

動物實驗之倫理規範

食品營養與保健生技學系
簡廷易

生命可以被創造嗎？

2012年6月，厄瓜多爾的加拉巴哥國家公園
宣布了平塔島陸龜（Pinta Island tortoise）
中的最後一隻老陸龜 - 寂寞喬治
（Lonesome George）的死訊。



動物對於人類的“功用”？

食物

衣物

交通工具

運動

展示品

寵物

實驗用途

...



圍觀狗的活體解剖 Emile-Edouard Mouchy 作品 (1832)



圖片來源：Federation of American Societies for Experimental Biology

Welcome

Journalists

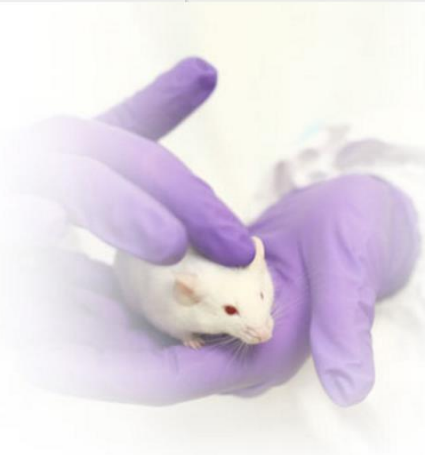
Scientists

Schools

Policy Makers

We aim to provide all you want to know about animal research, whether you are a concerned member of the public or have a special interest.

If you are a teacher, student, scientist, policy maker or a journalist, select one of the tabs above to find the content of particular interest to you.



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Video of the week
Bd: frog plague

Concordat on Openness on Animal Research
100 UK organisations have signed the Concordat - has yours?

Latest News

More articles



This week in animal research
27/05/16
27 May 2016



Bd: Amphibian Plague
23 May 2016



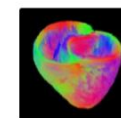
New leaflets from UAR
25 May 2016



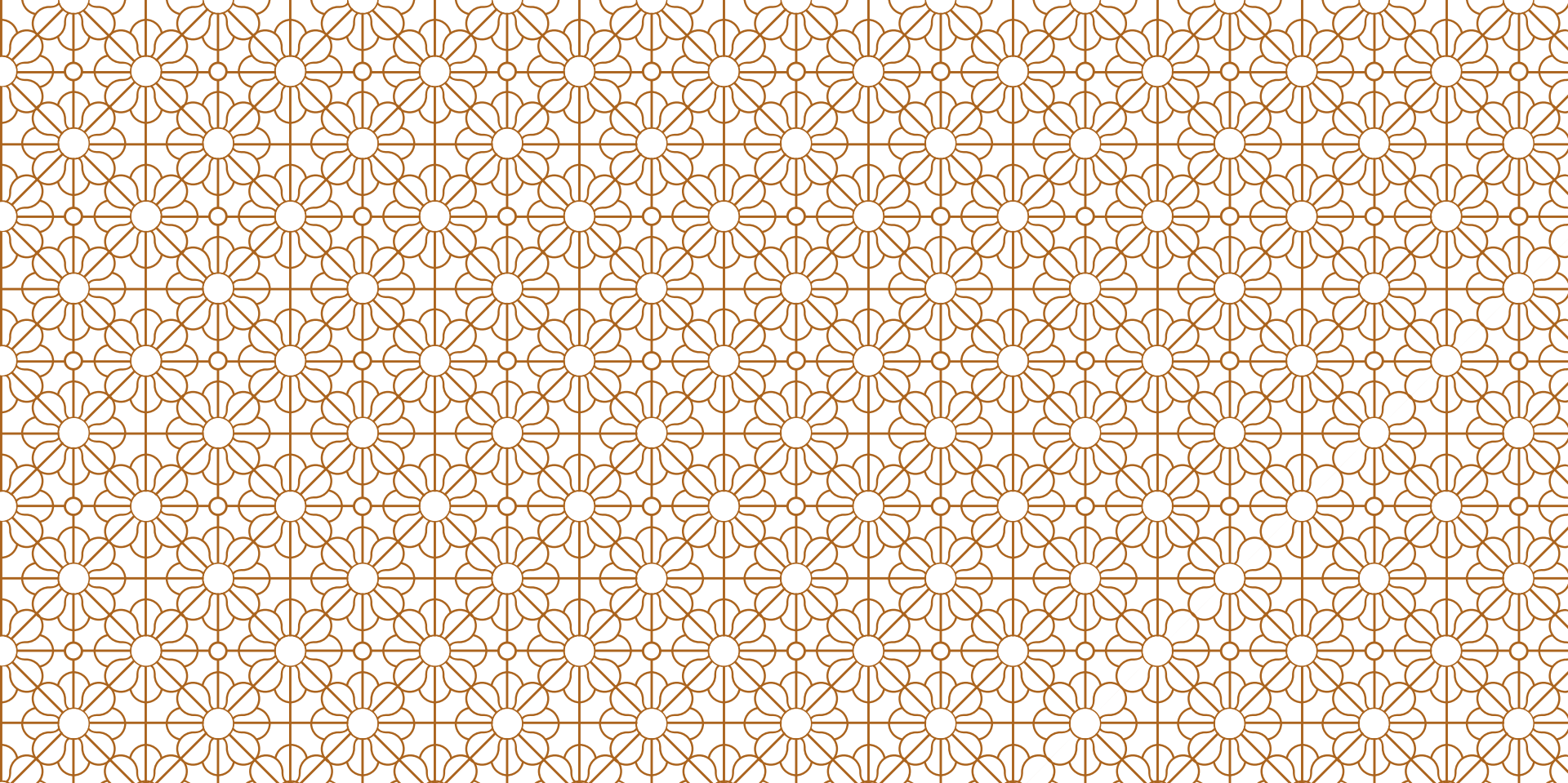
This week in animal research
16/05/16
23 May 2016



British public misled over cosmetic tests
12 April 2016



Animal welfare at Oxford University
6 April 2016



生命無價?

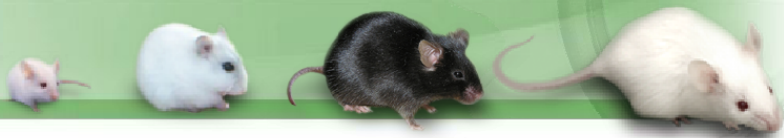


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財團法人國家實驗研究院

實驗動物中心

National Laboratory Animal Center



實驗動物 > 動物訂購 > 動物價格

動物訂購
銷售品系
動物價格
動物訂購流程
線上動物訂購
線上客訴表單

中心公告
專利讓與公告-105005
國研院動物中心105年預定辦理之教育訓練課程公告...
自105年3月14日起至105年4月15日止開放種...
特殊週齡之高齡小鼠特惠價格專案公告-105002
即日起供應新品系小鼠ASID 公告-105001

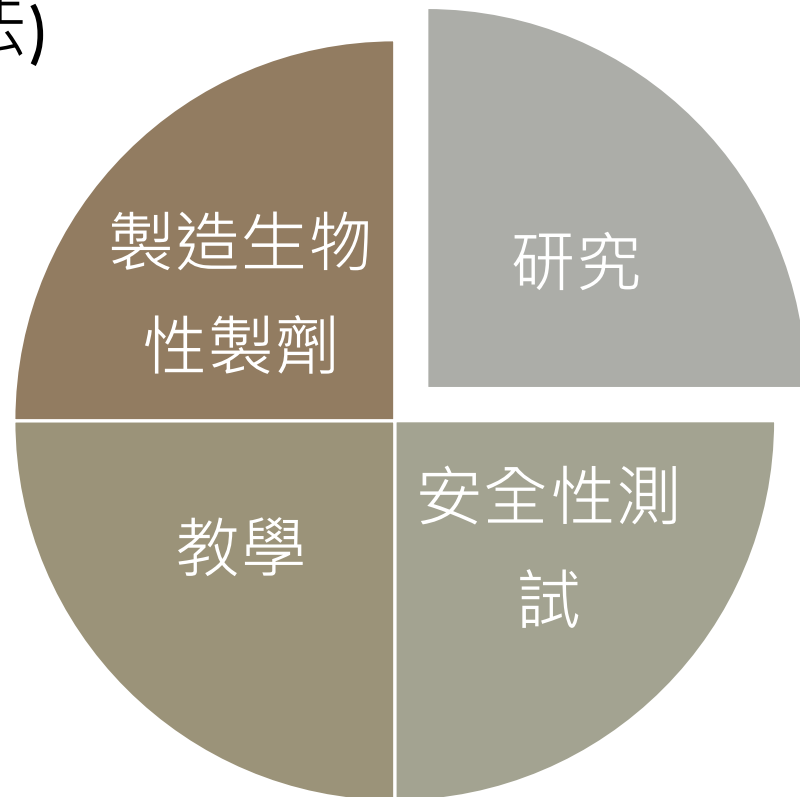
動物訂購

> 動物價格

動物銷售		一般客戶	科技部用戶
項次	品系名稱		
1	BALB/cByJNarl		
	3-5週	225	150
	6-8週	300	200
2	C3H/HeNCrNarl		
	3-5週	225	150
	6-8週	300	200
3	C57BL/6JNarl		
	3-5週	225	150
	6-8週	300	200
	懷孕母鼠	2,285	1,600
4	FVB/NJNarl		
	3-5週	225	150
	6-8週	300	200
	懷孕母鼠	2,285	1,600
5	CBA/CaJNarl		
	3-5週	225	150
	6-8週	300	200
6	BALB/cAnN.Cg-Foxn1 ^{nu} /CrINarl		
	BALB/cAnN.Cg-Foxn1 ^{nu} /CrINarl (裸鼠)	1,400	750

實驗動物

指為科學應用目的而飼養或管領之動物。
(動物保護法)



常見的實驗動物

分類學

- 動物界
- 脊索動物門
- 哺乳綱

與人類相似性高，故最為常用

哺乳類動物

- 猴、豬、狗、兔、天竺鼠、大鼠、小鼠及倉鼠等
- 人類

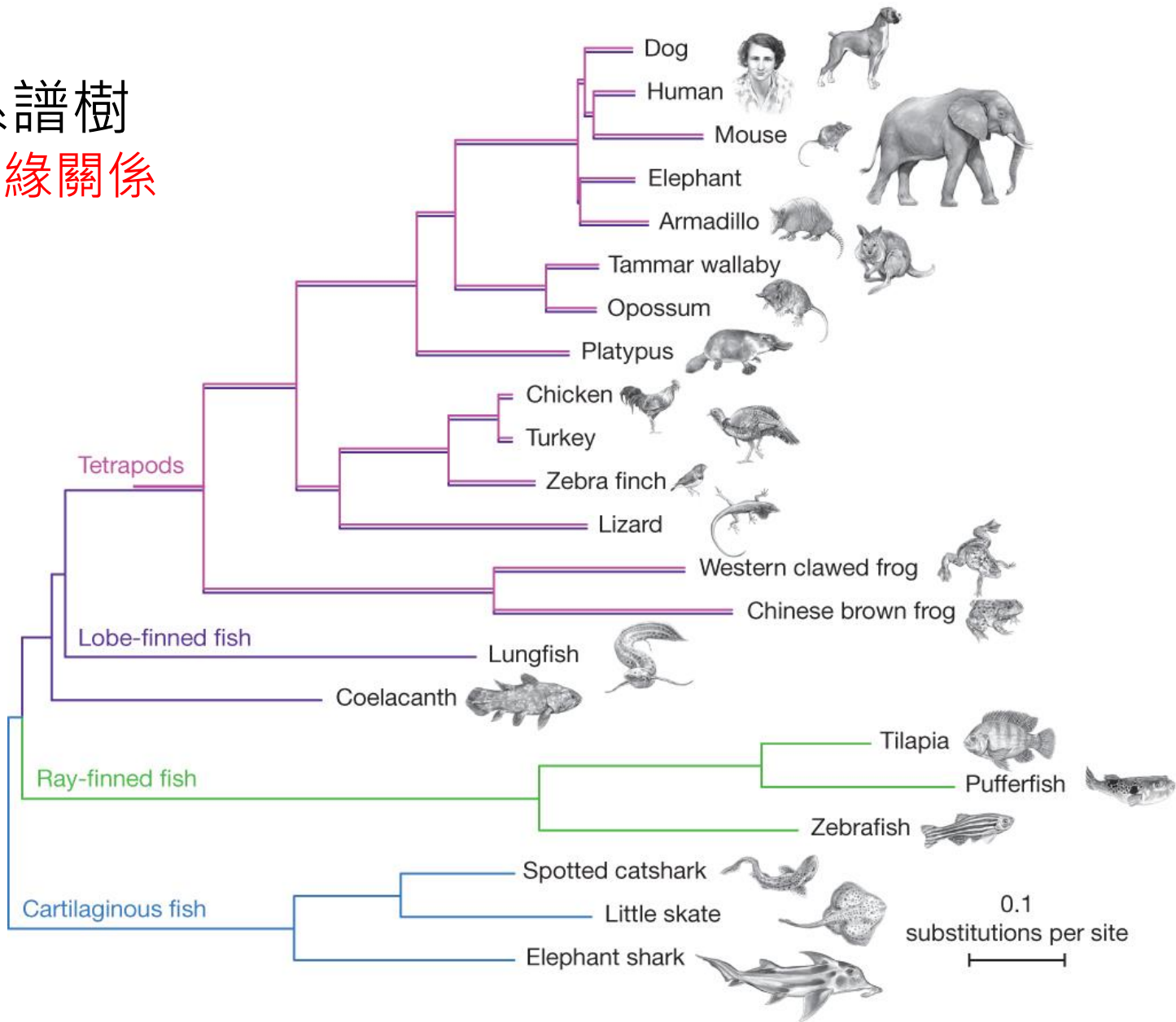
齧齒類

非哺乳類動物

- 鳥、雞、魚及蛙等

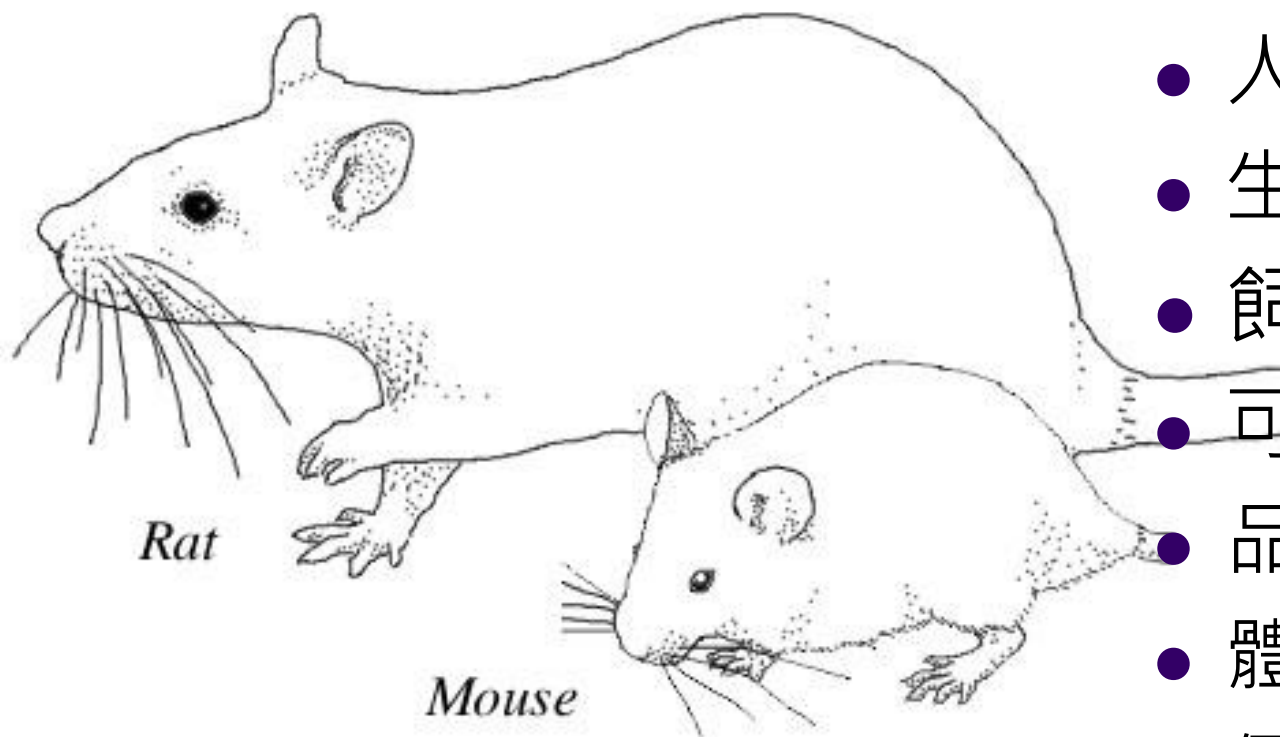
系譜樹

親緣關係



來源：Nature 496, 311–316

白老鼠?

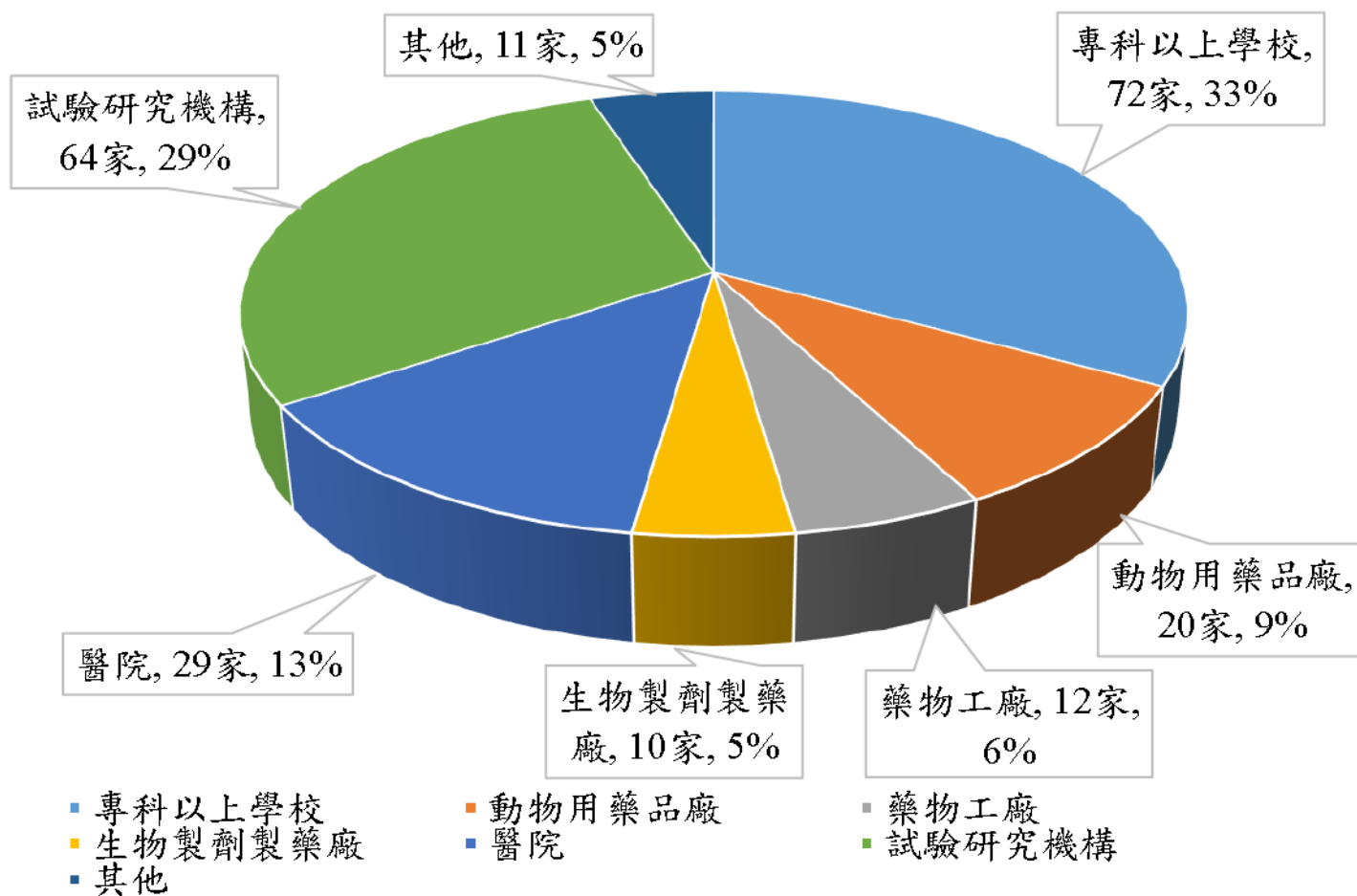


- 人體相似度高
- 生命週期短
- 飼養容易
- 可大量繁殖
- 品系明確
- 體積小
- 便宜

每年使用之實驗動物數量

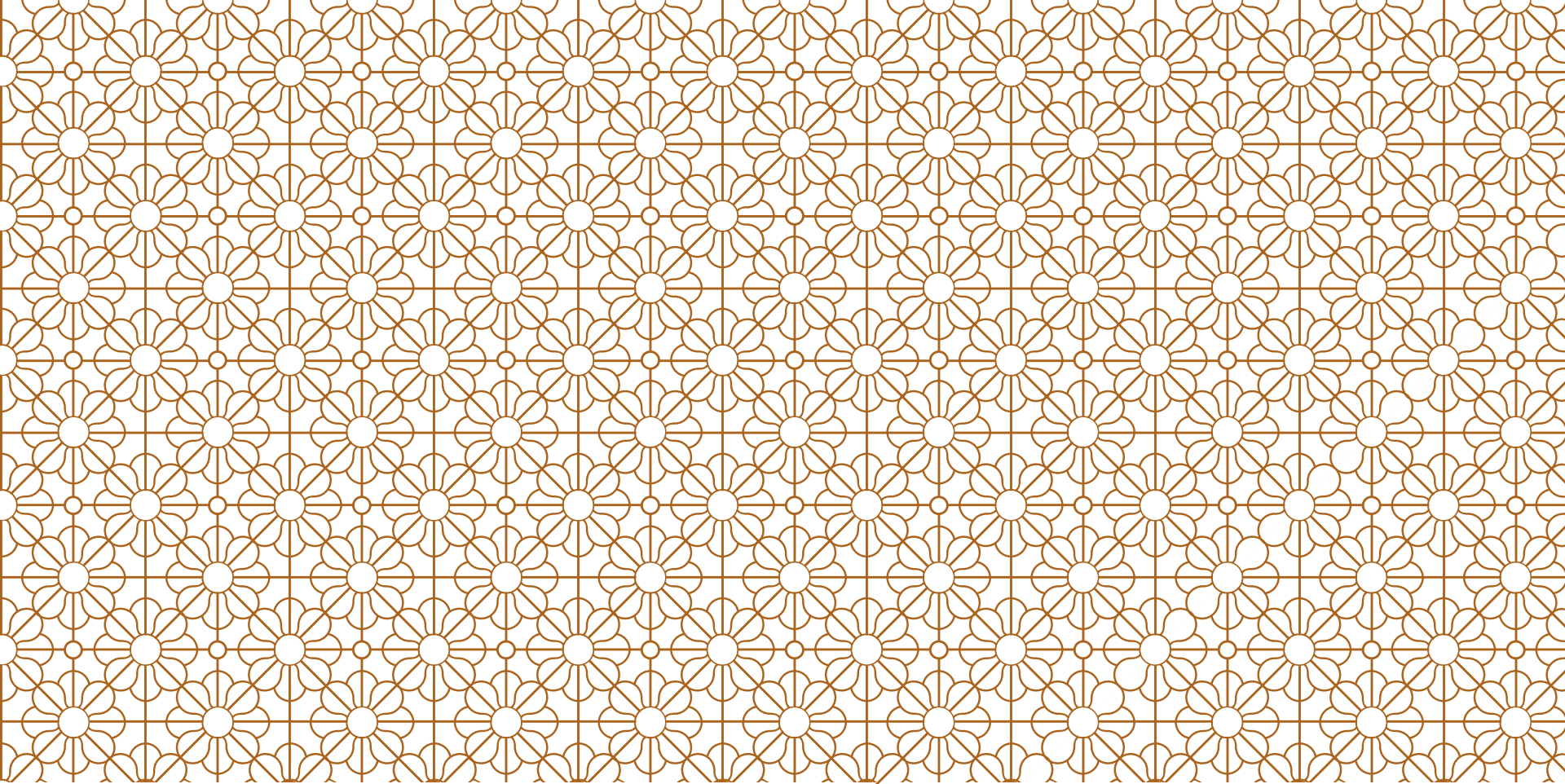
國家	數量(百萬)	資料來源
USA	22.0	US Congress Office of Technology Assessment (1986)
EU*	11.8	Commission of the European Communities (1994)
Japan	2.5	Estimated on the side of caution
Canada	2.1	Canadian Council on Animal Care (1995) Resource 18
Switzerland	0.86	Swiss Federal Office of Veterinary Care (1993)
Australia	0.75	Report of the Australian Senate Select Committee on Animal Welfare: Animal Experimentation (1989)
others	10	Estimated on the side of caution
Total	50.1	http://www.cix.co.uk/~embra/armyths.html

台灣各動物科學應用機構類別分佈



動物別	專科以上學校	動物用藥品廠	藥物工廠	生物製劑製藥廠	醫院	試驗研究機構	其他	合計	百分比(%)
齧齒類	246,200	7,415	9,289	10,806	77,394	311,268	4,760	667,132	53
兔	2,202	3,387	215	6,041	747	7,011	218	19,821	2
牛	134	0	0	0	0	518	0	652	0
犬 ^A	1072	0	0	0	39	237	16	1,364	0
羊	109	0	0	0	0	647	0	756	0
鳥類 ^B	2,120	0	0	0	0	132	4	2,256	0
豬	2,952	35	0	295	952	5,605	0	9,839	1
馬	13	0	0	0	0	46	0	59	0
鹿	20	0	0	0	0	67	0	87	0
雪貂	75	0	0	0	0	100	0	175	0
猿猴 ^C	86	0	0	0	0	9	1	96	0
貓 ^D	133	0	0	0	0	2	0	135	0
鴨	204	0	0	234	0	5,263	0	5,701	0
雞	24,636	1,360	0	3,192	0	22,314	0	51,502	4
鵝	87	0	0	0	0	2,314	0	2,401	0
魚類	184,569	0	0	2,100	641	173,891	6,180	367,381	29
兩棲類 ^E	3,590	0	0	0	0	6,275	12	9,877	1
爬蟲類 ^F	720	0	0	0	0	197	0	917	0
其他 ^{a/G}	12	0	0	0	0	235	54	301	0
小計	468,934	12,197	9,504	22,668	79,773	536,131	11,245	1,140,452	90

來源：實驗動物人道管理年報103



科學發展
一定要犧牲動物嗎?

搶救 錢財 人物 回憶...



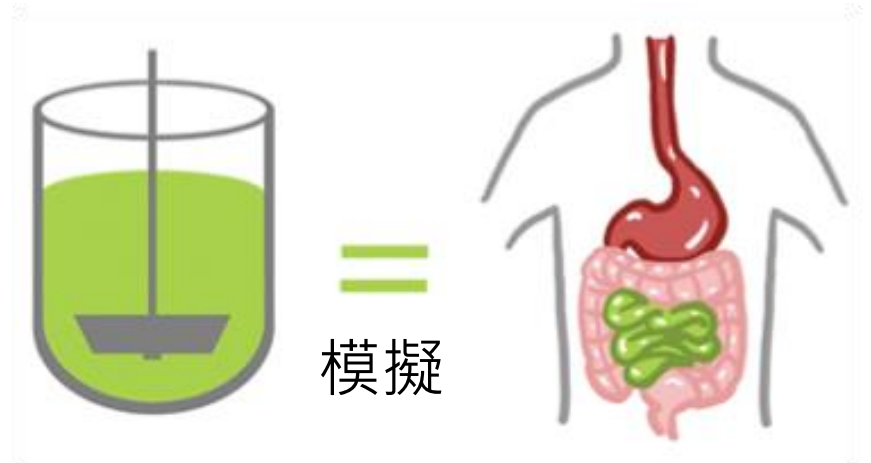
科學研究類型

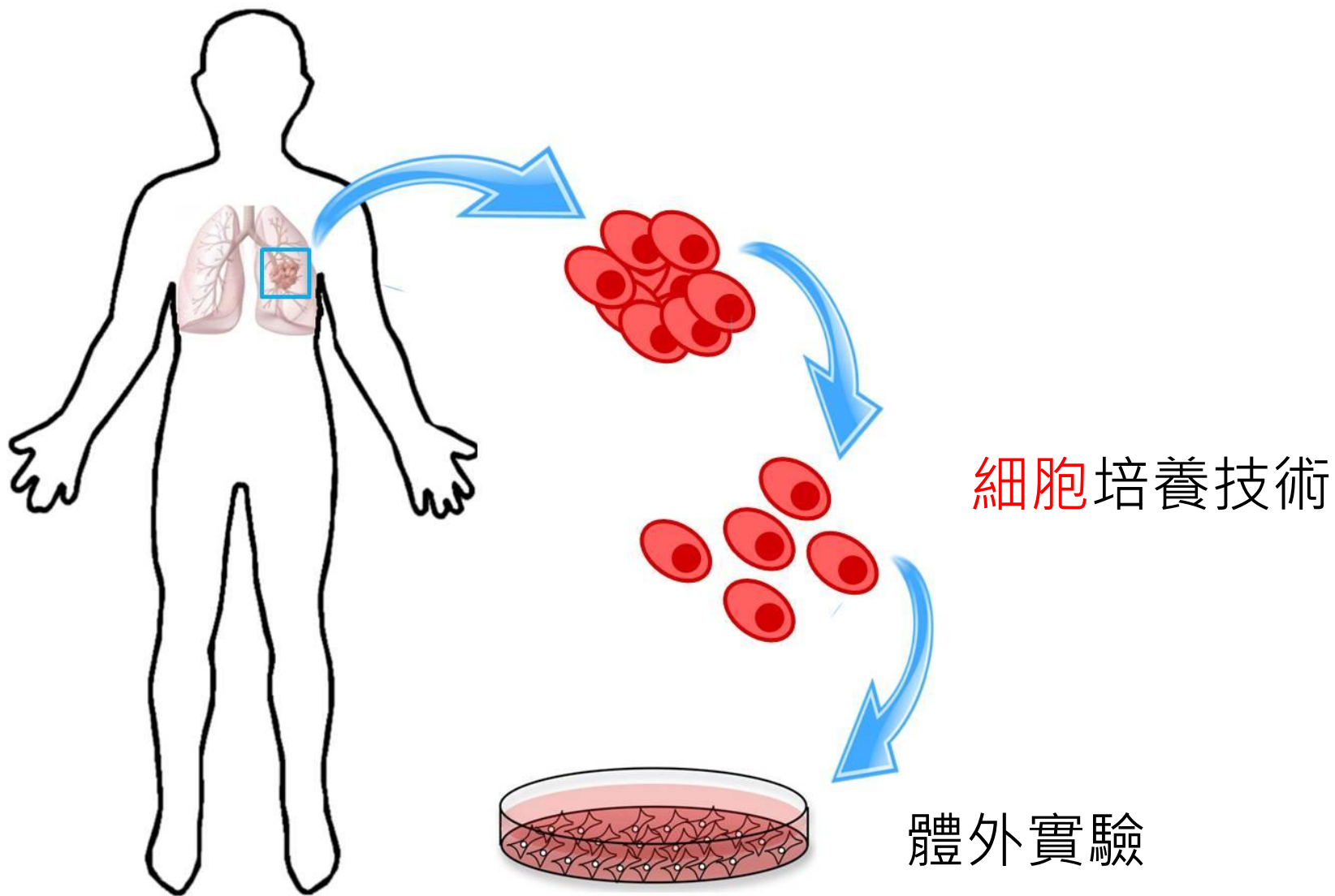
- ***In vitro*** 體外/離體

拉丁語中「在玻璃裡」的意思，意指進行或發生於試管內的實驗與實驗技術。

- ***In vivo*** 體內/活體

拉丁文「在活體內」之意。





生物構造的階層

1. 多種相似的**細胞**集合形成**組織**
2. 不同的**組織**形成**器官**
3. 功能相關的**器官**形成**系統**
4. 各系統建構完整的**生物體**

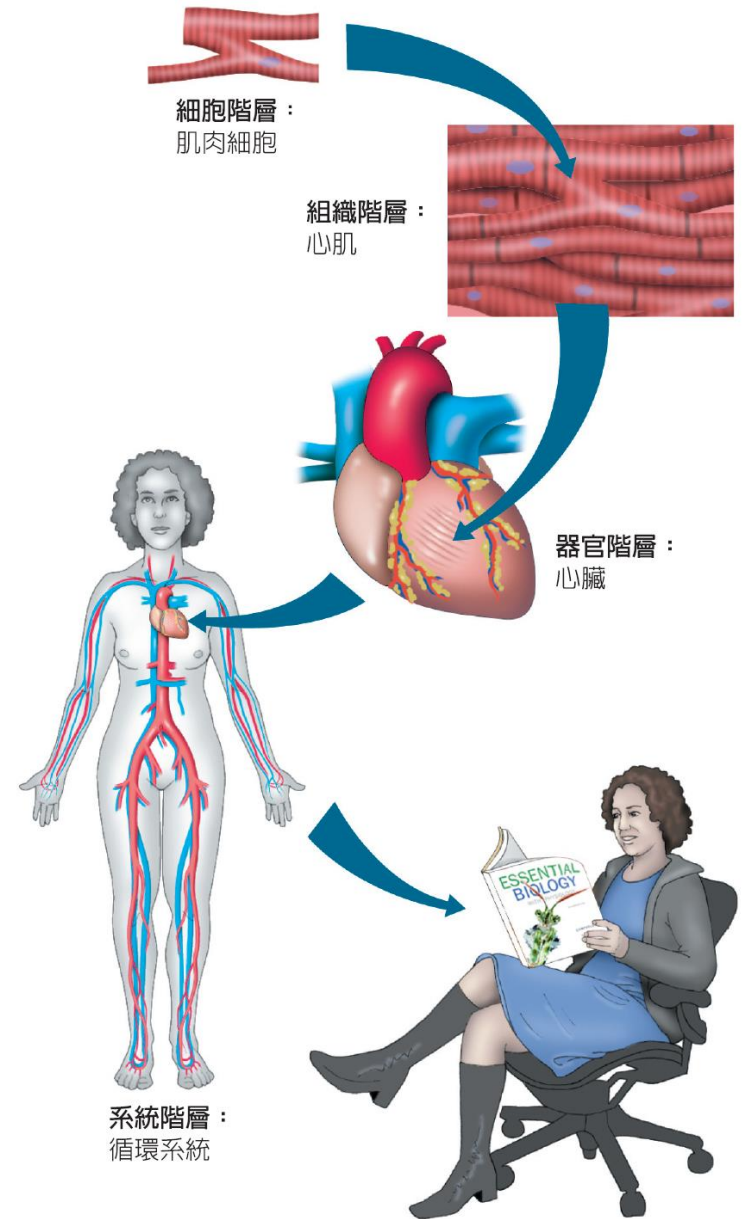


圖 21.2 人類構造的階層。

來源：生物學 Campbell/ Reece/ Simon 原著，
陳誌偉等譯

實驗動物的貢獻 (諾貝爾獎)

1901 白喉

- 利用天竺鼠發展出抗白喉的血清

1912 血管或器官移植

- 使用狗研究增進血管縫合技術

1932 胚胎發展

- 利用兩棲類觀察胚胎組織的分化形成

1954 小兒麻痺

- 利用猴腎臟細胞培養poliovirus，發展出減毒疫苗

1984 治療癌症

- 以小鼠研究發展單株抗體的技術

動物實驗 ANIMAL TESTING

疾病實驗動物模式

- 某些人類的疾病可在實驗動物再現或出現類似的疾病反應，例如癌症、高血脂、糖尿病鼠等

安全性(毒性)試驗

- 基於確保人體使用的安全性，必須證明確實無害人體健康，因此需進行不同的毒理試驗。
- 試驗的期程為28天、90天、1.5年和2年。藥品的試驗多半長達2年，而健康食品則多為28天與90天。

疾病實驗動物模式

實驗或誘發模式

- 將所研究之疾病以實驗誘導方式在動物身上表現。

自發模式

- 疾病自然發生，非由研究者所誘導。

負模式

- 指某特定人類疾病不會發生在此動物上，例如淋球菌感染不會發生在兔子上。

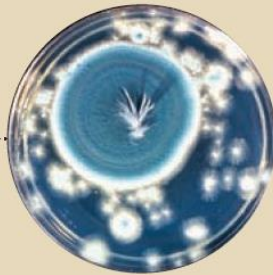
孤兒模式

- 某種疾病存在於某動物，鮮少在人類身上找出類似的疾病。

發現藥物 PENICILLIN



In 1940 eight mice were injected with a lethal dose of bacteria. Four mice given penicillin survived while the others all died.



By 1942, penicillin was being used to save dying patients. Just three years later, penicillin was being produced on an industrial scale and a Nobel Prize was given for its discovery and development.



During World War II, penicillin dramatically reduced the number of deaths and amputations caused by infected wounds.

[Ten medical advances from animal testing](http://www.understandinganimalresearch.org.uk/)

新藥研發之流程

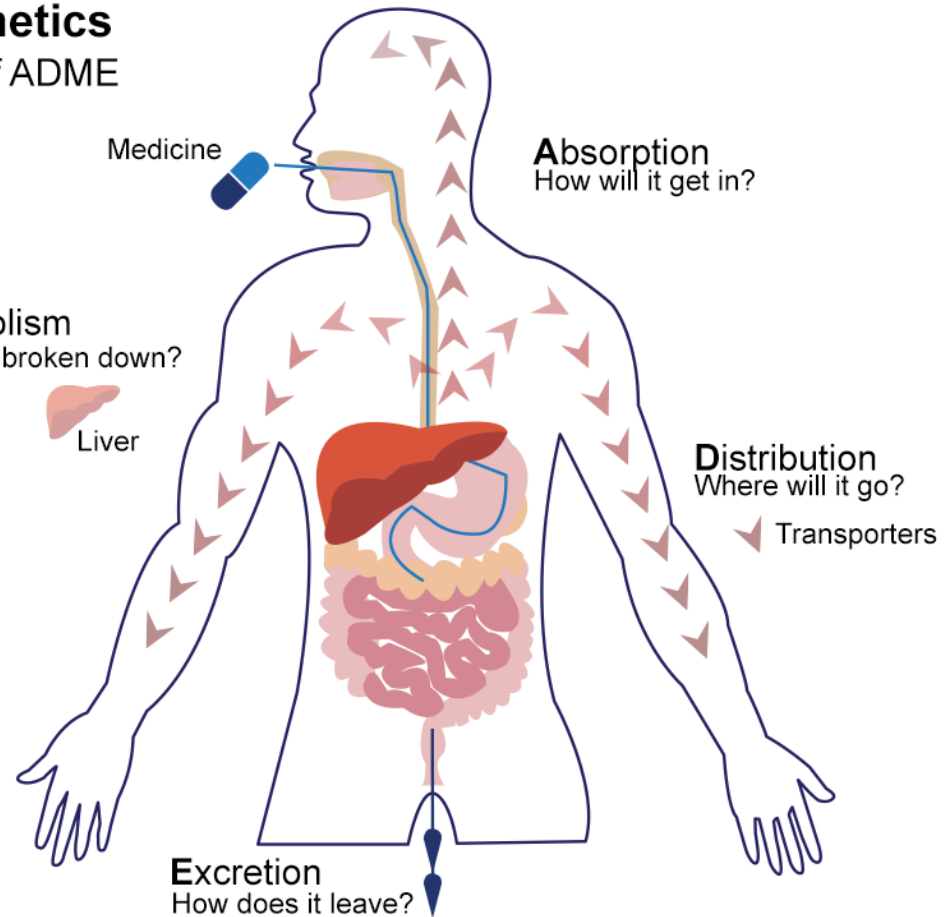


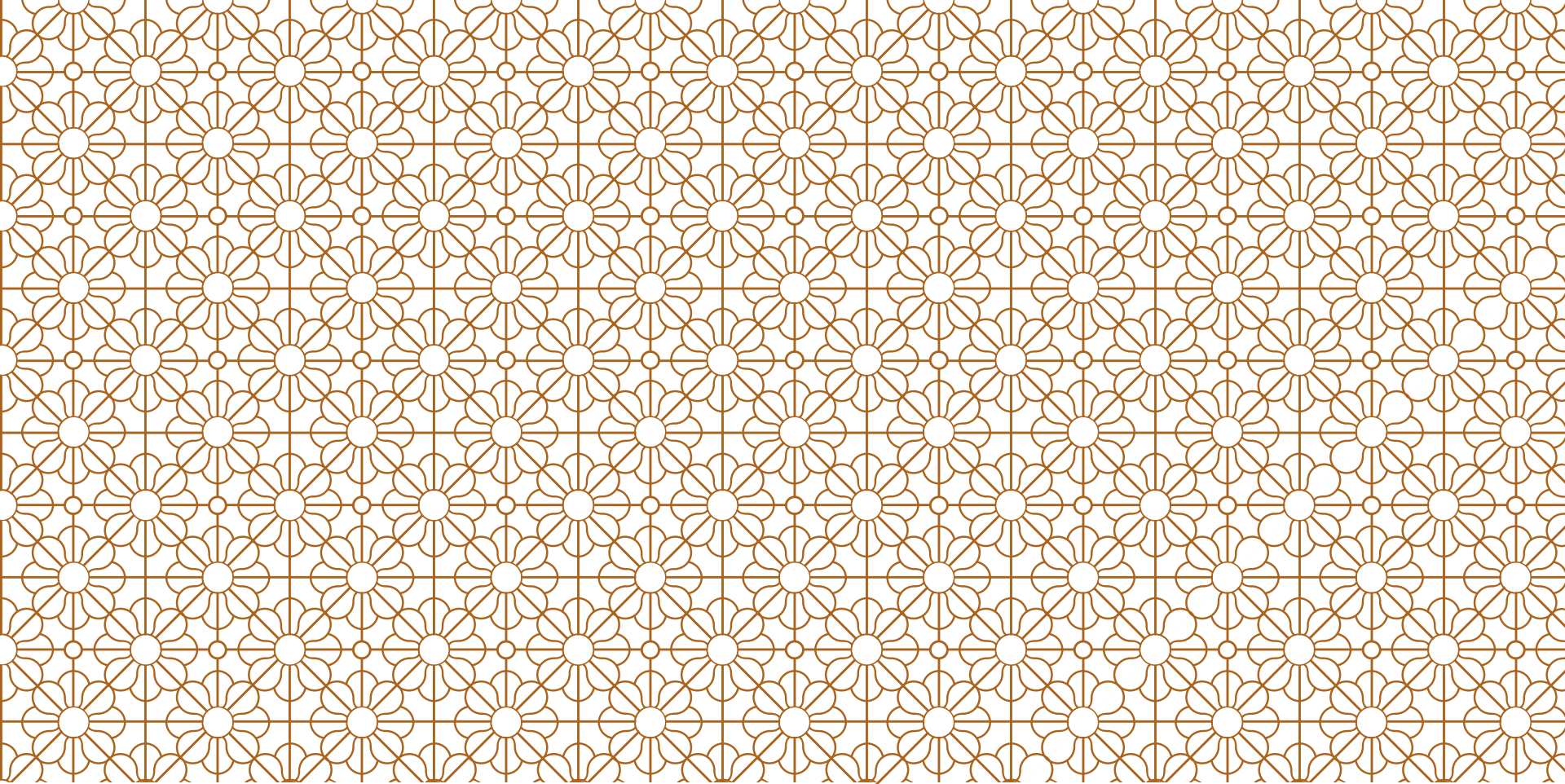
來源：科學月刊 第44卷第2期

藥物動力學

Pharmacokinetics The principles of ADME

吸收(Absorption)
分布(Distribution)
代謝(Metabolism)
消除(Elimination)





爭議性較大的實驗

兔子熱原試驗

兔子放於行為限制器

插入溫度探針，並持續記錄體溫。待兔子穩定，挑選試驗兔 (規格：體溫不得大於 39.8°C，體溫變異 $\leq 1^\circ\text{C}$)

試驗兔記錄插入溫度探針，並測量對照體溫 (須在注射前 30 分鐘內)

待測樣品

待測樣品

注射
3 隻兔子



(初試)

(品管 5~7)
10 mL/kg, 10 min 內完成

注射
5 隻兔子



(複試)^(註)

注射 1 小時後：
每隔 30 分鐘，記錄體溫 1 次。

1. 求算每一兔子體溫變化 (TC)：
= 最高體溫 - 對照體溫
2. 求算體溫變化之總和

眼刺激試驗 DRAIZE TEST

可以鑑別出對人類眼睛中等至嚴重刺激的化學物，但對輕度刺激藥物較無法鑑定。

測試物質放入大白兔的眼部，定時記錄角膜不透明的程度、虹膜充血、結合膜水腫及分泌物。



來源：維基百科

protest from scientists who have criticized APHIS, among other things, for paying more heed to public opinion than to their own judgments. The total cost of the draft regulations to the private sector has been estimated at \$1 billion (\$885 million in initial outlays, \$207 million in annual operating expenses), including \$250 million for the dog and primate facilities. (*Science*, 4 November 1988, p. 662). Animal researchers say this would render much research unaffordable.

Comments on the proposed regulations are not yet in (the deadline was 13 July), but they are likely to send APHIS back to the drawing board. And as it redrafts the regulations for a third time, it will have the benefit of some new research findings.

Dale Schwindaman of APHIS noted that at the time the law was passed, there was little research to guide implementation. But over the past few years researchers have been coming up with empirical findings on what it takes to keep dogs and monkeys fit and happy. In a word, they have established that, as with humans, a satisfying social life is more important than one's exercise regimen or the spaciousness of one's apartment.

APHIS, therefore, is moving toward definitions of "psychological well-being" and

Cosmetics Firms Drop Draize Test

Two major cosmetics companies, Avon and Revlon, have announced that they will no longer use the controversial Draize test to gauge the safety of their products. The test, which uses rabbits' eyes to measure irritancy, has been a major target of animal activists for the past decade.

Avon Products, Inc., said in April that it will henceforth rely on a new in vitro test it has developed, harmless tests on people, and a computerized database.

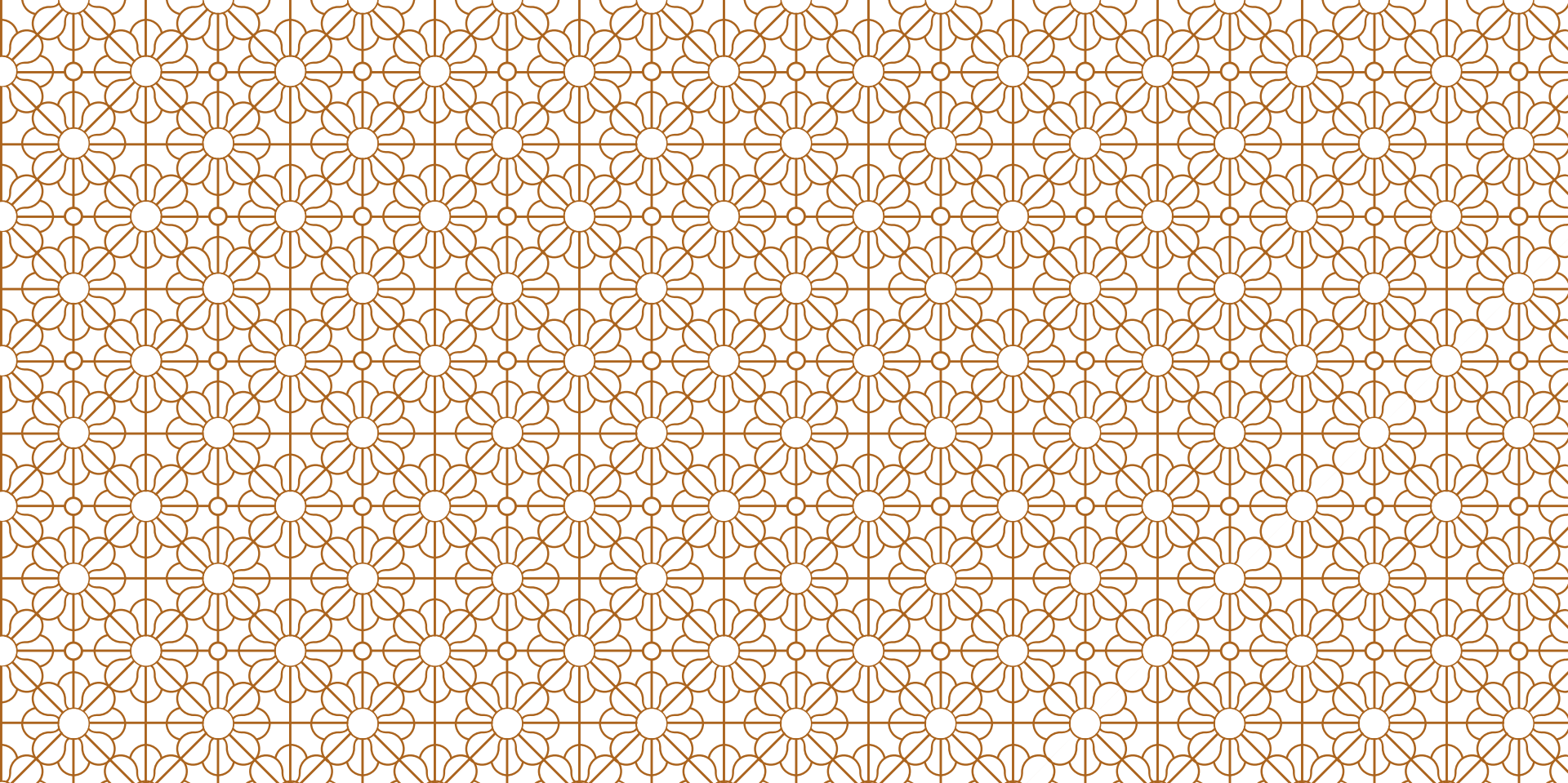
On 30 June, Revlon Inc., which closed down its animal testing facilities in 1986, announced that it will no longer use animals in product testing. Revlon, which for 6 years funded the Laboratory Animal Research Center at Rockefeller University, says it has put \$3 million into research on nonanimal alternatives since 1980.

Both companies have reduced animal use more than 90% in recent years. Avon is now employing Eytex, an in vitro method which it describes as a "biochemical matrix representing predominant components of the eye including mucopolysaccharides, proteins, and referenced salt solutions." In categories where Eytex doesn't work, the company will use proven formulations until new alternative tests are available.

Noxell Corporation is also moving toward elimination of animal use. Last January the company began using the agarose test, involving the application of cosmetics to human or animal cells in a culture, which it predicts will replace the use of rabbits in 80% of cases.

Scientists say that no one procedure is adequate to replace the multipurpose Draize test. Therefore, says New York activist Henry Spira, who launched the anti-Draize movement, companies "are seeking alternatives that will work for their product line, instead of looking for universal alternatives." ■ C.H.

For example, two studies by researchers at Smith Kline & French found that neither APHIS inspections, said Schwindaman, are going to "get away from the tape measure



營造友善環境

動物權(RIGHTS)與動物福利(WELFARE)

動物權

- 反對人類利用動物
- 動物有動物權，包括免於人類干預其生活。

動物福利

- 允許人類利用動物
- 防止動物遭受不必要痛苦
- 確保動物享有優良的生活品質及人道的結束生命。

動物福利 (ANIMAL WELFARE)

身體狀態(Physical state)

- 提供個身體與硬體環境(庇護所、飼料等)
- 以生理指標衡量，例如其腦內啡(endorphins)、心跳標準認定動物是否適合牠的環境

心理狀態(Mental State)

- 認為動物是有感覺的，以其行為來觀察動物福利，例如是否願意受指使或是有畏懼或挫折行為

自然狀態(Naturalness)

- 強調動物需能依其自然習性自在生活才是真正動物福利

5 freedoms for Animals

Freedom from *hunger & thirst*

Freedom from *discomfort*



Freedom from *pain, injury
& disease*

Freedom to express
normal behaviour



Freedom from *fear & distress*

動物五大
自由 **5F**

圖片來源：

<https://www.pinterest.com>

動物五大自由

免於飢渴及營養不良

- 容易取得維持健康身體與活力的飲水及食物

免於不適

- 提供適宜的居住環境，例如遮蔽空間及舒適的休息區

免於疼痛傷害或疾病

- 注意疾病預防，避免傷害與致疼痛，及時診斷與治療

表現正常行為的自由

- 提供足夠空間，適宜的設施與同種動物同伴

免於恐懼與痛苦

- 確保健康狀態，避免精神苦惱

3R

- Replacement (替代)
 - Reduction (減量)
 - Refinement (精緻)
- 使用動物進行科學應用，應儘量避免使用活體動物，有使用之必要時，應以最少數目為之，並以使動物產生最少痛苦及傷害之方式為之。(動保法第15 條)

替代 (REPLACEMENT)

體外
試驗

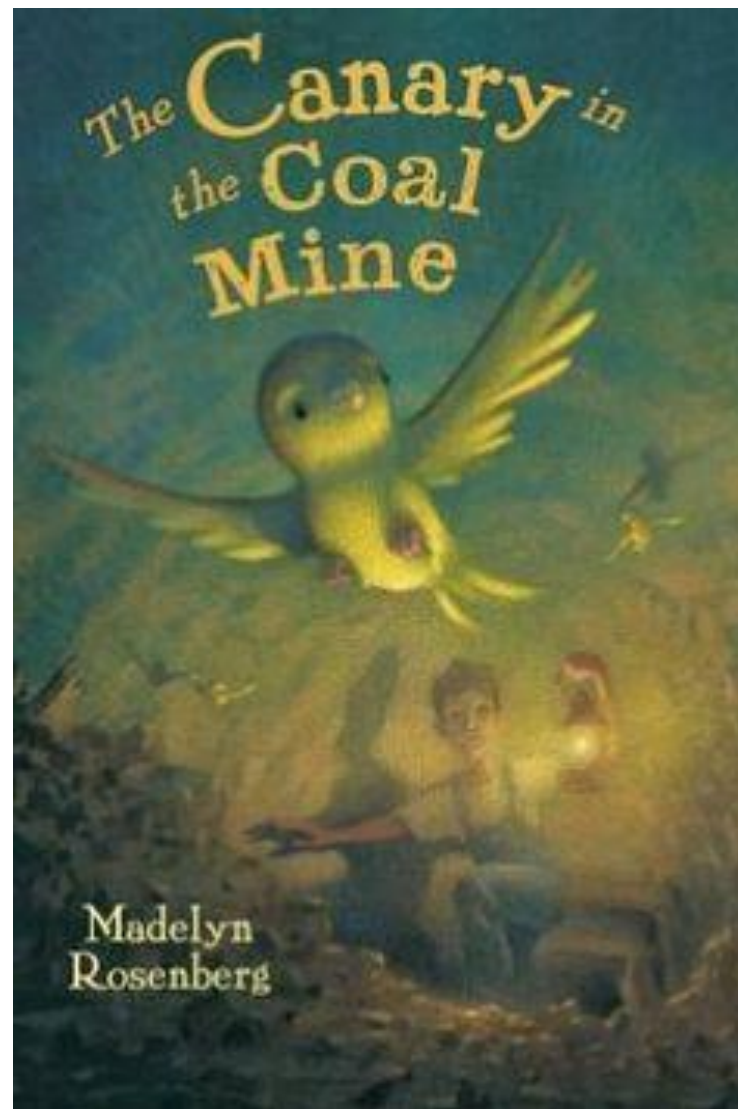
低等
生物

免疫
技術

數學
模式
分析

人體
試驗

金絲雀的眼淚



小英超猛「試毒箱」！致命氰化物難逃

f 推薦 870

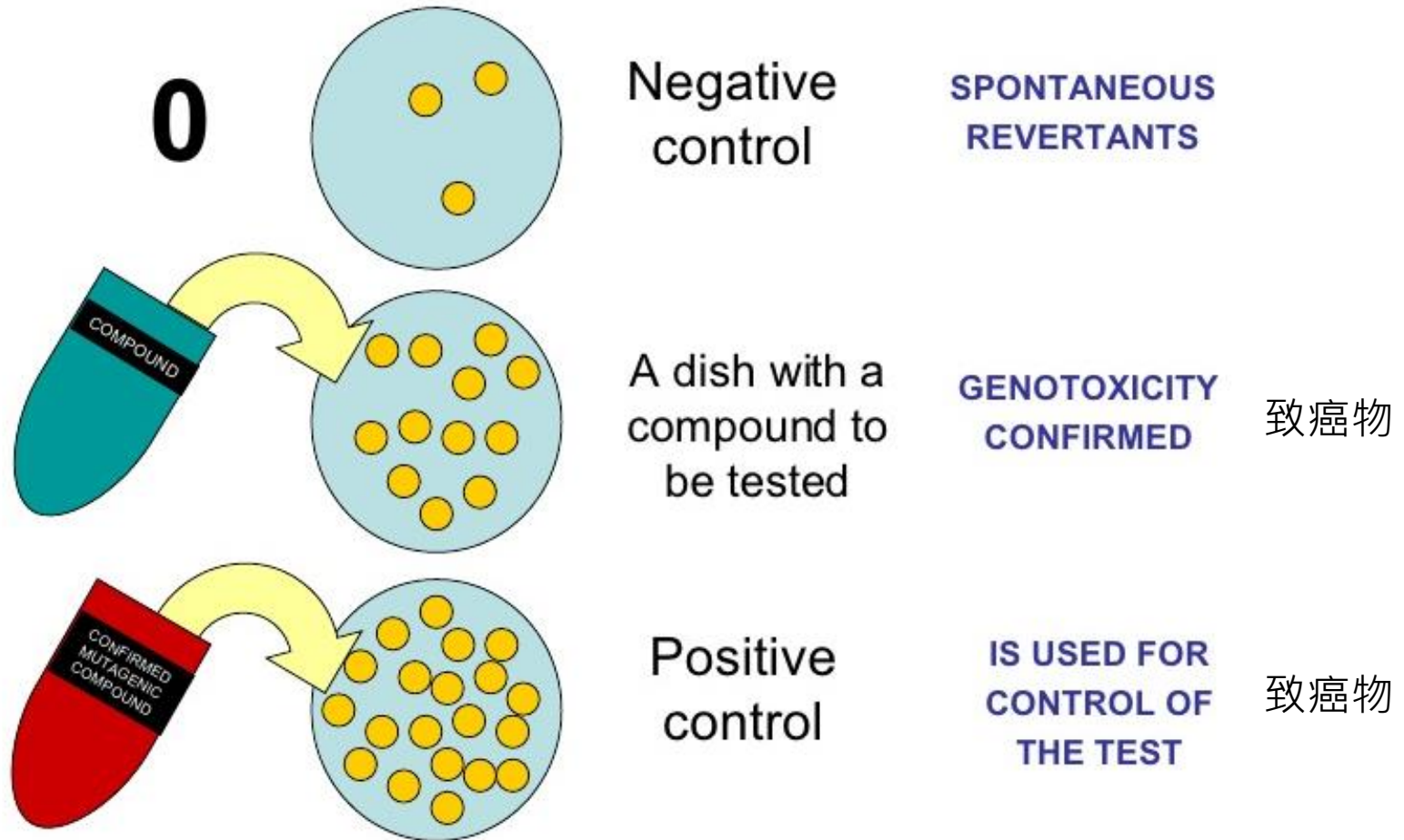
作者三立新聞 | 三立新聞網 setn.com – 2016年5月28日 上午7:49

記者潘建樺、陳秀瑜／台北報導

總統蔡英文現在外食的機會可能更多了，但很多東西不是她想吃就能吃。因為國安局針對總統飲食，有一套防毒機制，就怕有心人對總統下毒手，兩蔣時代會使用小動物，像是白老鼠或養金絲雀來驗毒，還有用銀針來看是否有毒物反應，不過現在科技發達，總統驗毒有一個「試毒箱」，裡頭可以精準測出致命的氰化物、重金屬，或是農藥等，就連瘦肉精，也能在3分鐘內，快速驗出。



安姆試驗 AMES TEST



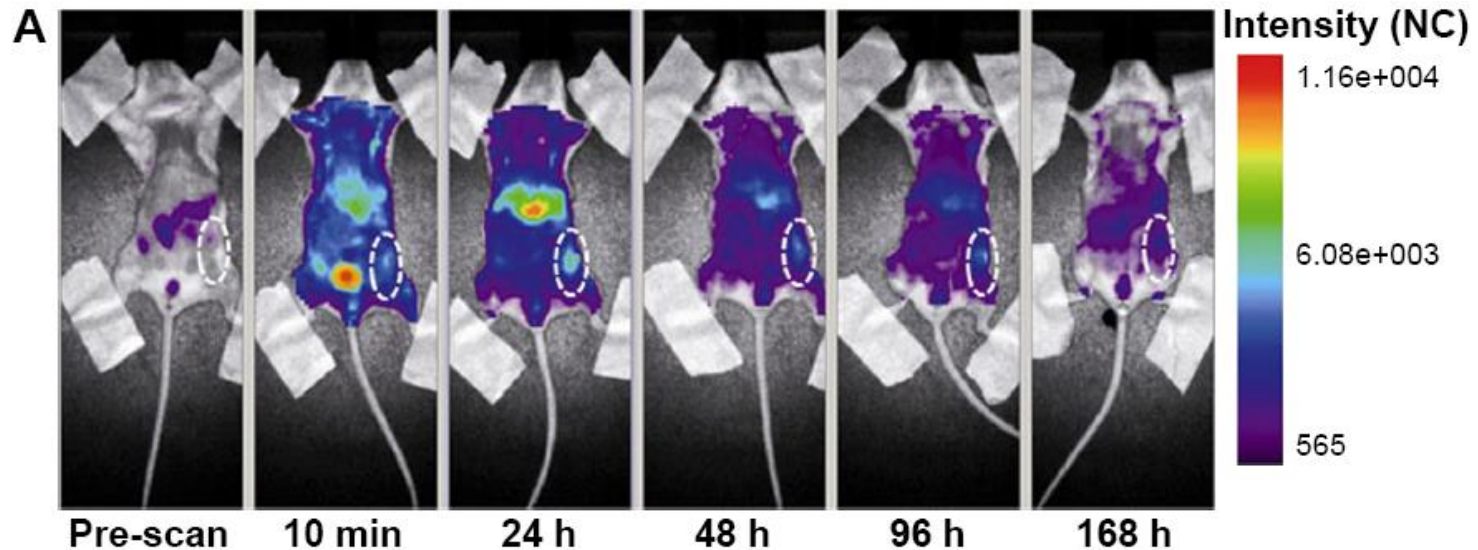
人血取代「兔子熱原實驗」？



圖片來源：台灣立報

減量(REDUCTION)

- 實驗設計與技術
- 統計分析
- 實驗數據分享



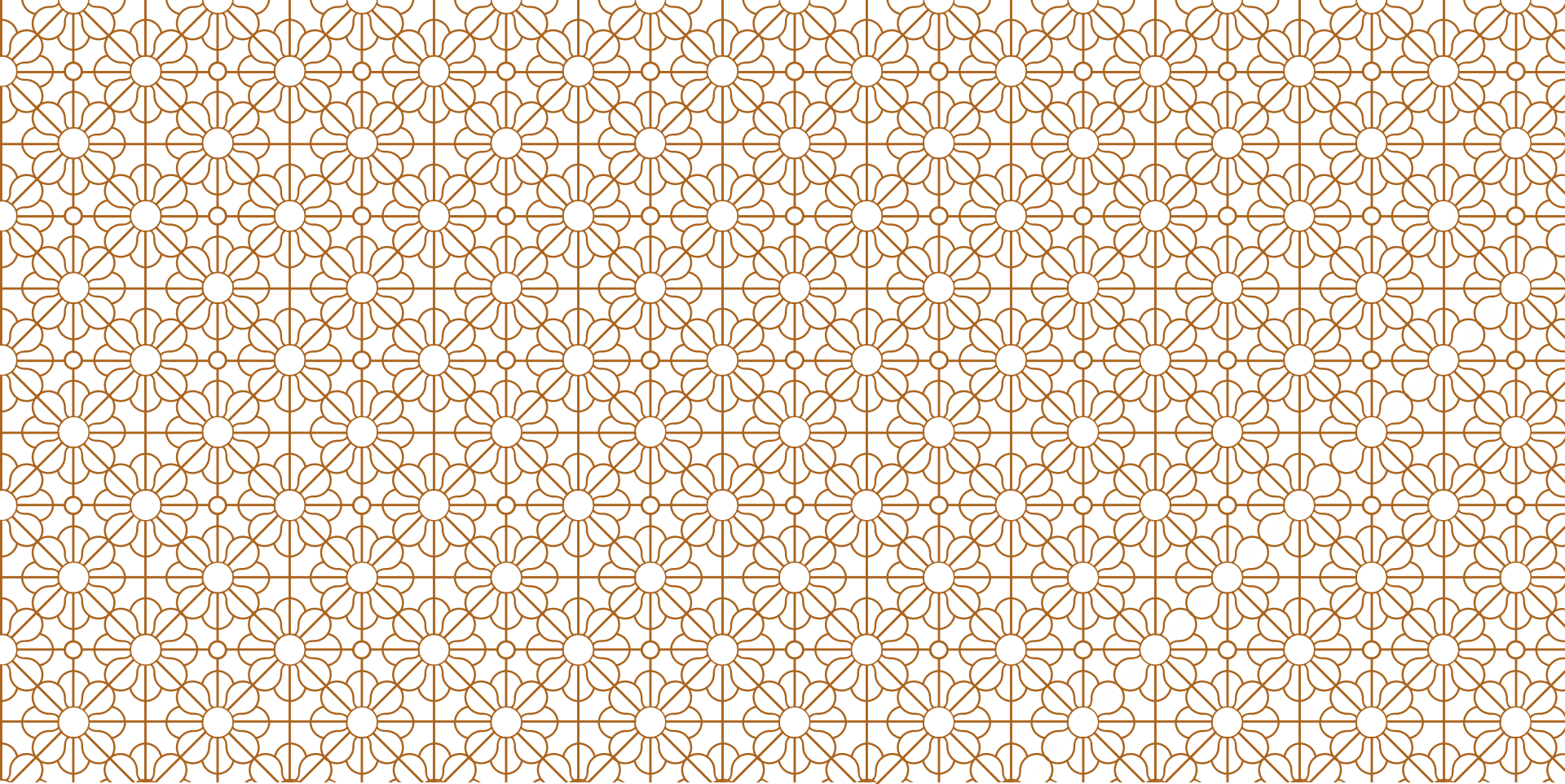
精緻化(REFINEMENT)

改善實驗操作及飼育時動物遭到的疼痛、痛苦及持續性傷害

- 利用非侵入性技術(non-invasive techniques)
- 使用麻醉劑與止痛劑緩解疼痛
- 設定人道終點(humane endpoints)
- 訓練動物合作配合實驗操作
- 確保居住環境符合動物需求(豐富化)

提升實驗操作人員技術

- 具有獸醫證照等相關人員
- 定期教育訓練



誰為動物發聲?



"The question is not, can they reason? nor, can they talk? but, can they suffer?"

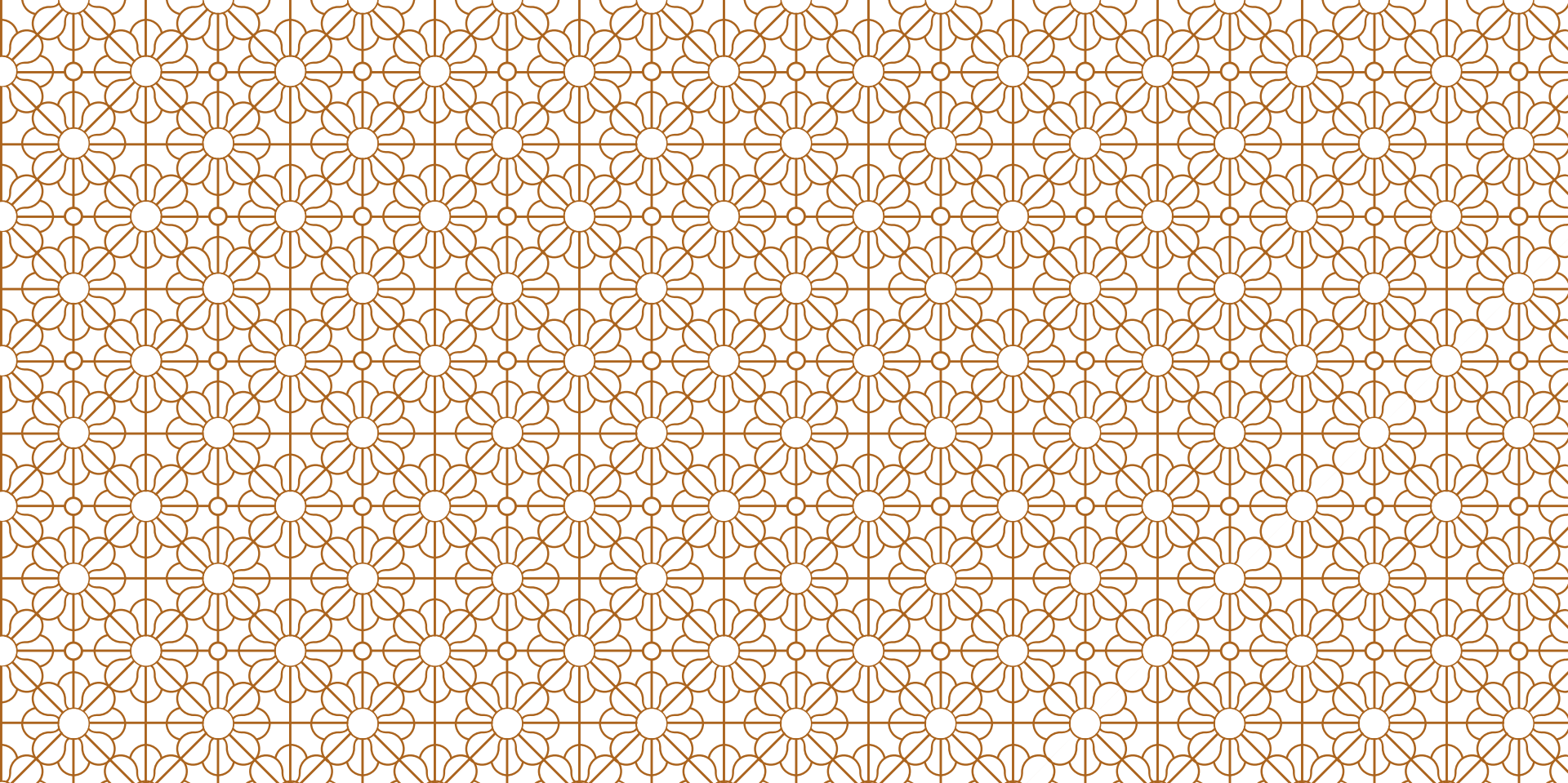
Jeremy Bentham

South Cloisters of the main building of UCL

動物保護法



我國現行「動物保護法」中已訂定**實驗動物**專章，規範動物科學應用機構應設置實驗動物照護及使用委員會或小組，督導該機構進行的動物科學應用。



疼痛控制

平衡點?



圖片來源：<http://www.myinterestingfacts.com/cancer-facts/>



ANIMALS ARE NOT OURS
TO EAT, WEAR, EXPERIMENT ON, USE FOR
NT, OR ABUSE IN ANY OTHER WAY. ▶

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PETA / ABOUT PETA

Frequently Asked Questions

- Is it OK to eat eggs from chickens I've raised in my backyard?
- What is PETA's stance on faux fur?
- Is tattoo ink vegan?
- What is gelatin made of?
- How do aquariums treat marine mammals?
- L'Oréal used to be included on the cruelty-free list. Now I see that it is included on the "do test" list. What happened?
- Are animal ingredients included in white sugar?
- Couldn't we just build more animal shelters rather than euthanize dogs and cats?
- Which beers are suitable for vegans?
- What's wrong with wearing wool?
- Is wine vegan?
- Why shouldn't cats be allowed outdoors?
- Which candies are vegan?
- Which cosmetics are cruelty-free?
- What is the best way to get rid of fleas and ticks?

... [12](#) [13](#) [14](#) [15](#) [Next »](#)

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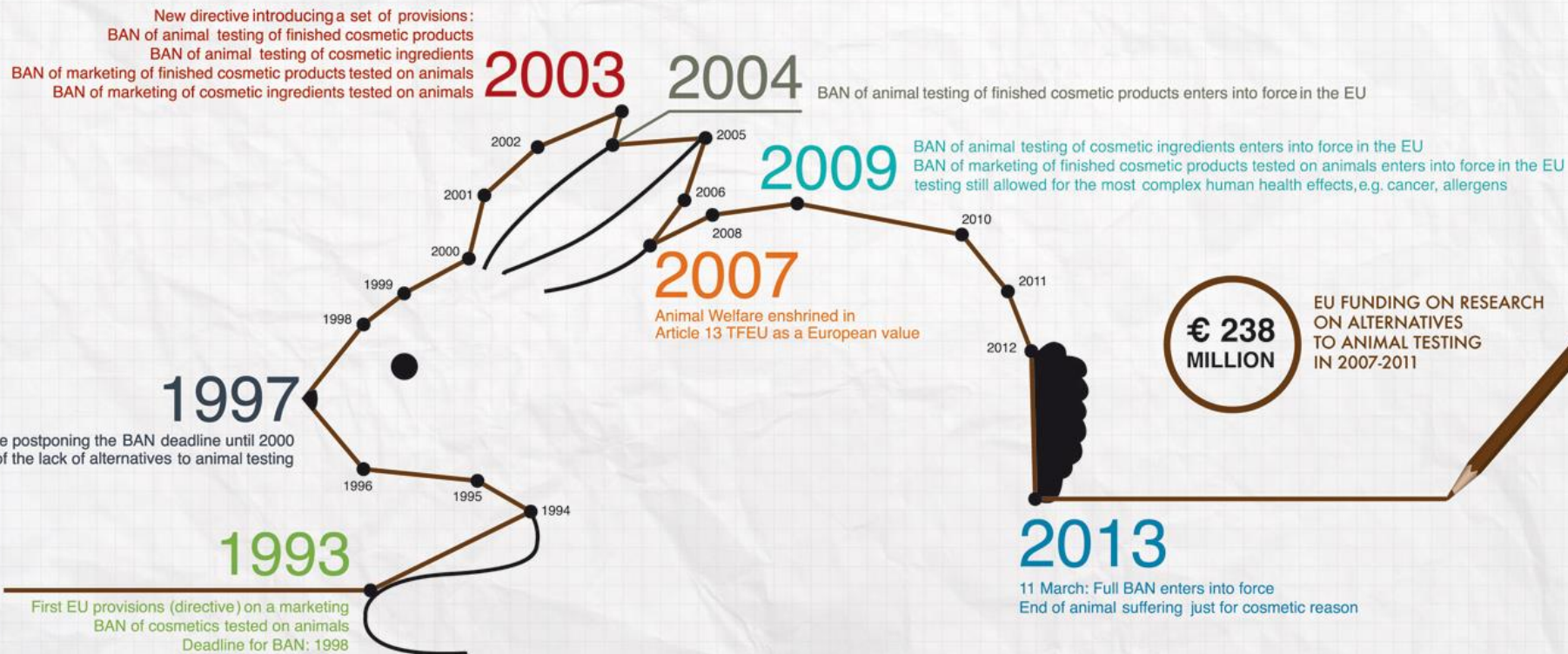
SUBMIT

In This Section

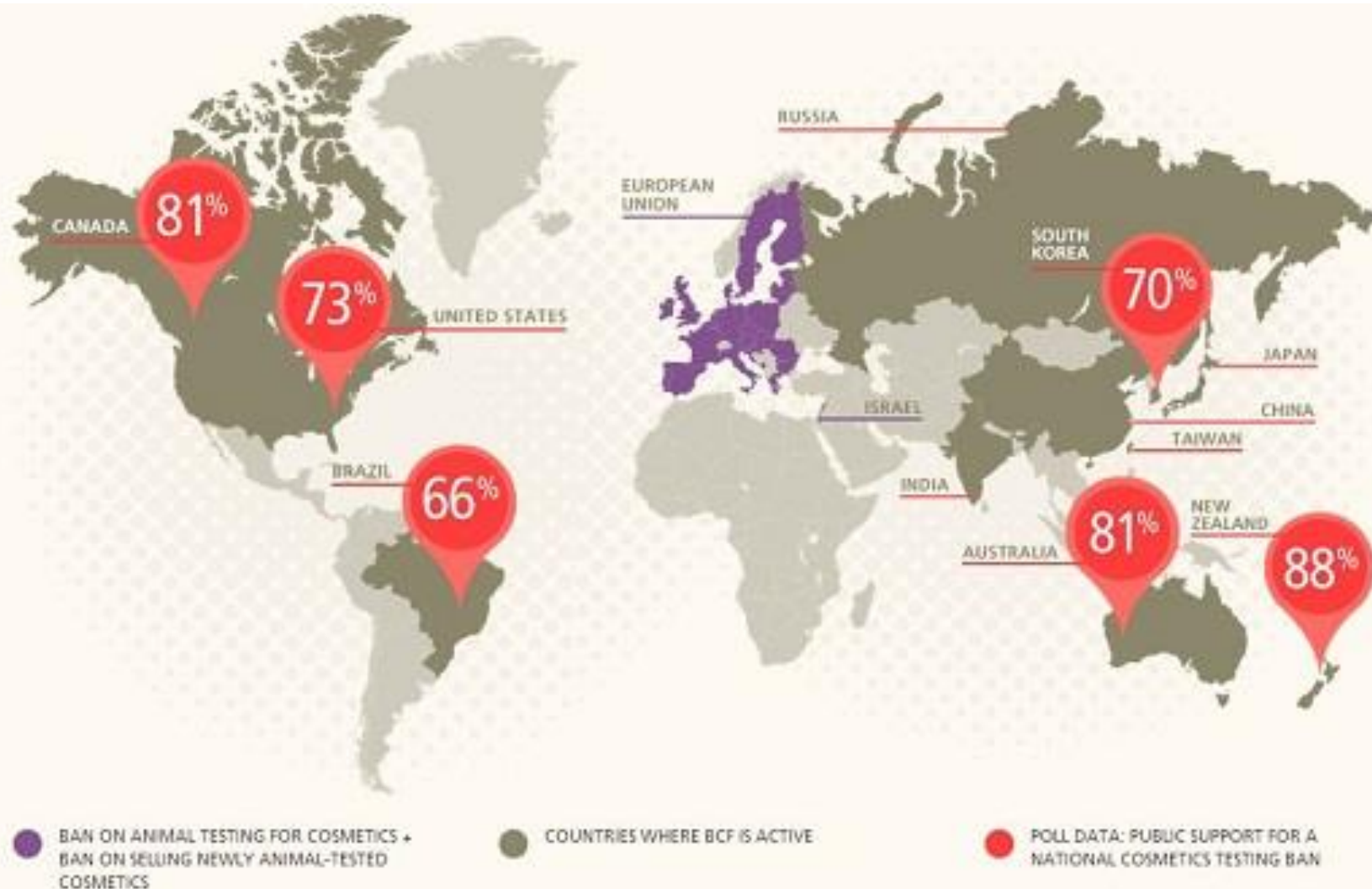
[Animal Experimentation](#)[Animals in Entertainment](#)[Beauty Without Bunnies](#)[Companion Animals](#)[General/Animal Rights](#)[Skins](#)[Vegan](#)

CONNECTING THE DOTS FOR ANIMALS:

HISTORY OF THE EU BAN ON ANIMAL TESTING FOR COSMETICS



Data from Humane Society International indicates that a majority of respondents in six regions around the world are opposed to animal testing for cosmetics.



Purpose and organisation

- Presenting the 3R Foundation
- Addresses
- Administrative Board
- Evaluation committee
- Guidelines for Awarding Research Grants
- Regulations
- Deed of foundation (d)

Reports

- Annual report 2014
- Annual report 2013
- Annual report 2012
- 20 years of 3R Research Foundation Switzerland
- Research report 2000 - 2003 (PDF)

Presenting the 3R Foundation

The Aim of the Foundation

The aim of the 3R Foundation is to promote alternative research methods to animal experimentation through grants for research projects as well as to implement and promote the 3R principles. The organisation supports first and foremost projects aimed at developing new methods or refining accepted methods (validation) which offer improvements vis-à-vis standard animal experimentation in line with the 3R motto Reduce, Refine, Replace. Research projects are selected for support according to periodically defined [principal areas for financial support](#).

How the Foundation is funded

The 3R Foundation is a cooperative institution set up in 1987 by the Parliamentary Group for Animal Experimentation Questions (public organ), Interpharma (www.interpharma.ch/fr/propos-damp039-interpharma/2810-membres) and the Foundation for Animalfree Research (animal protection). The organisation is supervised by the Federal Department of Home Affairs.

The [Administrative Board](#) of the Foundation is made up of nine members, two representing the Swiss parliament, two representing animal protection, two from Interpharma and two from the Federal Food Safety and Veterinary Office, as well as a representative of other interested circles.

The Board has appointed an [Evaluation Committee](#) to review proposed research projects and applications for grants. This Committee at present comprises 14 scientists from the academic and industrial sectors.

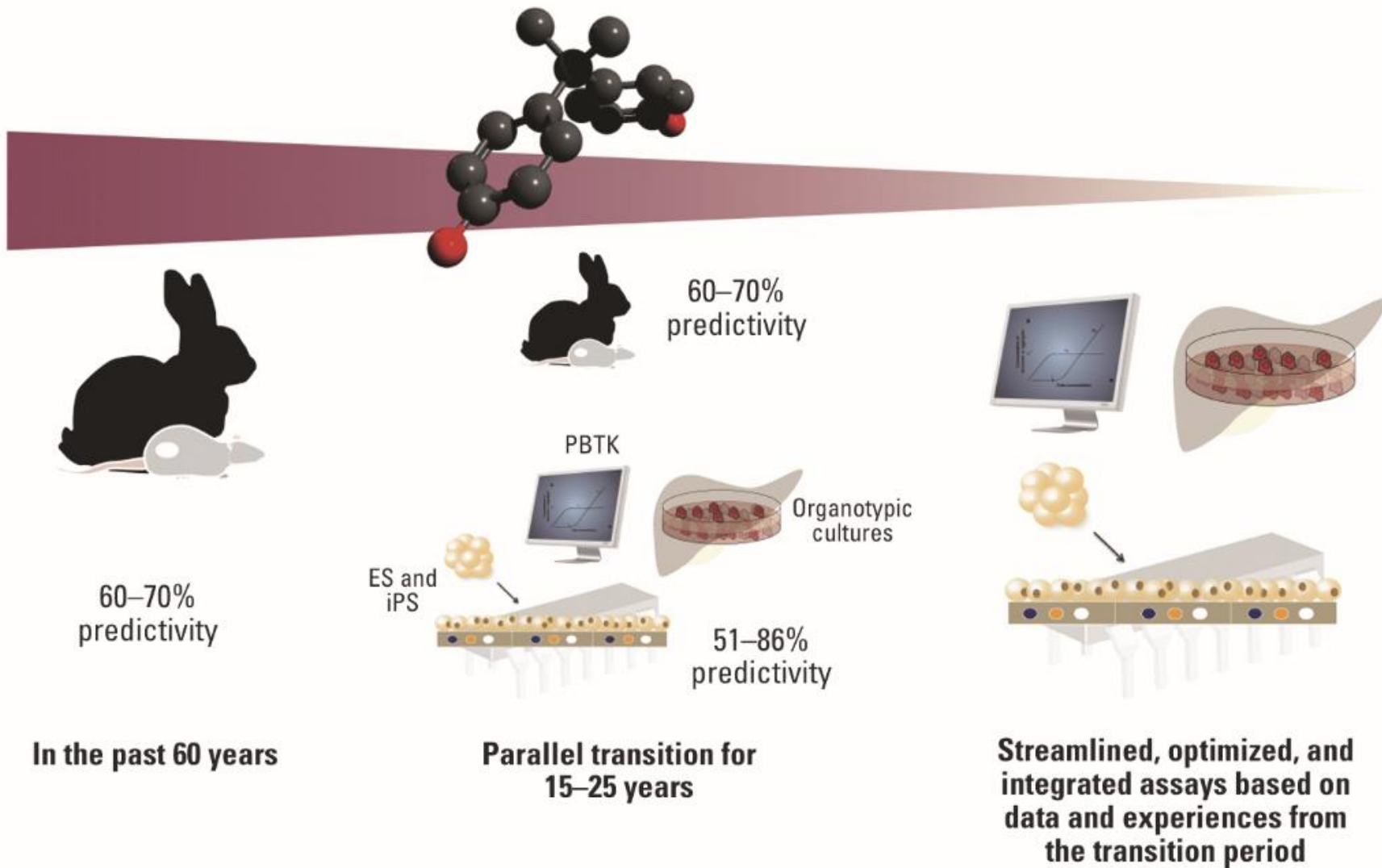
The Foundation's Achievements To Date

Research into experimental methods which do not involve live animals has played an important role in replacing animal experimentation by alternative methods. The Foundation also aims, however, at improving animal experimentation methods in line with increased animal protection. The research activities which have benefited from 3R's support have made a major contribution towards reducing the number of experiments involving live animals in Switzerland, as well as developing better or new methods.

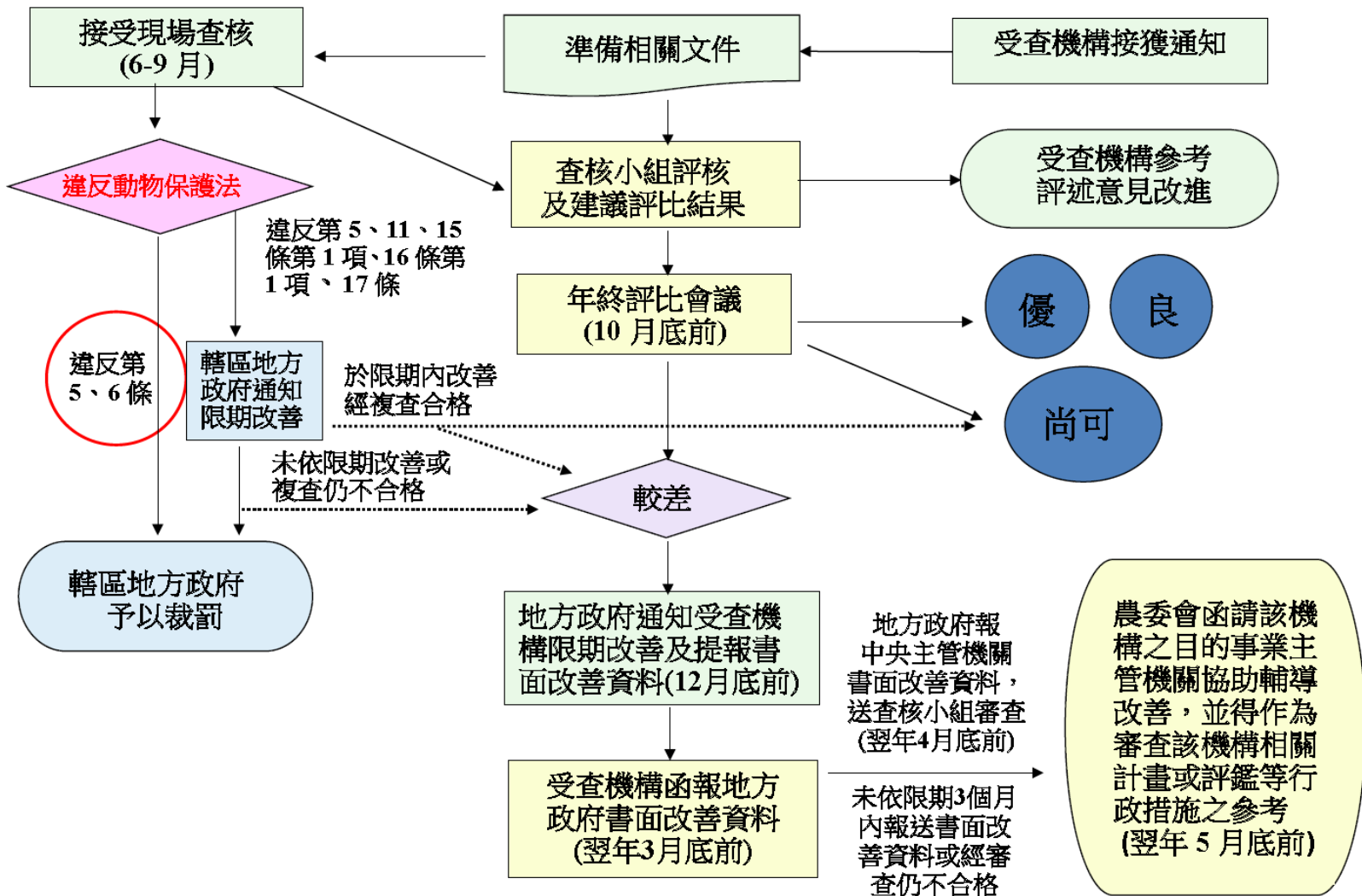
Since it was founded, 3R has received around 482 applications for research grants and 146 of these projects have received some financial aid.

The funds used to support approved projects are provided in equal parts by the Federal Food Safety and Veterinary Office and Interpharma. An annual amount of approximately CHF 500,000 is available for grants.

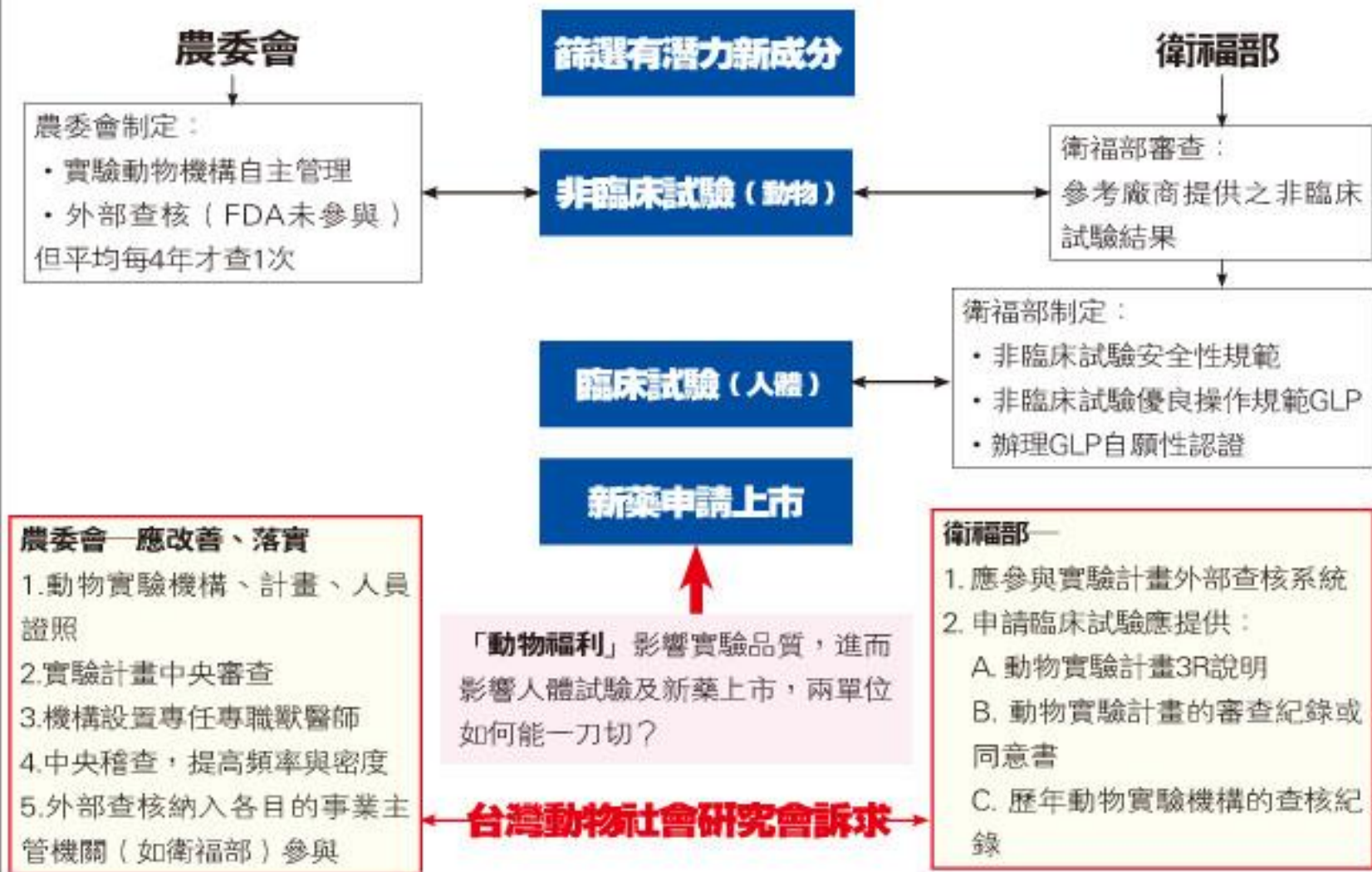
Total funding for approved projects	CHF 18 828 701.45
Grants paid out so far	CHF 17 971 720.00
Contributions from the Confederation	CHF 11 463 000.00
Contributions from Interpharma	CHF 11 918 000.00



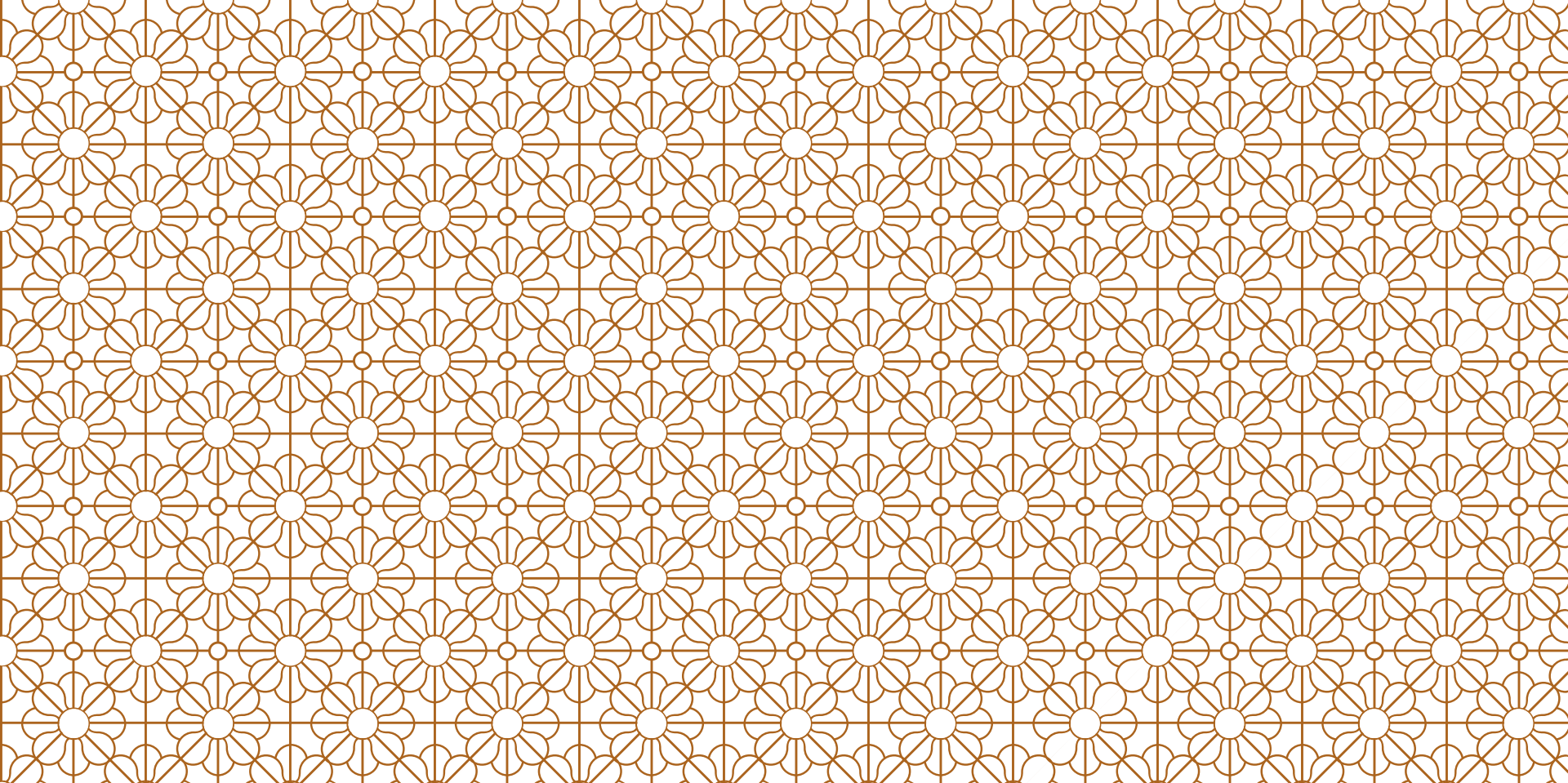
動物科學應用機構實地查核流程



動物實驗管理制度漏洞：以衛福部新藥研發管理為例



（資料來源／台灣動物社會研究會 製圖／俞普榮）



尊重生命

3歲童爬進圍欄 殺瀕危大猩猩



動物園無奈射

根據《法新社》報導，美國俄亥俄州辛辛那提(Cincinnati)動物園17歲大猩猩Harambe慘遭動物園射殺，原因是一名3歲男童爬過柵欄掉進壕溝內，為及時救出男童，園方決定射殺柵欄內的17歲大猩猩Harambe確保男童安危。但事件結果讓網友不滿、氣憤，認為是男童父母疏於管教，害死一隻無辜的猩猩。

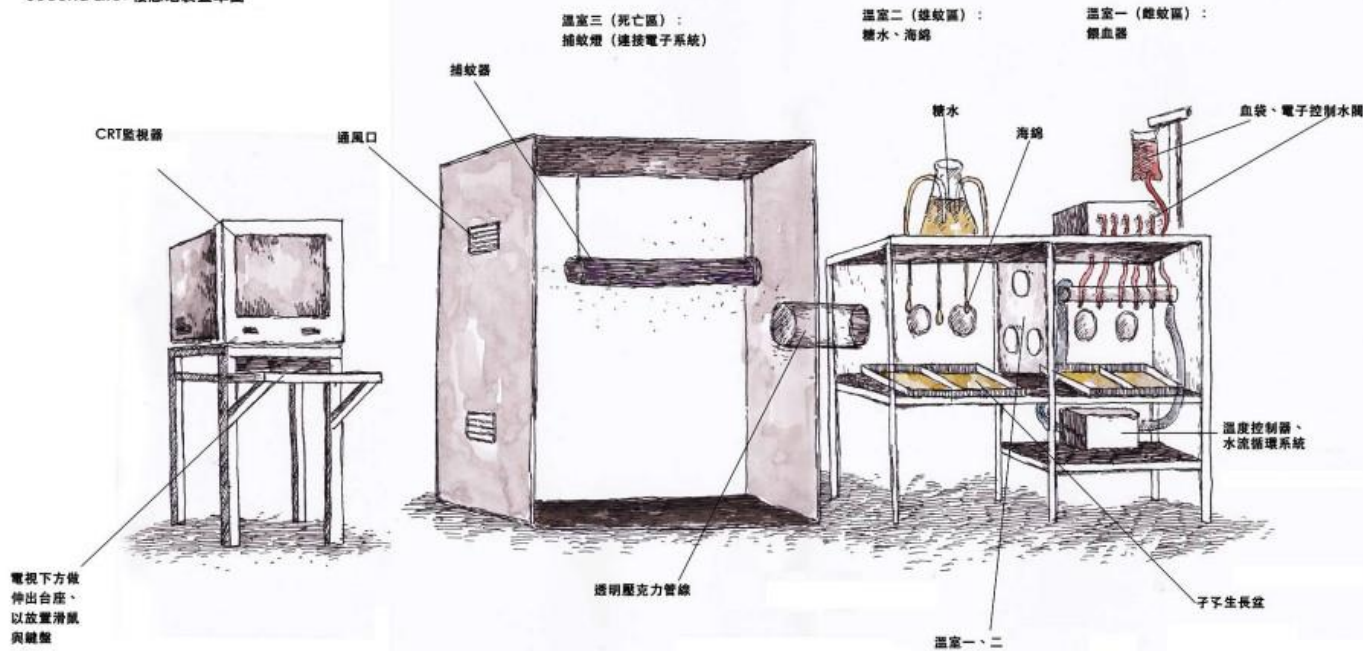
HOW IS
THIS DIFFERENT FROM **THIS?**



LOVE IS EQUAL, ISN'T IT?

All beings love their children.
In the things most important we are all the same.

Second Life: 棲息地裝置草圖



主辦單位 / 洪建全教育文化基金會 MEME Space 覓空間
計畫合作 / 台灣大學昆蟲系黃榮南教授、洪媽媽海水舖
贊助單位 / 國家文化藝術基金會、台北市文化局

覓空間
MEME
SPACE

THANK YOU!

參考文獻

- PanSci泛科學網站 <http://pansci.asia>
- Federation of American Societies for Experimental Biology
- Understanding Animal Research 網站 <http://www.understandinganimalresearch.org.uk/>
- <http://www.ratbehavior.org/images/RatMouse.jpg>
- 人類疾病動物模式 - 國家衛生研究院實驗動物中心
- 實驗動物人道管理年報
- Signals Blog <http://www.signalsblog.ca/cell-lines-patient-samples-and-cultures-oh-my/>
- 生物學 Campbell/ Reece/Simon原著 · 陳誌偉等譯
- 國家衛生研究院電子報
- 國家實驗研究院電子報
- 國防醫學院動物中心 梁善居
- Understanding Animal Research 網站 <http://www.understandinganimalresearch.org.uk/>
- 藥物食品檢驗局調查研究年報
- 維基百科
- 臺大動物中心 蔡倉吾
- <https://www.pinterest.com>
- www.slideshare.net
- www.dovepress.com
- University College London 網站 <http://blogs.ucl.ac.uk/transcribe-bentham/jeremy-bentham>
- michelsonmedical.org
- 3R Research Foundation Switzerland
- Environ Health Perspect 網站 <http://ehp.niehs.nih.gov/>
- <https://www.pinterest.com/>