生命與生物科技概論

輔英科技大學博雅涵養課程

科技寫作與報告簡介

www.youtube.com/watch?v=QmcQ5W-VZPI

https://www.youtube.com/watch?v=B_VmcC7epfo&list=PLtnT22QLECXhMiLiHiqn23DFw7x1sIZ5e

陳誌偉

生物科技系暨生技研究所

創新性研究推動生命科學向前發展

一、生命科學是一個變化發展的過程

二、如何進行創新科學研究

三、科技論文與學術交流

四、科學研究的驅動力

By Chih-Hsin Hung, 2007

一、生命科學是一個變化發展的過程

生物學是一門科學（science）。science一詞來源於拉丁文，原意為「去認知」，這種認知是漸進的。科學是一個漸進的、動態的變化發展過程，生命科學更是如此。

人類文明和科學技術發展的大革命

第一次：瓦特發明蒸汽機為標誌和起始的工業革命 。

第二次：資訊技術革命，以電腦和網路廣泛應用為主要標誌。

第三次：生命科學與生物技術的飛躍。

生命科學研究可以分為基礎研究與應用研究兩個領域

基礎研究：涉及人類和重要物種的基因體測序、生命的起源與演化、光合作用的分子機制等研究課題。

應用研究：涉及藥物開發、生物晶片、作物育種等研究課題可以歸入應用研究，應用研究追求經濟效益和成果商品轉化。

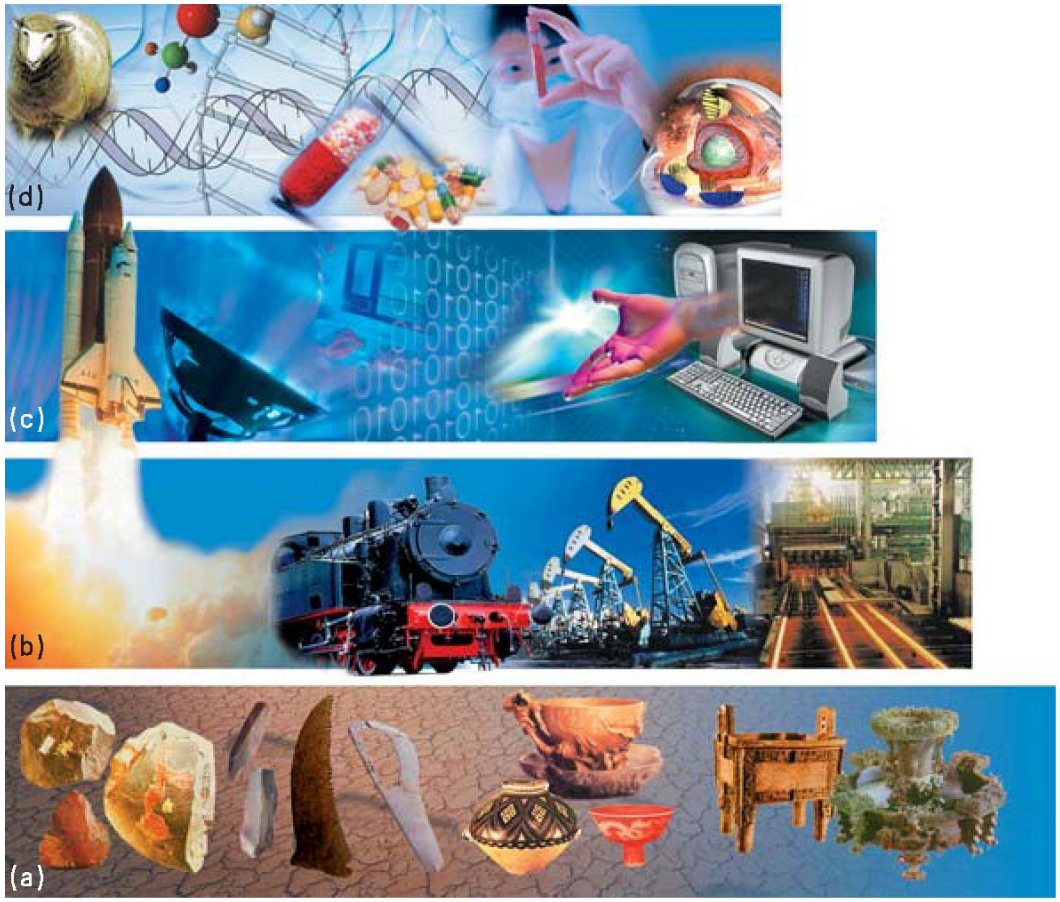

圖 1-20　人類文明與科學技術發展的三次革命

在工業革命前，人類社會科學技術水準很低，200～300 萬年前，早期的原始人以狩獵為生，只能製造和使用簡單的石器。10,000～15,000 年前，原始部落的人們開始栽培植物和馴養動物，於是出現了早期的農業，人類製造和使用工具的能力進一步增強，並逐漸開始製造陶器、銅器和鐵器。18 世紀以後，人類社會科學技術真正快速發展起來，先後經歷了工業革命、電腦科學與資訊技術革命、生命科學與生物技術革命的階段。圖中顯示的(a) 石器、陶器和銅器是人類科技發展不發達時期的代表象徵，(b) 蒸汽機與飛機反映了工業革命的主要成果，(c) 電腦及網路則是資訊技術革命的代表產物，(d) 重組 DNA 技術、綿羊「桃莉」的複製和重要物種基因組測序相繼完成，這一系列重大突破標誌了人類文明與科學技術發展的第三次革命——生命科學與生物技術革命已經開始。

二、如何進行創新科學研究

創新性科學研究的方法: 演繹（deduction）和歸納（induction）

演繹: 就是應用一般的法則或定律去推論出一個新的特殊結論或假設。

例如：如果我們接受一個一般的假定或前提：所有的鳥都具有翅膀。我們又接受另一個事實：大雁具有翅膀。於是我們便利用演繹的思維方式推論出這樣的結論：大雁也是鳥。

歸納: 就是應用一些特殊的觀察或實驗來獲得一個新的一般法則或定律。

例如：如果我們知道，大雁有翅膀，是鳥；如果我們還知道，麻雀、杜鵑、鴿子、鷹等都有翅膀，它們都是鳥，於是我們便可歸納出這樣的結論：所有的鳥都有翅膀。

演繹是由一般到特殊；歸納是由特殊到一般。它們是相互對應的兩種系統思維方式。

科學研究的過程通常包括

1. 客觀現象的觀察（實驗）或對前人研究成果的思考分析，
2. 提出特殊有意義的問題
3. 針對問題引出若干可能的推測性解釋，即提出一些假說。
4. 設計和進行實驗（包括進一步觀察）來排除那些不能成立的假說。
5. 對沒有被排除的假說作出預測，再經過實驗從不同方面證實預測的正確性。

假說，是以人們一定的經驗和已知的事實為依據，以已有的科學理論和技術方法為指導，對未知的自然事物或現象產生的原因及其規則所作出的推測和推測性解釋。

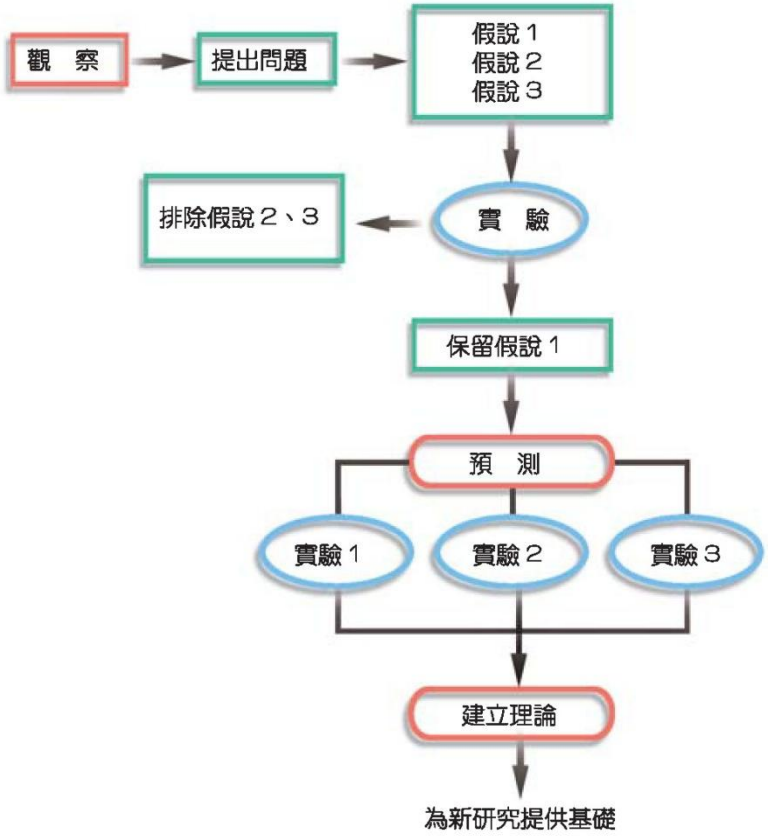

圖 1-22　科學研究的一般步驟

如何解釋或回答問題?

取決於經過科學的演繹提出最符合邏輯的各種假說，更取決於科學的實驗設計、精確的實驗操作和對實驗結果進行科學地歸納分析。

所謂科學的實驗設計，就是要避免在實驗中產生假像。因此只要可能，所有的研究都應該設立**對照實驗**。

雙盲設計（double-blind fashion）

由醫生將病人分為相同的兩組，一組病人服用編號為1的藥片，另一組病人服用編號為2的安慰劑（對照），該安慰劑的形狀、顏色等都與1號藥片完全相同，然後由醫生檢測服藥後的效果，做好記錄。在以上過程中，醫生和病人兩方面都不知道誰服用的是藥物，誰服用的是安慰劑，因此稱為「雙盲」。只有實驗全部結束後，醫生才得知編號的內容，即誰是實驗組，誰是對照組。科學家根據實驗組與對照組結果比較是否具有顯著的差異，來判定受測藥物的療效。

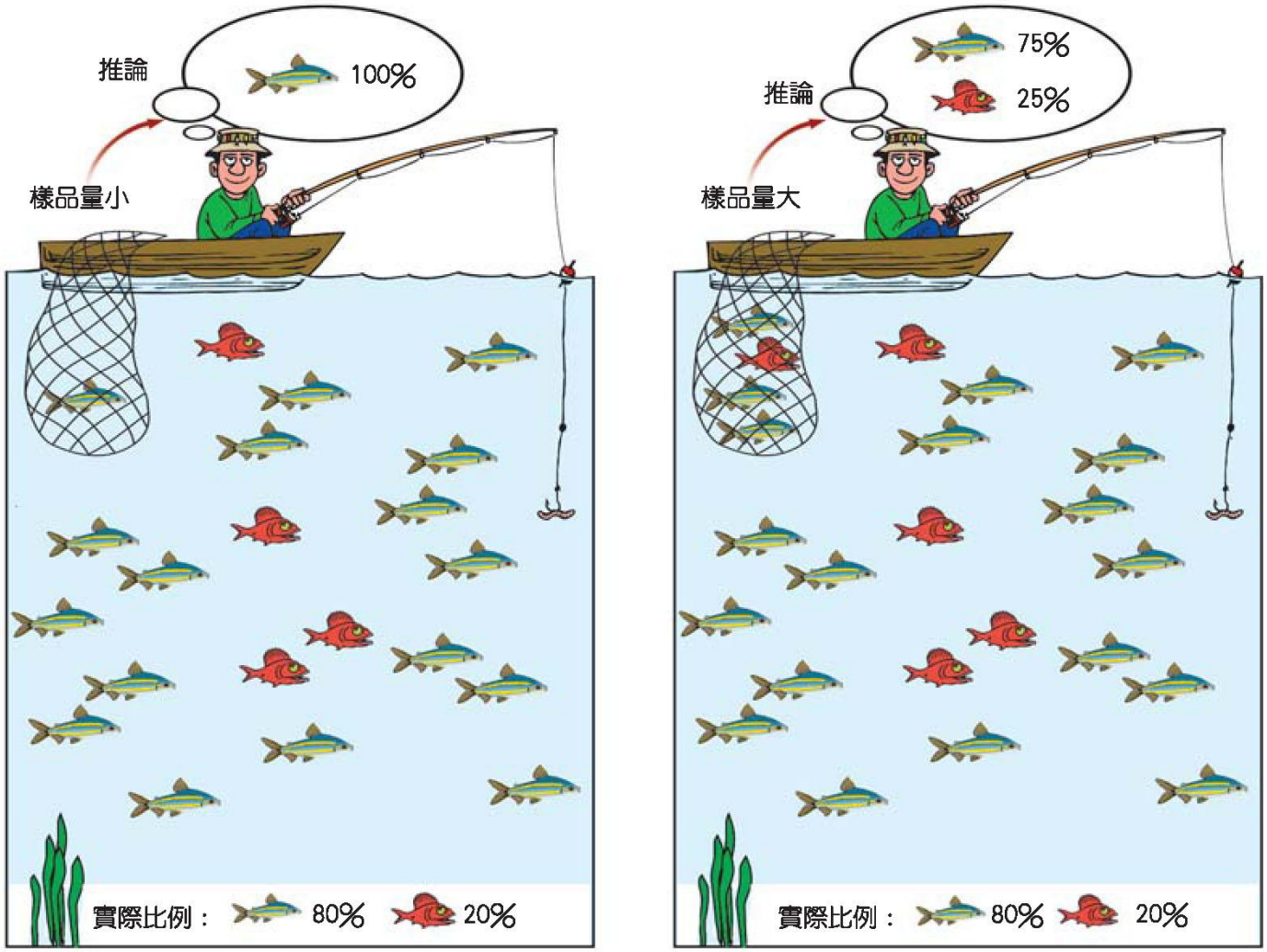

圖 1-23　受測樣品數量足夠大才能減小實驗誤差　該卡通圖以釣魚為例，說明對未知對象取樣量（上鉤的各種魚數量）的不同，可造成對未知對象判斷即分析結果（如池塘中兩種魚數量比例）的差別。從未知系統中取樣檢測，樣品量小，實驗誤差就大。增加樣品量可以減少由樣品誤差造成的假象。

避免實驗中的假象及樣品的隨機誤差

1. 設計多次重複實驗。
2. 受測樣品的數量應該足夠大。
3. 根據數學統計的原則，對實驗數據進行統計分析，報告實驗的誤差範圍，並找出出現誤差的原因。

三、科技論文與學術交流

科學家取得的新成果大部分都以科技論文（又稱學術論文）的形式發表在學術期刊上，撰寫科技論文是科學研究活動的一個組成部分，在論文通過評審接受發表以後，該項研究工作才能算告一段落。

1. 一篇完整的科技論文，通常包括題目、作者署名與通訊地址、摘要、關鍵詞、前言、研究方法和材料、結果、討論及結論、參考文獻等幾部分內容。

2.一篇好的論文要求所報導的成果內容真實、創新性強、論點明確、數據可靠、條列清晰、文字精練、圖表簡潔、書寫形式合於規範。

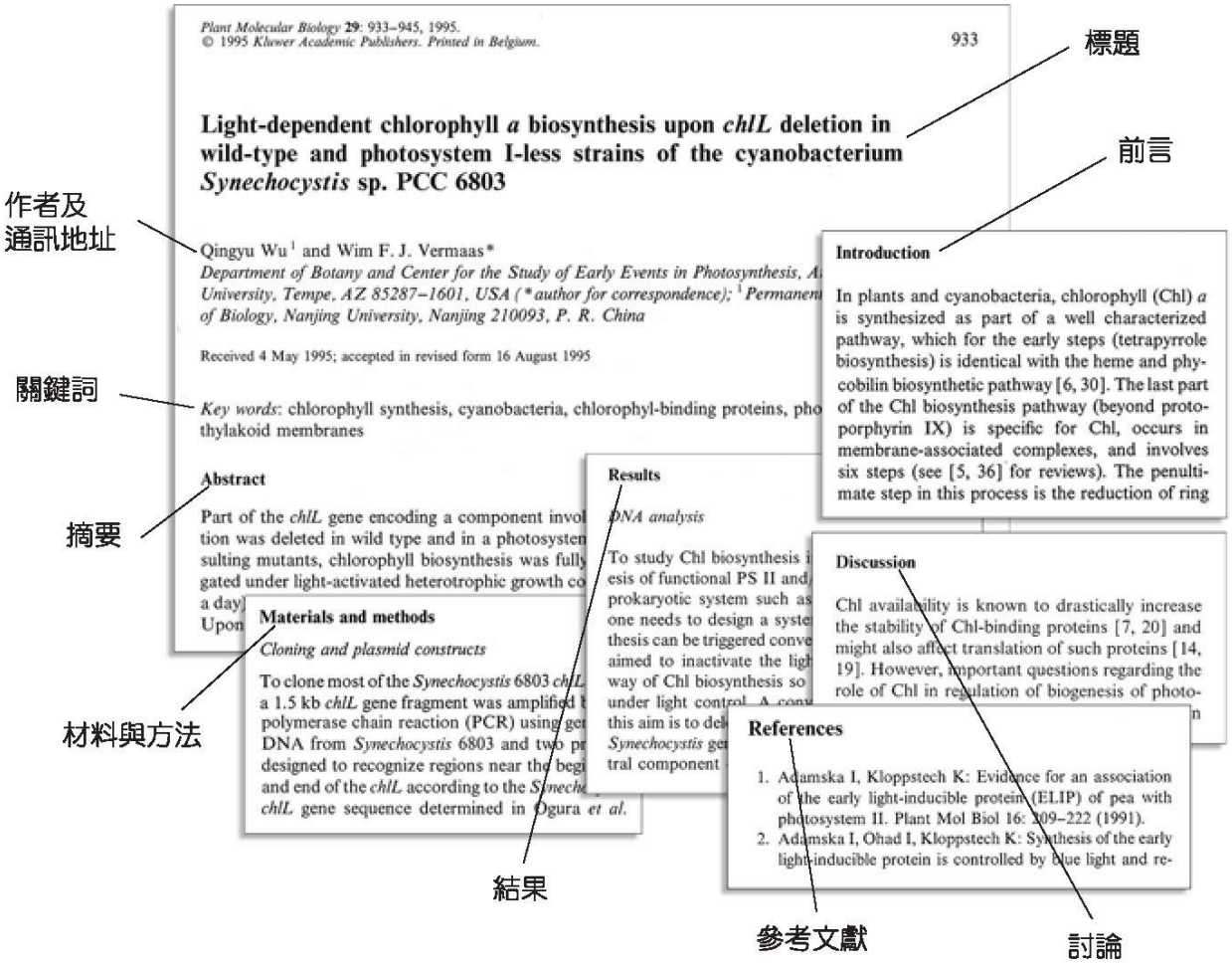

圖 1-24　科技論文的格式與組成　不同的學術期刊（雜誌）對來稿的學科領域範圍及內容、質量、格式等都有各自的要求，作者可以查閱這些刊物的徵稿簡則獲取有關投稿的須知。一篇完整的科技論文通常包括題目、作者署名與通訊地址、摘要、關鍵詞、前言、研究方法和材料、結果、討論及結論、參考文獻等幾部分內容。

美國科學情報研究所（Institute for Scientific Information, ISI）

http://scientific.thomson.com/

國際期刊分類

SCI (**S**cience **C**itation **I**ndex)

科學引用索引

SSCI (**S**ocial **S**cience **C**itation **I**ndex)

社會科學引用索引

EI (**E**ngineering **I**ndex)

工程索引.

AHCI (**A**rts and **H**umanities **C**itation **I**ndex)

藝術與人文索引

Impact factor (期刊點數)

ISI每年對包括SCI收錄在內的4,700種期刊之間的引用和被引用數據進行統計、運算，並針對每種期刊定義了影響係數（impact factor）等指標加以報導。一種期刊的影響係數，指的是該刊前二年發表的文獻在當前年的平均被引用的次數。一種刊物的影響係數越高，也即其刊載的文獻被引用率越高，一方面說明這些文獻報導的研究成果影響力大，另一方面也反映該刊物的學術水準高。

JCR (Journal Citation Report)查詢 **Impact factor** (期刊點數)
http://portal.isiknowledge.com/portal.cgi?DestApp=JCR&Func=Frame

圖 1-25 許多科學家都希望能在有高影響力的學術期刊，發表高水準的科技論文 Nature, Science 屬於國際上影響最大的綜合性學術期刊，與其他各學科領域相比，近年來所刊登的生命科學領域重要成果的比例最大。Cell 屬於生命科學領域高影響力的專業期刊。一般情況下，科學家們以在這些學術期刊上發表研究成果為榮。

Paper content

- Title
- Author
- Abstract
- Keyword
- Introduction
- Material and method
- Results(figures and tables)
- Discussion (Conclusion)
- Acknowledge
- Reference

Annals of Clinical Microbiology and Antimicrobials

BioMed Central

Research

Open Access

Comparison in a rat thigh abscess model of imipenem, meropenem and cefoperazone-sulbactam against *Acinetobacter baumannii* strains in terms of bactericidal efficacy and resistance selection

Kolayli Fetiye[1], Aynur Karadenizli[1], Erdem Okay[2], Sarpkaya Oz[3], Fatma Budak[1], Sibel Gundes[4] and Haluk Vahaboglu*[4]

Address: [1]Mikrobiyoloji AD, Kocaeli Universitesi Tip fakultesi, Kocaeli, Turkey, [2]Genel Cerrahi AD, Kocaeli Universitesi Tip fakultesi, Kocaeli, Turkey, [3]BiyoFizik AD Kocaeli Universitesi Tip fakultesi, Kocaeli, Turkey and [4]Enfeksiyon Hastalýklarý & Klinik Mikrobiyoloji AD, Kocaeli Universitesi Tip fakultesi, Kocaeli, Turkey

Email: Kolayli Fetiye - fetiye99@yahoo.com; Aynur Karadenizli - aynur98@yahoo.com; Erdem Okay - ieokay@mynet.com; Sarpkaya Oz - skayaoz@yahoo.com; Fatma Budak - fatma.budak@isbank.net.tr; Sibel Gundes - sgundes@yahoo.com; Haluk Vahaboglu* - vahabo@hotmail.com

* Corresponding author

Published: 08 January 2004

Annals of Clinical Microbiology and Antimicrobials 2004, 3:2

Received: 07 November 2003
Accepted: 08 January 2004

This article is available from: http://www.ann-clinmicrob.com/content/3/1/2

Abstract

Background: We compared imipenem, meropenem and cefoperazone-sulbactam against hospital originated *A. baumannii* strains in terms of bactericidal efficacy and selection of resistant mutants during treatment in a rat thigh abscess model.

Methods: A total of 18 strains were inoculated in 54 animals (one strain for three animals). Randomly selected 10 among these 18 strains were inoculated in another 10 rats as the control group. Imipenem, meropenem and cefoperazone-sulbactam were the antibiotics compared. After four days of treatment, Wistar albino rats (200 to 250 g) were sacrificed and the abscess materials were processed for mean colony counts and for the presence of resistant mutants.

Results: The mean CFUs per gram (mean ± (std. deviation) [×10⁴]) of the abscess were: 9,14 (25,24), 2,11 (3,78), 1,20 (1,70) in the imipenem (n = 17), meropenem (n = 18) and cefoperazone-sulbactam (n = 17) groups, respectively. The differences were not significant. On the other hand, no resistant mutant was detected in abscess materials.

Conclusion: This study indicated; first, cefoperazone-sulbactam is comparable to carbapenems in bactericidal efficacy in this particular abscess model and second, emergence of resistance due to spontaneous mutations is not at least a frequent phenomenon among *A. baumannii*.

Available online at www.sciencedirect.com
SCIENCE DIRECT®
Peptides 24 (2003) 1733–1740
PEPTIDES
www.elsevier.com/locate/peptides

Two different propionicins produced by *Propionibacterium thoenii* P-127

Galit Ben-Shushan, Varda Zakin, Natan Gollop*

Department of Food Science, Agricultural Research Organization, The Volcani Center, P.O. Box 6, Bet-Dagan 50250, Israel

Received 25 June 2003; accepted 12 August 2003

Abstract

The bacteriocin GBZ-1 was purified from the growth media of *Propionibacterium thoenii* P-127 and was found to have a molecular weight of 6000 Da. *P. thoenii* P-127 also known as the producer of the bacteriocin PLG-1 (MW 10 kDa). Under specific growth conditions, on semi-solid media, *P. thoenii* P-127 produced both PLG-1 and GBZ-1. The N-terminal of GBZ-1 was microsequenced, the gene was cloned and the DNA sequence was determined and identified. GBZ-1 is highly homologous to a protease-activated antimicrobial peptide (PAMP). In contrast to PAMP, it was purified in its active form and no protease digestion was required for its activation. The survival curve of indicator bacteria *Lactobacillus delbrueckii* subsp. *lactic* ATCC 4797 showed two phases. The fast phase of 20 min was followed by a slow phase. While bacterial survival was reduced by 2 logs during the fast phase, bacterial survival was reduced by additional 3 logs up to 200 min during the slow phase. GBZ-1 activity was affected by magnesium and its activity was completely abolished at 50 mM magnesium chloride. Other divalent cations had no effect on GBZ-1 activity of GBZ-1. To the best of our knowledge this is the first report of a bacterium producing two different bacteriocins under different growth conditions.

Keywords: *Propionibacterium thoenii*; PAMP; Bacteriocins

Comparison in a rat thigh abscess model of imipenem, meropenem and cefoperazone-sulbactam against *Acinetobacter baumannii* strains in terms of bactericidal efficacy and resistance selection

Kolayli Fetiye[1], Aynur Karadenizli[1], Erdem Okay[2], Sarpkaya Oz[3], Fatma Budak[1], Sibel Gundes[4] and Haluk Vahaboglu*[4]

Address: [1]Mikrobiyoloji AD, Kocaeli Universitesi Tip fakultesi, Kocaeli, Turkey, [2]Genel Cerrahi AD, Kocaeli Universitesi Tip fakultesi, Kocaeli, Turkey, [3]BiyoFizik AD Kocaeli Universitesi Tip fakultesi, Kocaeli, Turkey and [4]Enfeksiyon Hastalýklarý & Klinik Mikrobiyoloji AD, Kocaeli Universitesi Tip fakultesi, Kocaeli, Turkey

Email: Kolayli Fetiye - fetiye99@yahoo.com; Aynur Karadenizli - aynur98@yahoo.com; Erdem Okay - ieokay@mynet.com; Sarpkaya Oz - skayaoz@yahoo.com; Fatma Budak - fatma.budak@isbank.net.tr; Sibel Gundes - sgundes@yahoo.com; Haluk Vahaboglu* - vahabo@hotmail.com

* Corresponding author

Published: 08 January 2004

Received: 07 November 2003
Accepted: 08 January 2004

Annals of Clinical Microbiology and Antimicrobials 2004, 3:2

This article is available from: http://www.ann-clinmicrob.com/content/3/1/2

APPLIED AND ENVIRONMENTAL MICROBIOLOGY, Apr. 2005, p. 1836–1842 Vol. 71, No. 4
0099-2240/05/$08.00+0 doi:10.1128/AEM.71.4.1836–1842.2005

Potential of the Polyvalent Anti-*Staphylococcus* Bacteriophage K for Control of Antibiotic-Resistant Staphylococci from Hospitals

S. O'Flaherty,[1,2,3] R. P. Ross,[2,4]* W. Meaney,[2] G. F. Fitzgerald,[3,4] M. F. Elbreki,[5] and A. Coffey[5]

Dairy Products Research Centre[1] and Dairy Production Research Centre,[2] Teagasc, Moorepark, Fermoy, County Cork, and Department of Microbiology, University College Cork,[3] Alimentary Pharmabiotic Centre,[4] and Department of Biological Sciences, Cork Institute of Technology, Bishopstown,[5] Cork, Ireland

Received 27 May 2004/Accepted 6 November 2004

The increasing prevalence of antibiotic-resistant staphylococci has prompted the need for antibacterial controls other than antibiotics. In this study, a lytic bacteriophage (phage K) was assessed in vitro for its ability to inhibit emerging drug-resistant *Staphylococcus aureus* strains from hospitals and other species of *Staphylococcus* isolated from bovine infections. In in vitro inhibitory assays, phage K lysed a range of clinically isolated methicillin-resistant *S. aureus* (MRSA) strains, *S. aureus* with heterogeneous vancomycin resistance and vancomycin resistance, and teicoplanin-resistant strains. In these assays, 14 of the MRSA strains were initially only weakly sensitive to this phage. However, propagation of phage K on these less-sensitive strains resulted in all 14 being sensitive to the modified phages. The results enforce the principle that, while certain target bacteria may be relatively insensitive to lytic phage, this can be overcome by obtaining modified phage variants from passage of the phage through the insensitive strains. Model in situ hand wash studies using a phage-enriched wash solution resulted in a 100-fold reduction in staphylococcal numbers on human skin by comparison with numbers remaining after washing in phage-free solution. Infusion of the phage into a nonimmunogenic bismuth-based cream resulted in strong anti-*Staphylococcus* activity from the cream on plates and in broth.

The increasing prevalence of antibiotic resistance in clinical isolates of *Staphylococcus aureus* is a major problem, given that the bacterium causes a wide variety of human infections ranging from simple abscesses to fatal sepsis, as well as endocarditis, pneumonia, mastitis, phlebitis, meningitis, and toxinoses (for a review see reference 24). The rapid emergence of penicillin-resistant *S. aureus* in the 1950s led to the use of methicillin and related drugs for treatment of infections. In the 1960s, methicillin-resistant *S. aureus* (MRSA) strains emerged and have since become endemic in many hospital environments (14). In addition, these MRSA strains also frequently exhibit resistance to a variety of other common antibiotics (20). Indeed, over 95% of patients worldwide with *S. aureus* infections do not respond to first-line antibiotics, for example, ampicillin and penicillin (33). Recently, the SENTRY antimicrobial surveillance program reported that 36.8% of *S. aureus* isolates ribotyped belonged to multidrug-resistant, oxacillin-resistant *S. aureus* strains (7). In Ireland, Naylor et al. (23) found that MRSA was the commonest single organism cultured from patients with complex wound and graft infections after vascular surgery. In addition, the latest data from the European Antimicrobial Resistance Surveillance System showed an increase in MRSA from 30% in 1999 to 45% in 2002 in Ireland (37). Until recently, *S. aureus* has exhibited sensitivity to the glycopeptide antibiotics vancomycin and teicoplanin, and therefore these antibiotics represent one of the last lines of defense available against staphylococcal infection. However, the recent emergence of vancomycin-resistant *S. aureus* and also teicoplanin-resistant strains in hospital infections poses a major threat to this approach (13). As a result, investigations for new and alternative antimicrobials effective against *S. aureus* have become increasingly relevant.

Bacteriophages (phages) were investigated as far back as 1921 to eliminate bacteria including staphylococci in human infections (35). The majority of human phage therapy studies have been performed in Poland (29) and the former Soviet Union and have included challenges against *Staphylococcus* (for a review see reference 36). Although research on phage therapy diminished outside of the former Soviet Union with the advent of antibiotics, it has been revisited primarily as a result of the antibiotic resistance problem. This renewed interest is evident from the number of reviews published recently (2, 3, 5, 8, 9, 19, 22, 36). For *S. aureus* the potential of phage as an antibacterial therapeutic was shown by Matsuzaki and coworkers (21), who significantly reduced the mortality of mice previously injected with *S. aureus* by intraperitoneal injections of phage MR11 (21). Moreover, since the early 1990s, a variety of new companies that have placed major emphasis on bacteriophage research, with the aim of treating multidrug-resistant bacteria causing infections, have been established worldwide.

Phage K is a polyvalent phage with a broad host range, inhibiting both coagulase-positive and -negative staphylococci (32). It is a member of the family *Myoviridae* (1) and has been the subject of previous studies (15–17, 28–30). The origin of phage K is unclear. Both Rountree in 1949 (32) and Rippon in 1956 (31) state that phage K of Krueger and Northrop (18) is identical to phage Au2 described by Burnet and Lush in 1935 (4). Burnet and Lush also state that the phage used by Krueger and Northrop in 1930 (18) is Au2 and suggest that phage Au2 could be derived from the H strain of *S. aureus* of Gratia and

* Corresponding author. Mailing address: Teagasc, Dairy Products Research Centre, Moorepark, Fermoy, Co. Cork, Ireland. Phone: 353-25-42220. Fax: 353-25-42340. E-mail: pross@moorepark.teagasc.ie.

1.

Acknowledgements

This study was supported by a grant from the National Science Council, Taiwan (NSC-92-2314-B-006-060).

2.

Acknowledgements

We thank Josiane Ferreira for technical assistance during molecular assays.

Reference (參考文獻)

change. This was done by crossing the virus with a virus that had a deletion in genomic segment L and a segment M that carried the host attachment genes of bacteriophage ϕ13 (17, 24). Products of the cross were plated on strain LM2509, which does not support the attachment of bacteriophage ϕ6. These

17. **Mindich, L., X. Qiao, J. Qiao, S. Onodera, M. Romantschuk, and D. Hoogstraten.** 1999. Isolation of additional bacteriophages with genomes of segmented double-stranded RNA. J. Bacteriol. **181:**4505–4508.
18. **Olkkonen, V. M., P. Gottlieb, J. Strassman, X. Qiao, D. H. Bamford, and L. Mindich.** 1990. In vitro assembly of infectious nucleocapsids of bacteriophage ϕ6: formation of a recombinant double-stranded RNA virus. Proc. Natl. Acad. Sci. USA **87:**9173–9177.
19. **Onodera, S., X. Qiao, J. Qiao, and L. Mindich.** 1995. Acquisition of a fourth genomic segment in bacteriophage ϕ6: a bacteriophage with a genome of three segments of dsRNA. Virology **212:**204–212.
20. **Onodera, S., X. Qiao, J. Qiao, and L. Mindich.** 1998. Directed changes in the number of dsRNA genomic segments in bacteriophage ϕ6. Proc. Nat. Acad. Sci. USA **95:**3920–3924.
21. **Onodera, S., X. Qiao, J. Qiao, and L. Mindich.** 1998. Isolation of a mutant that changes genomic packaging specificity in ϕ6. Virology **252:**438–442.
22. **Pirttimaa, M. J., and D. H. Bamford.** 2000. RNA secondary structures of the bacteriophage ϕ6 packaging regions. RNA **6:**880–889.
23. **Qiao, X., G. Casini, J. Qiao, and L. Mindich.** 1995. In vitro packaging of individual genomic segments of bacteriophage ϕ6 RNA: serial dependence relationships. J. Virol. **69:**2926–2931.
24. **Qiao, X., J. Qiao, S. Onodera, and L. Mindich.** 2000. Characterization of ϕ13, a bacteriophage related to ϕ6 and containing three dsRNA genomic segments. Virology **275:**218–224.

enzyme that also contains iron (Zahn & DiSpirito, 1996). Genes designated *pmoA* and *pmoB* have been characterized, and the nucleotide sequence of a third gene, *pmoC*, is described in the sequence databases (Semrau *et al*., 1995; Zahn & DiSpirito, 1996; accession numbers L40804 and U94337). The AMO is also believed

Sayavedra-Soto, L. A., Hommes, N. G. & Arp, D. J. (1994). Characterisation of the gene encoding hydroxylamine oxidoreductase in *Nitrosomonas europaea*. *J Bacteriol* **176**, 504–510.

Semrau, J. D., Chistoserdov, A., Lebron, J., Castello, A., Davagnino, J., Kenna, E., Holmes, A. J., Finch, R., Murrell, J. C. & Lidstrom, M. E. (1995). Particulate methane monooxygenase genes in methanotrophs. *J Bacteriol* **177**, 3071–3079.

First name (名字)　Last name (姓氏, 家族姓)

志勳	洪
Chih-Hsin	**Hung**
比爾	**柯林頓**
Bill	**Clinton**
喬治	**布希**
George	**Bush**

姓不會被縮寫
名字才會被縮寫: 如 洪先生, 田中先生

柯林頓總統 布希總統
陳總統.... 等

Ex.

Shiroh Onodera, Xueying Qiao, Jian Qiao and Leonard Mindich

19. **Onodera, S., X. Qiao, J. Qiao, and L. Mindich.** 1995. Acquisition of a fourth genomic segment in bacteriophage ϕ6: a bacteriophage with a genome of three segments of dsRNA. Virology **212:**204–212.

17. **Mindich, L., X. Qiao, J. Qiao, S. Onodera, M. Romantschuk, and D. Hoogstraten.** 1999. Isolation of additional bacteriophages with genomes of segmented double-stranded RNA. J. Bacteriol. **181:**4505–4508.

First name (名字) Last name (姓氏, 家族姓)

JOURNAL OF BACTERIOLOGY, Aug. 1999, p. 4505–4508 Vol. 181, No. 15
0021-9193/99/$04.00+0

Isolation of Additional Bacteriophages with Genomes of Segmented Double-Stranded RNA

LEONARD MINDICH,[1]* XUEYING QIAO,[1] JIAN QIAO,[1] SHIROH ONODERA,[1] MARTIN ROMANTSCHUK,[2] AND DEBORAH HOOGSTRATEN[1]

Department of Microbiology, Public Health Research Institute, New York, New York 10016,[1] and Department of Biosciences, Division of General Microbiology, University of Helsinki, Helsinki, Finland[2]

Received 15 March 1999/Accepted 26 May 1999

19. **Onodera, S., X. Qiao, J. Qiao, and L. Mindich.** 1995. Acquisition of a fourth genomic segment in bacteriophage ϕ6: a bacteriophage with a genome of three segments of dsRNA. Virology **212:**204–212.

Acquisition of a Fourth Genomic Segment in Bacteriophage Φ6, a Bacteriophage with a Genome of Three Segments of dsRNA

Shiroh Onodera, Xueying Qiao, Jian Qiao and Leonard Mindich

Department of Microbiology, The Public Health Research Institute, New York, New York 10016

By Chih-Hsin Hung, 2007

enzyme that also contains iron (Zahn & DiSpirito, 1996). Genes designated *pmoA* and *pmoB* have been characterized, and the nucleotide sequence of a third gene, *pmoC*, is described in the sequence databases (Semrau *et al.*, 1995; Zahn & DiSpirito, 1996; accession numbers L40804 and U94337). The AMO is also believed

Sayavedra-Soto, L. A., Hommes, N. G. & Arp, D. J. (1994). Characterisation of the gene encoding hydroxylamine oxidoreductase in *Nitrosomonas europaea*. *J Bacteriol* **176**, 504–510.

Semrau, J. D., Chistoserdov, A., Lebron, J., Castello, A., Davagnino, J., Kenna, E., Holmes, A. J., Finch, R., Murrell, J. C. & Lidstrom, M. E. (1995). Particulate methane monooxygenase genes in methanotrophs. *J Bacteriol* **177**, 3071–3079.

JOURNAL OF BACTERIOLOGY, June 1995, p. 3071–3079
0021-9193/95/$04.00+0

Vol. 177, No. 11

Particulate Methane Monooxygenase Genes in Methanotrophs

J. D. SEMRAU,[1] A. CHISTOSERDOV,[1] J. LEBRON,[1] A. COSTELLO,[1] J. DAVAGNINO,[1]† E. KENNA,[2] A. J. HOLMES,[2] R. FINCH,[2] J. C. MURRELL,[2] AND M. E. LIDSTROM[1]*

Environmental Engineering Science, California Institute of Technology, Pasadena, California 91125,[1] and Department of Biological Science, University of Warwick, Coventry CV4 7AL, United Kingdom[2]

Received 29 December 1994/Accepted 21 March 1995

四、科學研究的驅動力

生命科學領域有兩方面是根本的:

第一、在知識經濟時代，科學技術是先進的生產力，它直接為人類創造財富和利益，滿足人類日益增長的物質與文化需求。

例如：社會越進步、物質生活越豐富，人類對健康和長壽的期望值就越高。從更高的視角來看，人類從事的一切生產活動（包括製造出最先進的電視機、汽車、電腦等，還包括其他學科的研究）都是服務於人類。

第二、求知慾和好奇心是人的天性，而創新性研究才能夠滿足人類的求知慾和好奇心，生命科學研究更能滿足人類對自身瞭解的需求。

為了探索未知世界，為了追求真理，在好奇心驅動下許多優秀的科學家，在不同的科學領域獲得了重大發現和突破。

科學研究的驅動力

生命科學是實驗科學，生命科學的大部分研究工作需要在野外現場或實驗室來完成。

圖 1-26　學生們在野外現場進行生命科學研究

圖 1-27　本書作者正在實驗室內做藍細菌 DNA 體外重組實驗　該實驗需要建構重組質體，經過酶切和電泳，分離回收需要的基因片段，將不同來源的 DNA 片段連接後轉化大腸桿菌，獲得重組質體，再轉化藍細菌，獲得基因轉殖突變體。圖中本書作者正在紫外投射光下分離電泳膠上的 DNA 片段，頭上戴著有機玻璃防護罩可保護眼睛不受紫外光的傷害。之後用了 5 個月時間完成了藍細菌轉基因實驗，又用了 7 個月時間進行了基因轉殖突變體的光合作用分子生物學研究。