研究計畫書撰寫策略
(研究計畫類)

連正章
國立陽明交通大學 神經科學研究所

申請計畫是一門藝術

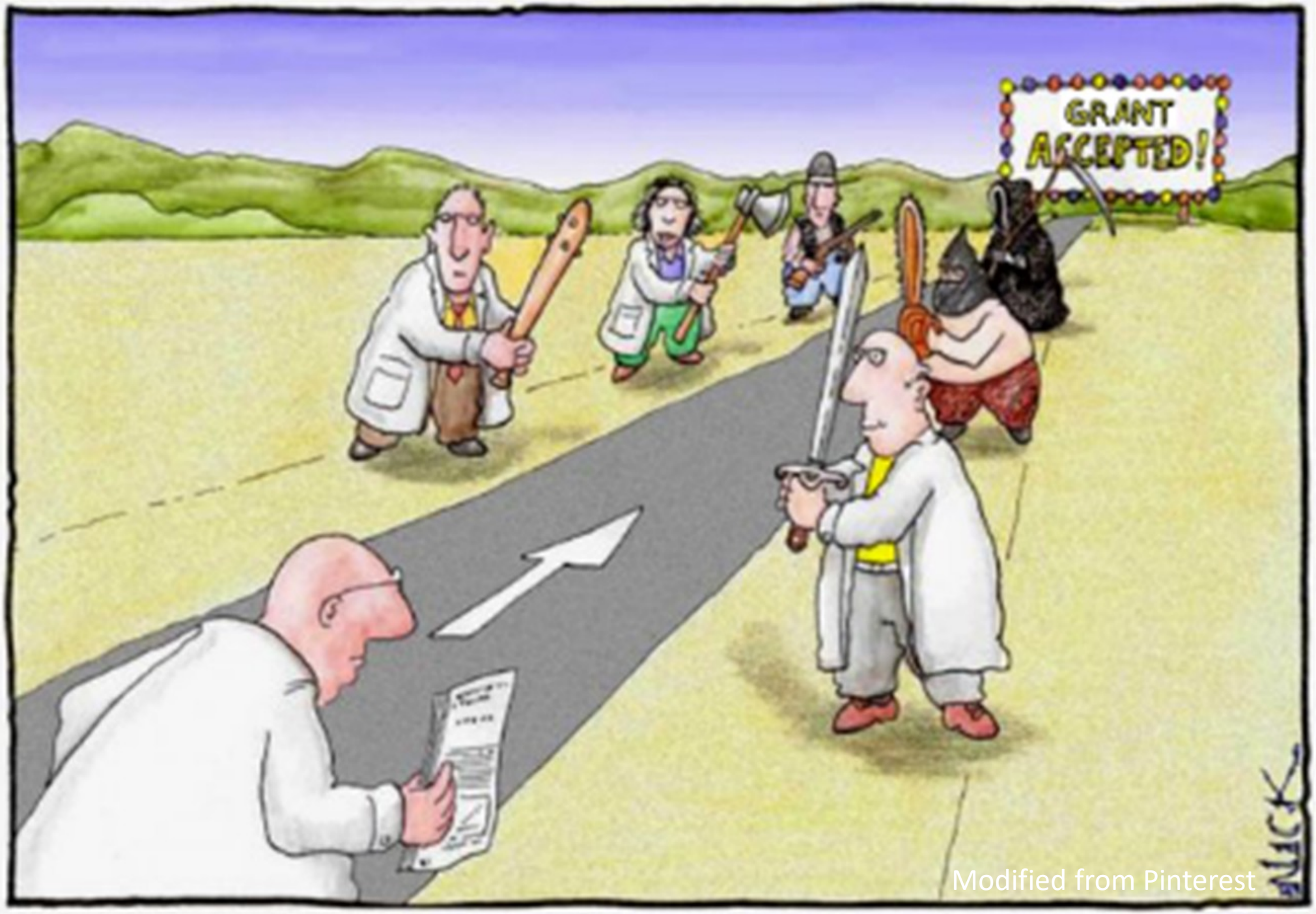
參考文獻

1. How to write a successful grant application and research paper. Ardehali H. Circ Res. (2014) 114(8):1231-1234
2. Ten simple rules for getting grants. Bourne PE, Chalupa LM. PLoS Comput Biol. (2006) 2:e12.
3. The art of grantmanship. Kraicer J. Human Frontier Science Program (1997). Available: http://www.hfsp.org/how/ArtOfGrants.htm.
4. Writing a research proposal (PPT) 陽明大學生化所徐明達
5. 如何撰寫一份好的研究計畫書 (PPT) 中研院生醫所陳儀莊

計畫本身

Art of scientific presentation

- ✓Writing a research proposal
- ✓Manuscript for papers
- ✓Scientific talks/lectures



Modified from Pinterest

三組別學門計畫申請/核定情形

項目	生物農學組			
	申請件數	核定件數	通過率(%)	平均經費(千元)
109	764	306	40.1%	1,277
110	721	287	39.8%	1,329 ↑

項目	基礎醫學組			
	申請件數	核定件數	通過率(%)	平均經費(千元)
109	1,266	511	40.4%	1,289
110	1,243	493	39.7%	1,317 ↑

項目	臨床醫學組			
	申請件數	核定件數	通過率(%)	平均經費(千元)
109	2,997	1,191	39.7%	1,143
110	3,118	1,220	39.1%	1,092↓

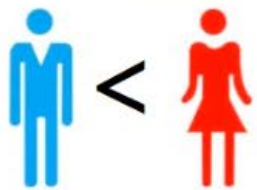
申請件數(5,082)男女占比

71.1% 28.9%

核定件數(2,000)男女占比

69.1% 30.9%

單一性別之核定比例



38.3% 42.0%

統計範圍:包含一般型研究計畫、新進人員研究計畫、優秀年輕學者研究計畫、特約研究計畫；不含整合型計畫。

學門專題計畫審查重點與配分

MOST 科技部 Ministry of Science and Technology

審查重點	一般研究計畫	新進人員計畫
一、專題研究計畫： 1.研究主題之**創新性與重要性**。 2.研究計畫之可能產出**效益**(撰寫之完整性、實驗設計及研究方法之可行性)。 3.研究計畫可能產生**對社會、經濟、學術發展等面向之預期影響性**。 4.文獻蒐集之完備性及對國內外相關研究現況瞭解清楚。	70%	80%
二、主持人近五年內之研究表現： 1.主要研究成果之**學術創新性/實務性**。 2.最近一件執行科技部研究計畫之**研究報告**及預期成果**達成效益**。	30%	20%

□極力推薦(88分以上；前12%)
□優先推薦(87-85分以上；前20%)
□推薦 (84-80分；前40%)
□不推薦 (79分以下)

五個要素

1. Investigator (PI)
2. Specific Aims
3. Significance/Innovation
4. Approach
5. Environment

} 計劃書本身

Adopted from *Hossein Ardehali (2014) Circ Res. 2014;114:1231-1234*

開工

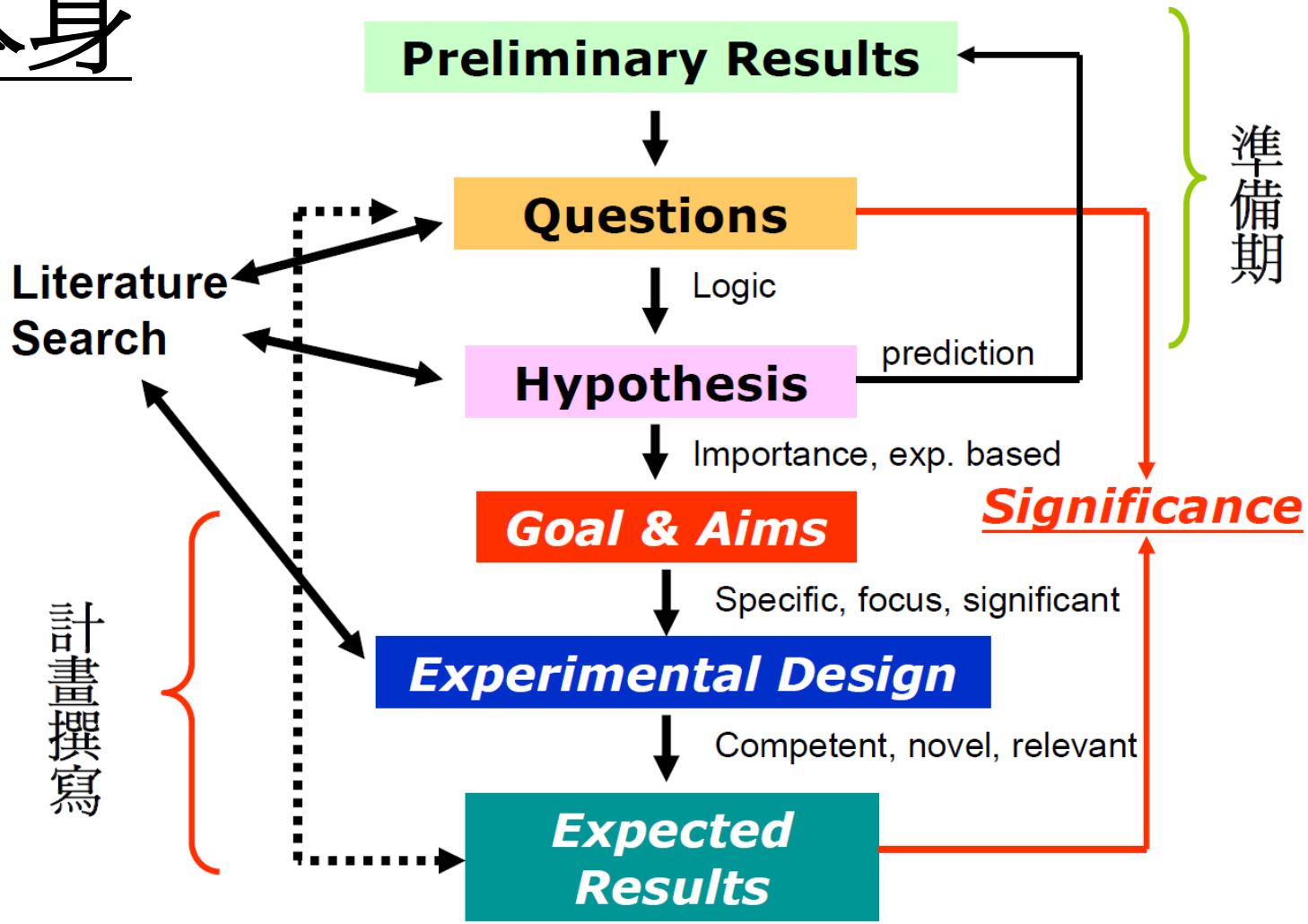
1. 擬研究的問題
2. 最適合的學門（或申請途徑）
3. 詳讀計畫徵求及申請說明

Credit:如何撰寫一份好的研究計畫書 (PPT) 中研院生醫所陳儀莊

計畫主持人的養成

- ✓ Learn from senior PIs (與成功的耆老學習)
- ✓ Find and study previous grant proposals of colleagues that have been successful (與成功的同儕學習)
- ✓ Find out, if you can, who are the members of the review committee and focus accordingly (認識與請教計畫審查委員)
- ✓ Socialize in your community (多參與學會活動)
- ✓ Become a grant reviewer early in your career (在學術生涯盡早成為計畫審查委員)

計畫本身



Credit: Writing a research proposal (PPT) 陽明大學生化所徐明達

計畫本身

整體原則 3C (Clear-Concise-Complete)

✓**Clear (Readability) 清楚易讀 (記住: 審查委員也是人)**

✓**Easy to follow**

- 減少縮寫
- 句子的強化 (計畫不同於期刊論文，允許適當的底線，**粗體**來強調重點)

計畫本身

整體原則 3C (Clear-Concise-Complete)

✓ **Concise (Minimalism) 精簡**

- 新人通常會提出很多內容 (記住: 有頁數限制)
- 適當的圖 (graphics)及表(tables)有助審查委員了解

計畫本身

整體原則 3C (Clear-Concise-Complete)

✓**Complete** 完整性

- 用Graphical Summary 或 Flow Chart來總結計畫內容或**寫一段話來替審查委員回答: 本計畫研究內容簡述**

✓ - 替審查委員抓重點，幫忙回答審查意見的四大基本問題，包括 (1)創新性、重要性及成果效益; (2)優缺點; (3)主持人之研究潛力; (4)具體專業意見

計畫內容

- ✓ **Novelty**: “Me-too” science will not get funded. 新穎性
- ✓ Clear, concise and **Testable Hypothesis**? 清楚精簡及可測試假說
- ✓ Appropriate **Background** 適當的背景
- ✓ Clear questions and **Specific Aims** 明確的問題及目的

  建議:用一句話描述計畫的**Outstanding Question** (適當的底線，粗體來強調)
- ✓ **Experimental Designs**
- ✓ **Preliminary Data** or pilot studies: whether the experimental approaches are feasible 初步的實驗數據 (可證明實驗方法可行)

highlight

Specific Aims

brief

- **Specific Aim #1**. Identification of downstream genes involved in ----. This purpose of this aim will test the hypothesis that------- Specifically,--- Yeast two-hybrid technique will be used to ----- Deletion analysis will be used to ----- *This study will be able to allow us to identify -----*

Title

Approaches

Hypothesis

Importance

Credit: Writing a research proposal (PPT) 陽明大學生化所徐明達

Approaches

Rationale and hypothesis

Specific Aim 1. ***To determine the role of nucleosomes in the regulation of Igk locus rearrangement.*** Our preliminary results showed that the V(D)J recombinase could not recognize RSS targets if they were arranged into a nucleosome structure. We propose experiments to extend these observations by 1) determining what fraction of the Jk gene segments are in the nucleosomal structure in cells undergoing rearrangement as compared with non-lymphoid cells, 2) determining if nucleosomes are phased across the Jk locus, 3)determining whether nucleosome remodeling complex can alter the accessibility of the Jk cluster in native or reconstituted chromatin. This analysis will give us insight of the mechanism of Igk gene rearrangement.

Significance

Credit: Writing a research proposal (PPT) 陽明大學生化所徐明達

Experimental Design(1)

- ***Do not write as Materials and Methods***
- ***Design the experiments to solve the problems*** posed in the specific aims in logical order
- Be ***realistic***, do not plan too many experiments or out of your expertise; manageable; focus!
- Be ***logical***; step-by-step leading to your goal

Credit: Writing a research proposal (PPT) 陽明大學生化所徐明達

Experimental Design(2)

- Updated technologies; Do not re-invent the wheel
- Competence in using techniques proposed
- Evaluate the design critically; alternative approaches, pros and cons
- ***Control! Control! Control!***
- A schematic diagram for the overall design will help the reviewers understand

Credit: Writing a research proposal (PPT) 陽明大學生化所徐明達

計畫初稿內審

- ✓ Done is better than perfect 提早完成第一版
- ✓ Internal review (feedback from students; lab members….)

  計畫初稿給內部同事與研究生閱讀，檢討與批評
- ✓ Proofs 多次校訂 (正確文法，拼字，及圖文的一致性)
- ✓ Final File Checklist

用評審的角度看自己的計劃書

1. Reviewers in general are busy.
2. Many of the reviewers may have expertise not related to the subject of your application.
3. Abstract is crucial.
4. Make sure the application is structured well and does not contain spelling and grammatical errors.
5. Including figures and flowcharts that summarize the aims of the grant application.
6. Proofread the grant and ask colleagues to review it for you.

Adopted from *Hossein Ardehali (2014) Circ Res. 2014;114:1231-1234.*

生科司104年度專題研究計畫

一、專題研究計畫：請綜合下列五點審查項目勾選等級及評給分數 **(70分)**

○ 極優(70-63) ○ 優(62-57) ○ 可(56-50) ○ 差(< 50)

1.研究主題之重要性與創新性。
2.研究計畫撰寫之完整性及妥適性，實驗設計及重要研究方法之可行性。
3.預期成果在學術上或實用上之價值。
4.主持人研究能力及經驗，文獻蒐集之完備性及對國內外相關研究現況是否清楚瞭解。
5.研究人力配置、儀器、經費之申請額度及執行期限之合理性。

二、主持人近五年內之研究成果及所反映之學術研究能力：

請綜合下列二點審查項目勾選等級及評給分數 **(30分)**

○ 極優(30-27) ○ 優(26-23) ○ 可(22-20) ○ 差(< 20)

1. 最近一件執行科技部研究計畫之研究報告及成果是否良好。
2. 近五年發表之研究成果（論文、專利及技轉等）之質與量，在同研究領域同儕中之相對表現。

!

總分(上兩項評分相加)：□

※等級參考分數：(A)優先推薦(≧ 90) (B)推薦(89- 80) (C)勉予推薦(79-70) (D)不推薦(<70)

生科司104年度專題研究計畫

三、本計畫是否涉及國家機密或敏感科技?

四、本研究計畫若涉及下列實驗，須附相關核准或同意進行實驗之文件：

1. ☐ (1)涉及人體試驗/臨床試驗/取用人體檢體； ☐ (2)涉及人之問卷、訪談等研究； ☐ (3)涉及人類胚胎/人類胚胎幹細胞實驗

   ○ 已附「醫學倫理或人體試驗委員會」核准之證明文件 ○ 須補送前述證明文件

2. ☐ 涉及基因重組實驗

   ○ 已附「生物實驗安全委員會」同意進行實驗之證明文件 ○ 須補送前述文件

3. ☐ 涉及基改生物(GMO)田間試驗

   ○ 已附相關主管機關同意進行田間實驗之證明文件 ○ 須補送前述文件

4. ☐ 涉及動物實驗

   ○ 已附「動物實驗管理委員會」同意進行實驗之證明文件及動物實驗倫理3R說明 ○ 須補送前述文件

   動物實驗倫理3R說明內容評審等級： ○ 極優 ○ 優 ○ 可 ○ 差

5. ☐ 涉及第二級以上感染性生物材料實驗

沒成功計畫的實例解說

✓Examples: Unsuccessful vs. Successful grants

沒成功計畫的原因

1. 預算編列不合理
2. 提出的問題不夠明確或白話
3. 計畫內容不夠清楚不易讀
4. 缺乏合適或足夠的插圖 (graphics & tables)

生科司104年度專題研究計畫

五、本計畫經費編列是否合適？

1.建議本計畫每年合適之總金額：

第1年 □

第2年 □

第3年 □

第4年 □

2.(1)說明本計畫每年合適金額以及各細項經費刪減或調整等之意見。

(2)本計畫或相似計畫若已獲其他單位經費補助或同時向其他單位申請補助，亦請指明。

生科司104年度專題研究計畫

!

六、綜合審查意見：(請對申請計畫優劣做具體且客觀之評述及提供建設性意見與建議，避免使用不當的尖銳文字。請特別留意審查意見及審查評分之優劣應一致，勿造成評語佳而評分低之相互矛盾情形。)

1、本計畫研究內容簡述：

2、審查意見：(請分別就前頁之專題計畫及研究成果等項目審查，針對以下四點列舉具體的審查意見及建議)

(1) Significance & Novelty：

(2) Weakness：

(3) PI Performance：

(4) Specific Comment：

預算編列不合理

執行年次 / 補助項目	第一年 (96 年 1 月~96 年 12 月)	第二年 (97 年 1 月~97 年 12 月)	第三年 (98 年 1 月~98 年 12 月)
業務費	**1,739,728**	**1,595,146**	**1,478,824**
研究人力費	558,909	990,746	1,017,524
耗材及雜項費用	1,180,819	604,400	461,300
國際合作研究計畫國外學者來臺費用	0	0	0
研究設備費	**11,220,062**	**785,040**	**3,600,000**
國外差旅費	**239,550**	**239,550**	**239,550**
國外或大陸地區差旅費	79,850	0	0
出席國際學術會議差旅費	159,700	239,550	239,550
國際合作研究計畫出國差旅費	0	0	0
管理費	**360,959**	**339,271**	**321,823**
合計	**13,560,299**	**2,959,007**	**5,640,197**

成功計畫的實例解說

計畫類別（單選）	一般研究計畫				
研究型別	整合型				
計畫歸屬	生科司				
申請機構/系所（單位）	國立陽明大學神經科學研究所				
本計畫主持人姓名	連正章	職稱	特聘教授且兼任所長	身分證號碼	A12372****
本計畫名稱	中文	記憶痕跡細胞之圖譜建立，機制分析與功能調控 - 跨領域整合研究			
	英文	Mapping, deciphering, and modulation of memory engrams - an interdisciplinary approach			
整合型總計畫名稱	記憶痕跡細胞之圖譜建立，機制分析與功能調控 - 跨領域整合研究				
整合型總計畫主持人	連正章			身分證號碼	A12372****

成功計畫的自我分析

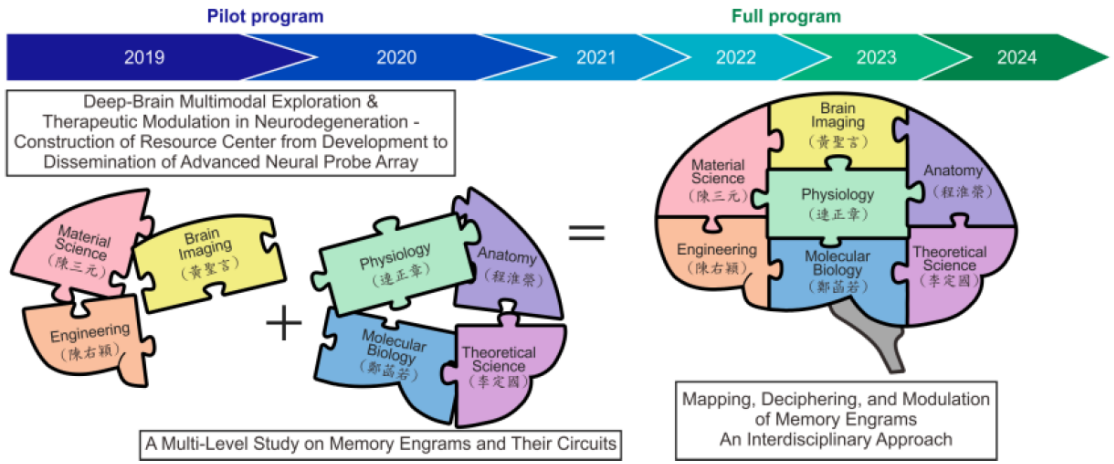
✓Examples: Successful grants

成功計畫的原因

1. 提早準備 (個人經驗: 至少三個月前)
2. 提出明確的問題及假說 (outstanding questions and guiding hypothesis)
3. 提出明確的目的 (clear specific aims and sub-aims)
4. 明確敘明計畫的優點及重要性 (scientific merit and significance of the overall project)
5. 新穎性及原創性 (novelty and originality of the research)
6. 幫助審查委員瞭解的插圖
7. 有適量 (15~20%) 的初步研究結果支持
8. 跨領域整合，敘明計畫主持人如何整合

3.1 RATIONALE AND BACKGROUND

When the brain forms a memory of a new experience, neurons called engram cells, which undergo enduring physical or chemical changes, encode the details of the memory and are later reactivated whenever we recall it. The German zoologist Richard Semon was the first to conceive the concept of engram (Semon, 1921). According to Semon, a neuronal ensemble, subserves the physical representation for a given memory stored in the brain. Recent advances in mouse genetics enable scientists to label engram neurons that are active during memory encoding (Reijmers et al., 2007; Liu et al., 2012; DeNardo et al., 2019). A combination of these engram-labeling techniques with the cutting-edge optogenetic tools further allows engram cells to be selectively manipulated at later times (reviewed by Tonegawa et al., 2015). Over the past one and half years, our interdisciplinary team approach has addressed several fundamental and outstanding questions regarding the identity, function, plasticity, and connectivity of engram cells (see **Preliminary Results**).



To continue our teamwork conducted during the pilot program, we initiated a four-year integrated research project. In this full program, we strengthen the uniqueness and competitiveness of our cross-campus research collaboration by strategically merging two research teams with complementary strengths, both f which have been funded by the pilot program. On the basis of already-established techniques and discoveries by both teams, we focus on two interrelated scientific directions: (1) Mapping and deciphering the function of inhibitory amygdala engrams; (2) Developing circuit-based brain stimulation for modulation of memory function and emotional behaviors.

明確敘明計畫的優點及重要性

3.1.1 Scientific merit and significance of the overall project

This program project grant (PPG) represents an integrated research project by targeting well-defined scientific problems in the engram research. We aim to conduct multi-level and large-scale interrogation of engram cell research, including mapping their activity and connectivity, studying their gene expression, and modulating their function. The accomplishment of this project will create a causality memory engram map linking activities to genes and circuits, deduce new theories of engram behavior, update conceptual models for memory processing in the brain, and ultimately leads to a paradigm shift in memory research.

3.1.2 Novelty and originality of the research: This project focuses on "non-classical" engram cells, that is, inhibitory engrams, instead of excitatory engrams. To date, inhibitory engrams represent an important yet little explored topic. Moreover, we focus on the interplay of diverse dentate gyrus (DG) cell types in engram formation and memory processing. The significant role of neighboring non-engram cells in support of engrams is largely overlooked. Finally, we also focus on developing tools and paradigms for brain stimulation, including engram modulation. Brain modulation remains an exciting and largely unexplored area.

3.1.3 Strengths and contributions of all PIs to the proposed PPG and our past and current integration activities: Over the past one and half years, activity-dependent engram targeting (or TRAPing; TRAP stands for Target Recombination of Active Populations; see Fig. 2 for the detail)

有助審查委員瞭解的插圖

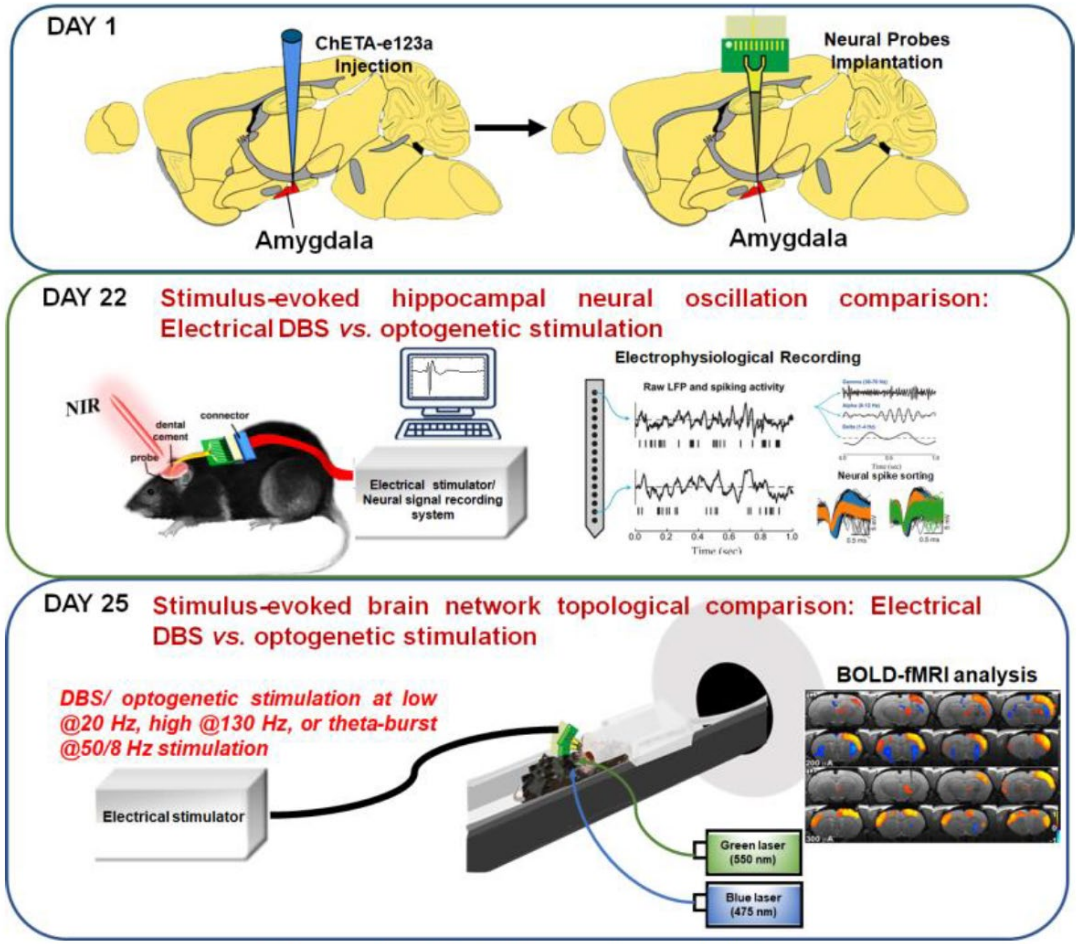


Figure 16. Aim 3.2 experimental design.

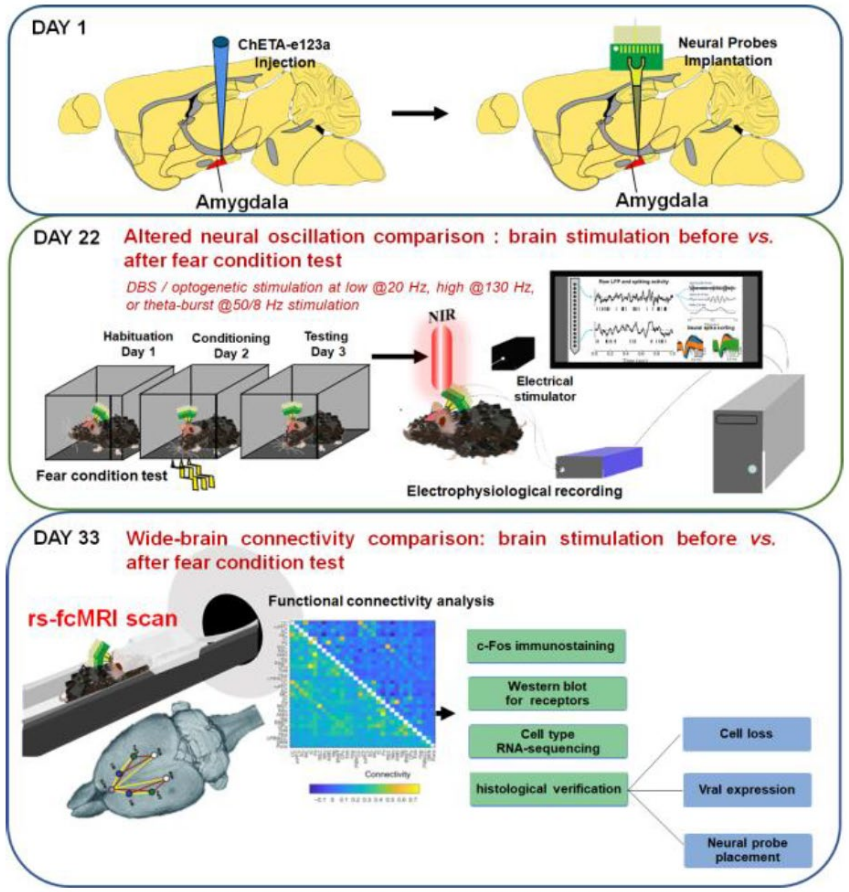
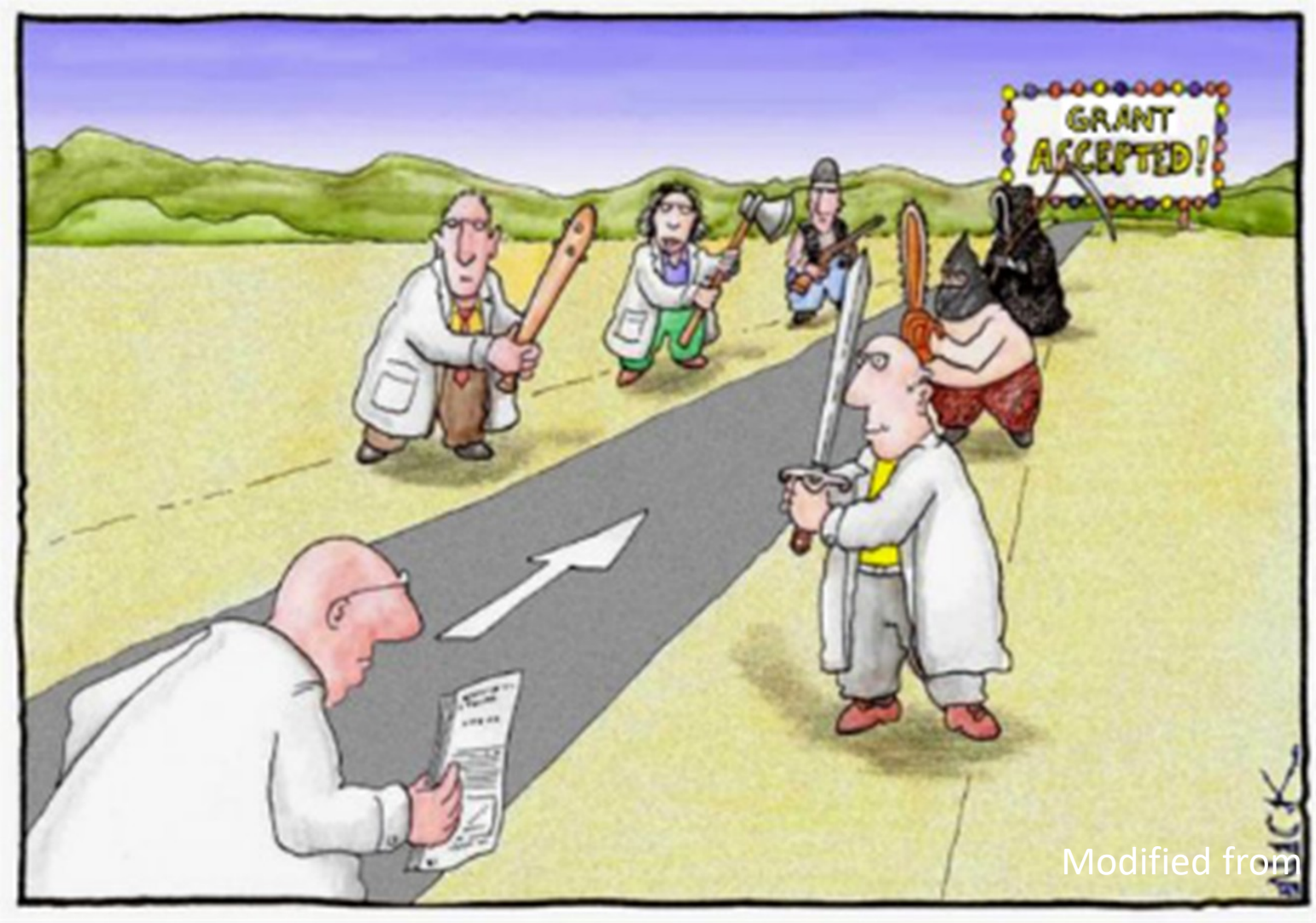


Figure 17. Aim 3.3 experimental design.

謝謝聆聽，祝你成功!



Modified from