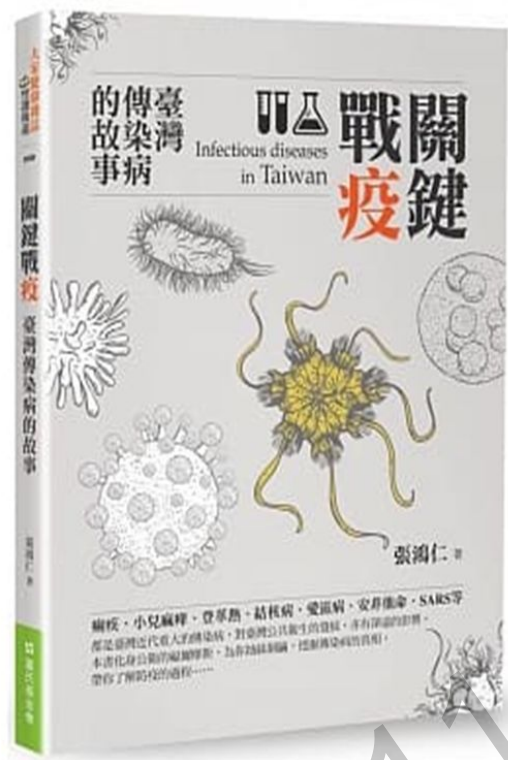


由CTCs看精準醫療產業的發展

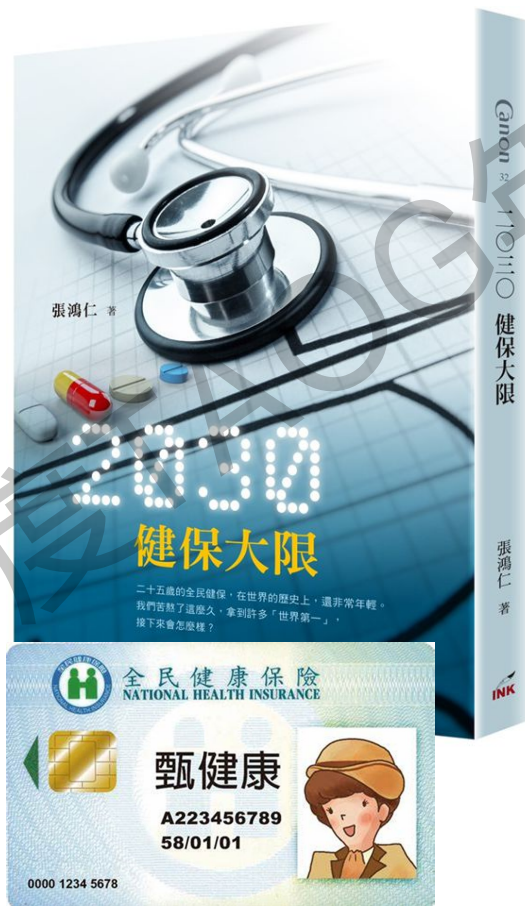
上騰生技顧問股份公司

張鴻仁 董事長

1995-1998 防疫處處長
1999-2000 首任疾管局局長

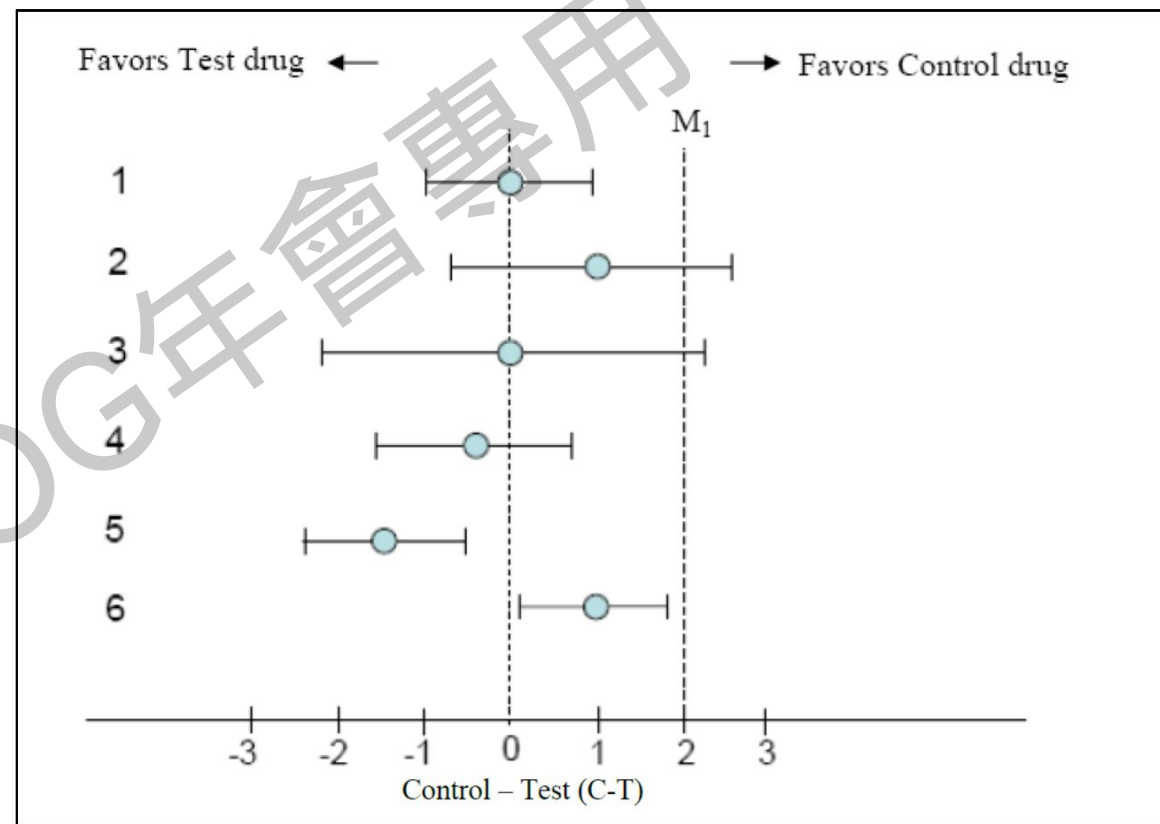
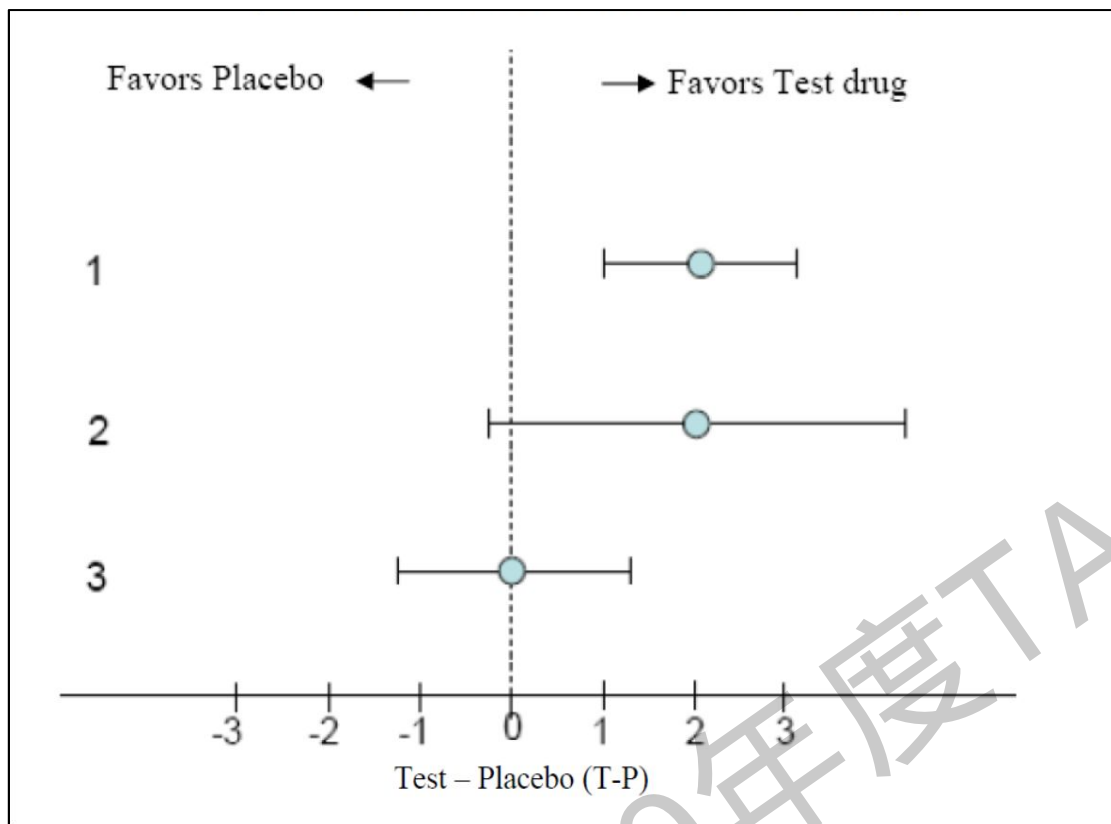


2001-2004 健保局總經理



1989-1993 藥政處
2005 - 現在 生技創投





110年度TAOG年會專用

Non-Inferiority Clinical Trials to Establish Effectiveness

Guidance for Industry

**U.S. Department of Health and Human Services
Food and Drug Administration
Center for Drug Evaluation and Research (CDER)
Center for Biologics Evaluation and Research (CBER)**

**November 2016
Clinical/Medical**

Published online 2014 Jul 15. doi: [10.1155/2014/819362](https://doi.org/10.1155/2014/819362)

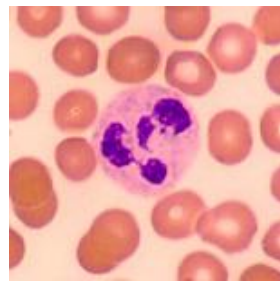
Detection of Circulating Tumor Cells

[Sanne de Wit](#), [Guus van Dalum](#), and [Leon W. M. M. Terstappen](#)*

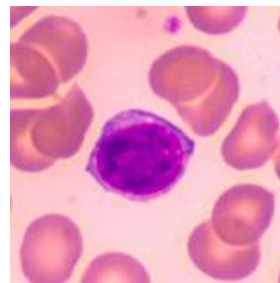
In 1869, Thomas Ashworth described the microscopic observation of circulating tumor cells (CTC) in the blood of a man with metastatic cancer. He concluded that the CTC must have passed through the circulatory system to arrive at the vein from which the blood was collected [1]. The critical role that circulating tumor cells play in the metastatic spread of carcinomas has been demonstrated more than 100 years later [2]. Only recently technology has become available with the requisite sensitivity and reproducibility to explore the diagnostic potential of CTC [3].

大海撈針 (Needle in a haystack)

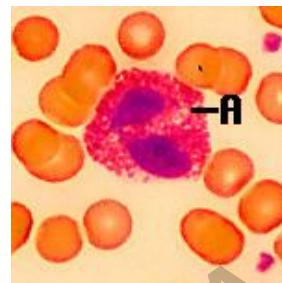
Circulating Tumor Cells in Blood



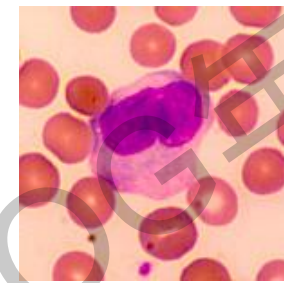
Neutrophil:
50-70%



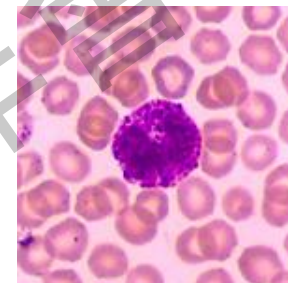
Lymphocyte:
25-35%



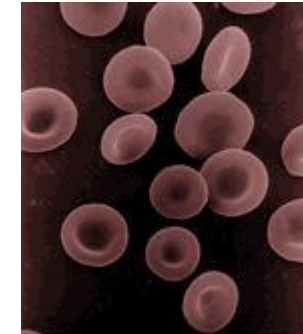
Eosinophil:
~ 5%



Monocyte:
~ 5%



Basophil:
~ 1%



Red Blood Cells:
~ 1%

In 1 mL
of Blood:

~ 5 Million
White Blood Cells

~ 5 Billion
RBCs

scientific reports (2021)



OPEN

Circulating tumour cells as an indicator of early and systemic recurrence after surgical resection in pancreatic ductal adenocarcinoma

Yejong Park^{1,4}, Hye Ryeong Jun^{2,4}, Hwi Wan Choi³, Dae Wook Hwang¹, Jae Hoon Lee¹, Ki Byung Song¹, Woohyung Lee¹, Jaewoo Kwon¹, Su Hyeon Ha¹, Eunsung Jun^{1,3} & Song Cheol Kim¹

這個韓國技術，處理一個sample要8小時

CellSearch by Veridex

(The only system approved by US FDA for CTC enumeration)



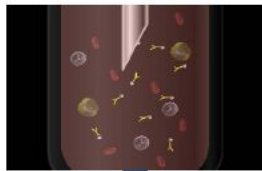
AutoPrep for
CTC Enrichment

CellAnalyzer for
CTC Identification



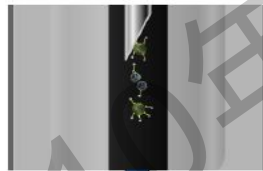
Processing by the CellTracks® AutoPrep® System

Aspirate plasma
Add buffer
Add ferrofluid.



Magnetic incubation

Aspirate fluid and
unlabeled cells

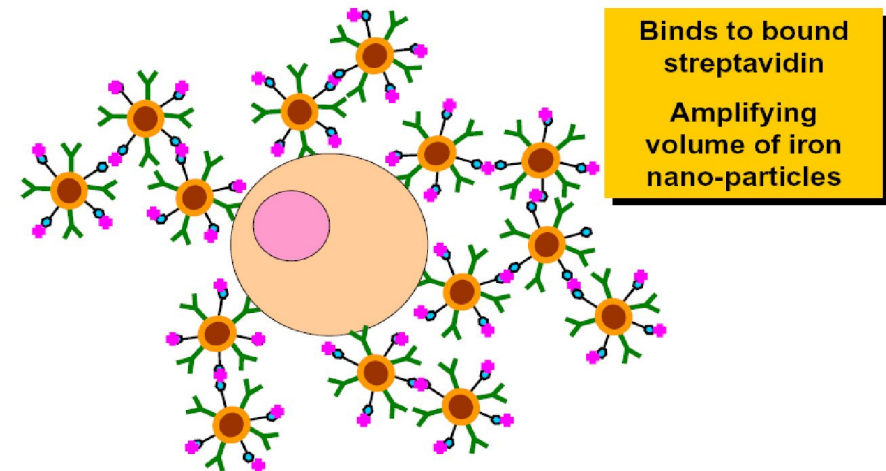
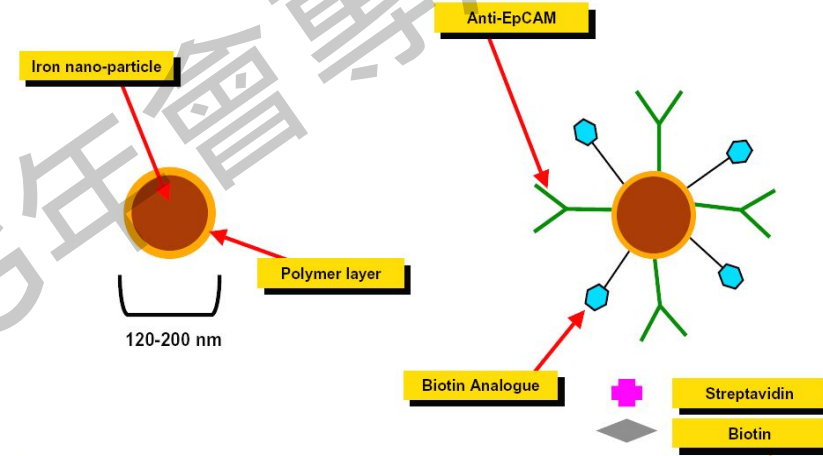


Remove magnets.
Resuspend target
cells in buffer

Permeabilize and
add Staining
Reagents



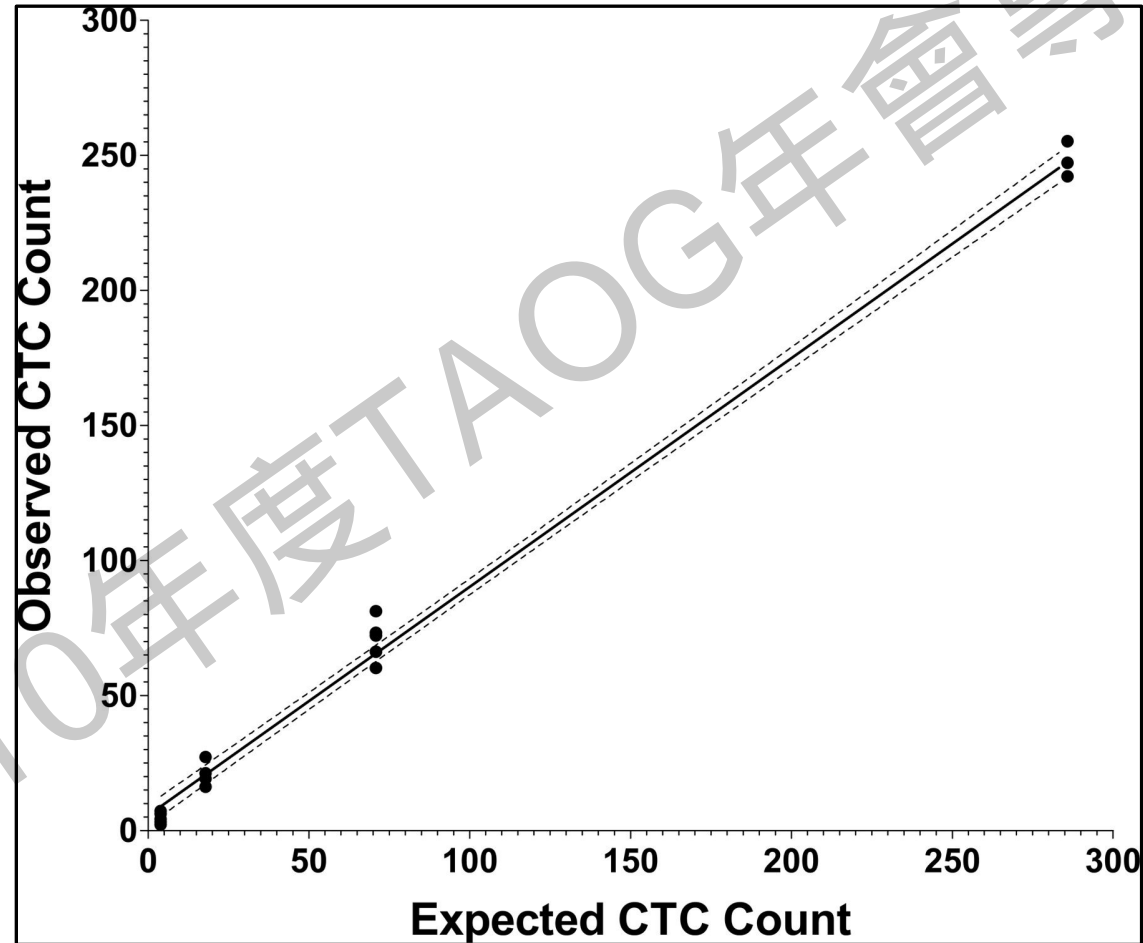
CTC leukocyte



Tumor Cells Circulate in the Peripheral Blood of All Major Carcinomas but not in Healthy Subjects or Patients With Nonmalignant Diseases (2004)

W. Jeffrey Allard, Jeri Matera, M. Craig Miller, Madeline Repollet, Mark C. Connelly, Chandra Rao, Arjan G. J. Tibbe, Jonathan W. Uhr, and Leon W. M. M. Terstappen

DOI: 10.1158/1078-0432.CCR-04-0378 Published October 2004

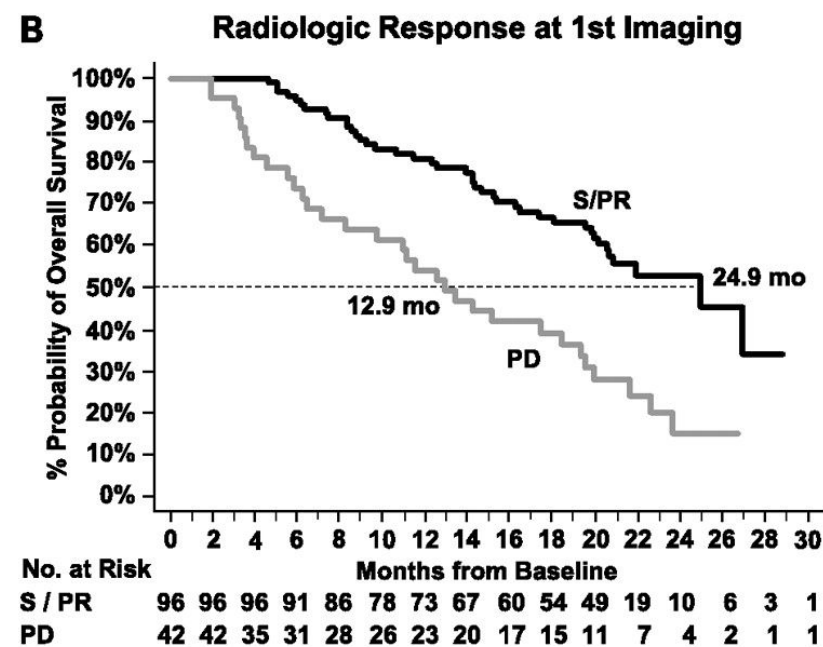
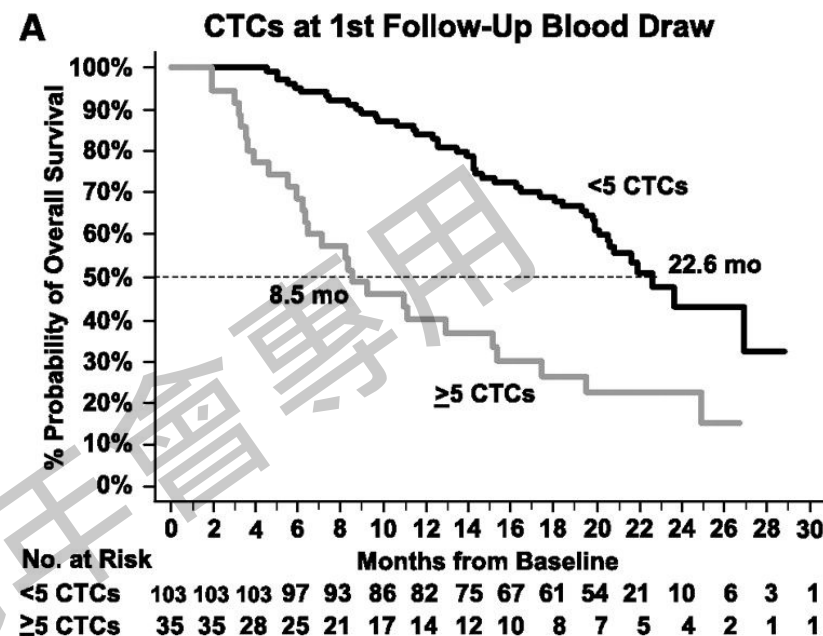


Circulating Tumor Cells versus Imaging--Predicting Overall Survival in Metastatic Breast Cancer (2006)

December 2006 · [Clinical Cancer Research](#) 12(21):6403-9

DOI:10.1158/1078-0432.CCR-05-1769

Source · [PubMed](#)



110年度TAOGR

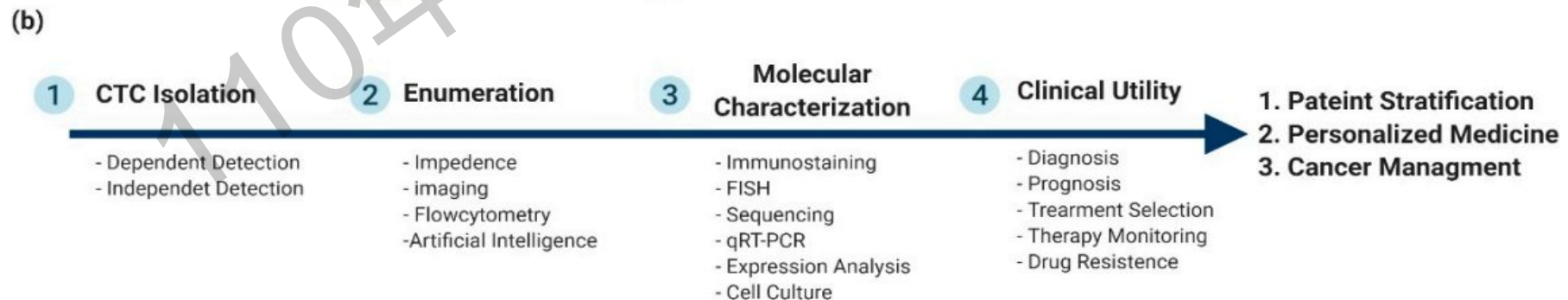
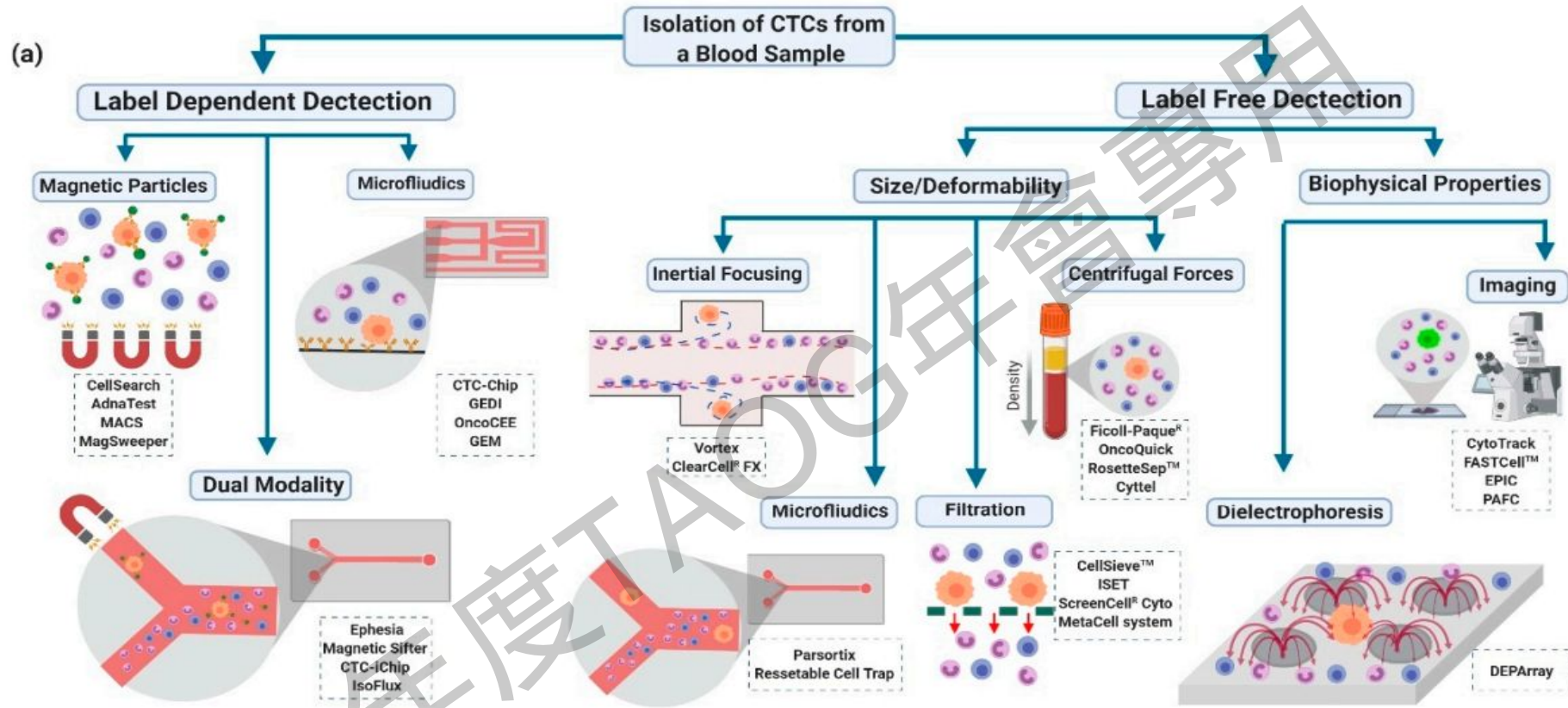
Circulating tumour cells: their utility in cancer management and predicting outcomes (2010)

Matthew G. Krebs, Jian-Mei Hou, Tim H. Ward, Fiona H. Blackhall and Caroline Dive

Enumeration of CTCs	Molecular characterisation of CTCs
<ul style="list-style-type: none">• Guide prognosis• Assist in measuring response to anticancer therapy – predictive and/or pharmacodynamic biomarker• May lead to more accurate prognosis when added to existing staging classifications• Select patients for adjuvant chemotherapy• Detect recurrent disease• Aid diagnostic process	<ul style="list-style-type: none">• Surrogate for biological activity of underlying tumour – ‘real-time biopsy’• Elucidate prognostic and predictive molecular features• Detection of treatment-resistant profiles – ease of serial sampling• Improve understanding of mechanisms of biological processes• Discover and identify new targets for therapeutic manipulation

Potential applications of circulating tumour cell (CTC) analysis.

Methods and Platforms for CTC Analysis



罕見細胞的分析技術

罕見細胞分析技術	特點
依據細胞尺寸或物理特性	Enrichment 設備較簡易, 價格較低 需前處理移除紅血球, 易造成目標細胞流失 (40-70%) 分離出的細胞純度低, 需進一步螢光染色鑒定是否為目標細胞
直接細胞影像掃描鑒定法 (EPIC)	直接進行目標細胞鑒定, 已分析檢體可留存 需前處理移除紅血球, 易造成目標細胞流失 (40-70%)
磁珠分選法	可進行全血分析, Enrichment 儀器價格較便宜 細胞具有重量, 即使磁珠貼附也不一定能回收細胞 需另用螢光顯微系統進行鑒定, 增加額外成本
微流體晶片免疫捕抓法 (魔鬼沾, On-Q-iety CTC Chip)	靈敏度較高, 可能可直接使用全血 純度及專一性中等 生物標誌選擇彈性低, 且難同時進行 multiple biomarker 捕抓
螢光分選法 (流式細胞儀)	可進行 multiple biomarker 分選 使用全血偵測非常耗時效率不佳 前處理又會導致罕見細胞流失, 用於罕見細胞靈敏度低
螢光分選+尺寸篩選+自動影像鑒定	上準微流體 (MiCareo) 獨有整合技術

MiCareo Technology (eDAR): Sorting from Billion to Thousand



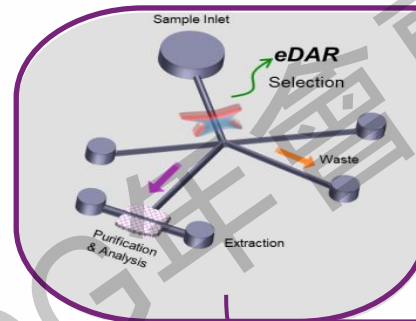
We begin with whole blood

This ensures minimal target cell loss.

A single tube of blood contains **billions** of cells.

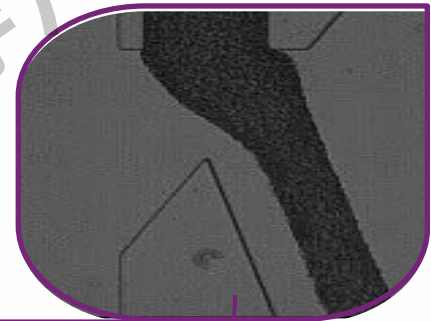


We label the **target cells** with **single or combined** florescent antibodies to enhance sorting sensitivity.

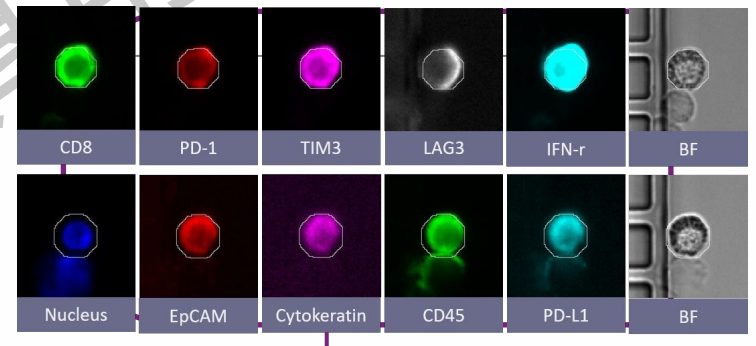
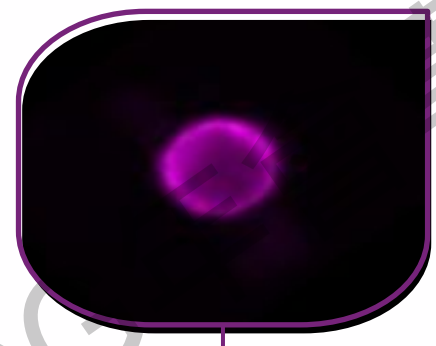
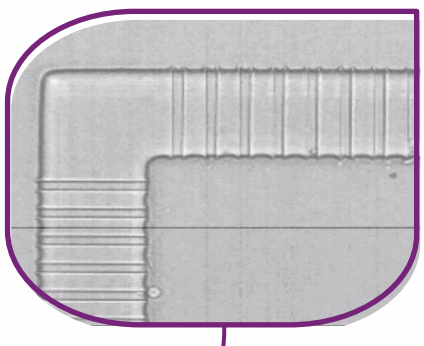
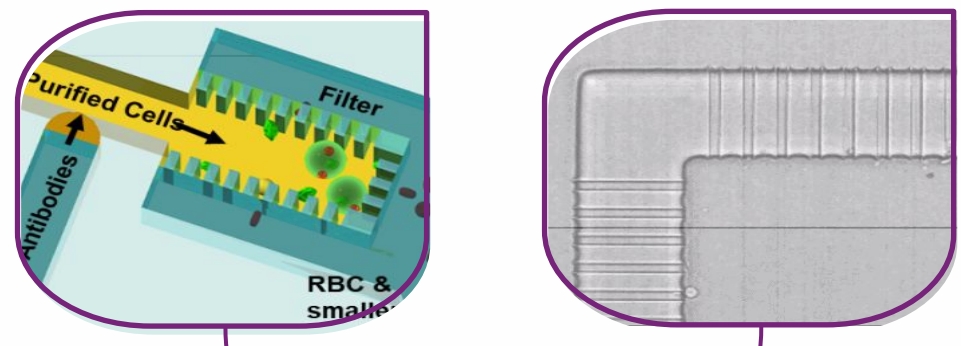


eDAR sorts out the nano-liter **"aliquots"** of blood containing the target cells – in milliseconds.

Resulting aliquot contains **thousands** of cells (~25,000 RBC, ~25 WBC, 1 target cell)



MiCareo Technology (eDAR): Enriching from Thousand to One



On-Chip Filtration

to remove RBC and small nucleated cell, with **5 or 2.5 micron** filter to retain different size of target cells.

No clogging, cell shear stress or capacitance issues found with other technologies.

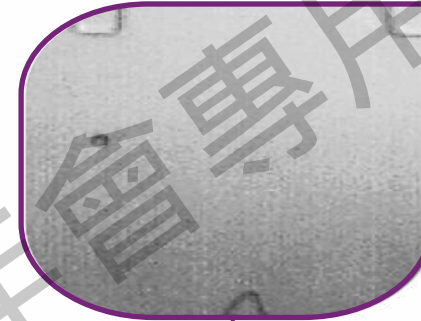
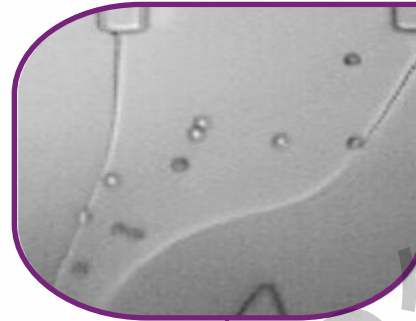
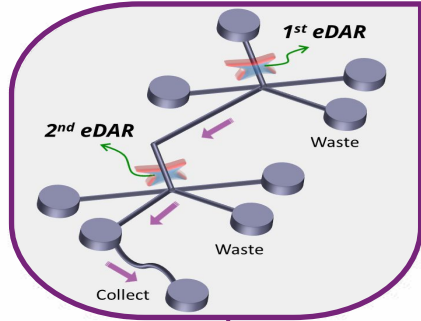
Reagent Staining & Imaging

Fully automatic and up to **13 biomarkers** can be analyzed.

Imaging & Analysis

Automated imaging and comprehensive analysis software

MiCareo Technology: Cell Retrieval from Billion to One



We begin with whole blood and label the target cells. This ensures minimal sample loss.

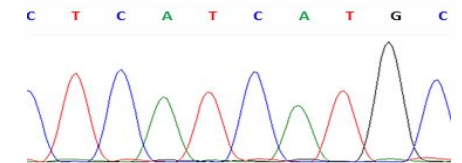
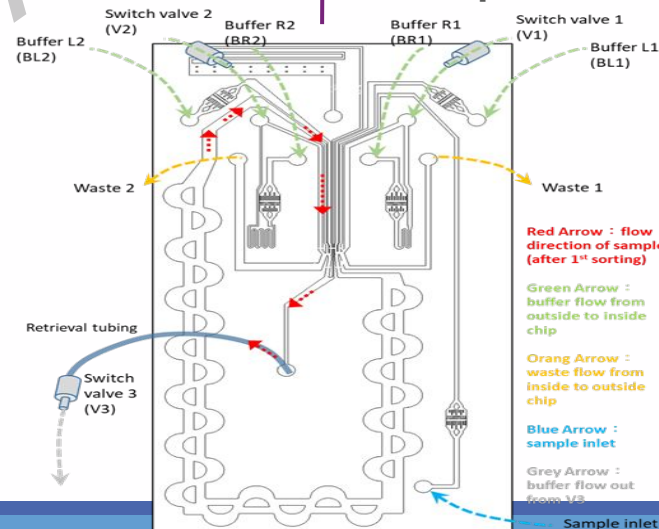
Two stages of eDAR sorting for excellent cell purity.

First stage for initial enrichment

Second stage for single cell purification

Collect in Vial
A vial of 150 μ L volume with high purity of target cells.

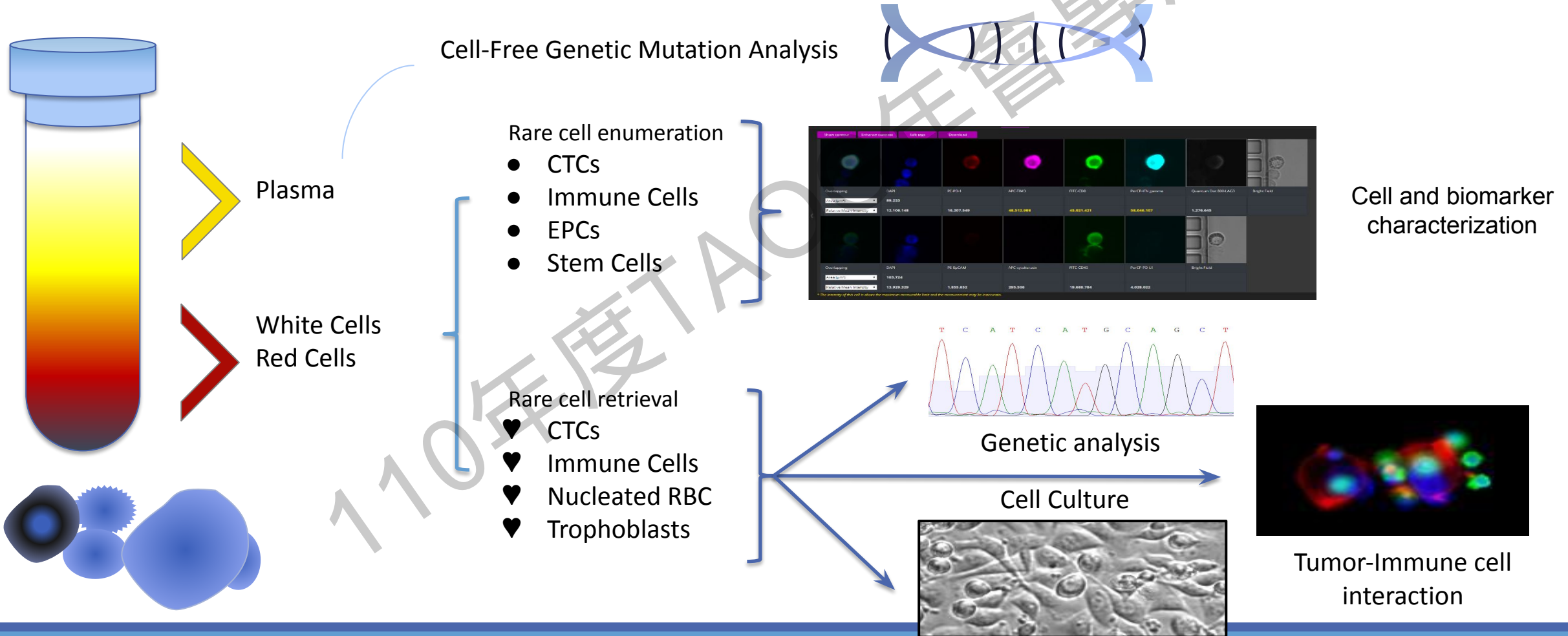
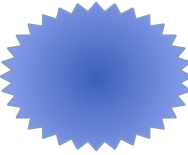
A single tube of blood contains **billions** of cells.



Mutation analysis
By NGS or Q-PCR

Liquid Biopsy Analysis from Blood

Both cellular and cell-free plasma analysis can be performed with a single tube of blood.



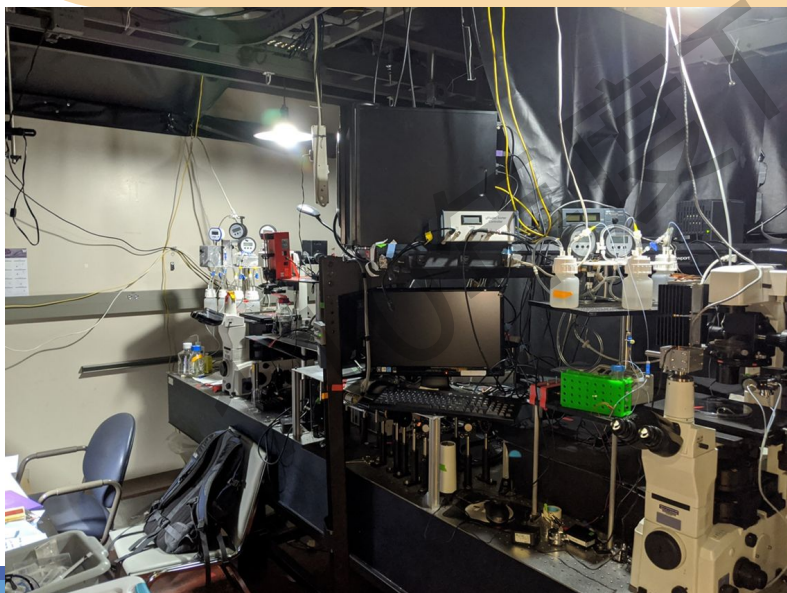


Professor Daniel T. Chiu (邱德雲教授)
University of Washington, Seattle

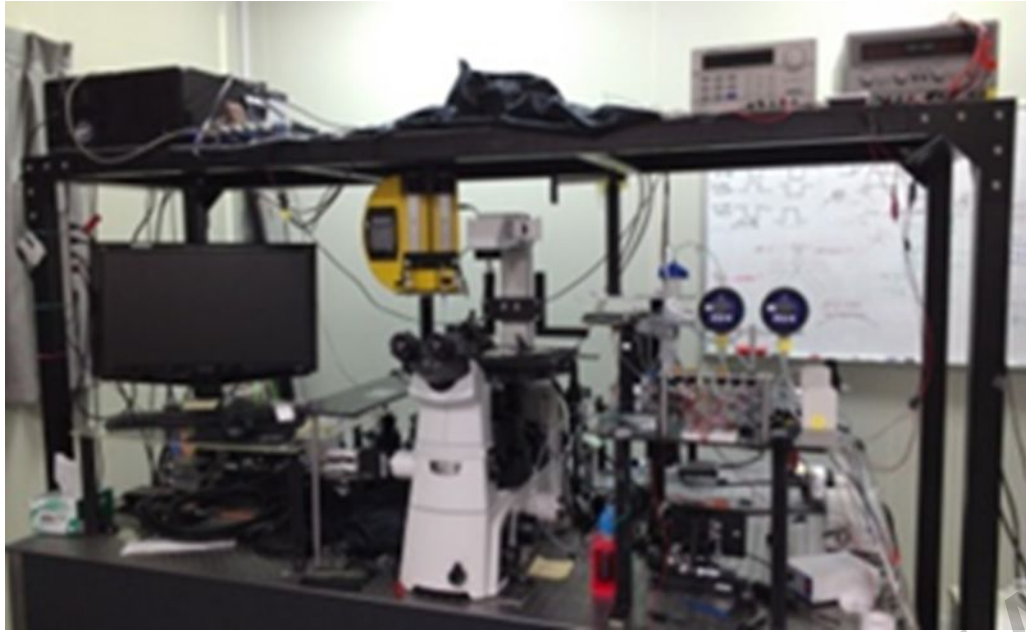
Postdoctoral research Harvard University, 1999

Ph.D. Stanford University, 1998

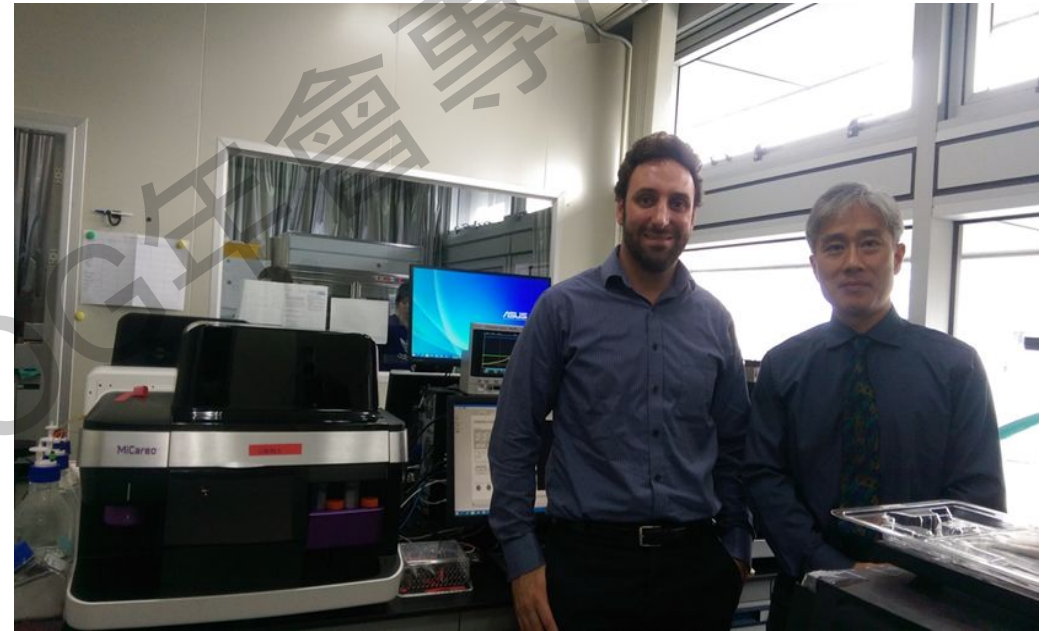
B.S. and B.A. UC Berkeley, 1993



2011年



MiSelect R Open System 2012

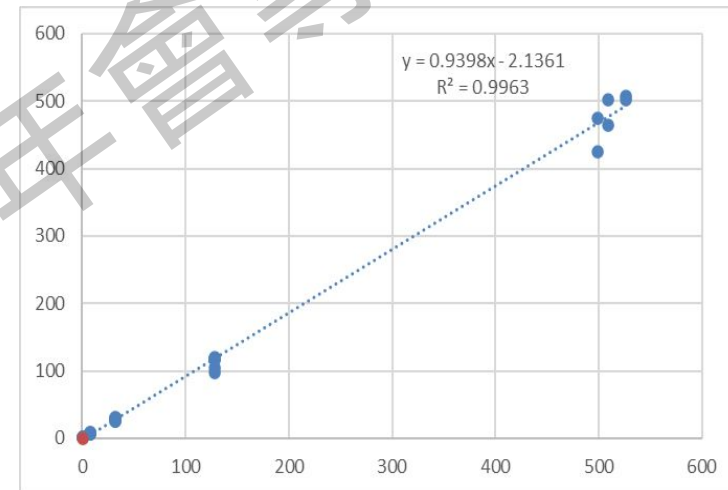


Engineer model-2015

Superb Detection Performance

檢測準確度 PPA、NPA 之結果			
CTC enumeration LoD = 1 cell			
	Positive	Negative	Total
Test positive	79	0	79
Test negative	1	28	29
Total	80	28	108
	Number tested	Agreement	95% Confidence Interval
PPA	80	98.8%	(93.2%, 100%)
NPA	28	100.0%	(87.7%, 100%)
陽性檢體 (N=80) 為外添加 1 顆 (N = 50) 或 2 顆 (N = 9) 或 3 顆細胞 (N = 21) 至健康捐贈者全血之檢測 陰性檢體 (N=28) 為 28 個未外添加細胞之健康捐贈者全血檢體檢測			
*PPA – Positive Percent Agreement			
*NPA – Negative Percent Agreement			

Reportable Range: 1-512 cells* in 8mL whole blood



*1, 8, 32, 128 and 512 cells spiked into 8mL whole blood, N=6 for each

- 於 8 毫升健康捐贈者全血中分別外添加 0 顆 (N=28) 或 1-3 顆 (N=80) 癌細胞進行檢測, PPA: 98.8%, NPA: 100%
- 在 8 毫升全血中, 即使只有 1 顆罕見細胞也能精準偵測; 相當於在全世界的 5 倍人口中找到一個人!
- 在 8 毫升全血中, 1 到 512 顆癌細胞皆可精準定量

2012年 首度發表

> *Angew Chem Int Ed Engl.* 2012 May 7;51(19):4618-22. doi: 10.1002/anie.201108695.
Epub 2012 Feb 22.

Sensitive and high-throughput isolation of rare cells from peripheral blood with ensemble-decision aliquot ranking

Perry G Schiro¹, Mengxia Zhao, Jason S Kuo, Karen M Koehler, Daniel E Sabath, Daniel T Chiu

兩階段分離細胞 (2019)

> *Anal Chem.* 2019 Nov 19;91(22):14605-14610. doi: 10.1021/acs.analchem.9b03690.
Epub 2019 Nov 7.

Isolating Rare Cells and Circulating Tumor Cells with High Purity by Sequential eDAR

Eleanor S Johnson¹, Shihan Xu^{1 2}, Hui-Min Yu³, Wei-Feng Fang³, Yuling Qin¹, Li Wu¹, Jiasi Wang¹, Mengxia Zhao¹, Perry G Schiro³, Bryant Fujimoto¹, Jui-Lin Chen³, Daniel T Chiu^{1 2}

Affiliations: — collapse

Affiliations

- ¹ Department of Chemistry, University of Washington, Box 351700, Seattle, Washington, United States.
- ² Department of Bioengineering, University of Washington, Seattle, Washington, United States.
- ³ MiCareo Inc., Xing-Ai Road Ln. 77 No. 69 5F, Taipei City, Taiwan.

與陽明大學/台北榮總合作(2018)

> Nat Commun. 2018 Sep 12;9(1):3696. doi: 10.1038/s41467-018-06134-z.

STAT3-coordinated migration facilitates the dissemination of diffuse large B-cell lymphomas

Yi-Ru Pan ¹, Chih-Cheng Chen ^{2 3}, Yu-Tien Chan ¹, Hsiao-Jung Wang ⁴, Fan-Tso Chien ⁵,
Yeng-Long Chen ⁵, Jing-Lan Liu ⁶, Muh-Hwa Yang ^{7 8 9}

與中研院合作(2021)

> Proc Natl Acad Sci U S A. 2021 Jan 19;118(3):e2014408118. doi: 10.1073/pnas.2014408118.

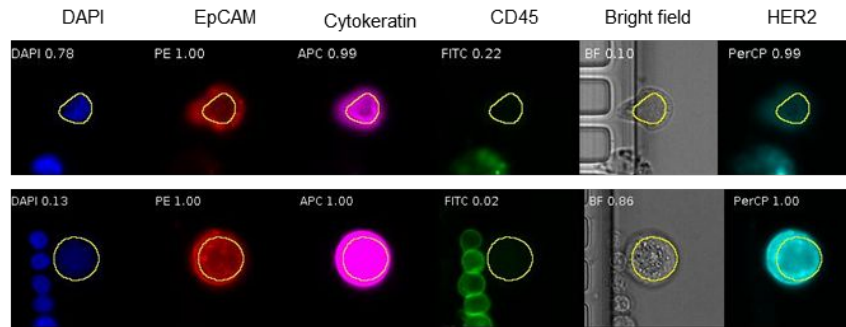
Interplay between desmoglein2 and hypoxia controls metastasis in breast cancer

Po-Hao Chang ¹, Min-Che Chen ², Ya-Ping Tsai ², Grace Y T Tan ¹, Pang-Hung Hsu ³,
Yung-Ming Jeng ⁴, Yi-Fang Tsai ⁵, Muh-Hwa Yang ⁶, Wendy W Hwang-Verslues ⁷

HER2 Status Identified by CTCs are Highly Concordant with IHC Test Results

mBC study

A. HER2 Status Identification of Isolated CTCs in mBC Patients



CTC#1: HER2 (0)

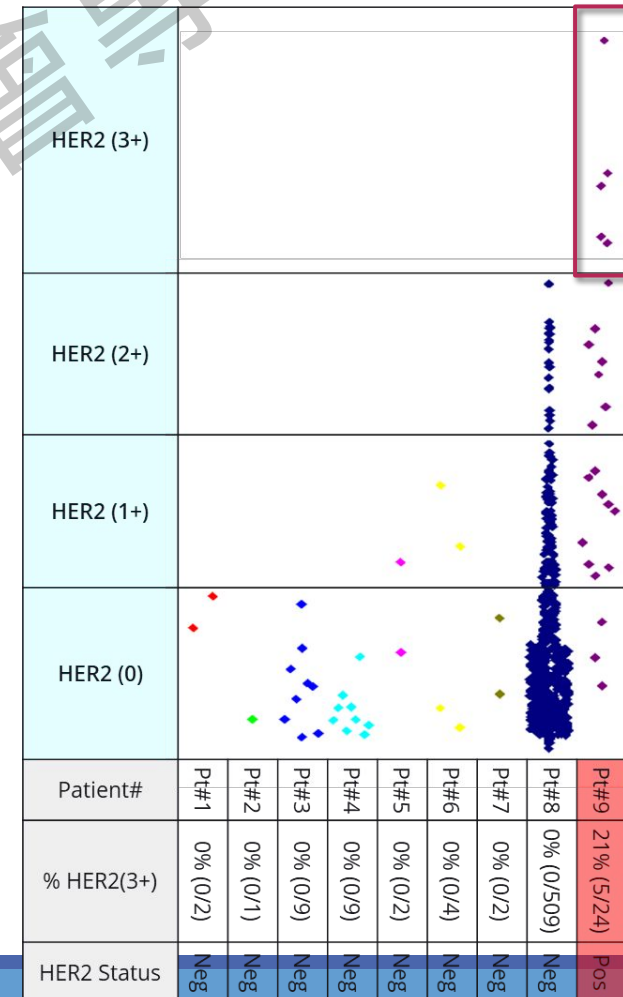
CTC#2: HER2 (3+)

HER2 (3+) >10%

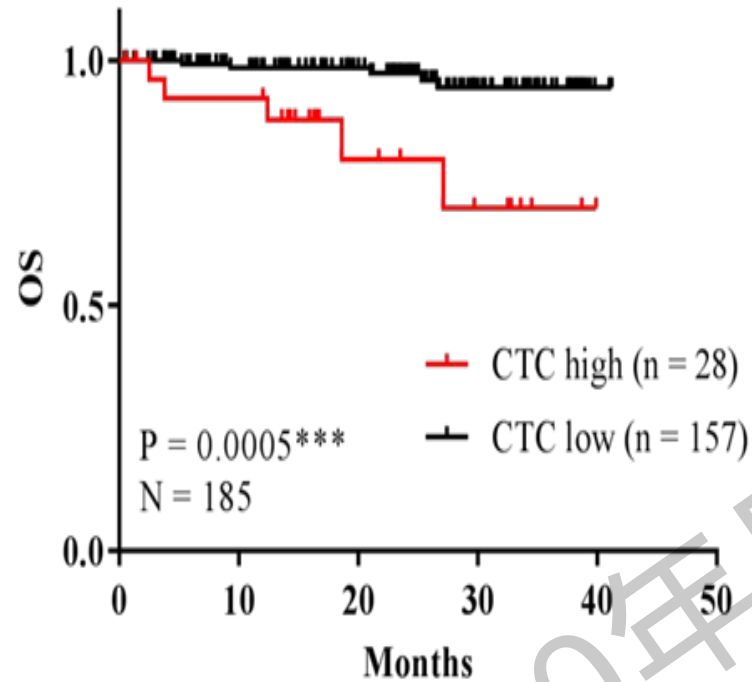
- HER2 positive is defined as >10% HER2(3+) of total CTCs.
- One patient (Pt#9) is identified as HER2 positive.

B. Compared to IHC Results

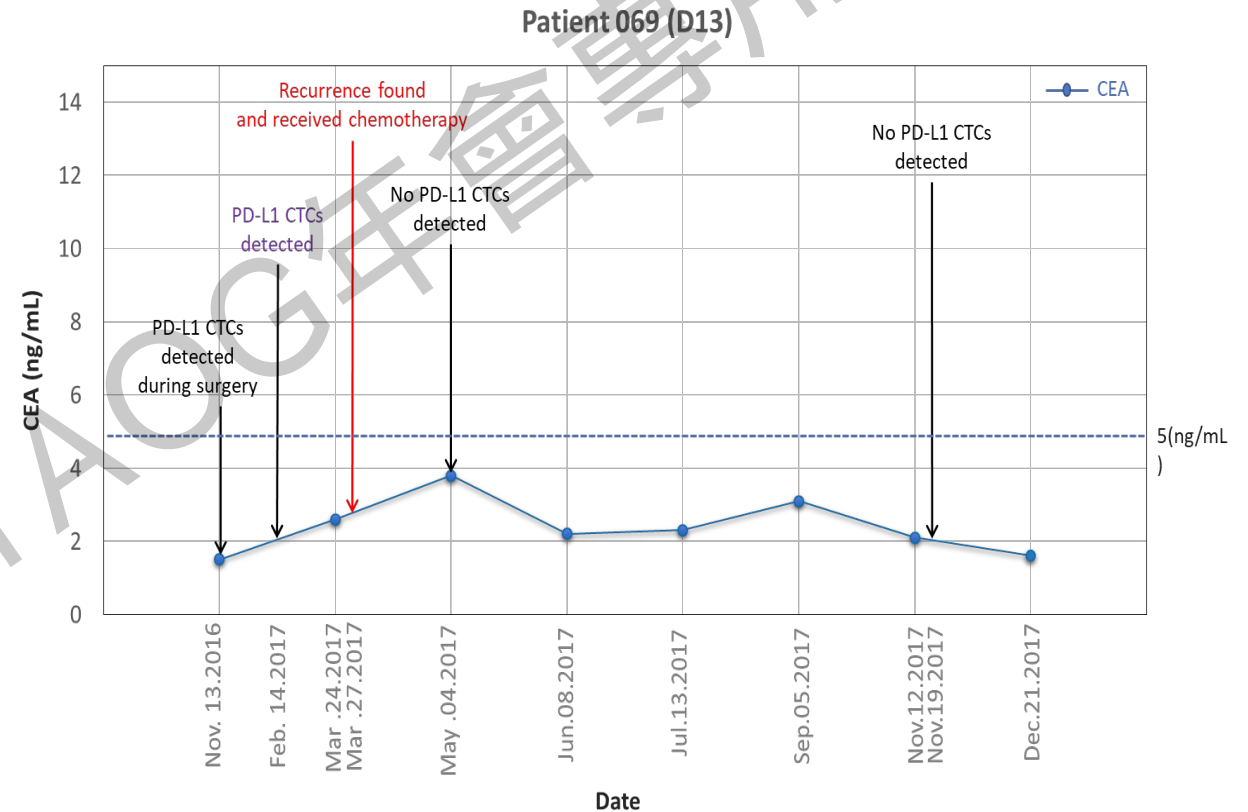
IHC Test	IHC Test	
	HER2 (Pos)	HER2 (Neg)
MiSelect R		
HER2 (Pos)	1/9	0/9
HER2 (Neg)	0/9	8/9
Sensitivity	100%	-
Specificity	-	100%



CTC as Prognostic Marker and Can Reveal Early Recurrence in CRC



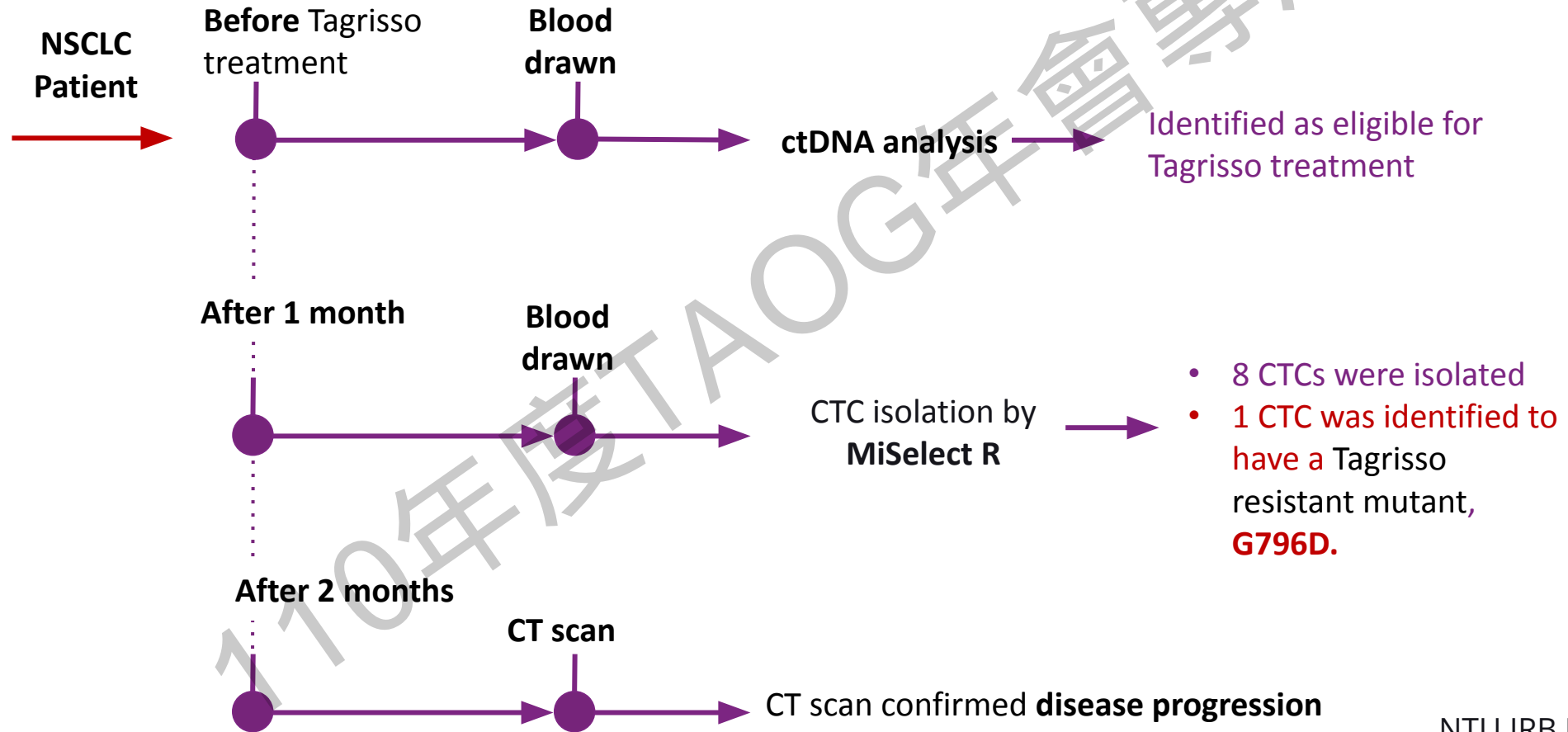
- CTC analysis before surgery as good prognostic marker



- Treatment monitoring using PD-L1(+) CTC analysis
- PD-L1(+) CTC reveal early recurrence

Detection of Drug Resistance on CTC before CT Assessment

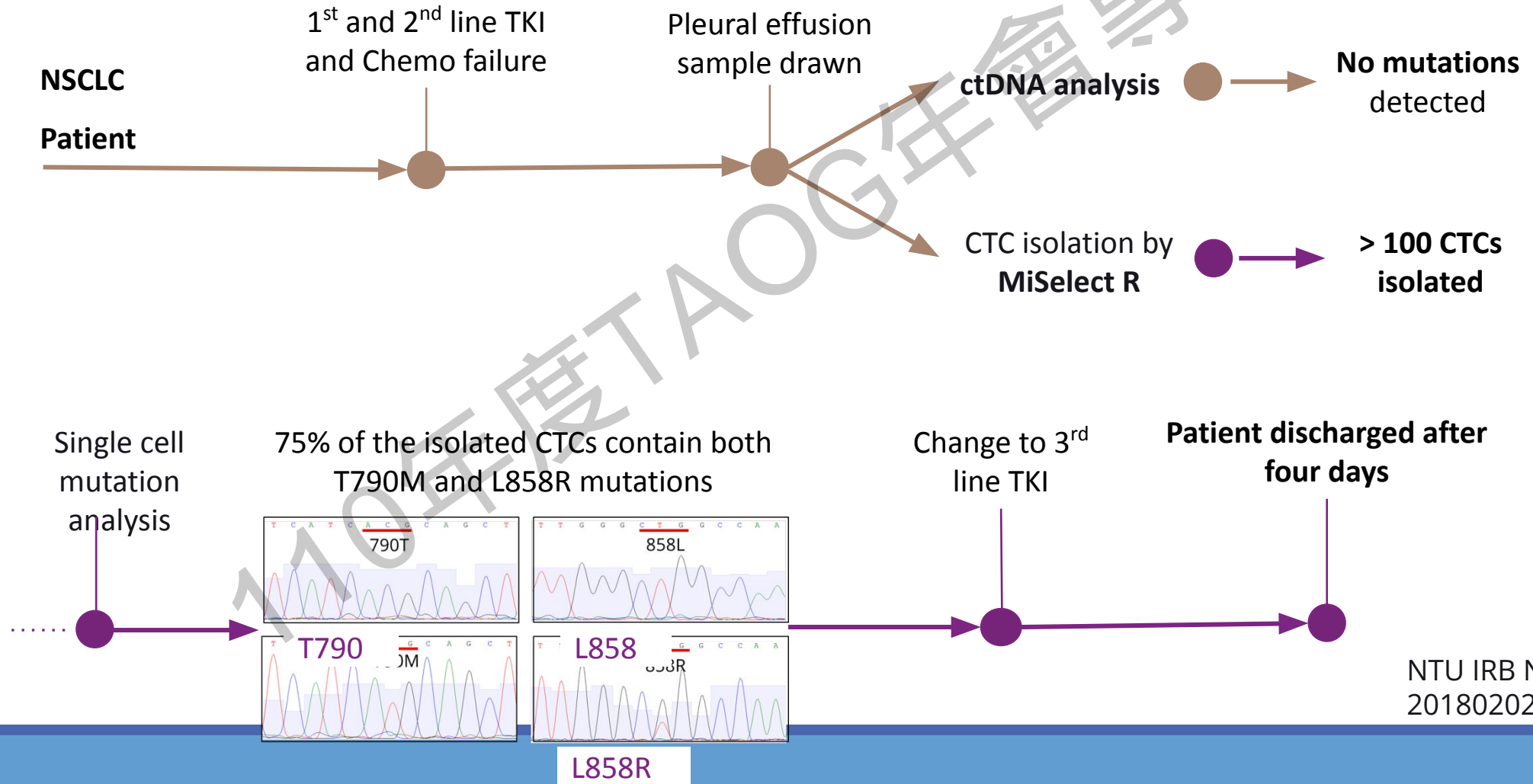
NSCLC Study



NTU IRB No:
201802025RIPD

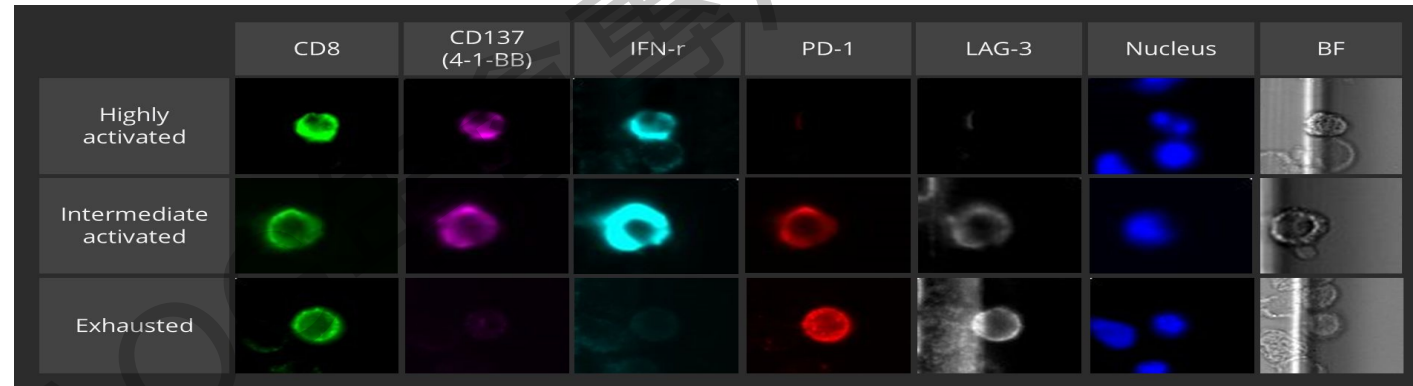
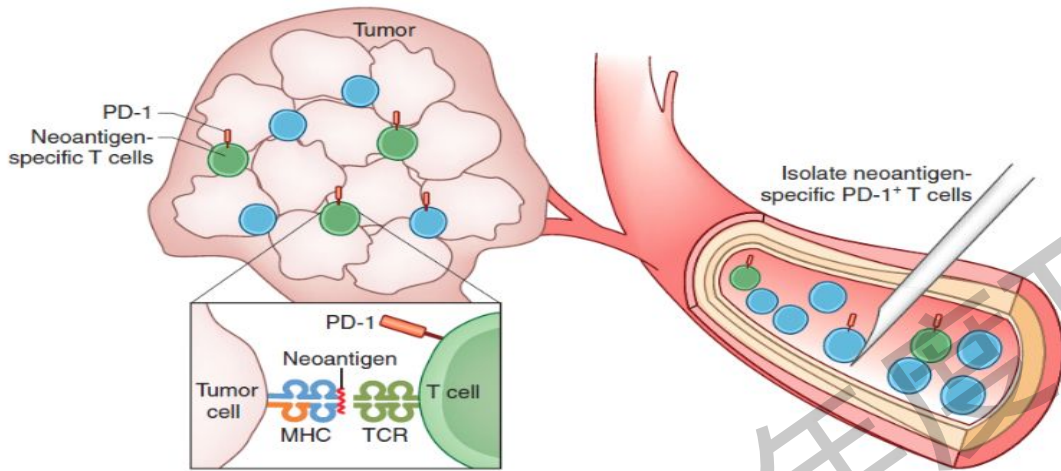
EGFR Mutation Analysis on CTC Reveals Heterogeneity

NSCLC Study



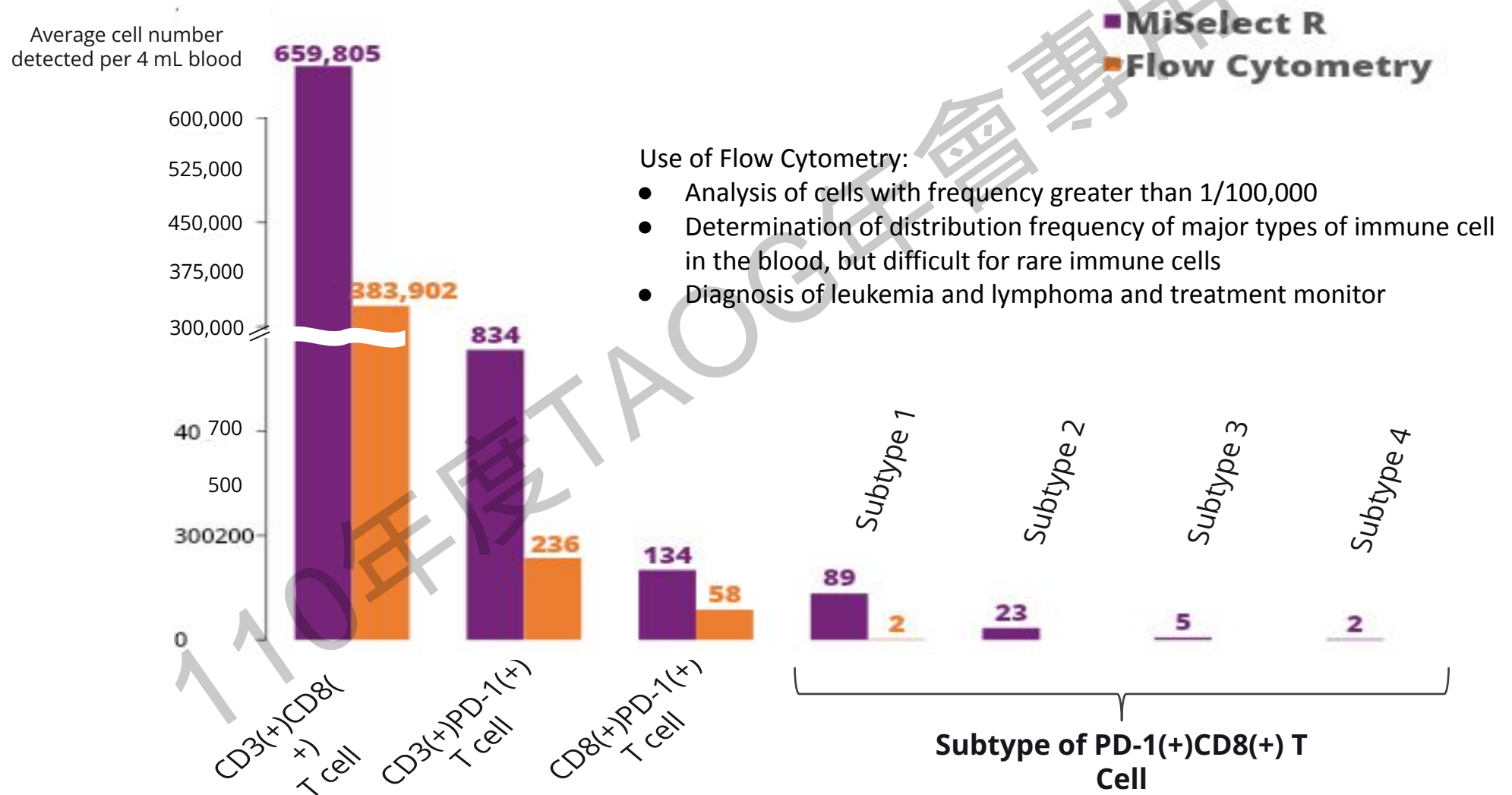
Profiling Tumor-Related Rare Immune Cell for Immunotherapy

Specific rare immune cells from peripheral blood are critical for selection of patients suitable for immuno-therapy and monitoring of treatment response



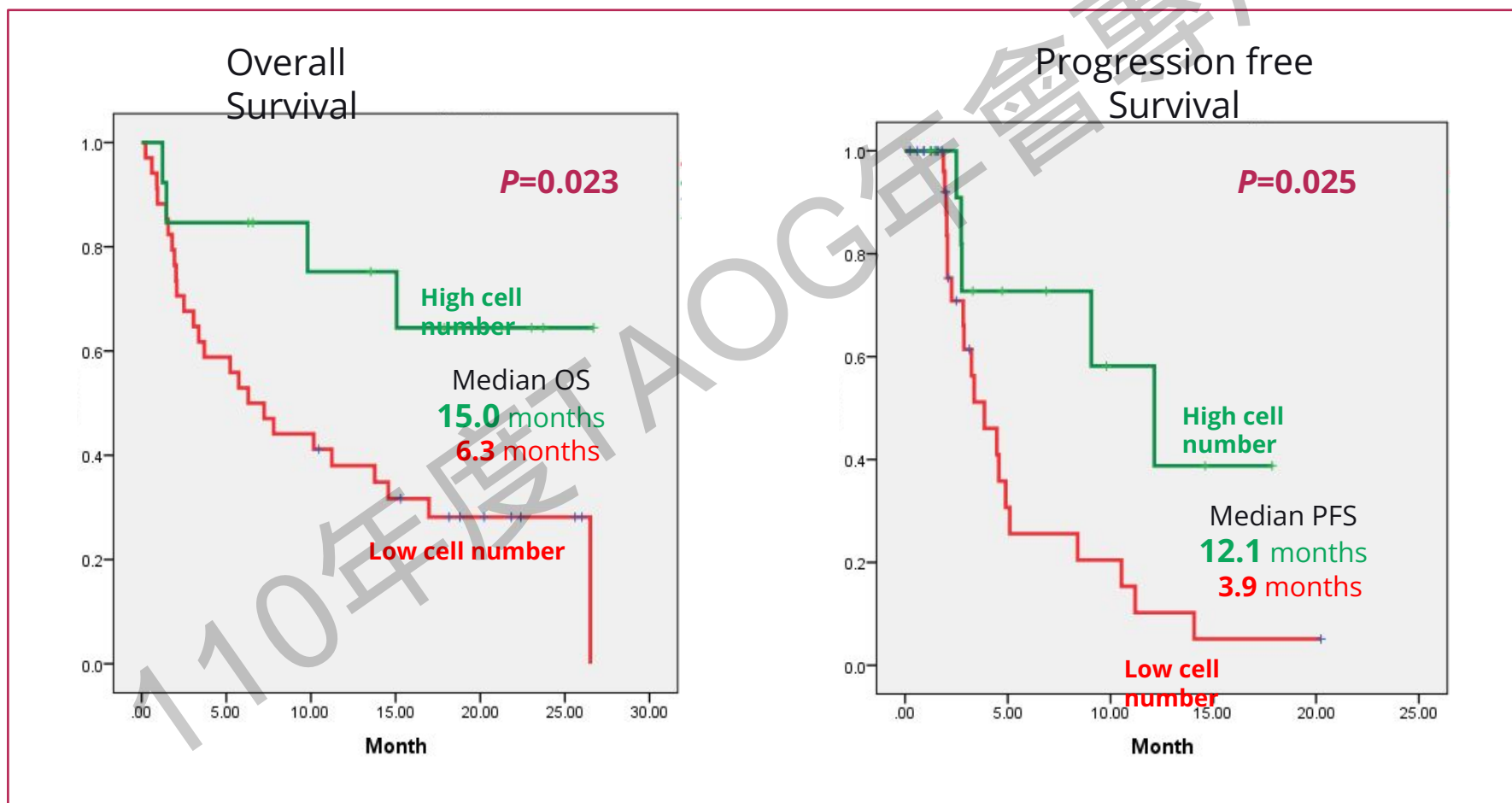
	Marker Characteristics	Biomarkers
#1	Activation marker	4-1-BB (CD137), B7 super family, IL-2, OX-40...
#2	Lineage marker	CD3, CD4, CD8, CD11b, CD11c, CD19, CD56,...
#3	Functional marker	TNF α , IFN γ , Granzyme...
#4	Exhaustion marker Chemokine receptor	LAG3, TIM3, PD1, CTLA-4... CXCR4, CCR7...

Rare immune cell analysis by MiSelect R and Flow Cytometry



Number of CD8+PD-1+ Immune Cell Can Predict OS and PFS of Immune Therapy

CD8+PD-1+ cells were determined **before** anti-PD-1 therapy in HCC Patients



- Patients with high cell number survive **2-5 times** longer than those with low number.

Potential Uses of MiSelect R in Cell Therapy



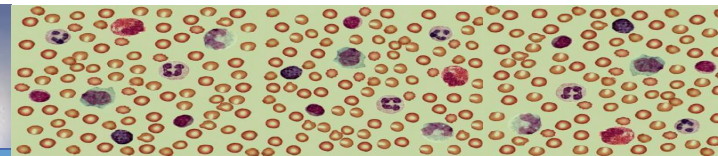
1. Immune cell profiling of patients

2. Enrichment of therapeutic cells from patient blood

3. Potency analysis of therapeutic cell during expansion and activation

4. Quality control of therapeutic prep

5. Monitor the change of therapeutic cells on number, activity, and memory status after injection



極高的精確度

可明確區分0顆與1顆細胞

可同時分析高達 13 種生物標誌物

全自動螢光染色與取像

回收高活性，高純度罕見細胞

強而有力的研究工具，接續二代測序等分析

可使用全血上機 無須前處理

5 分鐘手動置備時間，罕見細胞不流失

世界獨創整合系統

自動化影像分析，可定量，高再現性

快速高效率，3小時內完成全程檢測

MiSelect R II 自動化細胞分析及分選微流體影像平台



 YouTube

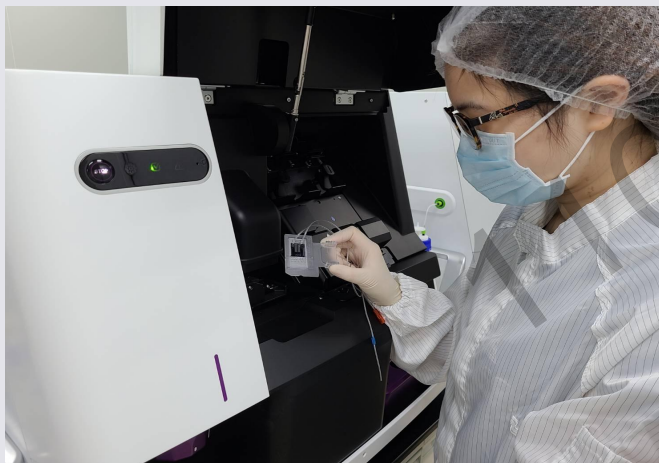


 LinkedIn

上準精準醫療檢測實驗室 (LDTs)



檢測名稱	分析標的	用途	技術項目	服務範圍	列冊申請狀態
EGFR常見變異位點檢測(CTC)	<ol style="list-style-type: none"> 腫瘤類別:上皮細胞癌 檢體型態: 全血 基因名稱: EGFR 突變位點: E19 deletion, T790M, L858R 	全血中之循環腫瘤細胞EGFR常見變異位點檢測	即時偵測基因擴增 (Real-Time PCR)	體細胞突變 (Somatic Mutation)	LDTs列冊申請中
循環腫瘤細胞數量檢測	<ol style="list-style-type: none"> 腫瘤類別:上皮細胞癌 檢體型態:全血 Biomarker: EpCAM, Cytokeratin, CD45 	全血中之循環腫瘤細胞計數	特定細胞計數 (Specific Cell Counting)	蛋白質表達量檢測 (Protein Expression Profile Test)	LDTs列冊申請中
帶有特定生物標誌 (HER2,PD-L1) 循環腫瘤細胞數量檢測	<ol style="list-style-type: none"> 腫瘤類別:上皮細胞癌 檢體型態:全血 Biomarker: EpCAM, Cytokeratin, HER2, PD-L1, CD45 	全血中之帶有特定生物標誌循環腫瘤細胞計數	特定細胞計數 (Specific Cell Counting)	蛋白質表達量檢測 (Protein Expression Profile Test)	開發完成, LDTs列冊準備中
循環毒殺T細胞檢測	<ol style="list-style-type: none"> 腫瘤類別:上皮細胞癌 檢體型態:全血 Biomarker: CD8,IFN-γ,PD1,TIM3,LAG3 	全血中之腫瘤毒殺細胞計數	特定細胞計數 (Specific Cell Counting)	蛋白質表達量檢測 (Protein Expression Profile Test)	開發完成, LDTs列冊準備中
血管前驅內皮細胞數量檢測	<ol style="list-style-type: none"> 檢體型態:全血 Biomarker: CD34,CD133,VEGFR 	全血中之血管前驅內皮細胞計數	特定細胞計數 (Specific Cell Counting)	蛋白質表達量檢測 (Protein Expression Profile Test)	開發中



Milasen: The drug that went from idea to injection in 10 months

A custom antisense oligonucleotide drug has set records for both personalization and speed in drug development

by [Ryan Cross](#)

OCTOBER 16, 2019 | APPEARED IN **VOLUME 97, ISSUE 42**



Credit: Boston Children's Hospital

Timothy Yu, Mila Makovec, and her mother Julia Vitarello at Boston Children's Hospital

Rare-Cell Diagnostics

THE NEW ENGLAND JOURNAL of MEDICINE

BRIEF REPORT

Patient-Customized Oligonucleotide Therapy for a Rare Genetic Disease

J. Kim, C. Hu, C. Moufawad El Achkar, L.E. Black, J. Douville, A. Larson, M.K. Pendergast, S.F. Goldkind, E.A. Lee, A. Kuniholm, A. Soucy, J. Vaze, N.R. Belur, K. Fredriksen, I. Stojkowska, A. Tsytsykova, M. Armant, R.L. DiDonato, J. Choi, L. Cornelissen, L.M. Pereira, E.F. Augustine, C.A. Genetti, K. Dies, B. Barton, L. Williams, B.D. Goodlett, B.L. Riley, A. Pasternak, E.R. Berry, K.A. Pflock, S. Chu, C. Reed, K. Tyndall, P.B. Agrawal, A.H. Beggs, P.E. Grant, D.K. Urion, R.O. Snyder, S.E. Waisbren, A. Poduri, P.J. Park, A. Patterson, A. Biffi, J.R. Mazzulli, O. Bodamer, C.B. Berde, and T.W. Yu

- **30M patients in U.S.**
- **7000 distinct conditions (globalgenes.org)**
- **Sequencing**
- **Early Childhood or Adolescence w/ Rapid Acceleration of Symptoms (Age 3 symptoms → Age 6 blindness, seizures, Batten Disease etc)**

Need to Know Prior to Birth?
→ **Prenatal**

MiCareo

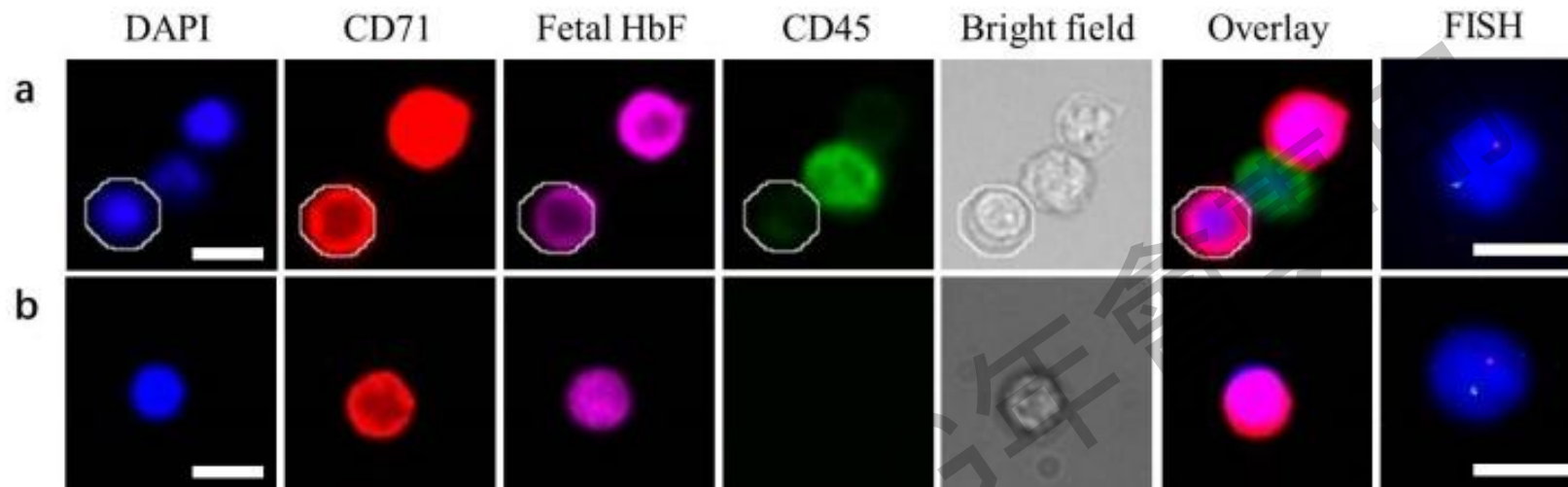
Inaccessible/Unknown Organs of Origin?
→ **Rare Circulating Cells**

MiCareo

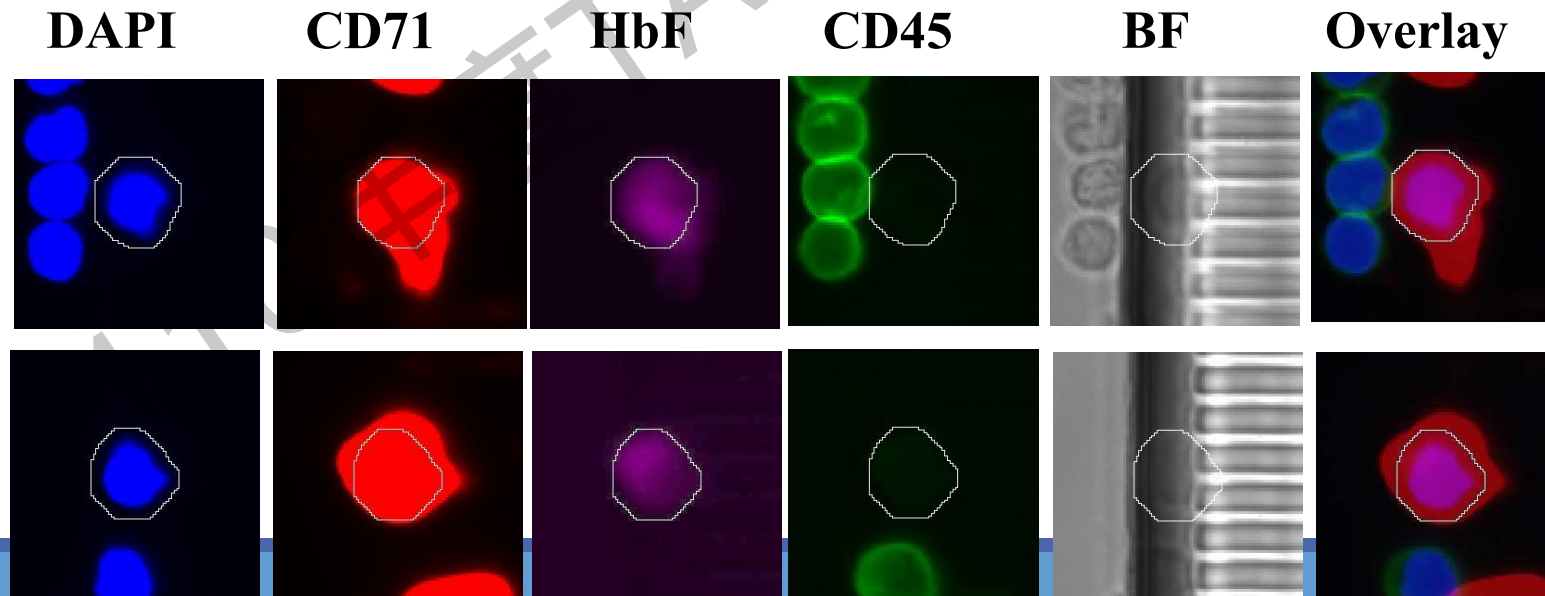
Readily Accessible and Abundant Cells

FACS

Cord Blood: Lots of fnRBCs + FISH



Maternal Peripheral Blood (8mL): 2 fnRBCs



護國神山

台積電 劉德音董事長



智慧醫療值多少錢？

台灣醫藥產業總產值 **1.5兆**
≈ **台積電**



陽明大學 郭旭崧校長

護國群山



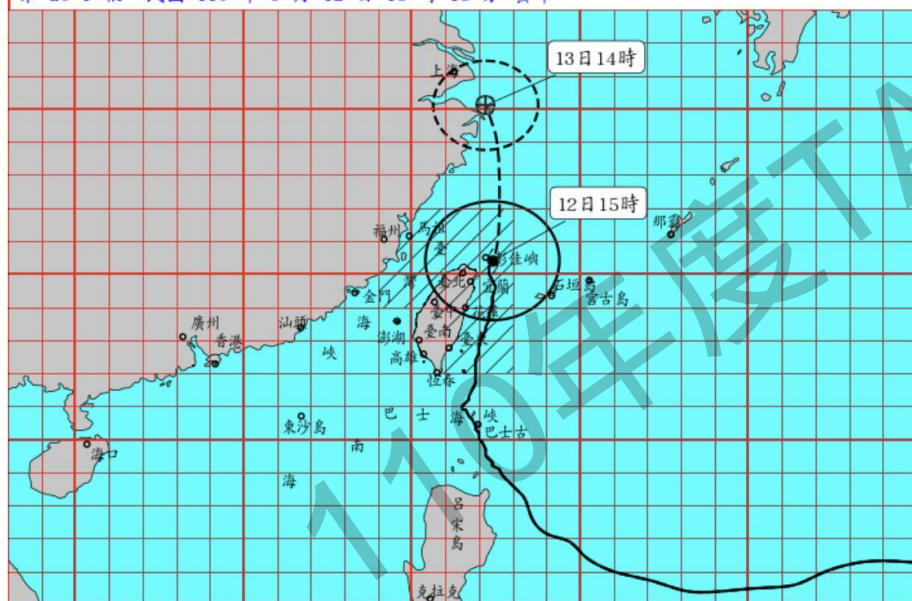
中度颱風 璨樹 (國際命名 CHANTHU) 海上陸上颱風警報

[點我看更多](#)

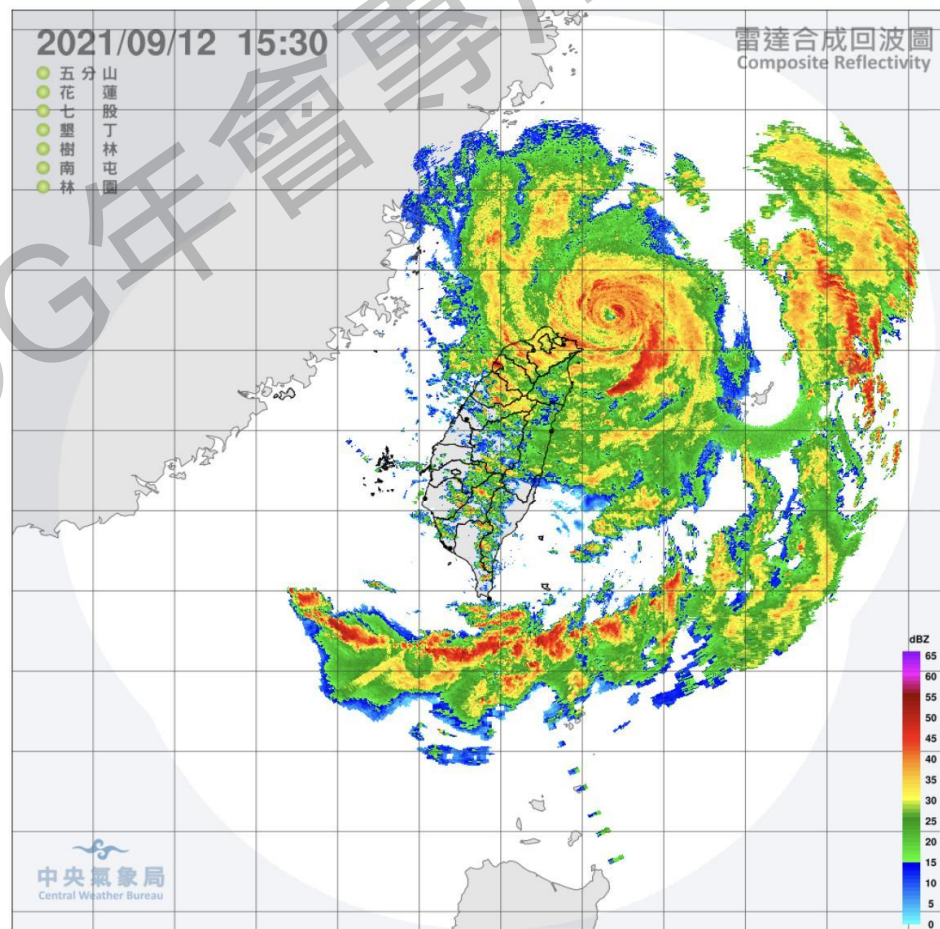
編號第14號颱風警報 第20-1報

發布時間：09/12 15:15

中度颱風 (編號第14號 國際命名: CHANTHU, 中文譯名: 璨樹)
第 20-1 報 民國 110 年 9 月 12 日 15 時 15 分 發布



無地形 有地形 降雨雷達



世紀大疫來襲 誰來護國？

The COVID-19 Pandemic and the \$16 Trillion Virus - David Cutler and Lawrence Summers



David Cutler

Otto Eckstein Professor of Applied
Economics, FAS

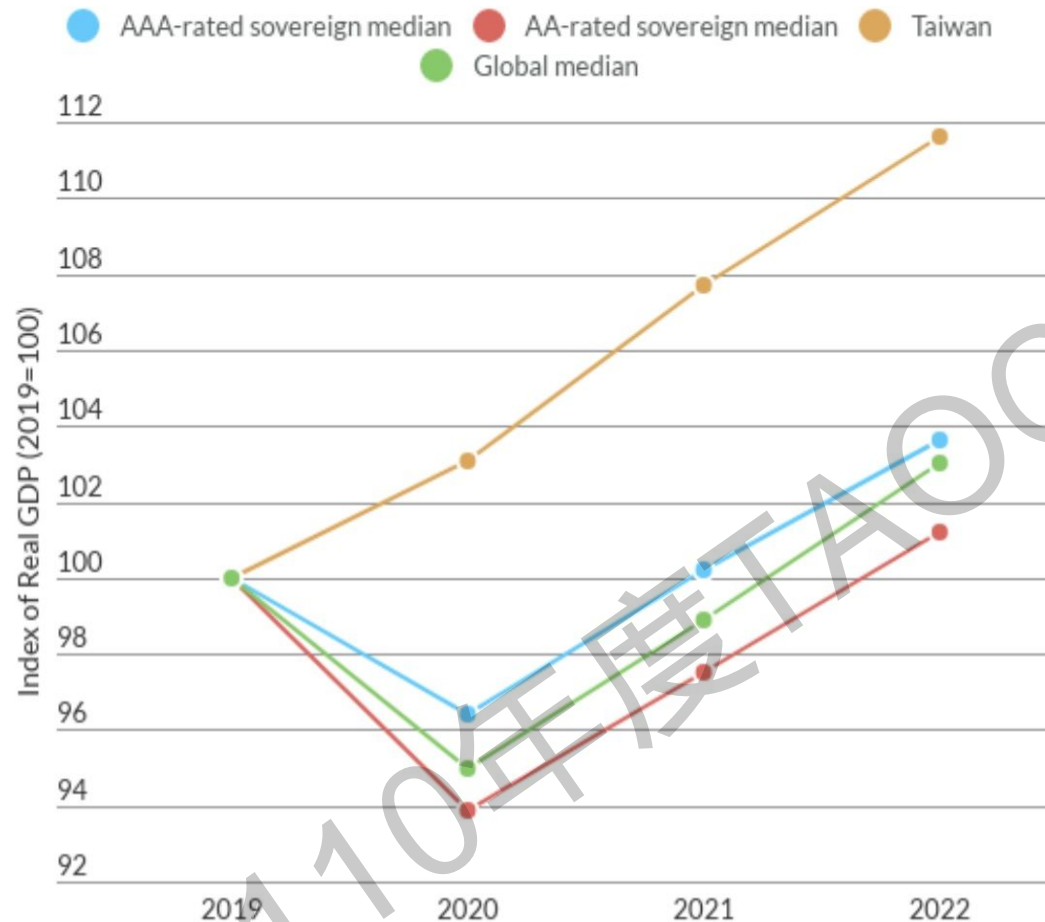


Lawrence H. Summers

Charles W. Eliot University Professor

October 12, 2020

Real GDP Levels, Taiwan vs Peer Groups (Index, 2019=100)



Note: Forecasts from Fitch March 2021 Sovereign Data Comparator; Global median is median for all Fitch-rated sovereigns
Source: Fitch Ratings

防疫成功值多少錢？

拯救西方世界的三支疫苗

- BioNTech – 2008年成立(Market cap > 20B)
- Moderna – 2010年成立(Market cap > 40B)
- Oxford University – Ebola/MERS (2014年)
– Disease X (2019年)

神速行動  川普花200億美元預訂七支疫苗

Moderna 市值與國際藥廠比較

USD,8/27/2021

Name	Market Cap
Novartis	205B
Merck	193B
AstraZeneca	181B
Moderna	154B
Bristol-Myers Squibb	147B
Sanofi	130B
Amgen	126B

Moderna 目前市值154B (4.3兆台幣),
跟台灣所有公司比只輸台積電(市值15兆台幣)

相當於 鴻海+聯發科+台塑化+富邦金

(精準)醫療：專業與產業的結合

科學是根本

110年度TAOG學會專用

Industry = 「工業」?

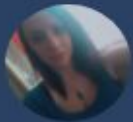
Industrial Development Bureau

經濟部工業局

Tourism Industry

Health care industry

The State of Healthcare Industry – Statistics for 2021



By Smiljanic Stasha

Last modified: August 6, 2021

US largest employer

World largest and fastest growing sector

Fauci Wants to Make Vaccines for the Next Pandemic Before It Hits

If funded, a government program costing several billion dollars could develop “prototype” vaccines to protect against 20 families of viruses.



Dr. Anthony Fauci, director of the National Institute of Allergy and Infectious Diseases, spoke during a Senate hearing on Tuesday. Stefani Reynolds for The New York Times

The New York Times
2021.7.25

Fauci 說只要給他「幾十億」美金，他就可以在下一個病毒來襲前準備好疫苗！

遠距醫療大爆發

TELEMEDICINE, HEALTH TECH

Teladoc, Livongo finalize \$18.5B merger

The two companies finalized their merger on Friday, with Livongo becoming a subsidiary of Teladoc. Shareholders overwhelmingly approved the deal on Thursday.

By ELISE REUTER

Post a comment / Oct 30, 2020 at 2:39 PM



他打造「全女醫」陣容 要讓台灣生殖醫療走向國際 金融老將林羣揪「試管媽」團隊 助人圓夢

撰文・林宏文

橫跨證券、電子及生技業的資深老將林羣，看好台灣生殖醫療的競爭力，今年成立宜蘊醫療集團，他要如何翻轉傳統作法，從台灣走向國際？

我們就是想翻轉這個產業，讓台灣生殖醫學以走向國際！」說這句話的人，是今年三月成立的宜蘊醫療集團董事長林羣。

在金融市場、資本市場，



林羣（中）率領全女醫團隊試管嬰兒大夢，左起為中醫診所院長陳玉娟、胚胎技術長陳映潔，右起為生殖中心院長陳菁徽、生殖中心副院長廖琪鈞。

Profile 宜蘊醫療集團

成立：2021年

董事長：林羣

事業目標：以全女性團隊，運用最先進的科技與技術，打造適宜懷孕、提升試管嬰兒成功率的生殖醫療環境

集團組成：宜蘊生殖醫學中心、宜蘊中醫診所、宜蘊胚胎實驗室

林羣都不是一個陌生的名字；他待過企管顧問龍頭麥肯錫，也在摩根大通、荷銀及麥格理證券等外資投行主導過多起併購及增資案，又歷任光寶、群光、藍天等公司財務長、策略長，之後轉進生技業，擔任美時、台資董事長，是少數橫跨證券、電子及生技業的資深老將。如今，他的新目標是精準不孕症生殖醫學，也就是俗稱的「試管嬰兒」。

公司在股權改組後，只花三年時間積極併購就成功上市，於是他開始認真研究生殖醫學市場的發展機會，發現這是一個台灣最具高成長機會的行業之一，只要透過專業團隊及科技升級，可以讓產業改造並進一步蛻變成功。

為何選擇生殖醫學領域？林羣說，他注意到這個產業，是因為二〇一九年六月在港股掛牌的錦欣生殖。當時，這家

根據統計，全球不孕症發生率為十五%，每年一、三億新生兒中，有〇、四%（約五十萬名）是經由人工生殖技術協助生產，但每年全球大約施行二五〇萬次（cycle）生殖醫療服務，卻只有五千餘家醫院可以提供服務，顯示不孕症的供需仍有瓶頸。

此外，台灣在這個行業

110年

結論

- 1) Liquid biopsy is the key to precision medicine
- 2) Rare cells are important component of liquid biopsy, which include CTCs, rare immune cells, and circulating fetal cells.
- 3) MiCareo (上準微流體) is one of the best platforms for detecting and isolating rare cells, which is developed in Taiwan.
- 4) Scientist need "industry" to develop "Innovative Scientific ideas" into commercializable products in order to save lives.