數據可靠性 (Data Integrity)
由GLP談到實驗記錄本

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TSQA

Outlines

- 什麼是Integrity
- 由Data Integrity導致GLP的誕生
- GLP的內容與生醫品質的關係
- 由幾個小故事說明Data Integrity與實驗記錄本的關係
  - Haruko Obokata of RIKEN, Jpn 的文章造假
  - AIDS 病毒的發現與NOBEL laurate
  - 行天宮神蹟與Western blotting的再現性
- 所有醫藥產品的Nonclinical Safety Test均須符合GLP
- GLP適用於學校研究機構嗎？
- 實驗記錄本撰寫原則

張忠謀與台積電的核心價值

ICIC

- Integrity 誠信正直
- Commitment 承諾
- Innovation 創新
- Customer trust 客戶信任

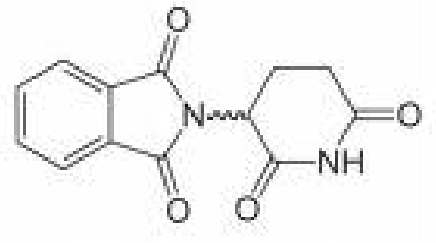
Integrity:

- The assurance that information is unchanged from its source (與原始數據無異), and has not been accidentally or maliciously modified(修改), altered (改變) or destroyed (損毀).

Integrity -- GLP

- GLP是如何產生的，這必須從1958年沙利竇邁(Thalidomide)的悲劇談起...

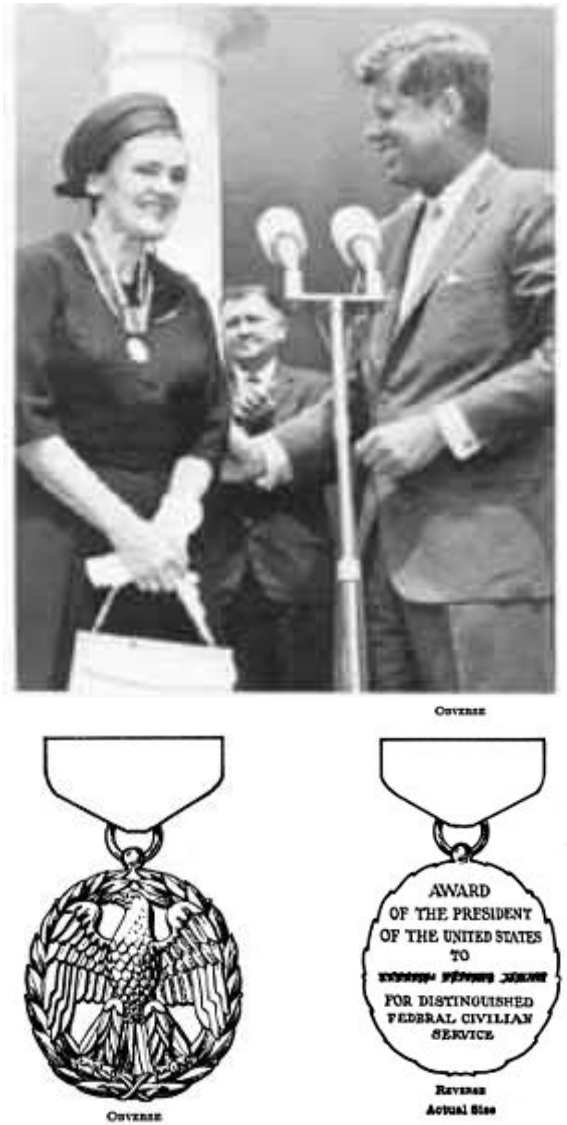
The Thalidomide Tragedy (沙利竇邁)



- Thalidomide, to treat morning sickness,
- 1957-1962 marketed in UK, Canada, Germany, Japan and Taiwan (大日本製藥於65、1、4日賠償38患者)
  -US FDA did not approve
- 12,000 babies with phocomelia
  – if used in the 1st trimester
- FDA (USA) relicened this drug on Aug 1998, to treat leprosy.

Thalidomide
IMPORTANT PATIENT INFORMATION

- *Frances O. Kelsey, MD, the FDA medical officer who relied on the 1938 "new drug" law to refuse approval of thalidomide for marketing in the United States, receiving the Distinguished Federal Civilian Service Award from President John F. Kennedy, August 7, 1962.*



On October 10 President Kennedy signed the Drug Amendments of 1962, also known as the **Kefauver-Harris Amendments** (Drug Efficacy Amendment), which required drug manufacturers to prove to the FDA that their products were both safe and effective prior to marketing.

The Born of GLP

- The glory days
  - FDA prevented Thalidomide tragedy in US (1958)
- Scandals in CRO 1975 – 1978

  Biometric Testing Incorporated Industrial Bio-Test
  - performed 35-40% of all US toxicology studies!
  - 618/867 were invalid
  - falsified test procedures and data, and provided fraudulent reports of test results.

Another case:
G.D. Searle & Company

- Produced several major pharmaceutical and food products: Flagyl (Metronidazole), Aldactone and aspartame
- A researcher submitted an article to Journal of National Cancer Institute (JNCI), which showed that Flagyl (metronidazole) caused cancer in his animal study
- Inspection from October 6, 1975 until December 19, 1975
- Six teams of FDA investigators were assigned to investigation
- Investigation was estimated to have taken eleven person-years to complete
- Discrepancies between individual and summary data

- Problems
  - Lack of personnel training, deviations from study protocols, unexplained discrepancies and changes to data (SOP), lack of quality control（品管） of reported data, lack of quality assurance（品質保證） procedures, among others.

- These lead to the GLP（優良實驗室操作規範）

Good Laboratory Practice (GLP)

- As results, FDA decided to regulate laboratory testing
  - Proposed (in Federal Register) on 11/19/1976
  - Final 12/22/1978
  - Effective 6/20/1979
  - FDA GLP major revision 9/4/1987 (21 CFR Part 58)
- US EPA GLP issued 8/17/1989 under FIFRA (40 CFR Part 160) and TSCA (40 CFR Part 792)
- **凡走過必留下痕跡。**

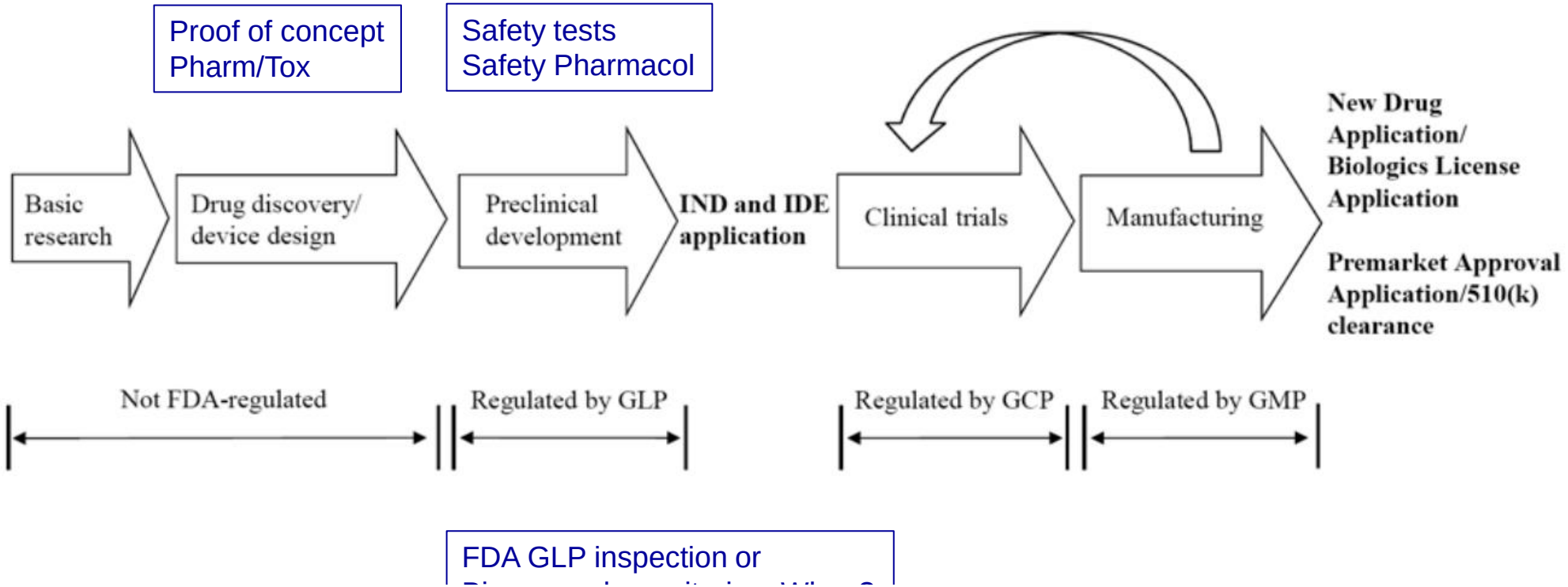
OECD Principles of GLP

- a managerial quality control system covering the organisational process and the conditions under which **non-clinical health** and **environmental studies** are planned計畫, performed執行, monitored稽核, recorded紀錄, reported報告 and retained (or archived)存檔.
- GLP是一品質/種品質系統，特別關注于安全試驗由計畫、執行、稽核、紀錄、報告、及存檔由組職執行的過程。

GLP的目的

- 為了**良好控制**下的實驗所提供的制度
  - 確保實驗資料的**品質**(quality)與**真實性**(integrity) [assures quality and integrity of the data]
  - 有助於實驗的**重現** [facilitates study reconstruction]
  - 提供最終的**責任** [provides overall accountability]
- All data generated during the conduct of a nonclinical laboratory study must be ALCOA
  - Accurate 正確; Legible 清晰; Contemporaneous 及時; Original 原始; Attributable 可歸於

Proposed § 58.180 (2016) Data quality and integrity



美國FDA管轄下所有物品
（食品添加劑、色素、人及動物藥品、醫療器材、生物製劑等）
上市前的非臨床試驗安全測試皆須遵造此規定

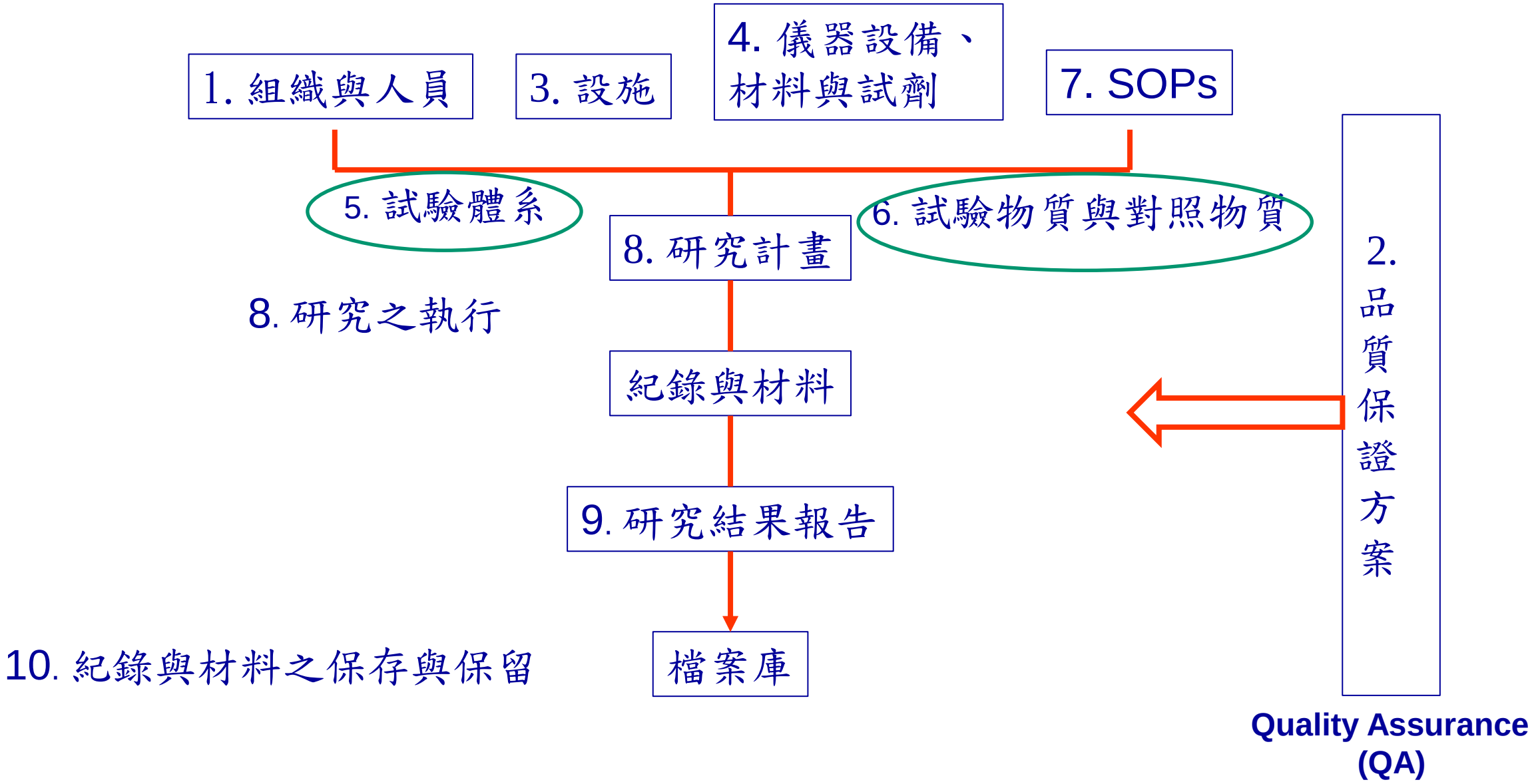
Acad Med. 2012 March ; 87(3): 279–284

GLP Principles

- GLP principles are a good idea even if you are not required to comply with the regulations.
  - Say What You Do (with written standard operating procedures)
  - Do What you Say (follow the procedures)
  - Be Able to Prove It (with good record keeping)

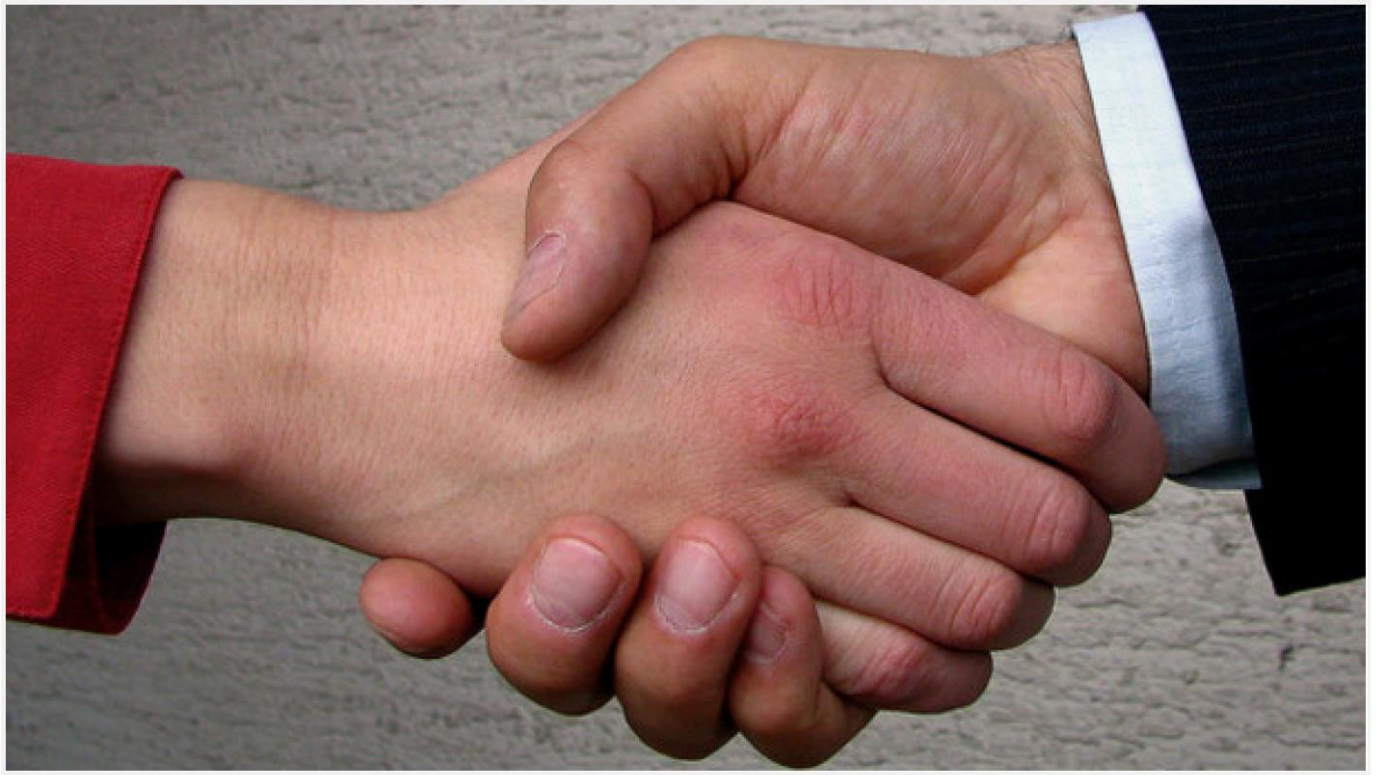
GLP—FDA Regulations

- Subpart A – General Provisions　第一章，總則
- Subpart B – Organizational personnel　二、組織與人事
- Subpart C – Facilities　三、設施
- Subpart D – Equipment　四、設備
- Subpart E – Testing facilities operation　五、試驗機構之操作
- Subpart F – Test and control articles六、試驗物質及對照物質
- Subpart G – Protocol for and conduct of a nonclinical laboratory studies　七、試驗計畫書及試驗之執行
- Subpart J – Records and reports　八、紀錄與報告
- ***Subpart K – Disqualification of testing facilities　罰則***


1. 組織與人員
3. 設施
4. 儀器設備、材料與試劑
7. SOPs
5. 試驗體系
6. 試驗物質與對照物質
8. 研究計畫
8. 研究之執行
紀錄與材料
9. 研究結果報告
檔案庫
10. 紀錄與材料之保存與保留
2. 品質保證方案
Quality Assurance (QA)

CRO Pays $22.5M to Dr. Reddy's to Settle Lawsuit

By Zachary Brennan , 26-Mar-2013
Last updated on 26-Mar-2013 at 09:33 GMT



Related tags: CRO lawsuits, Nordion, FDA Form 483, Dr. Reddy's

汎球

違反TAF/GLP後果....

〈南部〉台南道路工程舞弊 6實驗室涉案

2010-09-02

〔記者黃博郎、余雪蘭／綜合報導〕台南地檢署「路見不平查緝專案」全面清查道路工程

遍及嘉南高地區 嘉大澄清

該案經檢察官江孟芝指揮偵辦，針對中信、桂田、嘉富、弘基、嘉南與嘉義大學附設試驗場等實驗室，及永登瀝青、玉楠混凝土與堆高營造等9個處所搜索，並以被告身分傳訊39名涉案人員到案說明，查出涉嫌舞弊的實驗室遍及高雄、嘉義、台南，至少6家以上涉案。

實驗室人員對於出具不實鑑驗報告多坦承犯行，卻也無奈透露，若不願製作假報告，恐將面臨無廠商願意合作而倒閉的窘境，加上民代施壓，許多實驗室都不得不配合。

嘉義大學則澄清，表示該校材料試驗場絕無試驗不實或與包商勾結情事，而該校試驗場助理人員經台南地檢署帶回偵訊後已釋回，顯示該員並無重大關連，歡迎各界來檢驗。

財團法人全國認證基金會
Taiwan Accreditation Foundation

回TAF

認證報導 TAF Newsletter 第2期

發刊日期：2011/06/30

回目錄

土木工程測試領域與各地地檢署的合作

實驗室認證處／蔡榮一

自2010 年8 月31 日南檢「路見不平」專案起，全國認證基金會（TAF）積極配合全國地檢署道路工程弊案相關查緝行動，已陸續配合基隆、嘉義及新竹地檢署之查緝行動。以上配合地檢署偵辦活動，除樹立新的合作配合模式外，亦彰顯TAF 配合國家在偵辦工程弊

最新

2018.12.03 06:58

【標檢要人命】防火檢測作弊　一旦失火民眾恐成甕窯雞

文 | 洪振生　攝影 | 攝影組

標檢局說，TAF堅持明道務必回收簽出的報告書，認為茲事體大，但明道為規避龐大的回收和重測業務，主動申請廢止（放棄）指定實驗室資格，也就沒有回收的責任。明道實驗室則低調婉拒說明，強調應主管機關釐清疑義。

最新

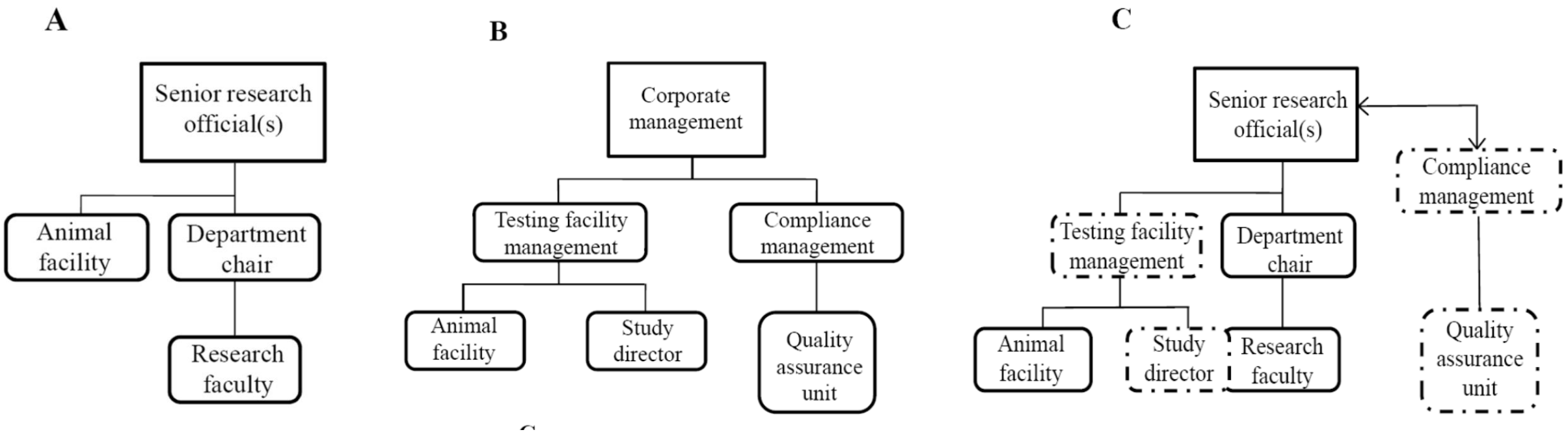
2018.12.03 06:58

【標檢要人命】成大打臉政府公信力　標檢局踐踏國家標準

12年了，學界的TAF實驗室改了嗎？

Research in Academia

- 為何美國FDA認為要有GLP規範？因為FDA發現，並不是所有科學研究或測試都有好的再現性。
- 但是同樣的，完全遵循規範亦不等於就是好的科學研究。只要有完善的紀錄(well-documented)但是其科學部分雖然很差，仍舊可以達到GLP標準。
- 學校研究要有GLP嗎？
  - GLP principles (data quality and integrity are essentials)
  - The management part of the system can be loosened



Comparison of the structure of the research organizations at a typical academic health center (AHC) (panel A) and a typical commercial laboratory (panel B). Panel C depicts a potential combination of the two for AHCs conducting research that meets the FDA's good laboratory practice (GLP) regulations by adding management and oversight functions that are not usually part of the AHC research structure.

Acad Med. 2012 March ; 87(3): 279–284

There are at least six things in this picture that a quality-assurance manager would try to improve. Can you spot them?

QUALITY TIME

IT MAY NOT BE SEXY, BUT QUALITY ASSURANCE IS BECOMING A CRUCIAL PART OF LAB LIFE.

BY MONYA BAKER

456 | NATURE | VOL 529 | 28 JANUARY 2016

Disorganized sample storage,
Inadequate data logging, Variable experiments
Unsecured data analysis, missed maintenance, old and undated reagents
Lab safety related issues

Nature 27 Jan 2016

實驗記錄本 Laboratory **Notebook**

- Must be Bound/Stitched, and serves as a primary record of research.
- Researchers use a lab notebook to document their hypotheses, experiments and initial analysis or interpretation of these experiments.
- The notebook serves as an organizational tool, a memory aid, and can also have a role in protecting any intellectual property that comes from the research. (Wikipedia)
- No official rules for how to write and keep a lab notebook

A Lab Notebook Is…

- Complete record of **procedures, reagents, data, and thoughts** to pass on to other researchers
- Explanation of **why** experiments were initiated, how they were performed, and the results
- **Legal document to prove patents** and defend your data against **accusations of fraud**
- Scientific *legacy/dowry* in the lab

Guidelines for SCIENTIFIC RECORD KEEPING
in the Intramural Research Program at the NIH

Documents needed for New Drugs

- Origin, history of discovery, etc.
- Physico-chemical properties
- Stability tests
- Safety tests
- Pharmacology study
- Pharmacokinetics (ADME)
- Clinical studies

實驗日誌 Laboratory **Logbook**

- The laboratory logbook is a **running record** of daily activities and is completed in chronological order as experimental work is being readied, done, and analyzed.

- Laboratory Logbook or

  Laboratory Notebook (Lab Notebook)

Outlines

- 什麼是Integrity
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- 由幾個小故事說明Data Integrity與實驗記錄本的關係
  - AIDS 病毒的發現與NOBEL laurate
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- 實驗記錄本撰寫原則

- Françoise Barré-Sinoussi and Luc Montagnier identified the HIV that causes AIDS in 1983, while working at the Pasteur Institute in Paris.
- In 1987 the French and US heads of state brokered an agreement to share the benefits of the discovery of the HIV.
- In 2008, the Nobel committee effectively ends years of bitter controversy arising from a counter claim for HIV‘s discovery by virologist Robert Gallo of the US NIH.

PERSPECTIVE

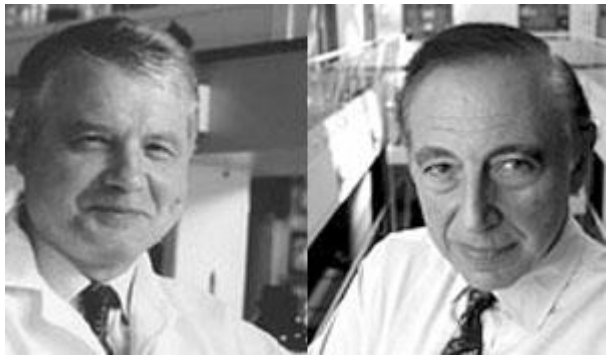
RETROSPECTIVE

The Discovery of HIV as the Cause of AIDS

Robert C. Gallo, M.D., and Luc Montagnier, M.D.

December 11, 2003
N Engl J Med 2003; 349:2283-2285
DOI: 10.1056/NEJMp038194

- In early 1983, a clear-cut isolate of HIV was obtained in Paris, from cultured T lymphocytes derived from a lymph-node–biopsy specimen from a patient with lymphadenopathy, a syndrome that was considered to be a precursor of AIDS.
- This technical breakthrough was first achieved in late 1983 in Bethesda. Among a few strains in the Bethesda laboratory that grew in continuous cell lines, one came, unbeknownst to both of us, from the third isolate from a patient with Kaposi's sarcoma in Paris. (the usefulness of lab notebook)



The New York Times

Discoverers of AIDS and Cancer Viruses Win Nobel

By LAWRENCE K. ALTMAN OCT 7, 2008

Who discovered HIV: Gallo, Montagnier or both?

…Half of the award will be shared by two French virologists, Françoise Barré-Sinoussi, 61, and Luc A. Montagnier, 76, for discovering H.I.V., the virus that causes AIDS. **Conspicuously** omitted was Dr. Robert C. Gallo, an American virologist who vied with the French team in a long, often acrimonious dispute over credit for the discovery of H.I.V.

諾貝爾獎主持正義？！

科學人新聞
2008/12/01

愛滋病毒到底是誰找到的？時值HIV發現25週年，
諾貝爾生醫獎還了歷史一個公道。

撰文／潘震澤

然而，今年該獎項引發的關注並不在此。凡是對愛滋病研究稍有認識，以及在1980年代關心生物醫學研究的人，都會發現他們較為熟悉的HIV「發現人」美國科學家蓋羅（Robert Gallo）並不在得獎名單上。兩位得獎者中，蒙坦耶（Luc Montagnier）與蓋羅齊名，並稱HIV發現人；至於另一位得獎人巴瑞－西諾希（Françoise Barré-Sinoussi）女士，聽過的人大概就不多了。

遭諾貝爾獎排除的巨星

一般人之所以對蓋羅印象深刻，主要是他曾經多次登上頭條新聞：1984年4月，蓋羅在美國衛生暨福利部部長赫克勒（Margaret Heckler）的協同下召開記者會，由赫克勒宣佈蓋羅發現了愛滋病的病原，並研發出能檢測血液中愛滋病毒的抗體；同時，赫克勒還誇下海口，預防愛滋病的疫苗將於兩年內問世。

Retrovirology

BioMed Central

Commentary

Open Access

A historical reflection on the discovery of human retroviruses

Retrovirology 2009, **6**:40 doi:10.1186/1742-4690-6-40

Anders Vahlne

The LAV/HTLV-IIIB contamination story and the patent feud between the Pasteur Institute and NIH

- Going through 13 foot high pile of Gallo's lab records including laboratory note-books, some 10,000 man hours of interviews with laboratory personal and other witnesses, all the Office of Research Integrity (ORI) could come up with in criticism was for Mika Popovic that he wrote "ND" in two occasions in one published table…
- The table legend didn't define "ND" :
  - "ND" meant, "not done" by ORI
  - Popovic insisted that by "ND" he meant, "not determinable". Popovic indeed had performed the experiment

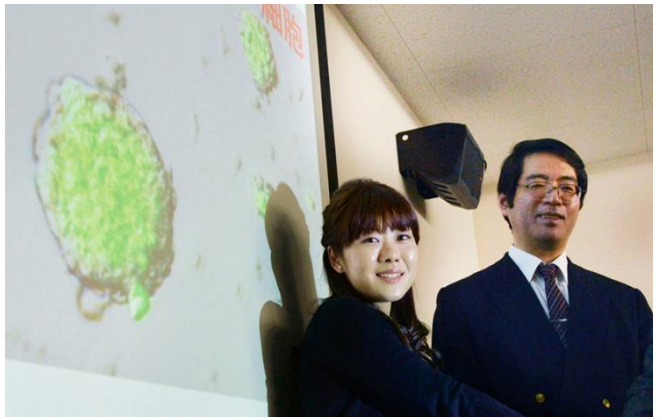
WORLD JAPAN TIME

Science Scandal Triggers Suicide, Soul-Searching in Japan

Kirk Spitzer / Tokyo Aug. 8, 2014

Yoshiki Sasai, right, deputy director of the Riken's Center for Developmental Biology, with Haruko Obokata on Jan. 28, 2014.
Kyodo/Reuters

Stimulus-**T**riggered **A**cquisition of **P**luripotency cells



《BBC知識》國際中文版分享了 1 張相片。
2014年8月5日 ·

【小保方晴子的指導教授笹井芳樹自殺身亡】

THE RISE AND FALL OF STAP

- Two papers published in Nature in January 2014 promised to revolutionize the way stem cells are made by showing that simply putting differentiated cells under stress can 'reprogram' them and make them pluripotent — able to develop into any type of tissue in the body. But soon, errors were found in the papers, and attempts to replicate the experiments failed. Haruko Obokata, the lead author, was found guilty of misconduct, the papers were retracted and the RIKEN centre where she worked was restructured. The aftermath of the episode has been felt by scientists across Japan, in the form of new anti-misconduct policies.

STAP retracted

Two retractions highlight long-standing issues of trust and sloppiness that must be addressed.

3 JULY 2014 | VOL 511 | NATURE | 5

"the RIKEN research centre in Japan, promptly organized an inquiry and found inadequacies in data management, record-keeping and oversight (see go.nature.com/2vrjxs)."

"Underlying these issues, often, is sloppiness, whether in the handling of data, in their analysis, or in the inadequate keeping of laboratory notes. As a result, the conclusions of such papers can seem misleadingly robust. ....."

自由時報
Liberty Times Net

8篇論文涉造假！ 中研院前生化所長在美遭查

- 「學術諮詢總會孫以瀚執行秘書表示，2017年底陳慶士已主動告知院方正接受美方調查，院方當時曾進行初步瞭解，惟因其研究均是在美國俄亥俄州立大學進行，該校當時已在調查，並蒐集研究原始圖檔做驗證，因研究資料已遭學校留存，當事人無法提出原始數據說明，故靜候美方調查結果。美國俄亥俄州立大學30日發佈調查報告後，中研院即刻啟動倫理委員會的調查機制。」 王秋燕 2018年03月31日

https://www.upmedia.mg/news_info.php?SerialNo=38042

自由時報
Liberty Times Net

首頁 > 報紙 > 生活

哈佛心臟病專家 驚爆31篇論文全造假

2018-10-17

Even before the paper was officially retracted, Dr. Anversa's and Dr. Kajstura's careers began unraveling. On Jan. 10, 2013, investigators at Harvard Medical School and Brigham and Women's Hospital raided Dr. Anversa's laboratory, Dr. Anversa said, seizing computers and scientific notes. He hired a team of lawyers.

New York Times Oct. 29, 2018

哈佛心臟病專家安斐沙。（取自網路）

及BWH擔任教授與再生醫學研究中心主任，因發現心臟幹細胞可再生心肌，從而用於治療心臟病，開創出心臟幹細胞療法而聲名大噪。各式研究心臟病的新創公司陸續成立，希望能將注射幹細胞修復心臟的方法商業化，卻都無法重現實驗結果。

哈佛醫學院和BWH於一三年一月開始審查安斐沙的著作。去年四月，BWH為了解決安斐沙涉嫌以偽造數據騙取政府資金問題，同意支付一千萬美元給政府。十四日更宣布建議撤回安斐沙所有發表論文。

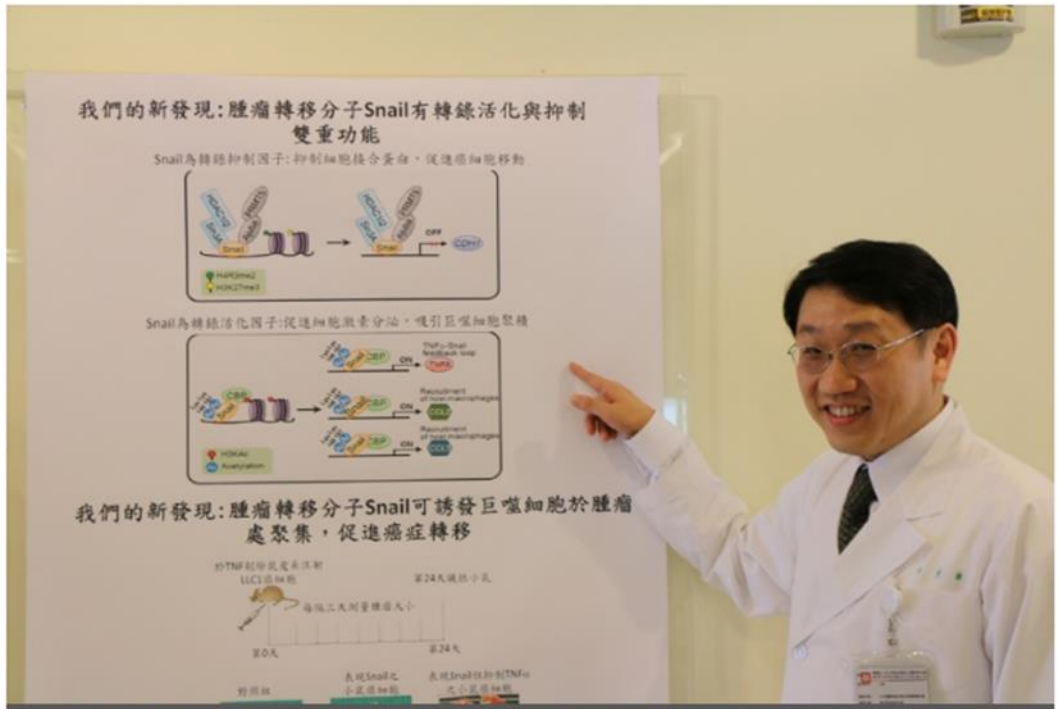
神蹟與西方墨點結果的再現

- Blame it on the antibodies (Nature, 19 May 2015)
- The pH of the transfer buffer, especially for nuclear protein (the tragedy happened in Yang Ming University)
- The correct and precisely written procedures in the Lab Notebook will usually gives a clue to the answer of these problems.

遭台大假論文案波及　陽明大學楊慕華教授卻默默做了這些努力....

因與張正琪合作的4篇論文遭PubPeer檢舉，為了舉證，他不只勘誤、還把每項實驗重做了3次

文 / 楊惠君 2017-04-17 10:13



陽明大學臨床醫學研究所教授楊慕華亦被捲入此次論文造假案，但他以科學精神面對科學上的質疑，希望重振台灣生醫界的聲譽。圖 / 取自陽明大學官網

由網路學界同儕論文審議平台PubPeer踢爆而引燃的台大論文造假案，其實被燒到的不只有台大自己人，在頭頸部癌症研究為學界翹楚的陽明大學臨床醫學研究所教授、也是台北榮民總醫院腫瘤醫學部醫師楊慕華，此次在PubPeer匿名檢舉事件中，有4篇論文與台大造假案中遭解聘的前口腔生物科學研究所教授張正琪共同發表，也遭科技部調查。

楊慕華是國內少數兼及臨床與研究的「醫師科學家」（M.D. Ph.D. Physician Scientist），2007、2010、2012年共有三篇論文在國際細胞生物學領域頂級的《自然：細胞生物學》（Nature Cell Biology）期刊發表，為國內該領域第一人，其研究解開頭頸癌細胞轉移基因的特性、對用藥策略及檢查方式有顯著貢獻。他接受《科學月刊》總編輯蔡孟利專訪，揭露這一段個人學術生涯最巨大的考驗與低潮。

勘誤還不夠、所有實驗重做3次

楊慕華至今已完成2篇論文的勘誤。他先找到原始資料，把所有的電腦資料調出來、所有的記錄本翻出來找，加上他有個習慣「只要當通訊作者的論文，一定都是自己完成線上投稿程序的，不會假手他人」，所以找到得資料。投稿過程常見的原始上傳檔案用JPEG或是TIF解析度很高的格式，在PDF壓縮過程就會遺失些細節，就用當時上傳時的原始資料去證明。

他也坦承，有些質疑是真的論文出現錯誤，那他就去追究錯誤是怎麼發生的？譬如說做了六組，有一組放錯了，就回去那個組的原始資料裡面找，確認那只是真的把圖片放錯而已，就寫信給期刊勘誤，然後把勘誤來往的信件留著。

更重要的是，楊慕華認為，「**一個負責任的科學工作者，不能只是勘誤就了事！**」必須要重複你的實驗，他被質疑的東西，雖然大部分都沒有錯，可是他重做、重複了3次！「我的實驗室有幾個月都沒有任何新的進度，全力把所有被質疑的地方的實驗都重複3次！」

所以他接到科技部去函表示，有人檢舉他論文有問題，其實就是PubPeer上檢舉的他與張正琪合作那4篇。他也立即像在回覆PubPeer的質疑那樣，把原始數據全部貼出來，「我告訴質疑者哪一些是他看錯的，哪一些是我有錯的。我有錯的就勘誤，但我可以把我勘誤的來回信件都給你看。再來是我重做3次的實驗結果也都貼給你看。」因此，無論是科技部的書面調查及陽明大學內部的詢問，對楊慕華提出的證據與證明，都沒有異議，未以造假案處理。

Integrity – GLP –Notebook – Academia/Scientific Arena

Lab Notebook 與GLP的關係

- 由上述例子知道Lab Notebook必須忠實呈現實驗過程與結果記錄。
- 這就是Data Integrity。
- Data Integrity 又與GLP有不可分的關係。
- GLP在生醫產業是基本要求；學界亦應對GLP精神有所認識與了解！

數據**完整性**通則及促成因子
General Data **Integrity** Principles and Enablers

- ALCOA
  - Attributable 可追述溯性
  - Legible 清晰性
  - Contemporaneous 同步性
  - Original / true copy 原始性
  - Accurate 正確性
- ALCOA+
  - Complete 完整性
  - Consistent 一致性
  - Enduring 耐久性
  - Available可取得性

Good Practice for Data Management and Integrity in Regulated GMP/GDP Environments (Draft PIC/S Guidance, August 2016)

- 紙本記錄(實驗紀錄本)必須管控，在數據生命週期中必須符合可追溯性 (Attributable)、清晰性(Legible)、同步性(Contemporaneous)、原始性 (Original)、及正確性(Accurate)。

紀錄的填寫

- 手寫紀錄應由執行該作業人員填寫
- 未使用之空白區域應**劃掉並簽名與寫上日期**
- 填寫內容應**清晰**可讀
- 完成日期應有**固定格式**
- 應於操作完成**同時**填寫紀錄
- 紀錄應**難以被消除**，如使用黑色墨水筆、不可使用鉛筆、注意熱感只會退色等
- 紀錄必須**簽名與日期**

數據完整性相關法規與專案查核結果，
陳詩穎，TFDA

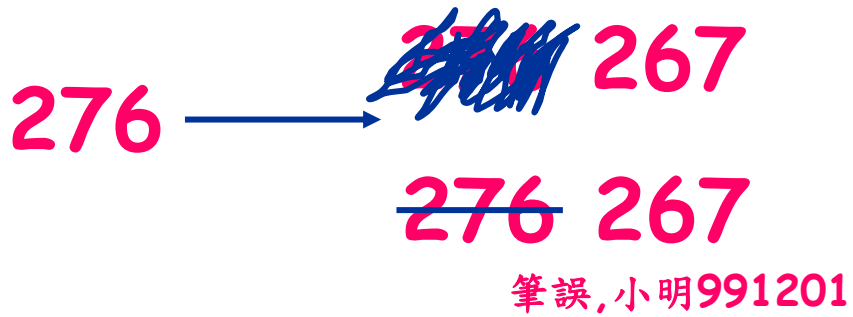
電子系統的列印輸出

- 常見的電子設備，如天平、pH meter等，其數據不儲存於儀器中，其列印的數據可直接貼在實驗記錄本中，但須由操作者簽名及日期，此時應注視不能使用熱感紙。

數據完整性相關法規與專案查核結果，
陳詩穎，TFDA

數據記錄/文件紀錄管控

- 記錄原則
  - 凡走過必留下痕跡
  - 包含人、事、時、地、物 (追溯性)
  - 清楚易懂
- 修改方式
  - 不可使用鉛筆
  - 不可使用立可白
  - 不可塗鴉、塗改



數據記錄/文件紀錄管控

- 時間表示格式標準化
  - 05/06/11
    - 2005年6月11日？
    - 2011年5月6日？
    - 2011年6月5日？
- 人員簽名對照一覽表
  - 正式簽名型式及簡便簽名型式
  - 中文、英文

- 整理、建檔容易辨識，尋找/取用(依產品別、日期別)
- 訂定紀錄之保存期限，按規定之年限實施保存
- 紀錄若以電子形式或其他媒體存放，應訂定程序以保護、備份之，並注意其安全性、有效性、正確性
- 記錄應適時、適切的被授權人員審查，以鑑別不確定的影響因素

The Basics of A Lab Notebook

- is the property of “the” lab (can’t take it home after you leave the lab)
- must be Bound/Stitched
- with printed serial page numbers.
- Use “black” non-erasable pen.
- Record the lab events, experiments, and results (Not Selective) every day (Not After). Don’t forget the date.
- The writing must be readable and the procedures traceable.
- Don’t leave any blank space.
- Checked and Signed by lab supervisor at the end of every week.

The Layout of a Lab Notebook

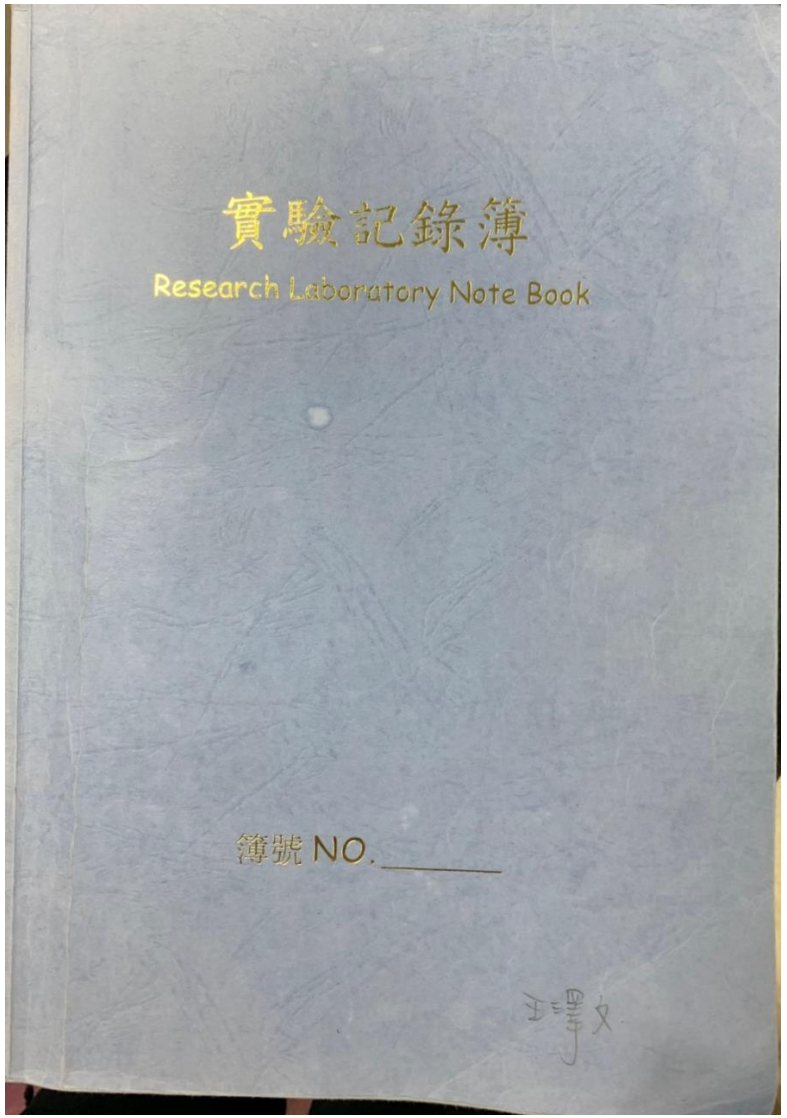
- Notebook name
- Inside cover or cover page
  - Your name and year
  - General project name
  - Lab mailing address
- Table of Contents
- Body of notebook
  - Experimental entries

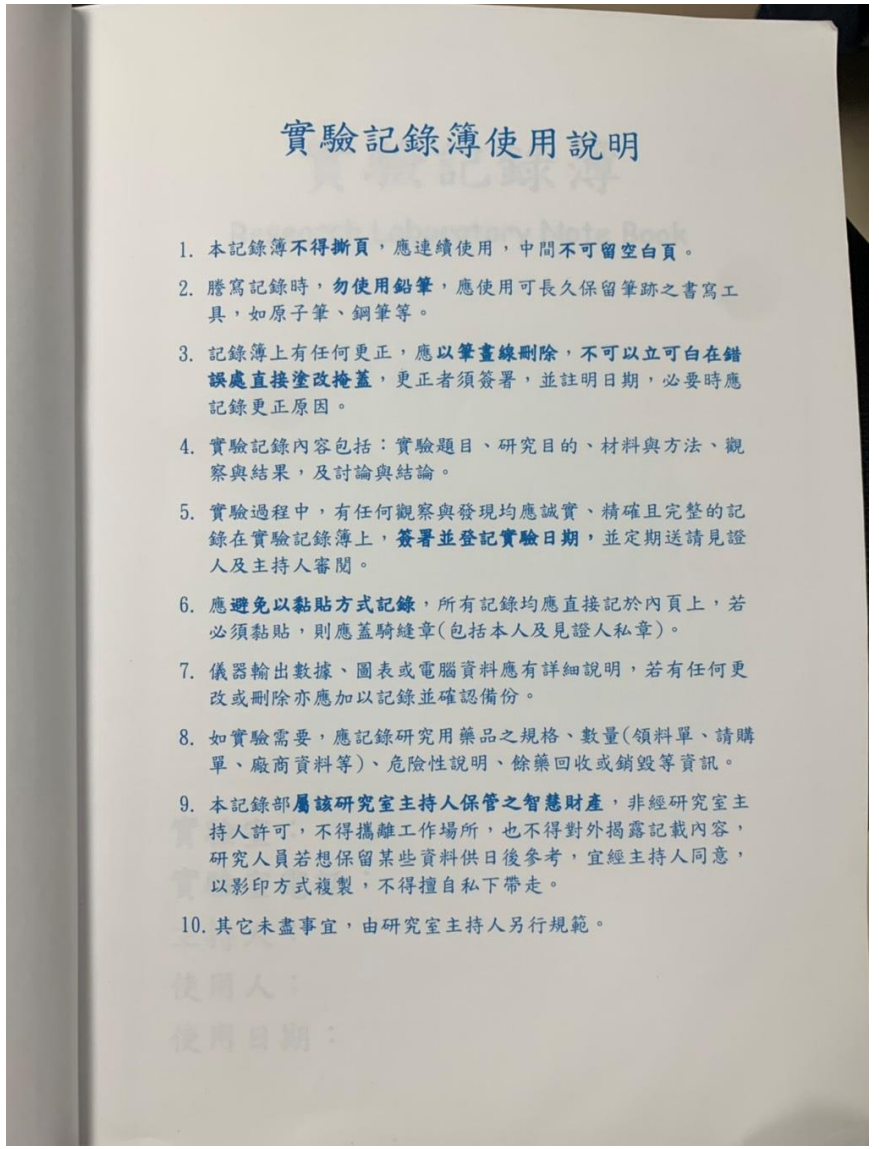
實驗記錄本撰寫原則

Records

GLP regulations specify what should be recorded.

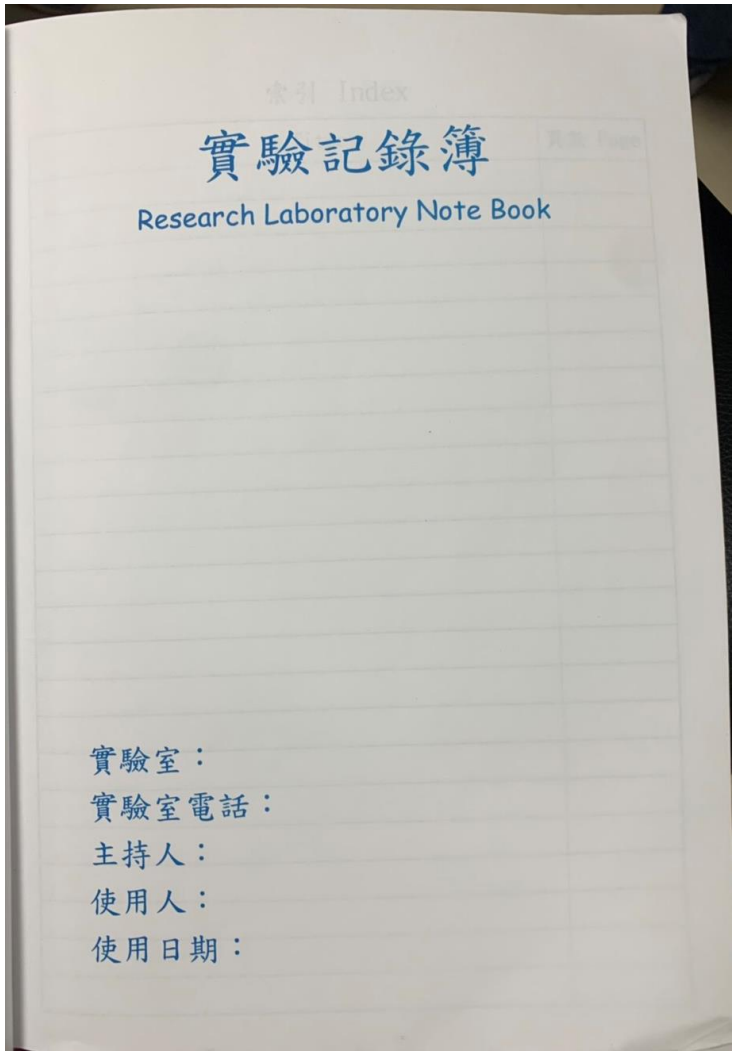
- Name and address of the laboratory
- Objectives and procedures
- Statistical methods
- Test and control articles, incl. stability data
- Description of methods
- Description of test system
- Description of dosage, route of administration, duration
- Name of the study director
- Location where raw specimens and data are stored
- Descriptions of transformations and calculations

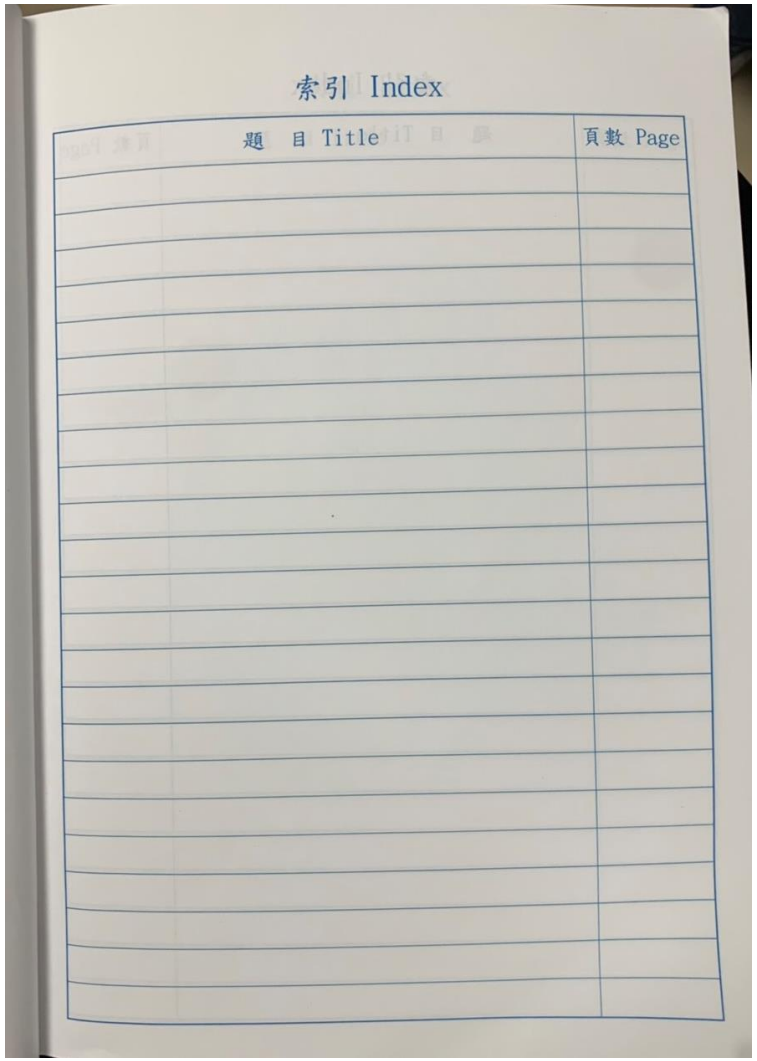




實驗記錄簿使用說明

1. 本記錄簿**不得撕頁**，應連續使用，中間**不可留空白頁**。
2. 謄寫記錄時，**勿使用鉛筆**，應使用可長久保留筆跡之書寫工具，如原子筆、鋼筆等。
3. 記錄簿上有任何更正，應**以筆畫線刪除，不可以立可白在錯誤處直接塗改掩蓋**，更正者須簽署，並註明日期，必要時應記錄更正原因。
4. 實驗記錄內容包括：實驗題目、研究目的、材料與方法、觀察與結果，及討論與結論。
5. 實驗過程中，有任何觀察與發現均應誠實、精確且完整的記錄在實驗記錄簿上，**簽署並登記實驗日期**，並定期送請見證人及主持人審閱。
6. 應**避免以黏貼方式記錄**，所有記錄均應直接記於內頁上，若必須黏貼，則應蓋騎縫章(包括本人及見證人私章)。
7. 儀器輸出數據、圖表或電腦資料應有詳細說明，若有任何更改或刪除亦應加以記錄並確認備份。
8. 如實驗需要，應記錄研究用藥品之規格、數量(領料單、請購單、廠商資料等)、危險性說明、餘藥回收或銷毀等資訊。
9. 本記錄部**屬該研究室主持人保管之智慧財產**，非經研究室主持人許可，不得攜離工作場所，也不得對外揭露記載內容，研究人員若想保留某些資料供日後參考，宜經主持人同意，以影印方式複製，不得擅自私下帶走。
10. 其它未盡事宜，由研究室主持人另行規範。


實驗記錄簿
Research Laboratory Note Book
實驗室：
實驗室電話：
主持人：
使用人：
使用日期：


索引 Index
題 目 Title
頁數 Page

Some Details

- Reagents: source, product number, lot number, expiration date, how and where stored
- Solutions and how they were made
- Cells used: type, source, passage number, growth medium
- Instruments: type, name, location, serial number
- Number and volume of washes
- Centrifuge speeds and duration of spins
- Heating rates and levels of agitation
- Time between and during steps
- Gel percentages
- Type of water used

Keeping a Lab NotebookBasic Principles and Best Practices Philip Ryan, NIH

How does your lab stack up?

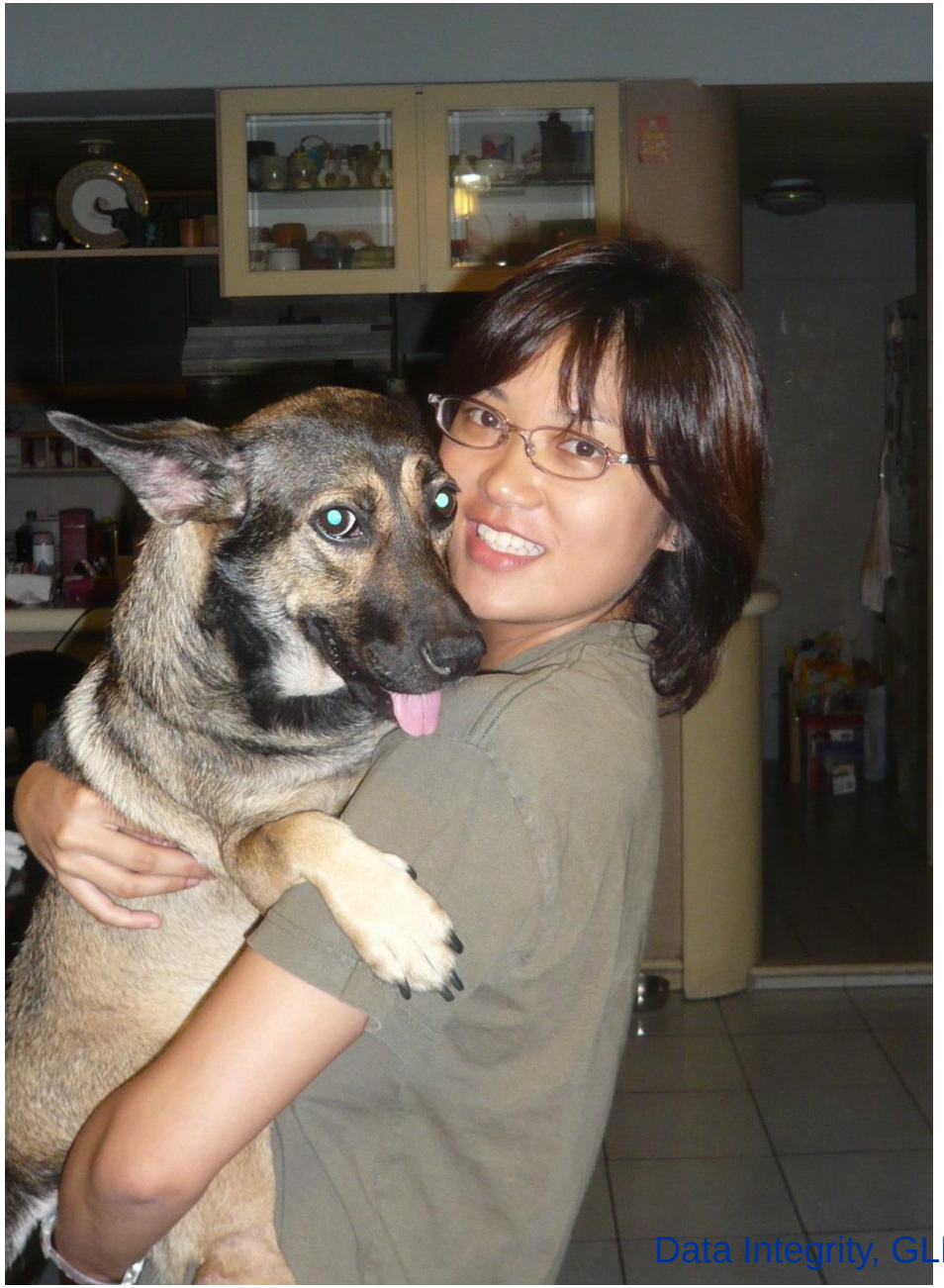
These are common QA practices, Does your lab...

- Audit notebooks
- Record full data, including instruments used
- Keep a calibration log for key equipment
- Have standardized experimental procedures
- Track storage of lab materials
- Store tamper-proof read-only files of data
- None of the above

Conclusion

- Data Integrity 的中文是…數據的完整性、一致性和準確性
- 如用一個字來說明…

  數據的真實呈現，或不要造假！
- 違背integrity在真實世界 (半導體、生醫等領域) 就活不下去。
- 唯有大家都做人、做事都遵循integrity，台灣才有前途！



感謝聆聽！