

# 動物細胞培養與品質



黃效民

國衛院 細胞庫

生物資源保存及研究中心



食品工業發展研究所

Food Industry Research and Development Institute



● .....  
“The winner of the “greatest technology” award for the past 25 years has got to be cell culture, which predates the biotech industry by many decades...”

Angelo DePalma, 25th Anniversary  
issue of Genetic Engineering News  
August, 2005

**GENETIC  
ENGINEERING  
NEWS**  
**GEN**



註冊 | 會員登入

----- 請輸入查詢類別 -----

請輸入關鍵字- B 產品搜尋

## PRODUCTS

### ○ 產品類別

- ├ 耗材
- ├ 免疫試劑
- ├ 細胞培養
- ├ 分子生物
- ├ 儀器設備
- ├ 委託服務

### ○ 優惠訊息

### ○ 訊息快遞

### ○ 售後服務

### ○ 知識庫專區



TEL:(02)2695-9935  
FAX:(02)2695-0403



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1024x768DPI

## 訊息快遞 • Information

首頁>訊息快遞>感謝踴躍報名~《2008細胞培養技術研討會》報名額滿!

2008/04/27

### 感謝踴躍報名~《2008細胞培養技術研討會》報名額滿!

報導

選對課程?投資自己!

歡迎參加免費細胞培養研討會，  
研習學員將頒發「細胞培養技術受訓證書」。

6月份場次報名踴躍，皆已全部額滿!(Basic及Advanced)

請密切注意本站訊息，預計9月11日在高雄舉辦Basic課程，此場報名時間將另行通知。

洽詢電話：(02)2695-9935轉8664

e-mail：[register@mail.level.com.tw](mailto:register@mail.level.com.tw)

相關活動訊息，請見以下海報~

# 2008 Cell Culture WorkShop 細胞培養技術研討會

上網報名 <http://www.level.com.tw>

# Cell culture is much like cooking...

● .....  
It requires

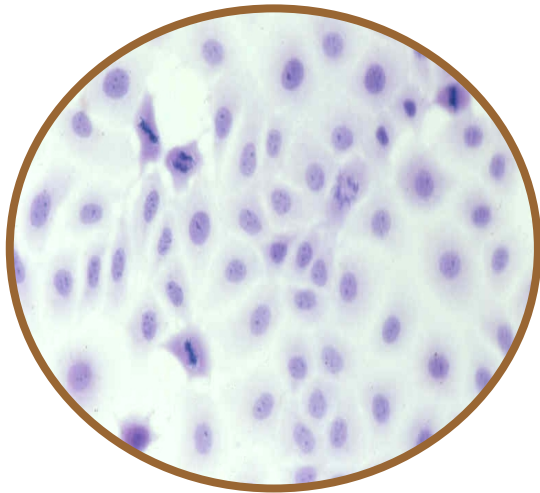
- ▶ A lot of liquid handling
  - ▶ Measuring
  - ▶ Mixing
  - ▶ Transfer
- ▶ Careful observations and control of the environment
- ▶ Good ingredients
- ▶ Good aseptic technique
- ▶ Sometimes, more “art” than science



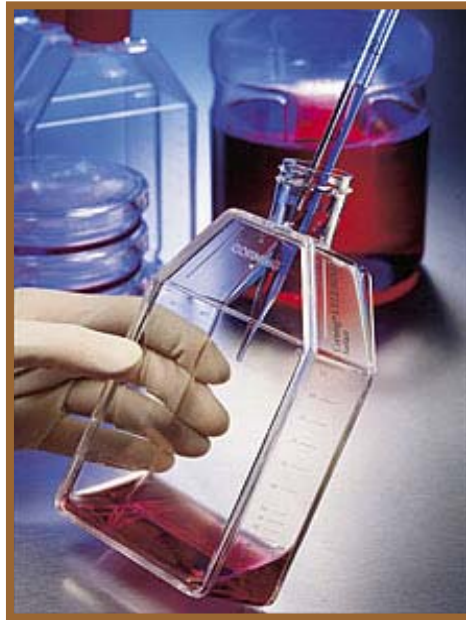
# How do I culture cells?



BCRC 60004 MDCK



Start with good cells



“Optimize” their culture environment



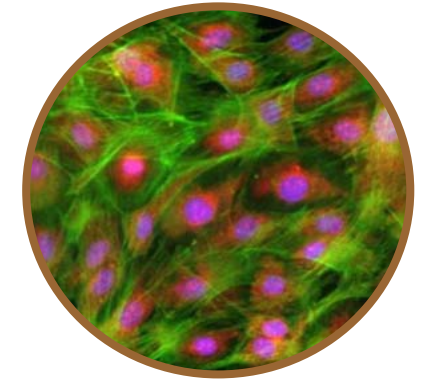
“Optimize” my culture technique



# What are good cells?

---

- ▶ Healthy growing, no mycoplasma or other contaminants
- ▶ Maintain their key characteristics and functions
- ▶ Come with a history and clear instructions
- ▶ Come from a reputable source, like BCRC cell bank



# How to “Optimize” the environment?

## Check the basics:

- ▶ Medium
- ▶ Serum
- ▶ Gas
- ▶ pH
- ▶ Temperature
- ▶ Surface



Happy cells perform better!



▶ ...

# How to “Optimize” my technique?

---

3 key areas:

- ▶ Harvesting
- ▶ Feeding
- ▶ Storing



Plus Aseptic procedures







實驗室名稱：  
生物資源保存及研究中心  
認證編號：1865 Testing Lab



紅麴  
MONASCUS 2008  
INTERNATIONAL SYMPOSIUM ON MONASCUS  
2008 紅麴國際研討會  
創新加值新思維 紅麴產業新契機

- 關於生資中心
- 關鍵技術
- 對外服務
- 中心公告 & 網頁新知
- 出版品
- 相關聯結

<http://www.bcrc.firdi.org.tw/Monascus2008/>

對外服務

- ➔ 生物資源提供(菌株訂購)
- ➔ 生物資源引進
- ➔ 委託試驗
- ➔ 委託鑑定
- ➔ 秘密寄存
- ➔ 公開寄存
- ➔ 專利寄存
- ➔ 委託代訓

網頁新知

- ➔ 電子顯微鏡下的乳酸菌胞外多醣  
(2008-08-01) [...More](#)

[更多網頁新知...](#)

最新消息

- ➔ 『2008人類胚幹細胞培養訓練課程』  
將於九月份開班，名額有限請及早報名！(2008-08-06) [Hot!](#) [...More](#)
- ➔ 台灣真菌知識庫上線 (2008-06-17)  
[...More](#)
- ➔ 2008紅麴國際研討會 (2008-06-11)  
[...More](#)

[更多最新消息...](#)

新技術/新資源/新服務

- ➔ 生理功效篩選服務 - 荷爾蒙調節  
活性與抗癌活性篩選 [Hot!](#)  
[...More](#)
- ➔ 明確迅速判斷產業用黃麴菌之安  
全性 [...More](#)
- ➔ 光合菌生產CoQ10不需照光  
[...More](#)

[更多新技術/資源/服務...](#)

資料庫連結

-  生物資源資料庫  
Strain Administration System
-  紅麴菌基因體計畫  
Monascus genome Database
-  BCRC客戶服務系統  
BCRC Customer
-  BCRC分類搜尋  
BCRC Taxonomy Search
-  台灣豬隻功能基因體網站  
Porcine Genome Database
-  台灣微生物知識網  
Taiwan Microbial Knowledge
-  國家衛生研究院細胞庫  
The NHRI Cell Bank



關於細胞庫



國家衛生研究院細胞庫  
The NHRI Cell Bank

與我們聯絡

關於細胞庫

教育訓練

細胞培養小常識

服務項目

文章報導

網站連結

回首頁

## 細胞庫簡介

動物細胞是研究生命科學重要的生物資源和研究材料。為配合國內相關研究人員的需要，建立專業並具有效率及公信力的動物細胞長期寄存場所，以提供良好品管的動物細胞株予各研究單位，國家衛生研究院特別與食品工業發展研究所合作推動細胞庫的設立，於民國85年7月起籌設，並於87年8月18日正式在食品工業發展研究所菌種中心掛牌成立了以全國學術界為服務對象的動物細胞庫。

細胞庫初期先行建立了細胞培養的品管標準作業及相關技術，同時自國外引進了常用的動物細胞株，並提供所保存之細胞株和相關資料，更於90年通過國際品質管理與服務標準ISO9001之驗證，為全球約490個菌種中心第一個獲得ISO9001認證之專業菌種中心及動物細胞庫，對於作業標準和產品品質均已達國際之肯定。

未來細胞庫的功能將以「收集」、「保存」和「品管」的工作為主，特別是國內研究人員已培育完成細胞株的收集，希望藉由菌種中心與國家衛生研究院的合作推動，建立具本土特色的細胞庫，並保存珍貴的細胞株研究成果。

【給Cell Bank的意見】



BCRC Strain Administration System - Microsoft Internet Explorer

檔案(F) 編輯(E) 檢視(V) 我的最愛(A) 工具(T) 說明(H)

← 上一頁 → 搜尋 我的最愛 媒體

網址(D) http://strain.bcrc.firdi.org.tw/BSAS/index.jsp

Y! 搜尋 信箱 知識+ 拍賣 交友 新聞 股市 購物 家族

BCRC Strain Administration System

FIRDI Home | BCRC Home

User:  Password:  Login

BSAS Home Online member : 6

Search

Search Strain Collection Catalog

Enter BCRC Number:

-- OR --

Enter keyword:

Display  entries on

Search for References

Enter Keyword:

Submit Search Clear

BCRC Strain Administration System - Microsoft Internet Explorer

檔案(F) 編輯(E) 檢視(V) 我的最愛(A) 工具(T) 說明(H)

← 上一頁 → 搜尋 我的最愛 媒體

網址(D) http://strain.bcrc.firdi.org.tw/BSAS/controller

Y! 搜尋 信箱 知識+ 拍賣 交友 新聞 股市 購物 家族

The search engine found 21 entries for **liver cells**  
 Entries 1 to 15 are currently being displayed.

[next](#) [Last](#)

| BCRC Number           | Name            | Designation   |
|-----------------------|-----------------|---|
| <a href="#">60025</a> | Hep G2          | Obtained from ATCC; ATCC number: HB-8065                                |
| <a href="#">60051</a> | Hepa 1-6        | Obtained from ATCC; ATCC number: CRL-1830                               |
| <a href="#">60104</a> | Hepa-1c1c7      | Obtained from ATCC; ATCC number: CRL-2026                               |
| <a href="#">60143</a> | MH1C1           | Obtained from ATCC; ATCC number: CCL-144                                |
| <a href="#">60168</a> | HA 22T/VGH      |   |
| <a href="#">60169</a> | HA 59 T/VGH     | Obtained from Dr. Cheng-Po Hu, Veterans general hospital-Taipei, Taiwan |
| <a href="#">60177</a> | C3A (HepG2/C3A) | Obtained from ATCC; ATCC number: CRL-10741                              |
| <a href="#">60180</a> | BNL CL.2        | Obtained from ATCC; ATCC number: TIB-73                                 |
| <a href="#">60211</a> | H4-II-E-C3      | Obtained from ATCC; ATCC number: CRL-1600                               |
| <a href="#">60215</a> | BNL 1MEA.7R.1   | Obtained from ATCC; ATCC number: TIB-75                                 |
| <a href="#">60216</a> | BNL 1NG A.2     | Obtained from ATCC; ATCC number: TIB-76                                 |



BCRC Strain Administration System - Microsoft Internet Explorer

檔案(F) 編輯(E) 檢視(V) 我的最愛(A) 工具(T) 說明(H)

← 上一頁 → 搜尋 我的最愛 媒體

網址(D) http://strain.bcrc.firdi.org.tw/BSAS/controller?event=SEARCH&bcrc\_no=60025&type\_id=4&keyword=liver;pells

Y! 搜尋 信箱 知識+ 拍賣 交友 新聞 股市 購物 家族

BCRC Strain Administration System

BSAS Home Online member : 6

**Info**

Cell

BCRC Number:

Name:

Type:

Strain Ethnicity:

Gender:

Morphology:

Isoenzyme An:

Cytogenetics:

Virus Resistant:

Tumorigenic:

Arrival Date:

Incubation Temp(°C):

Culture Medium:

SubCulture

BCRC Strain Administration System - Microsoft Internet Explorer


檔案(F) 編輯(E) 檢視(V) 我的最愛(A) 工具(T) 說明(H)


← 上一頁 → 搜尋 我的最愛 媒體

網址(D) http://strain.bcrc.firdi.org.tw/BSAS/controller?event=SEARCH&bcrc\_no=60025&type\_id=4&keyword=liver;pells

Y! 搜尋 信箱 知識+ 拍賣 交友 新聞 股市 購物 家族

**Image / Description:**

 200倍視顯

 200倍視顯

**Use Restriction:**

**Biosafety Description:**

**Patent Statement:** U.S. Pat. 4,393,133

**Reference:** Nature 282: 615-616, 1979; Science 23: 349-354, 1987; U.S. Pat.

**Price:** NTD\$4000

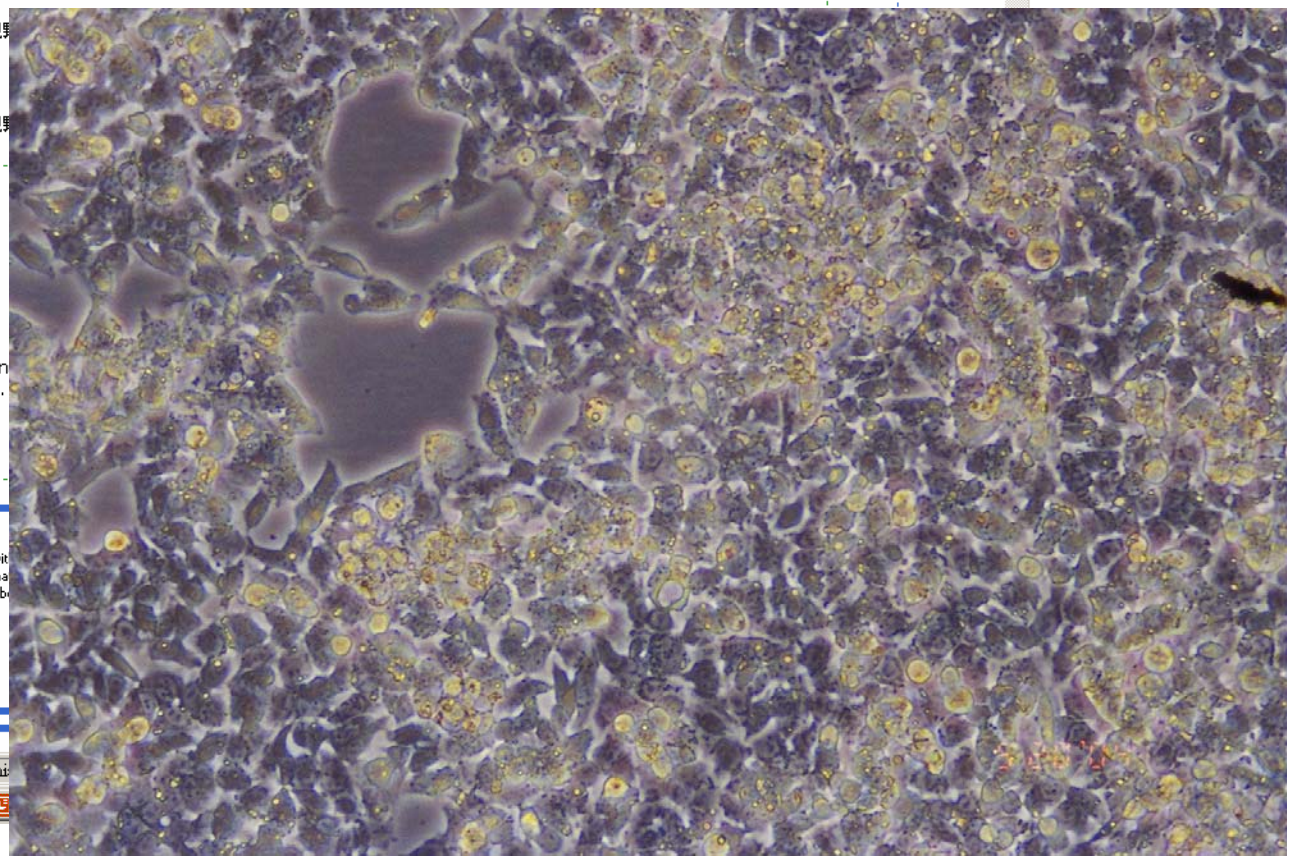
**Medium**

**Culture Medium:** 90% Minimum essential medium (Eagle) with adjusted to contain 1.5 g/L sodium bicarbonate and 1.0 mM sodium pyruvate+ 10% fetal bovine serum

**SubCulture Procedure:** trypsin-EDTA

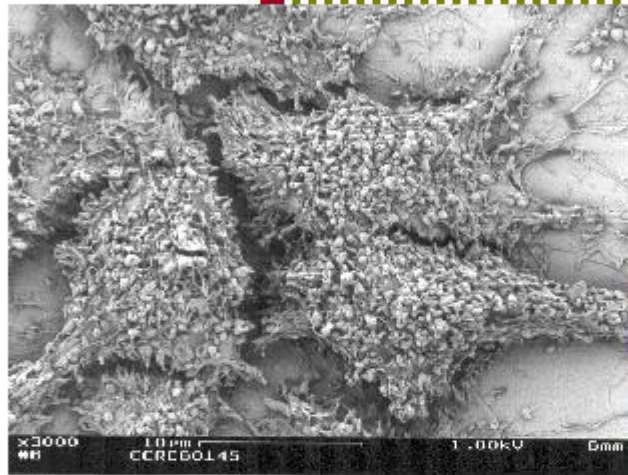
**Seeding Density:**

Date 2006/11/13 15:57:43 ~welcome to BCRC Strain Administration System



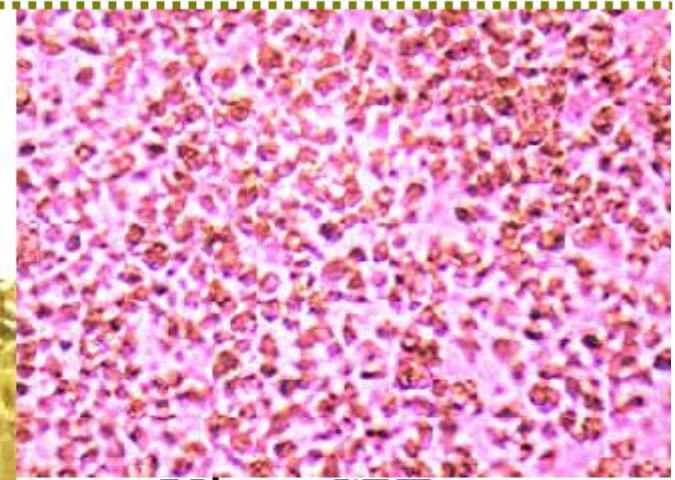
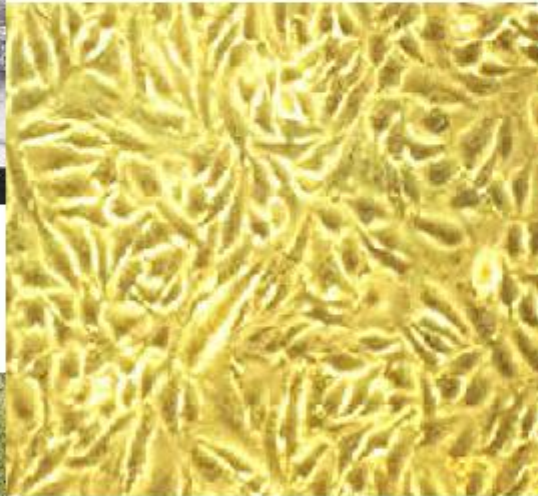
# QC management

**M&M detection:**  
Microbials and Mycoplasma



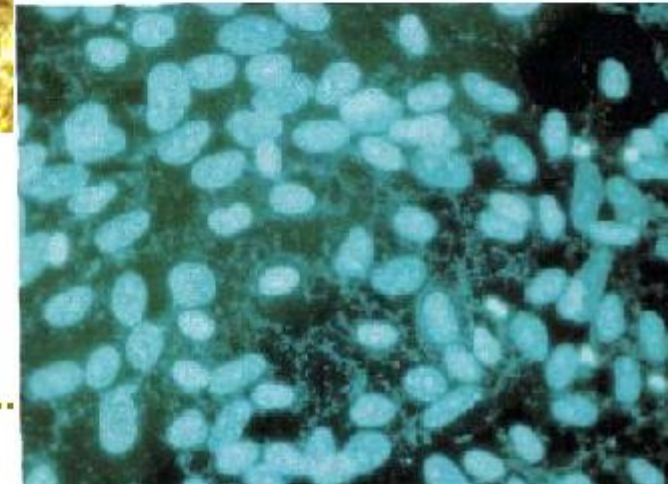
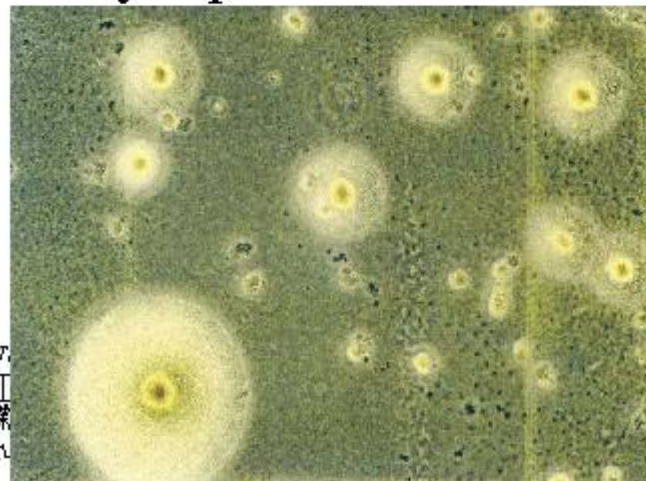
Mycoplasma EM

Mycoplasma colonies



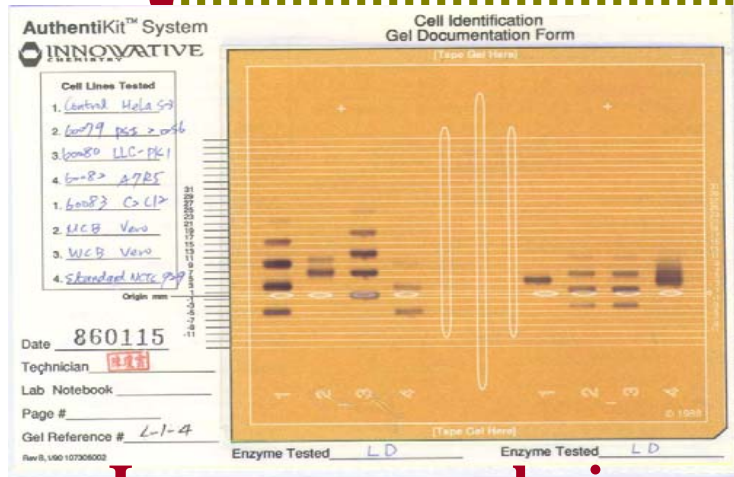
Virus CPE

Fluorescence detection



# QA management

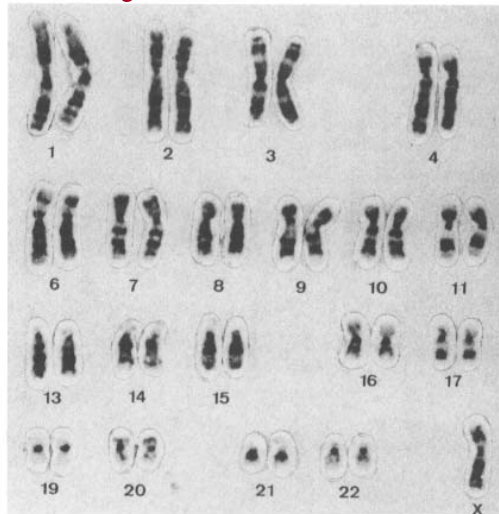
## Authentication: Origin & Species



**Isoenzyme analysis**

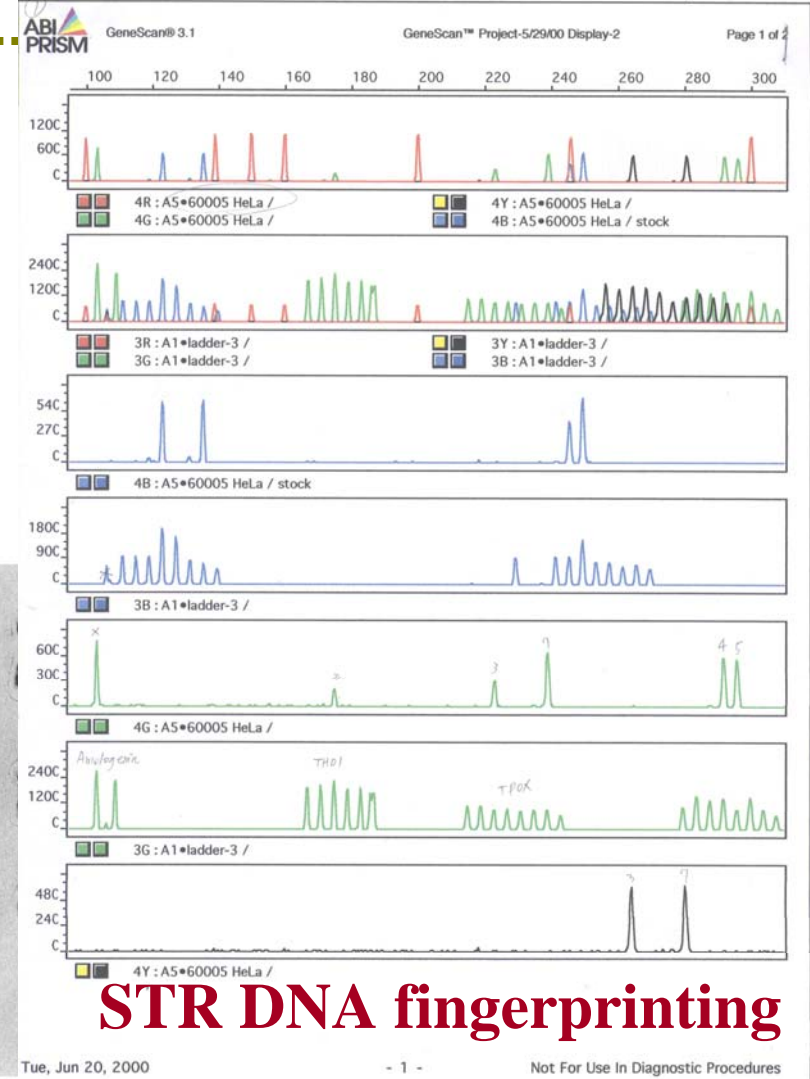


人類細胞株MRC-5之染色體條紋染色(G-banding)



圖五(6) G-banding (人類雙倍體細胞)

**Karyotype analysis**



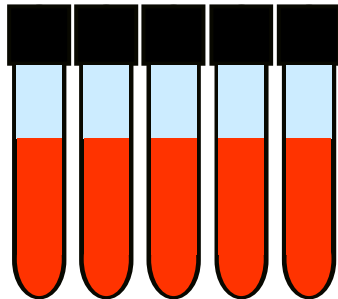
**STR DNA fingerprinting**



# Testing for bacteria, yeast and fungi

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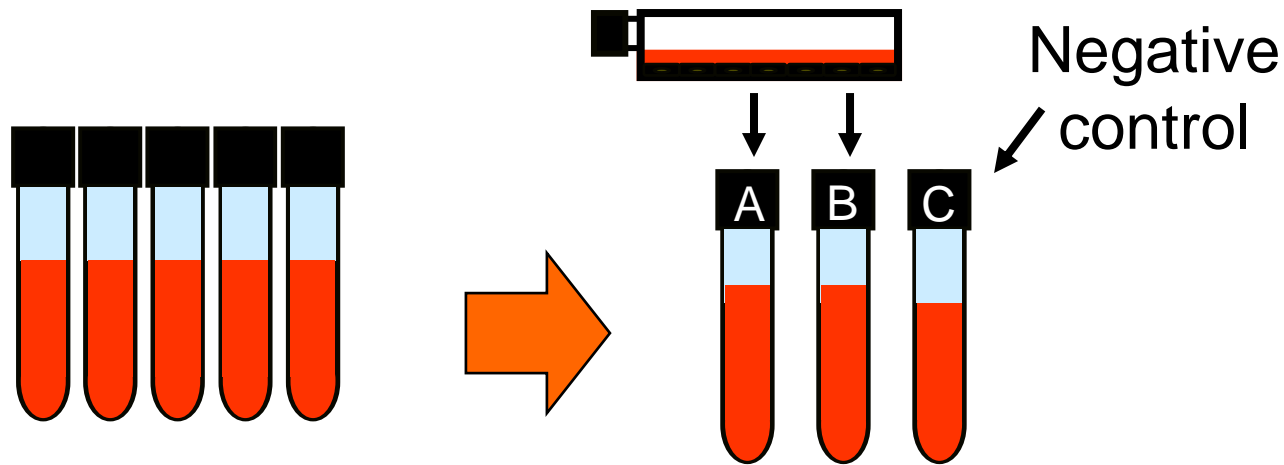
The simple approach (and, as a result, more likely to be used, such as checking of serum black dots)



Make a rack of antibiotic-free medium + sera in 15mL tubes & store at 4°C

# Testing for bacteria, yeast and fungi

The simple approach (and, as a result, more likely to be used, such as checking of serum black dots)



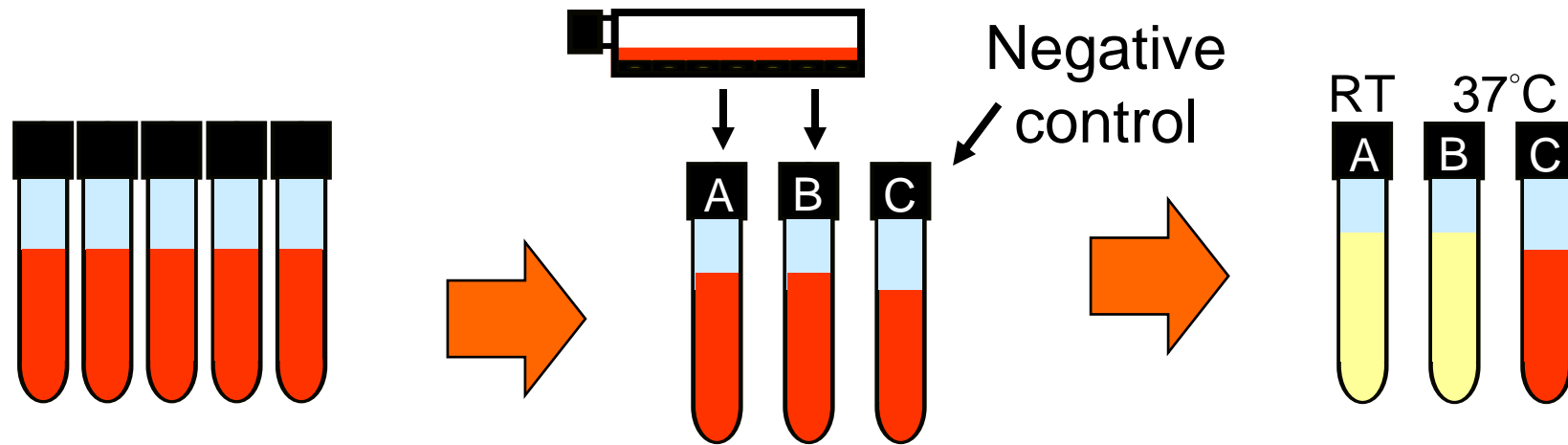
Make a rack of antibiotic-free medium + sera in 15mL tubes & store at 4°C

Add 1mL samples from suspicious culture or untested medium to each of 2 tubes



# Testing for bacteria, yeast and fungi

The simple approach (and, as a result, more likely to be used, such as checking of serum black dots)



Make a rack of antibiotic-free medium + sera in 15mL tubes & store at 4°C

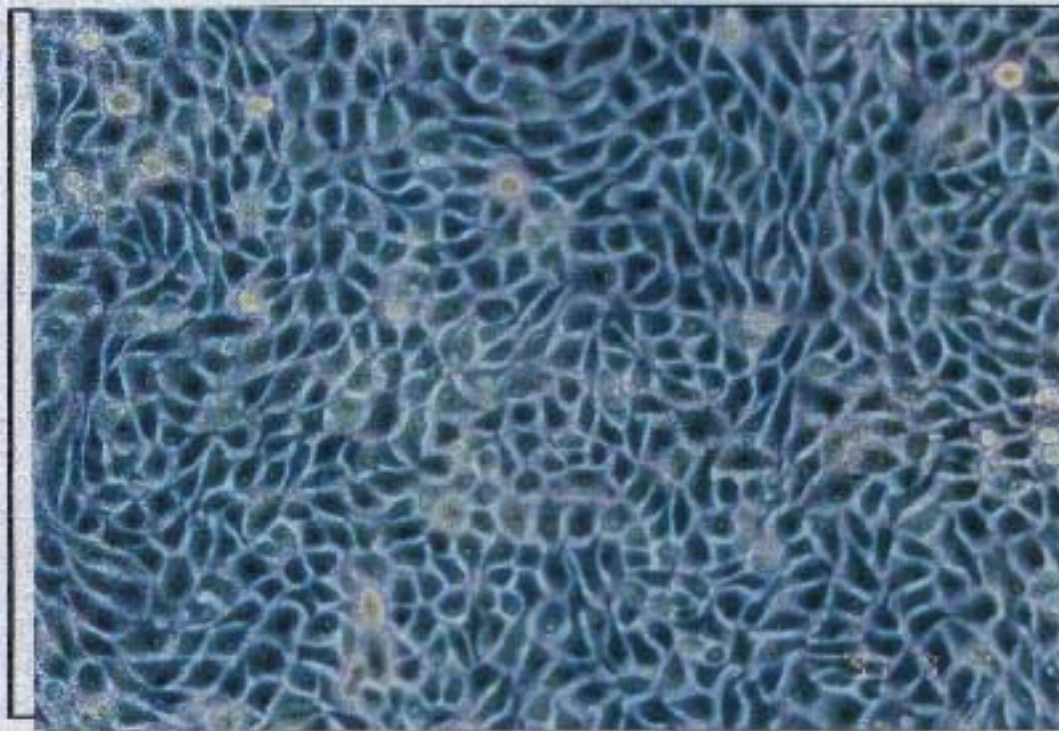
Add 1mL samples from suspicious culture or untested medium to each of 2 tubes

Incubate and examine tubes periodically by eye & at 400x

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# 黴漿菌檢測



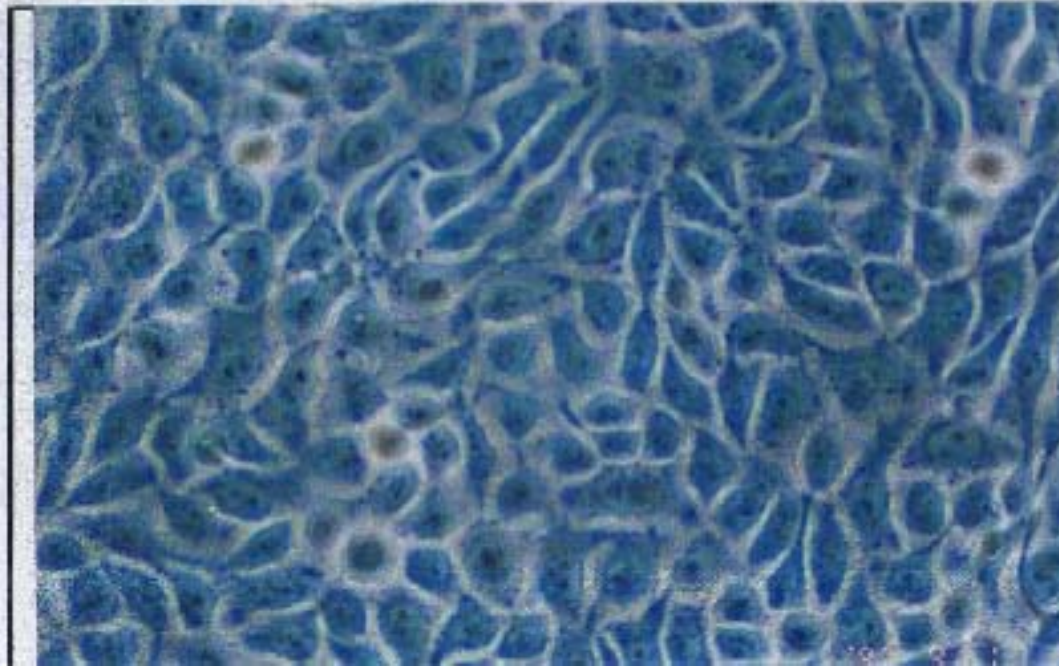


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培養天數 / 情形：

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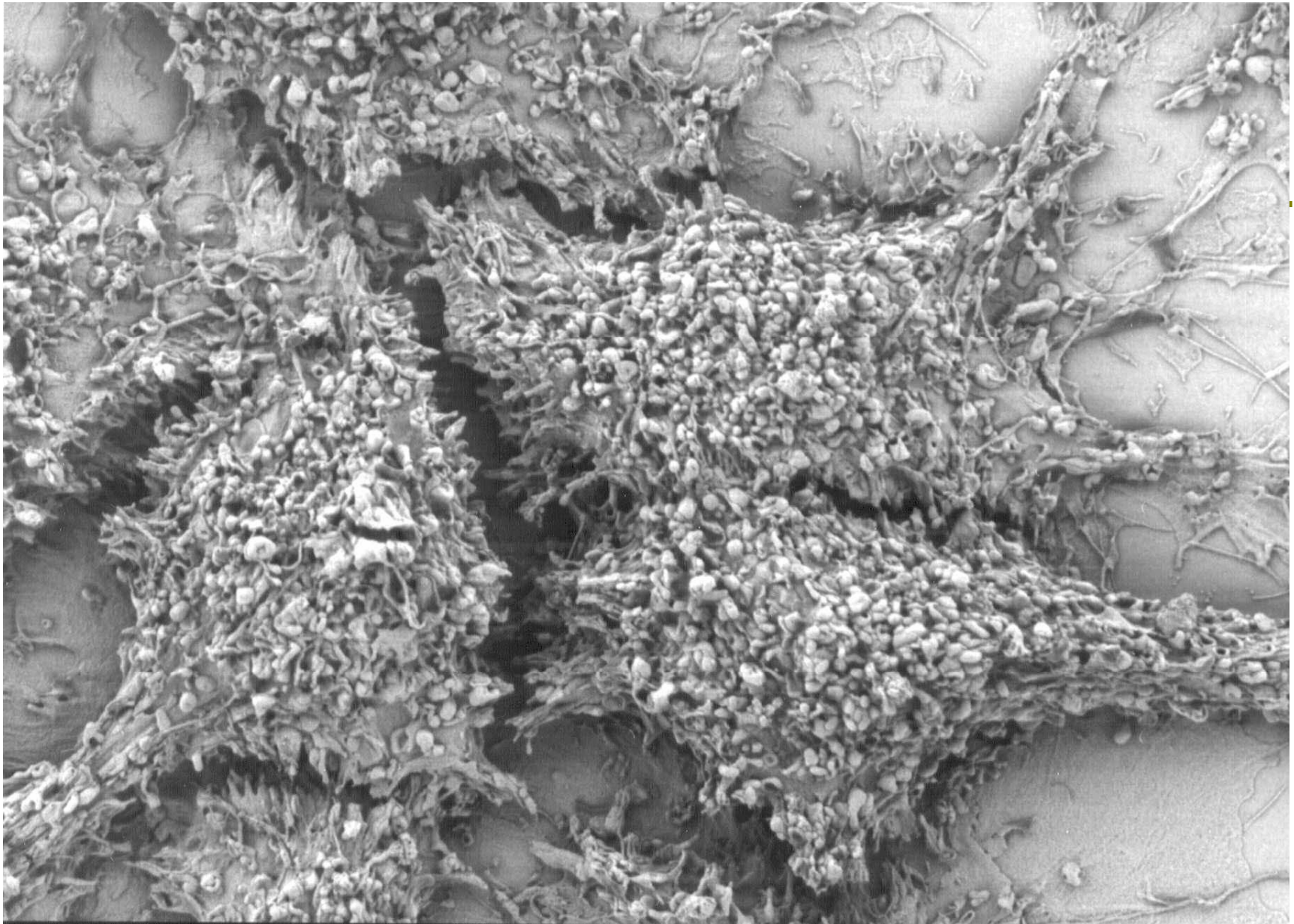
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培養天數 / 情形：

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x3000  
#6

10  $\mu$ m  
CCRC60145

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6mm



# Microbiological Culture Method

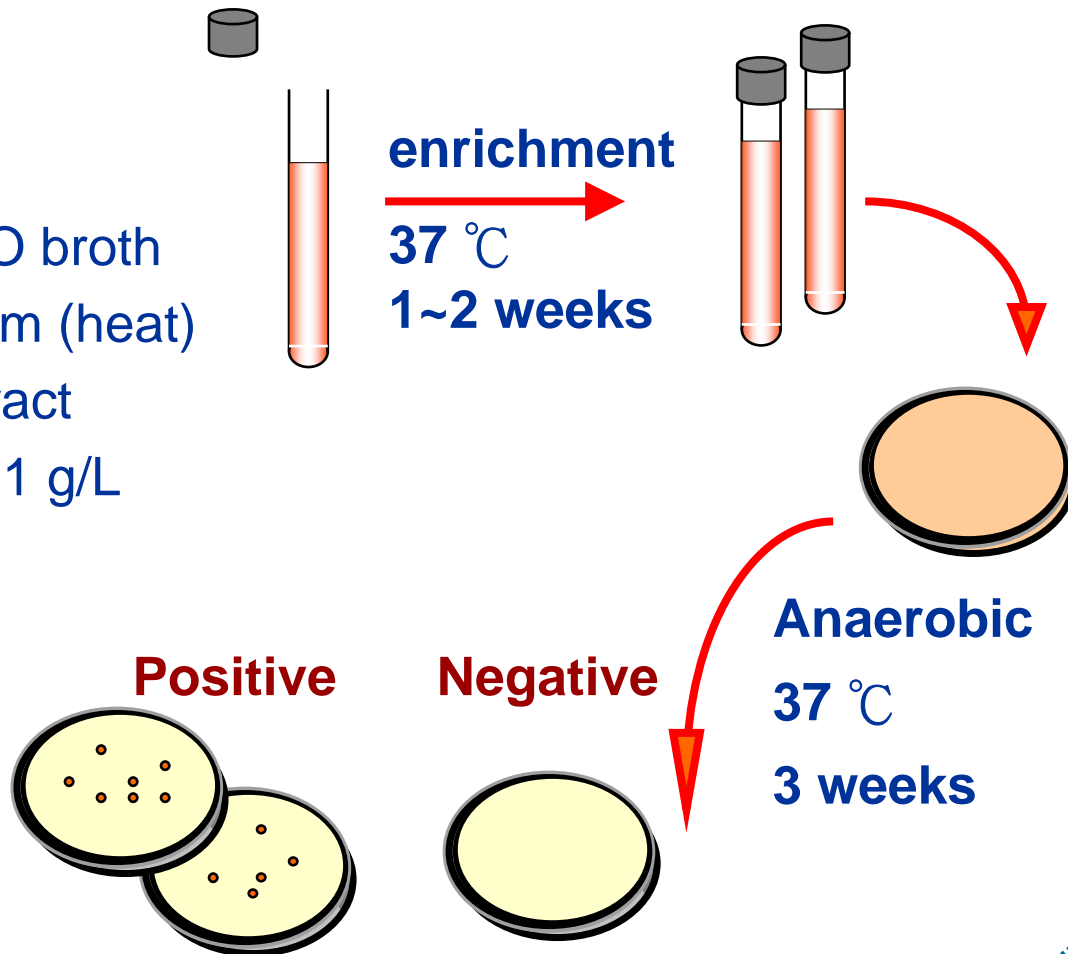
## ▶ Broth culture

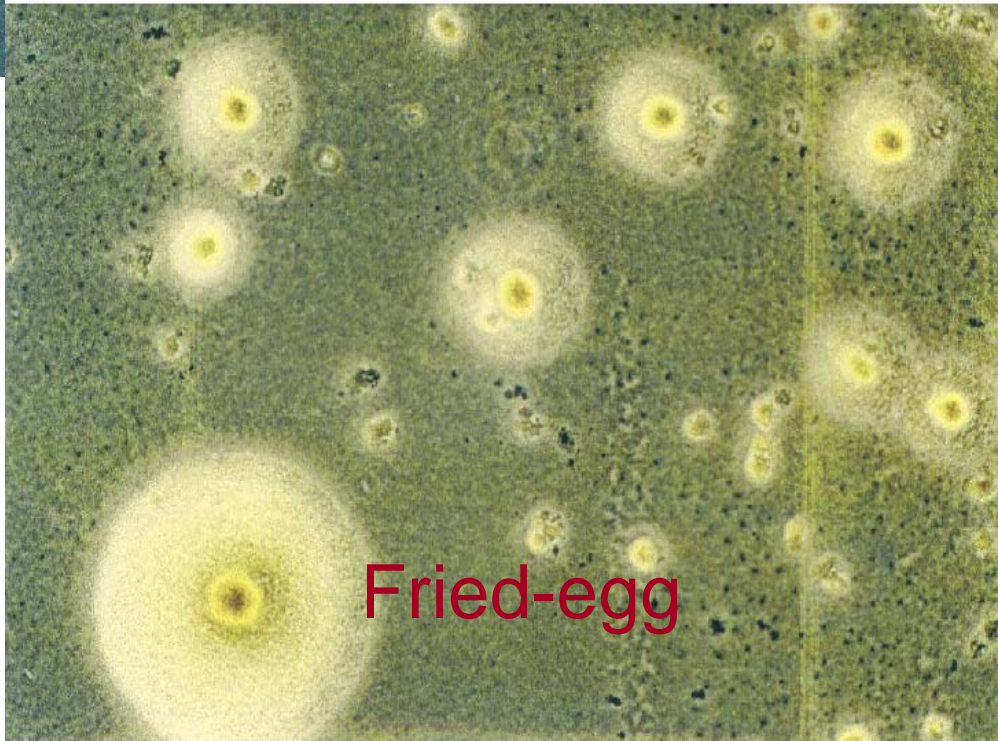
### ▶ **supplements:**

- ▶ 60% Difco PPLO broth
- ▶ 20% horse serum (heat)
- ▶ 1.5% Yeast extract
- ▶ L-Arginine.HCl: 1 g/L
- ▶ Dextrose: 5 g/L
- ▶ phenol red

## ▶ Agar culture

- ▶ **supplements**
- ▶ **1.5% agar**



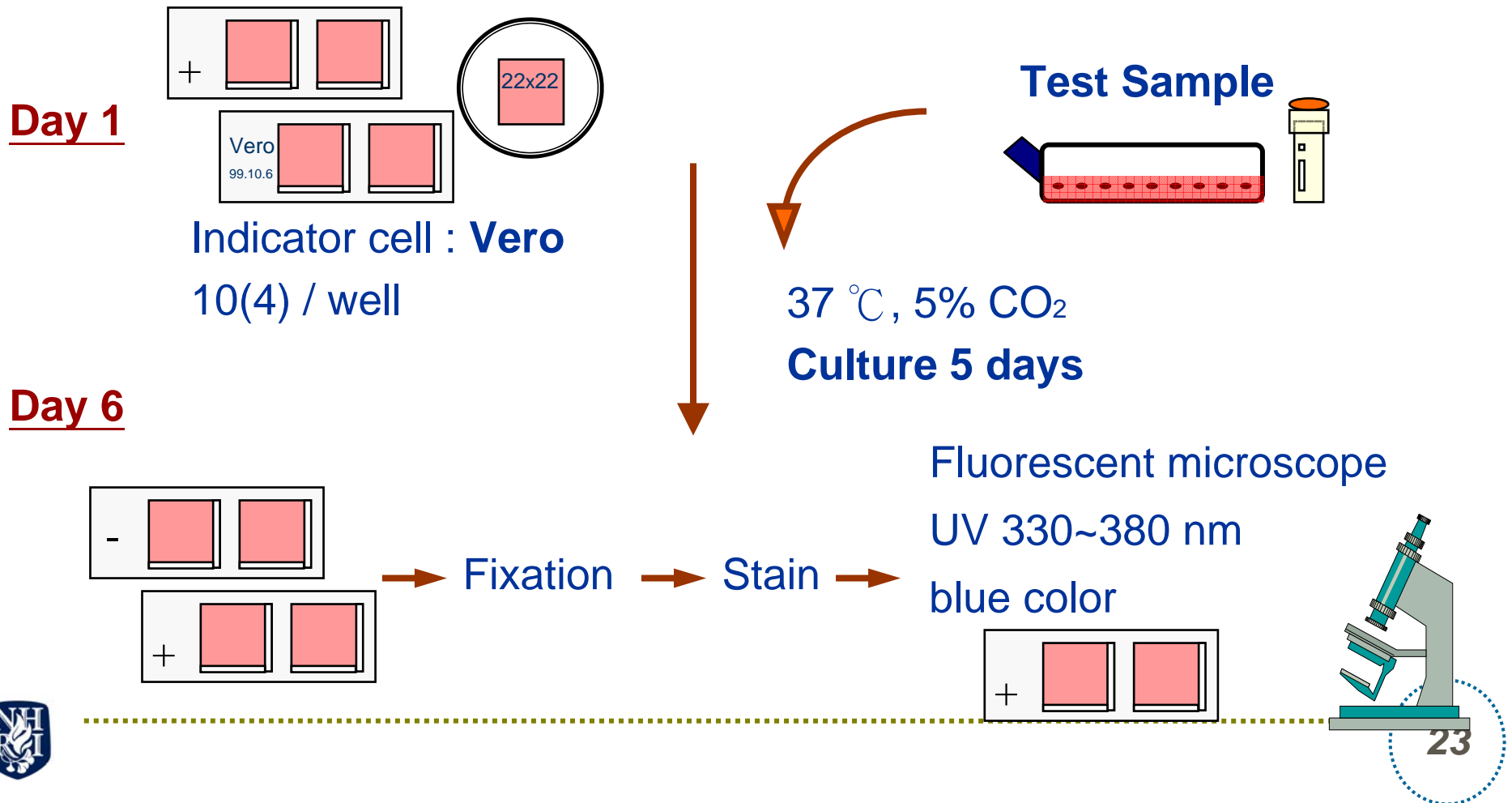


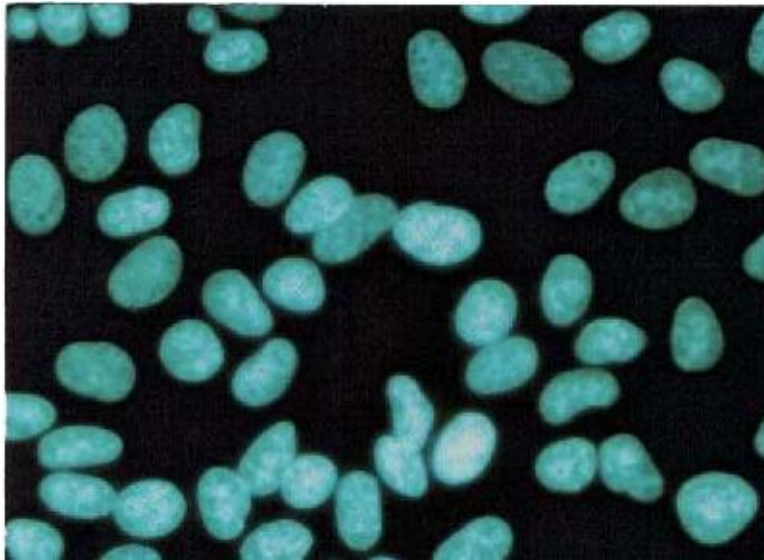
Fried-egg



# Hoechst DNA Staining

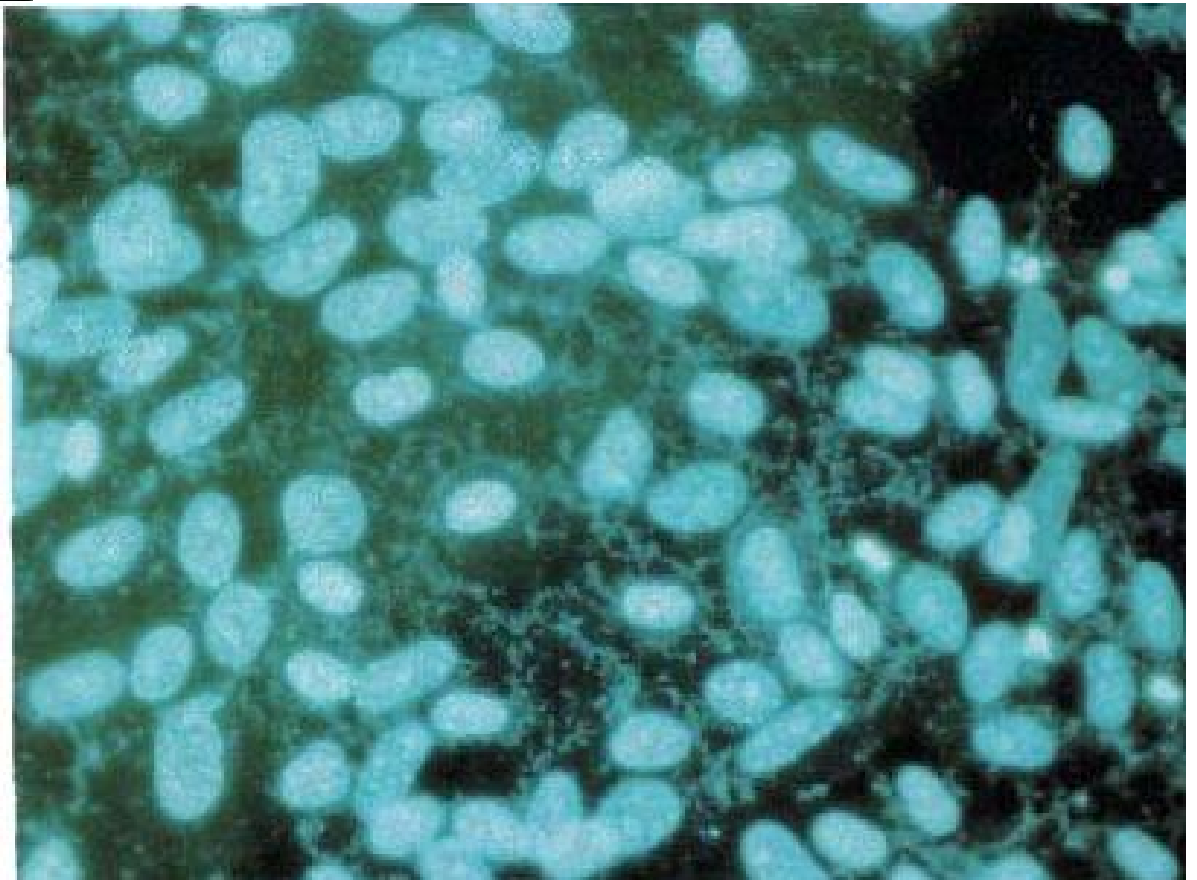
- ▶ bisbenzimidazole, Hoechst #33258: bind A-T rich DNA





negative

Positive

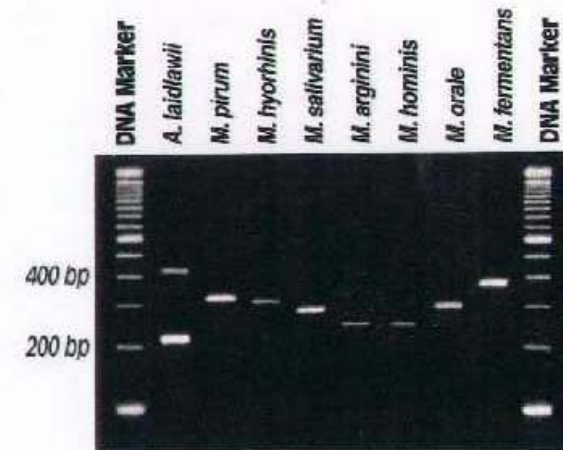




# PCR method

- ▶ Polymerase Chain Reaction
- ▶ Nested PCR : two-stage PCR

**FIGURE 1**  
Agarose Gel Electrophoresis of the 2nd-stage PCR Products from Eight Commonly Encountered Mycoplasma and A. Laidlawii Species.



Amplified DNA products were electrophoresed on 2% MetaPhor agarose (in 1X TBE) and visualized by ethidium bromide staining





## 實驗方法

|                            |
|----------------------------|
| > 無菌操作基本技術                 |
| > 實驗用品                     |
| > 培養基配製                    |
| > 抗生素                      |
| > 血清與生長測試                  |
| > 冷凍細胞活化                   |
| > 細胞繼代培養                   |
| > 細胞計數與存活測試                |
| > 細胞冷凍保存                   |
| > 收到細胞株的處理方式               |
| > 細胞污染測試--細菌與黴菌            |
| > 黴漿菌污染測試 (I) : 直接培養法      |
| > 黴漿菌污染測試 (II) : DNA 螢光染色法 |
| > 黴漿菌污染測試 (III) : PCR 方法   |



# HeLa 細胞汚染

HeLa-phobia ???



## HELA CONTAMINATION – AN OLD PROBLEM THAT HAS NOT GONE AWAY!

National Culture Collections such as ECACC supply authenticated cell lines for use in research and commercial applications. A common definition of the word 'authenticate' is 'to establish the truth of: to make valid'. All reputable culture collections employ methods to confirm at least the identity and origins of the strains they distribute.

properties and limitations. Without it, at best the cell line will generate irreproducible data; at worst the data will be false leading to misinterpretation and wasted resources trying to confirm them."





## Cases of Mistaken Identity

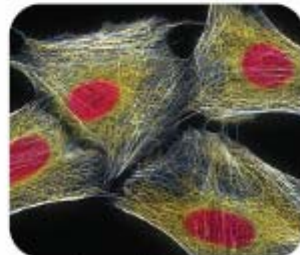
For decades, biologists working with contaminated or misidentified cell lines have wasted time and money and produced spurious results; journals and funding agencies say it's not their job to solve this problem

IN THE 1980S, WHEN HE WAS A postdoctoral fellow at the Scripps Research Institute in San Diego, California, Reinhard Kofler received what was supposed to be a human cancer cell line from a collaborator. "We cultured it, we cloned genes into it," he recalls, then "[we] genotyped it and realized it was 100% mouse."

After scores of similar experiences with misidentified cells, Kofler and his colleagues at the Tyrolean Cancer Research Institute in Innsbruck, Austria, now authenticate every line as soon as it arrives at the institute. And periodically afterward, they use a simple, cheap, quick, and reliable DNA fingerprinting technique to verify that each cell line continues to be what it should be. "It's an absolute must now," says Kofler. His lab "repeatedly" encounters problems with cell line contamination, and without this constant vigilance, Kofler says, "I wouldn't be confident about our work."

Not every biologist is so wary. A 2004 survey of nearly 500 biologists by Gertrude

Baehring of the University of California, Berkeley, and her colleagues, showed that less than 50% of researchers regularly verify the identities of their cell lines using any of the standard techniques such as DNA fingerprinting. "Everybody is in denial" about the widespread problem of cell line cross contamination, says Charles Patrick



Early warning: HeLa cells have contaminated scores of cell lines for more than 4 decades.

Reynolds of the University of Southern California and the Children's Hospital Los Angeles' Institute for Pediatric Clinical Research, who establishes new pediatric cancer cell lines and tests potential cancer drugs on existing lines.

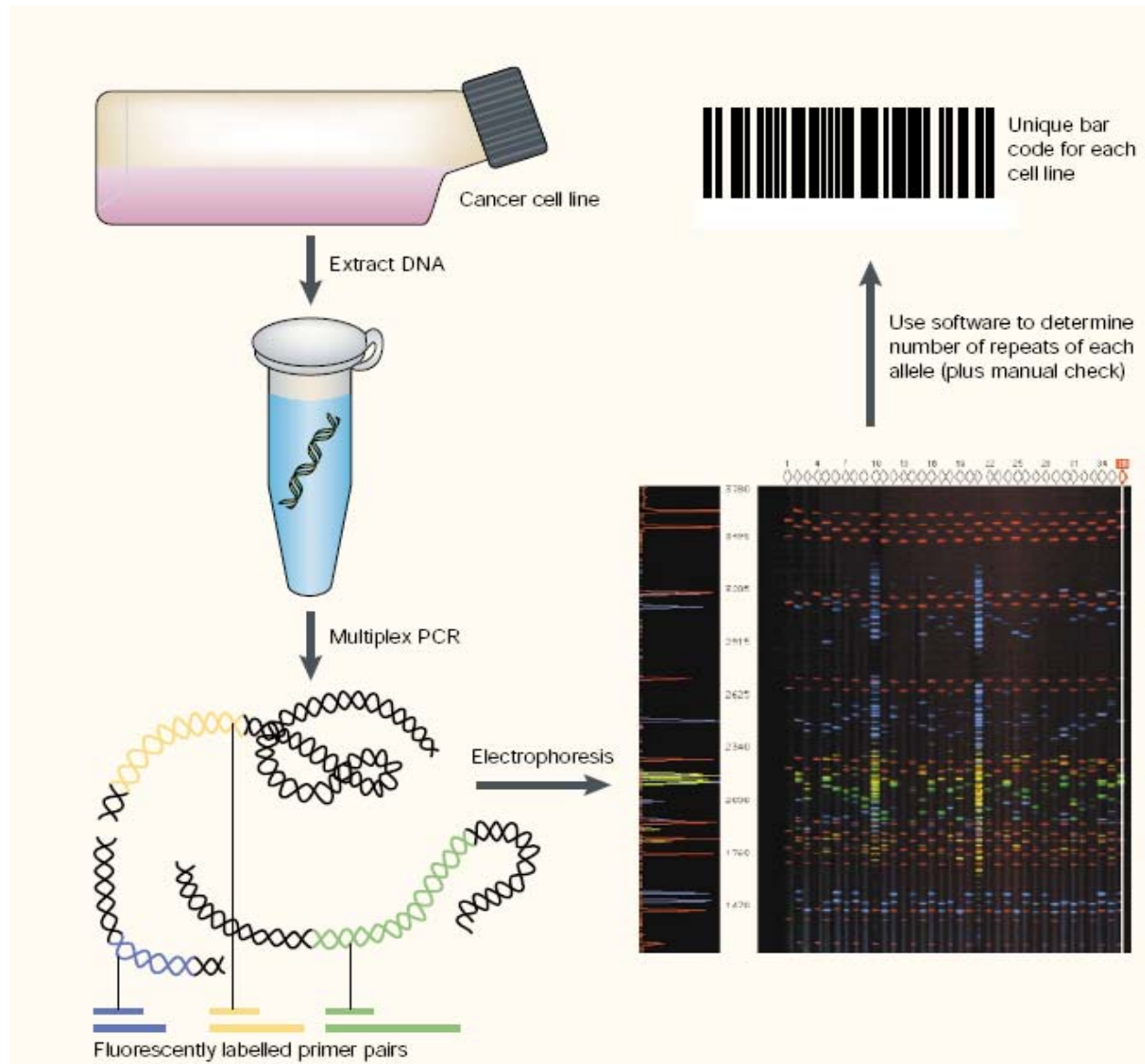
Indeed, many studies have shown that a surprisingly large number of cell lines have become contaminated, often by older, more well-established cancerous cells. For example, according to a 1999 paper by Roderick MacLeod and his colleagues at the German Cell Bank (DSMZ) in Braunschweig, 18% of 252 lines donated to the bank were misidentified or contaminated. The extent of the problem "always seems to come as a surprise for people," says John Masters of University College London, president of the European Tissue Culture Society.

And even though biologists read and hear about cross contamination, "people just think that this is not a problem in my lab," says Reynolds. If contaminated cell lines are used merely as "test tubes" to express proteins, a lab's work may not be affected. But, say Masters and others, research with contaminated lines continues to obscure potential drug leads and

Downloaded from www.sciencemag.org on March 23, 2007

Science (2007)  
315:928-931





# 細胞株錯誤 (I)

Data from ATCC web.

- ▶ HeLa-contaminated cells
  - ▶ Chang Liver (liver)
  - ▶ KB (oral, epidermoid carcinoma)
  - ▶ Intestine 407 (embryonic intestine)
  - ▶ HEp-2 (larynx, epidermoid carcinoma)
  - ▶ WISH (amnion)
  - ▶ L-132 (embryonic lung)
- ▶ still available, noted by HeLa marker



## 細胞株錯誤 (II)

Data from ATCC web.

- ▶ Identities in question
  - ▶ ECV 304 (=T24) endothelium → bladder
  - ▶ KSY-1 (=T24) Kaposi's sarcoma → bladder
  - ▶ U-373 MG (=U251) glioblastoma
  - ▶ U-118 MG (=U138 MG) glioblastoma
  - ▶ SNB-19 (=U251) glioblastoma
- ▶ Stop distribution, except KSY-1 under patent law



# 冷凍細胞之 儲存管理

1. 單株細胞(菌) 2. LN2 3. 種子庫 儲存位置圖

Tab: L17 Bac: GAG Pos: 00 Del

|   | 1      | 2      | 3      | 4      | 5      | 6      | 7      | 8      | 9      |
|---|--------|--------|--------|--------|--------|--------|--------|--------|--------|
| 1 | CM0200 | CM0201 | CM0202 | CM0203 | CM0204 | CM0205 | CM0206 | CM0207 | CM0208 |
| 2 | CM0209 | CM0210 | CM0211 | CM0212 | CM0213 | CM0214 | CM0215 | CM0216 | CM0217 |
| 3 | CM0218 | CM0219 | CM0220 | CM0221 | CM0222 | CM0223 | CM0224 | CM0225 | CM0226 |
| 4 | CM0227 | CM0228 | CM0229 | CM0230 | CM0231 | CM0232 | CM0233 | CM0234 | CM0235 |
| 5 | CM0236 | CM0237 | CM0238 | CM0239 | CM0240 | CM0241 | CM0242 | CM0243 | CM0244 |
| 6 | CM0245 | CM0246 | CM0247 | CM0248 | CM0249 | CM0250 | CM0251 | CM0252 | CM0253 |
| 7 | CM0254 | CM0255 | CM0256 | CM0257 | CM0258 | CM0259 | CM0260 | CM0261 | CM0262 |
| 8 | CM0263 | CM0264 | CM0265 | CM0266 | CM0267 | CM0268 | CM0269 | CM0270 | CM0271 |
| 9 | CM0272 | CM0273 | CM0274 | CM0275 | CM0276 | CM0277 | CM0278 | CM0279 | CM0280 |

BCRC 60103  
 RL95-2  
 Media Product Sheet  
 Item 37,55002  
 Lot 00997  
 P 129  
 09/23/2003

細胞庫  
Technologies



食品工業發展研究所  
Food Industry Research and Development Institute  
國家科學及技術委員會

產品名稱: [Barcode]

| 日期       | 操作 | 備註     |
|----------|----|--------|
| 02/01/03 | 入庫 | CM0200 |
| 02/02/03 | 出庫 | CM0201 |
| 02/03/03 | 入庫 | CM0202 |
| 02/04/03 | 出庫 | CM0203 |
| 02/05/03 | 入庫 | CM0204 |
| 02/06/03 | 出庫 | CM0205 |
| 02/07/03 | 入庫 | CM0206 |
| 02/08/03 | 出庫 | CM0207 |
| 02/09/03 | 入庫 | CM0208 |
| 02/10/03 | 出庫 | CM0209 |
| 02/11/03 | 入庫 | CM0210 |
| 02/12/03 | 出庫 | CM0211 |
| 02/13/03 | 入庫 | CM0212 |
| 02/14/03 | 出庫 | CM0213 |
| 02/15/03 | 入庫 | CM0214 |
| 02/16/03 | 出庫 | CM0215 |
| 02/17/03 | 入庫 | CM0216 |
| 02/18/03 | 出庫 | CM0217 |
| 02/19/03 | 入庫 | CM0218 |
| 02/20/03 | 出庫 | CM0219 |
| 02/21/03 | 入庫 | CM0220 |
| 02/22/03 | 出庫 | CM0221 |
| 02/23/03 | 入庫 | CM0222 |
| 02/24/03 | 出庫 | CM0223 |
| 02/25/03 | 入庫 | CM0224 |
| 02/26/03 | 出庫 | CM0225 |
| 02/27/03 | 入庫 | CM0226 |
| 02/28/03 | 出庫 | CM0227 |
| 02/29/03 | 入庫 | CM0228 |
| 02/30/03 | 出庫 | CM0229 |
| 03/01/03 | 入庫 | CM0230 |

## 庫房管理系統

Technologies

庫別

### 基本資料

- 員工管理 (E)
- 菌株基本資料 (D)
- 入出庫型態 (E)
- 入出庫原因 (E)
- 入庫作業登錄 (D)
- 出庫作業登錄 (D)

### 統計

- 菌株位置圖查詢
- 月-菌株入出庫
- 菌株數量
- 補庫菌株

### 系統功能

- 返回系統資料庫
- 結束庫房管理

NUM SCRL

Microsoft

我的電腦 菌株庫房主... 上午 10:40







液氮筒

大型液氮槽內部



BCRC 60103

RL95-2

Prod#In Product Sheet

Test 37.59(02)

Lot 00497

F 124

09/28/2003







# 低溫庫房之線上監控

The screenshot displays a software interface for monitoring a cryogenic storage facility. The main area shows a floor plan with various storage units and their current temperatures:

- Left Section (Green background):**
  - Row 1: L16 (-161), L13 (-161), L15, L02, L01, L06, L05
  - Row 2: U1, U2, U3, U4, U5, U6
  - Row 3: L17 (-157), L18 (-165), U7, U8, SCO2 (164), SCO1 (-165)
  - Row 4: U9, U10, U11, U12
- Center Section (Blue background):**
  - Row 1: L11 (-176)
  - Row 2: L04
  - Row 3: L10
  - Row 4: L07 (-148)
- Right Section (Green background):**
  - Row 1: R04 (-79), R02 (-79), R05 (-79), R03 (-81), R07 (-79), R00 (-79), R09 (-79), R10 (-81), R11 (-76)
  - Row 2: U13, U14, U15, U16, U17, U18, U19
  - Row 3: U20, U21, U22, U23, U24, U25, U26
  - Row 4: R01 (-80), U27, U28, U29, U30, U31

Below the floor plan, there are two status boxes:

- 液氮菌種保存庫 (Liquid Nitrogen Strain Storage):** 現在溫度 -164, 高溫警報 (High Temperature Alarm)
- 液態氮桶SCO2 醫帶血庫-種子庫 (Liquid Nitrogen Tank SCO2 Blood Bank - Seed Bank):** 低溫警報 (Low Temperature Alarm)

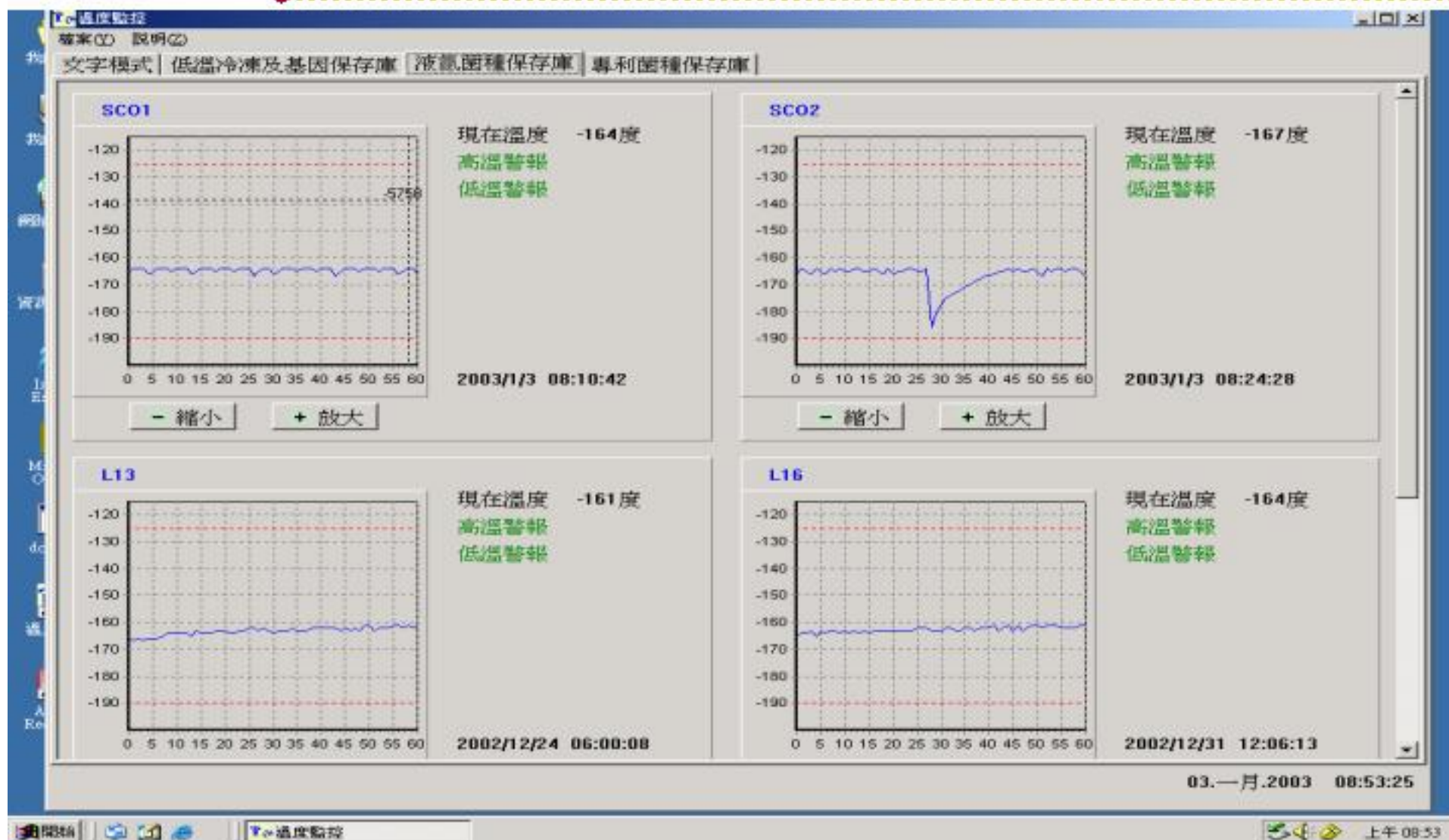
A log of temperature changes is shown below the status boxes:

- Temp #1: -165C on 1/3/2003 08:00
- Temp #1: -167C on 1/3/2003 08:30
- Temp #1: -164C on 1/3/2003 09:00

The interface includes a taskbar at the bottom with the following elements:

- Taskbar: 開始 (Start), 網路 (Network), 溫度監控 (Temperature Monitoring), Microsoft PowerPoint - [開] (Microsoft PowerPoint - [Open]), 上午 08:57 (8:57 AM)
- System Tray: 03.一月.2003 08:57:17 (03. Jan. 2003 08:57:17)

# 液氮槽之線上溫度記錄圖示



# Thawing

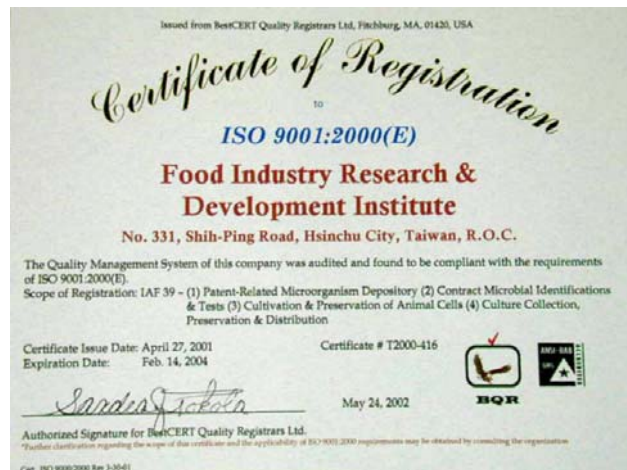


- ▶ Rapid thawing (60 to 90 seconds at 37°C)
- ▶ Double check label to make sure it is the right vial!
- ▶ Wipe off vial with 70% ethanol before opening
- ▶ Grow cells w/ or w/o removing cryoprotectant
- ▶ **Cell happy, You happy**



# ISO 9001:2000

BCRC is granted  
ISO certification  
since 2001



## CERTIFICATION



N° QUAL/2004/22052a

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3. CULTIVATION AND PRESERVATION OF ANIMAL CELLS
4. CULTURE COLLECTION, PRESERVATION AND DISTRIBUTION
5. COLLECTION, PRESERVATION AND DISTRIBUTION OF GENOMIC AND COMPLEMENTARY DNA LIBRARIES

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have been examined and found conform.  
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2007-04-01

2010-03-08

(année/mois/jour) Il est valable jusqu'au\*  
It is valid until\*

(year/month/day)

Managing Director of AFAQ AFNOR International  
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F. NICOLAS

On Behalf of the Firm  
Le Représentant de l'Entreprise

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- ▶ Oct. 24, 2007
- ▶ BCRC accredited as ISO 17025







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敬請指教