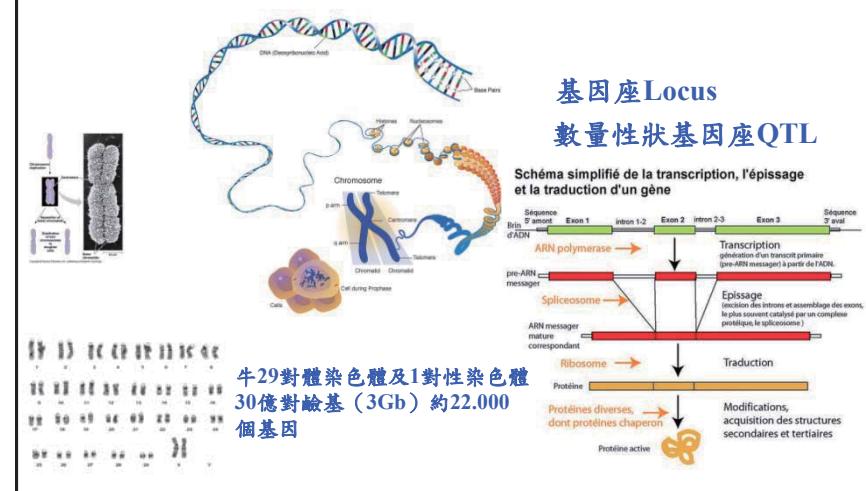
Figure 3 A 2.81 Mb gene cluster on *Bos taurus* chromosome 14 that was associated with significant effects of single nucleotide polymorphisms for fat percentage. Red arrow, fat percentage effect; gold arrow, milk yield effect; green arrow, fat yield effect. A) 1 Mb region with *ASD786*, *CYHR1*, *VPS28*, and *DGAT1* genes; *ASD786* was second largest gene in the cluster and contained *CYHR1* and *VPS28*. B) 1 Mb region with *NIBP*, the largest gene in the cluster.

Cole *et al.* BMC Genomics 2011, 12:408

單核苷酸多型性（Single Nucleotide Polymophism）

對偶基因Allele

The position of the SNP is indicated by the box. Individual 1 is *heterozygous*, while individuals 2 and 3 are *homozygous*.

美系荷蘭種乳牛各染色體上與13個預期傳遞能力（PTA）的生產、健康及生殖性狀存有最顯著關聯效應之100個單核苷酸多

Cole *et al.* BMC Genomics 2011, 12:408

Slide 1 (top-left):

Mapping genes for complex traits in domestic animals and their use in breeding programmes

Michael E. Goddard*‡ and Ben J. Hayes‡

Genomic selection

Reference population — Known genotypes and phenotypes

Selection candidates — Marker genotypes

Prediction equation
Genomic breeding value = $w_1x_1 + w_2x_2 + w_3x_3 \ldots$

Selected breeders — Using genomic breeding values

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Slide 2 (top-right):
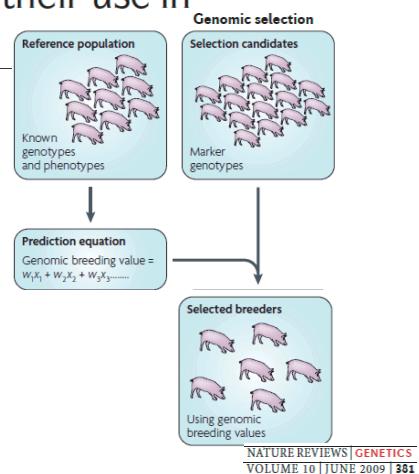
乳牛基因體選拔性狀評比資訊庫 數據建立與維護

Granddaughter Design

DNA → ... → Genetic Merit ← Phenotypic records
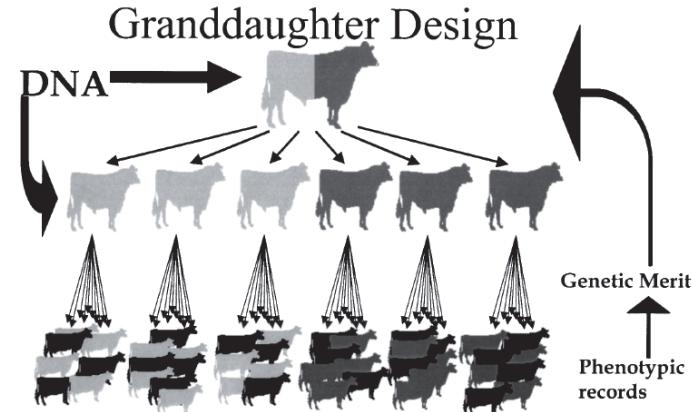
J. Anim. Sci. 79(E. Suppl.):E307–E315

Slide 3 (bottom-left):

Mapping genes for complex traits in domestic animals and their use in breeding programmes

Michael E. Goddard*‡ and Ben J. Hayes‡

a — Number of animals required in reference population vs Heritability
b — Accuracy of GEBVs in un-phenotyped individuals vs Number of individuals in reference population

$h^2 = 0.1$, $h^2 = 0.3$, $h^2 = 0.5$, $h^2 = 0.8$
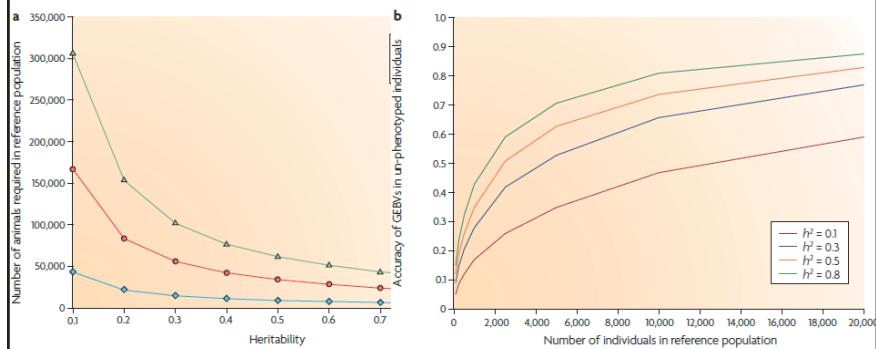
Figure 3 | Calculation of number of animals in a reference population and accuracy of breeding values. a | Number of animals needed in a reference population. To achieve an accuracy of 0.7 for estimated genomic breeding values (GEBVs) calculated from SNPs requires an increasing number of animals in the reference population as the heritability declines or the N_e of the population increases. **b |** Accuracy of GEBVs of un-phenotyped individuals with increasing number of phenotype records in the reference population used to estimated SNP effects, for different heritabilities (h^2). N was 100.

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Slide 4 (bottom-right):

大量準確基因型及表現型數據源自 公牛檢定、供精公牛、DHI紀錄

- 公牛檢定：基因型及表現型
- 供精公牛：表現型及（基因型）
- DHI：表現型

臺灣酪農乳牛選種模式

選用優良種牛精液

女牛選拔及育成

母牛初產

場內選留女／母牛

產乳及產仔循環

淘汰

乳房炎
代謝相關疾病
蹄部疾病
…………
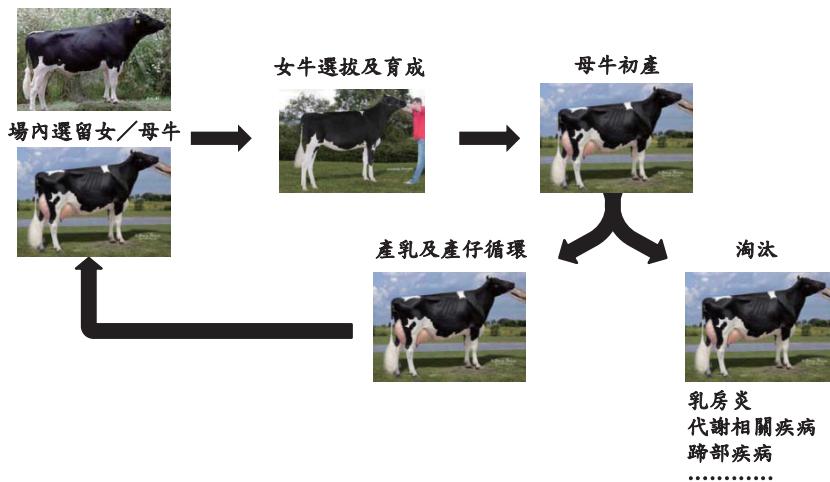
應用SNPs標記辨識特定染色體位置及溯源特定性狀基因

仔代　　親代　　祖代

龍生九子不成龍

• Bob Weaber, Ph.D.
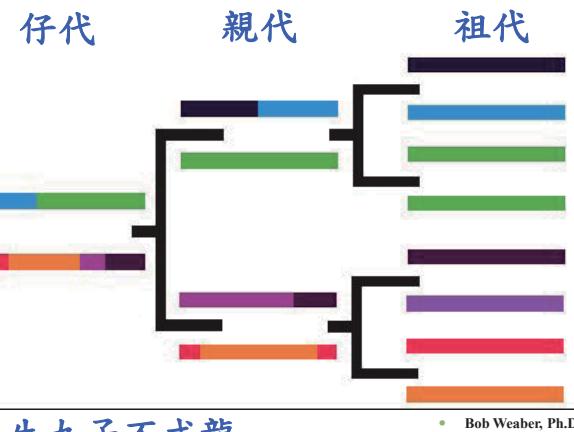
適者生存的乳牛選種模式有陷阱喔！！！

臺灣的氣候與飼養模式可能造就場內產乳性狀不優母牛的後裔愈多
高產母牛常見瘤胃過酸症、酮病、第四胃異位、胎衣滯留、難產、亞臨床型乳房炎、…等都影響泌乳量
泌乳量低，失重少，產仔牛後愈早發情及受孕………

體重（公斤）

泌乳與乾物攝食量（公斤）

體重

泌乳量

實際乾物攝食量

BW　Milk　Actual DMI

泌乳天數

Halachmi I. et. al.
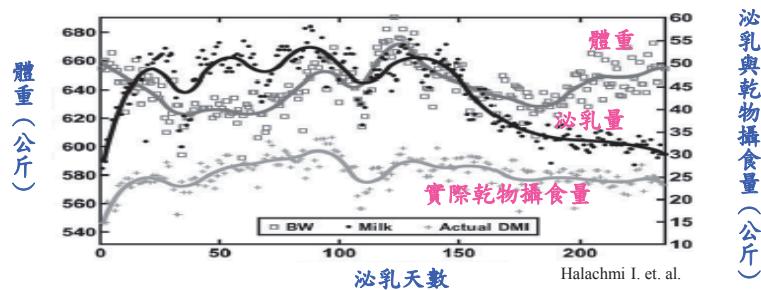
乳牛選種新法

基因體檢測已經可以做為乳牛選種的依據了！！！
乳牛高產乳是多基因所控制的數量遺傳性狀！！！

借力使力,不費力！
喝牛奶不必養乳牛！
臺灣乳牛基因體選拔借用
美國農部建立及維護的
基因體比對資訊庫

乳牛基因體檢測晶片

女牛基因體檢測一次讓您看個透

應用自場DHI成績選拔優良母牛

敬請指正