社團法人台灣建築醫學學會

台灣建築醫學學會
Taiwan Society of Architectural Medicine

Keep
Keep You HEALTHY
Taiwan Society of Architectural Medicine

議程

時間	活動內容
14：00~14：13	致詞
14：13~14：15	合照留影
14：15~14：20	學會介紹
14：20~15：10	日本講座：柳 宇 教授
15：10~15：20	日本講座交流時間(Q&A)
15：20~16：10	台灣講座：楊崑德 教授/醫師
16：10~16：20	台灣講座交流時間(Q&A)
16：20~	講座結束


2022
08/25
THU. 14：00~16：20
社團法人台灣建築醫學學會
Taiwan Society of Architectural Medicine
TSAM 2022年
公益講座系列(I)
柳 宇 教授
楊崑德 教授/醫師
講題｜Countermeasures against the SARS-CoV-2 in built environment
日本工学院大学 建築学部 建築学科 教授
東京都生活衛生審議会委員
東京都iCDCタスクフォースメンバー
東京大学 生產技術研究所 リサーチフェロー
国立保健医療科学院 生活環境研究部 客員研究員
講題｜抗老! 抗疫!! 免疫最給力
馬偕醫學院 長期照護研究所 兼任教授
國立陽明大學 臨床醫學研究所 兼任教授
馬偕兒童醫院 兒童醫學研究部 主任
馬偕紀念醫院 兒童過敏免疫風濕科 主治醫師
台灣過敏氣喘暨臨床免疫醫學會 理事長
線上免費講座
台日防疫研究經驗與交流
報名及詳細資訊請掃QR CODE
全程參與者提供電子教育訓練證明(書)

致詞

黃嘯谷 榮譽理事長

張智元 理事長

主辦單位 社團法人台灣建築醫學學會

協辦單位 財團法人國家衛生研究院
國家環境醫學研究所

高雄醫學大學公共衛生學系

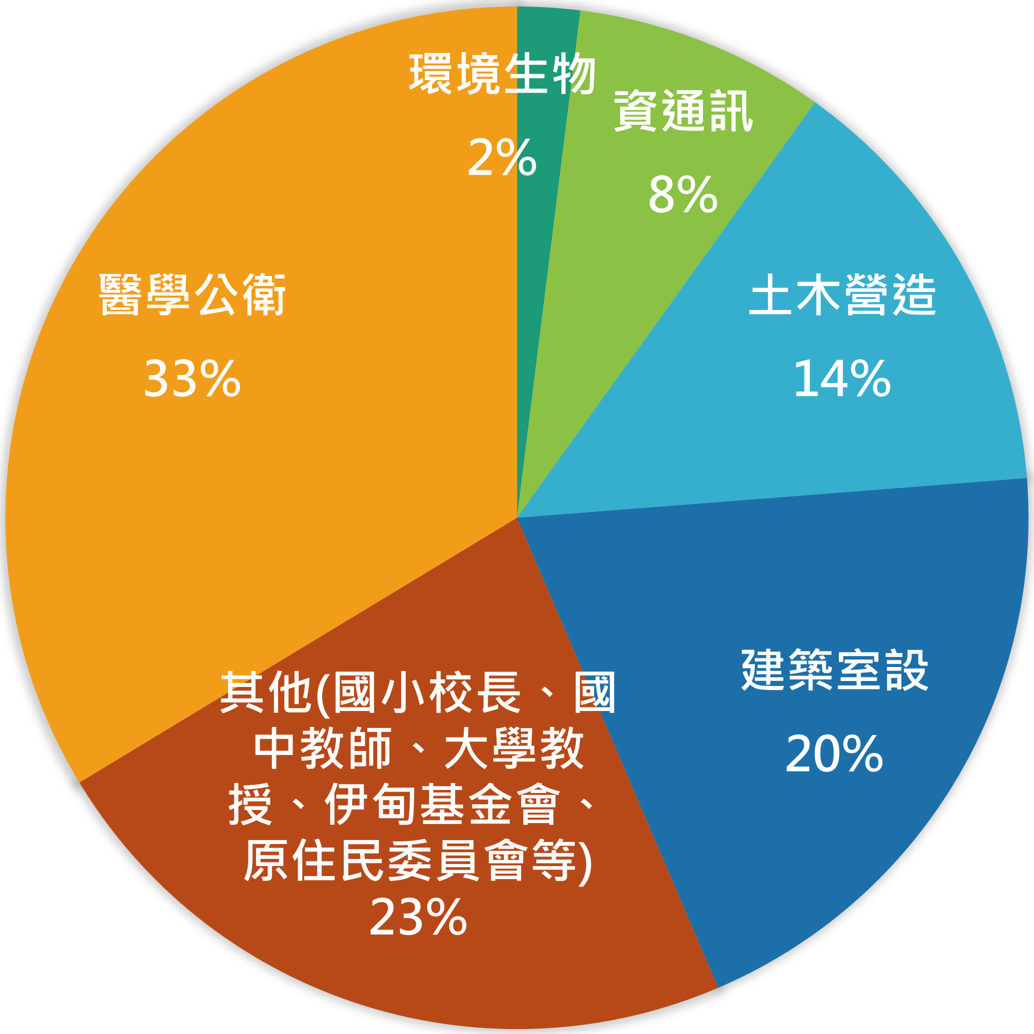
特別感謝

THANK YOU!

裕翔建設股份有限公司 張庚申 董事長

豐銘國際地產股份有限公司 李無惑 董事長

報名成員分析



本次報名講座

共計102人報名

學會介紹

黃琳琳 秘書長/教授

學會宗旨及願景

中華民國107年11月25日《台灣建築醫學學會》正式成立，中華民國107年12月13日內政部台內團字第1070084568號函核定。

中華民國108年1月21日《社團法人台灣建築醫學學會》正式設立登記

學會宗旨

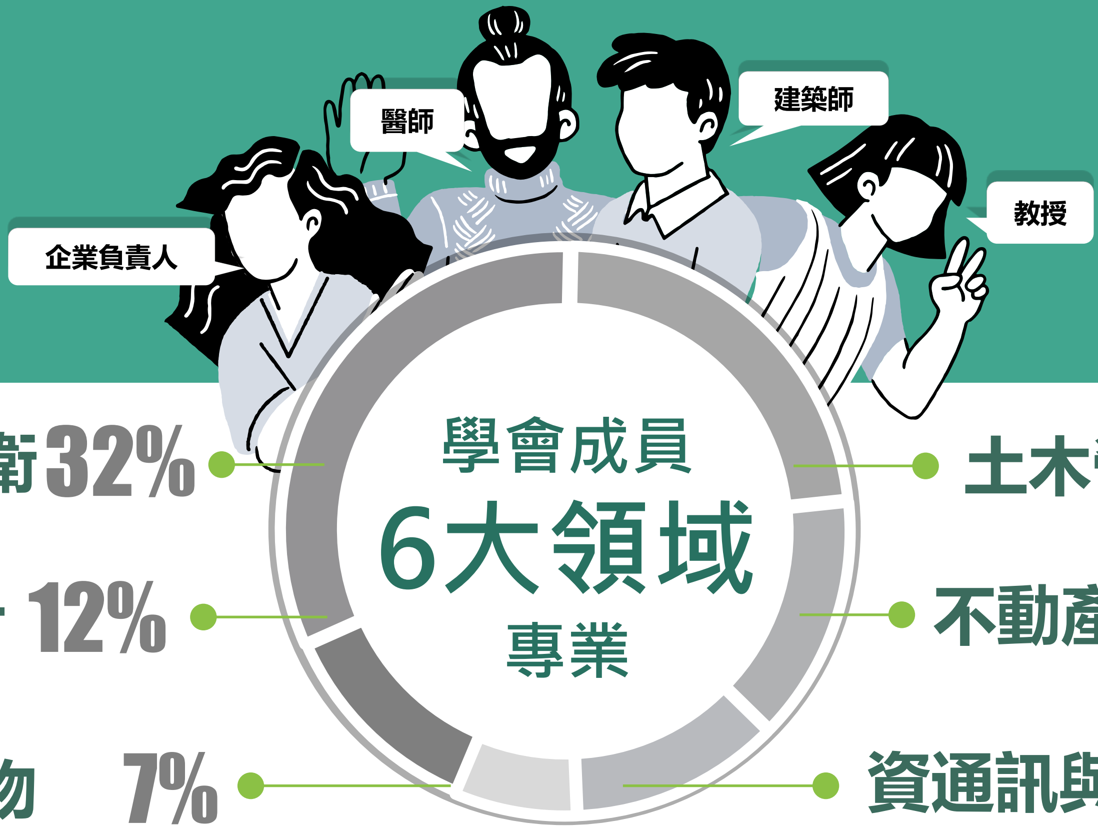
以推展**土木建築**、**建築醫學**、醫學、環境醫學、環境工程、住宅健診、健康建築與**智慧化環境**、資通訊與機電、**不動產與物業管理之應用**、教育、學術及研究教育、學術及研究為方向，並以提昇居住環境健康與生活品質為宗旨。

學會宗旨任務

1. 各領域學術教育及專業訓練之推廣等事項。
2. 引進國內外**建築醫學**、**智慧環控**、**驗屋師無害建材**與**物管**新知技術。
3. 接受國內外委託或自辦**學術研究**、座談會及討論會。
4. 發行相關著作與刊物以之交換學識。
5. 提供企業、政府、非營利組織之**專業諮詢**或**專案研究**。
6. 推動**健康環境**之**認證**制度。
7. 辦理其他與章程宗旨及任務相關事項。
8. 規劃設置健康環境評定委員小組及**優秀學位論文獎**評審小組。

TSAM 跨領域專業團隊(含顧問)

37位 教授　38位 博士　18位 企業負責人
10位 醫師　4位 建築師　17位 專業經理人



醫學公衛 32%
建築與都計 12%
環境生物 7%
土木營建 23%
不動產與物管 14%
資通訊與機電 12%

國內唯一以醫學公衛角度探討環境診斷組織團體

環境檢測 995 場次

檢測類型多元 (集合住宅、政府廳舍、建設公司等)

環境健檢實績 15 年

計畫主持人於建築醫學領域累積多年實務經驗

輔導改善 74 場次

透過建築、工程、機電、室設等跨領域專業輔導

擁有不動產之規劃與管理實業
具備政府與民間機構之豐富實務經驗

可提供**跨領域整合性**之相關諮詢與規劃服務，舉凡如：

學會專案服務實績

國家發展委員會
NATIONAL DEVELOPMENT COUNCIL

HURC
國家住宅及都市更新中心

NATIONAL HEALTH RESEARCH INSTITUTES
NHRI

工業技術研究院
Industrial Technology
Research Institute

TAIPEI
臺北市政府
Taipei City Government

新北市政府
New Taipei City Government

NTHURC
新北市住宅及都市更新中心
New Taipei City Housing and Urban Regeneration Center

臺中市政府
TAICHUNG CITY GOVERNMENT

臺南市政府
Tainan City Government

屏東縣政府

CECI
台灣世曦
工程顧問股份有限公司

財團法人 EDEN SOCIAL WELFARE FOUNDATION
伊甸社會福利基金會

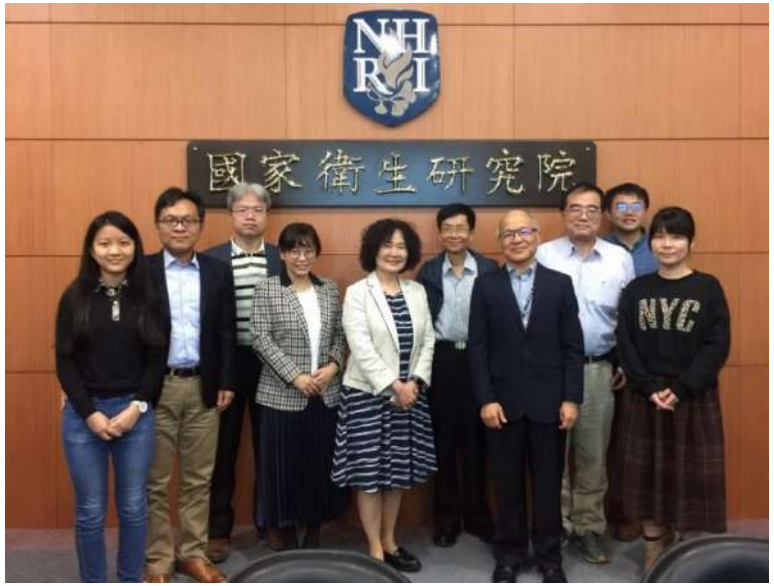
泛亞工程
PAN ASIA

港洲營建
KONG CHOU CONSTRUCTION

2020-2023 跨領域合作研究案

國家衛生研究院+**台灣建築醫學學會**+高雄醫學大學+中山大學+逢甲大學+東海大學+正修科技大學+林口長庚醫院+台中榮總醫院+小港醫院

專案名稱：利用網格模式、環境法醫與建築醫學探討空氣污染防制：著重於呼吸道健康與疾病之影響



學會協助小港醫院成為
國內第一家健康環境認證的醫院

健康環境標章

高雄市立小港醫院 OT 大樓之 7 樓公共空間

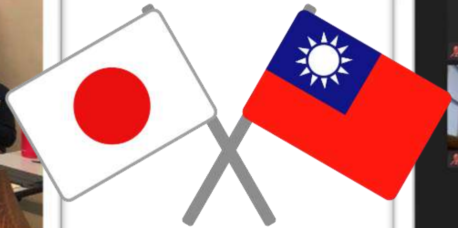
上列標的已達社團法人台灣建築醫學學會建立之健康環境認證標準，
並經健康環境評定小組完成實地評定，
評定結果為

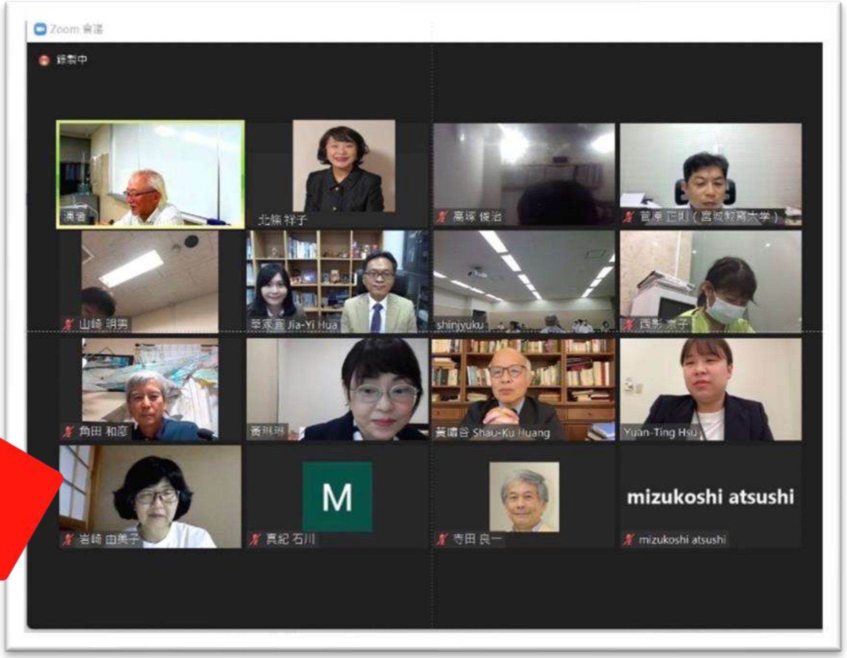
四 星 等

President Chih-Yuan Chang

Date of Issue: 2 July 2020

學會台日交流活動





本會於111年6月25日參加**日本臨床環境醫學會第30回學術集會**，發表由黃嘯谷 榮譽理事長主筆的文章，並於會後與**環境過敏症分科會**進行**線上台日交流學術會議。**

環境過敏症分科會代表是本會海外榮譽顧問北條祥子 教授，東京大學名譽教授柳沢幸雄(Dr. Yukio Yanagisawa)擔任會議主席，日本共計35位跨領域的學者參加，如基礎醫學、臨床醫學、公衛學、建築工學等；本會則由黃嘯谷 榮譽理事長、張智元 理事長、黃琳琳 秘書長、許媛婷 副秘書長、華家宜 秘書代表出席。

優秀學位論文獎

為持續推廣公正公平之學術研究風氣，於2019年起舉辦優秀學位論文獎，勉勵優秀學子

第一屆共有 **6校12篇** 參賽，選出4位論文優等獎(獎金1萬元整)及5位論文佳作獎

第二屆共有 **20校46篇** 參賽，選出5位論文優等獎(獎金1萬元整)及11位論文佳作獎

第三屆共有 **23校90篇** 參賽，選出5位論文優等獎(獎金1萬元整)及26位論文佳作獎(獎金2千元整)

~第四屆報名至8月 31日止，歡迎踴躍報名參加~

日本講座講者介紹

黃琳琳 秘書長/教授

日本講座

柳 宇 教授

演講主題

Countermeasures against the SARS-CoV-2 in built environment

【現職】
工学院大学 建築学部 建築学科 教授
東京大学 生産技術研究所 リサーチフェロー(研究員)
国立保健医療科学院 生活環境研究部 客員研究員
東京都生活衛生審議会委員
東京都iCDCタスクフォースメンバー(東京感染症対策中心特定事項特別委員會成員)

【學歷】
東京大学 工学 博士
Doctor of Public Health（National Institute of Public Health）
国立公衆衛生院（現 国立保健医療科学院）研究課程 修了
同済大学 機械工学部 建築設備学科 卒業

【參與學會】
空気調和・衛生工学会 学術理事
新型コロナ(COVID-19)対策特別委員会委員長
日本建築学会，元空気環境運営委員会主査
日本臨床環境医学会 理事

歡迎日本講座

柳 宇 教授

14:20~15:10

Countermeasures against the SARS-CoV-2 in built environment

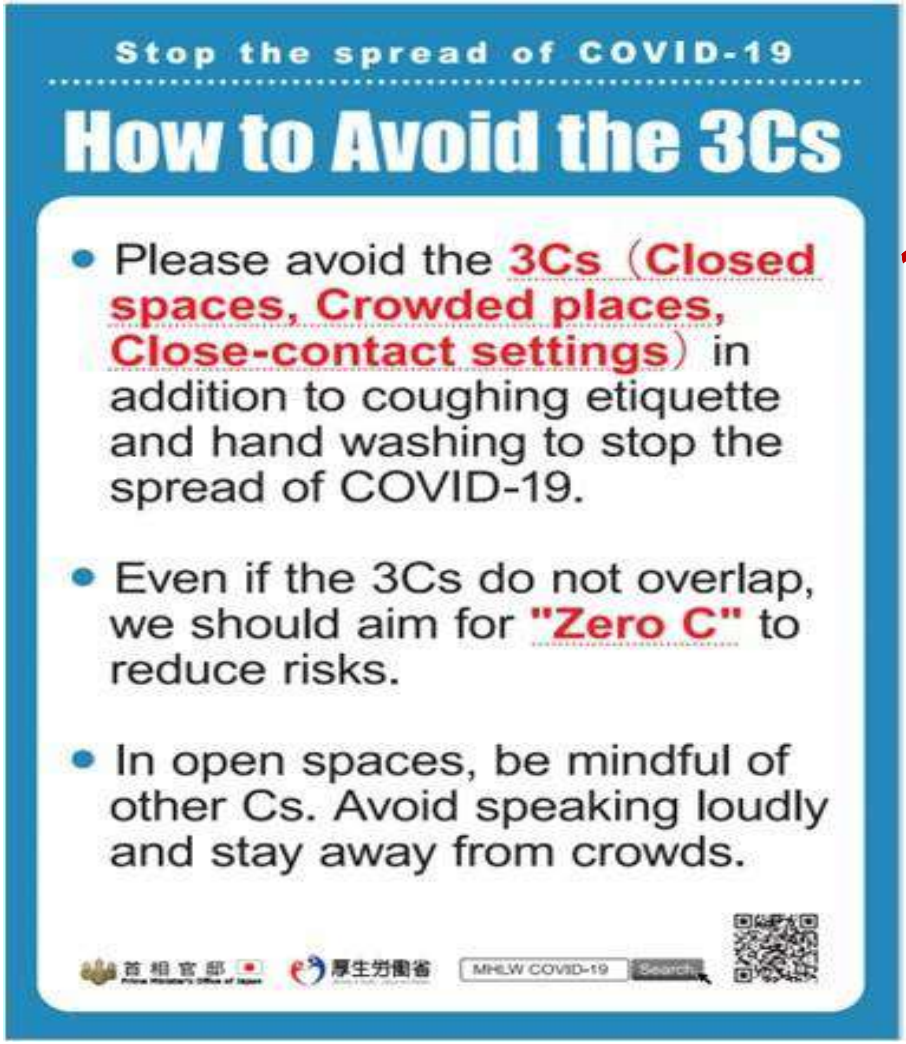
建築環境的 SARS-CoV-2對策

U Yanagi, Prof. D.P.H., Ph.D.
School of Architectural, Kogakuin University, Japan

2019年12月 在中國武漢確認了第一位病人
2021年1月26日（1年後）世界總病例超過**1億**
2021年8月5日 （6個月後） 總病例數超過**2億**
2022年1月7日 （5個月後） 總病例數超過**3億**
2022年2月9日 （1個月後） 總病例數超過**4億**
2022年4月13日（2個月後） 總病例超過**5億**
2022年8月24日（4個月後） 總病例5.97億；逼近**6億**

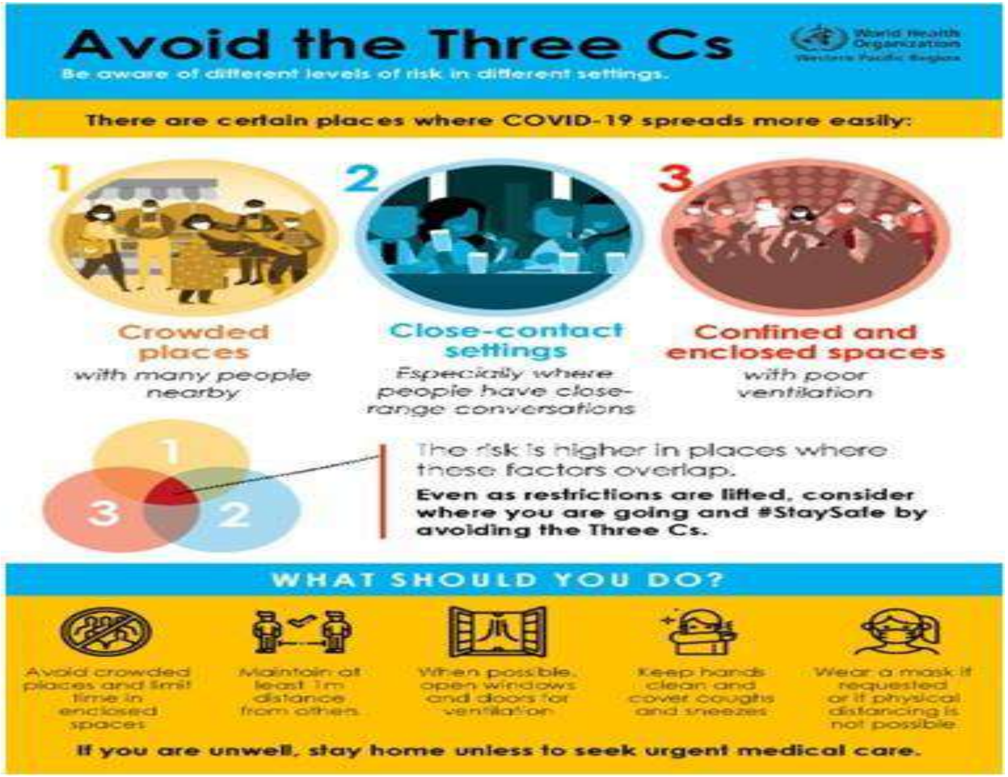
課題

- 日本政府和學術團體（SHASE，AIJ）在大流行期間的對策
- 空氣中SASR-CoV-2的物理和生物的特徵
- 呼吸道感染的主要緩解策略
- 通風
- 過濾（中央方式和獨立方式）
- UVGI（紫外線殺菌照射）



日本衛生、勞動和福利部

3 Cs
Closed spaces 封閉的空間
Crowded places 擁擠的地方
Close-contact settings 密切接觸的環境



WHO

March 23, 2020

The Society of Heating, Air-Conditioning and Sanitary Engineers of Japan (SHASE)
President Shin-ichi Tanabe
Architectural Institute of Japan (AIJ)
President Izuru Takewaki

Role of ventilation in the control of the COVID-19 infection:
Emergency presidential discourse

At the Ministry of Health, Labour and Welfare's Expert Meeting on Novel Coronavirus Infectious Disease Control on March 9, 2020, "A View on Novel Coronavirus Infectious Disease Control" was announced [1]. Subsequently, on March 18, the Prime Minister's Office, together with the Ministry of Health, Labour and Welfare, published a leaflet titled "Let's Avoid These Three Conditions When We Go Out!" [2], according to which to be avoided are closed spaces with poor ventilation, crowded places, and close contact. Inquiries about ventilation have been received from members of the Architectural Institute of Japan and the Society of Heating, Air-Conditioning and Sanitary Engineers of Japan, both of which specialize in indoor environments.

公益社団法人
空気調和・衛生工学会
The Society of Heating, Air-Conditioning and Sanitary Engineers of Japan [SHASE]

Operation of air-conditioning equipment and other facilities as SARS-CoV-2 infectious disease control

April 8, 2020

The Society of Heating, Air-Conditioning and Sanitary Engineers of Japan (SHASE)
Ventilation equipment committee
Member author Takashi Kurabuchi (Tokyo University of Science), U Yanagi (Kogakuin University)
Cooperating author Masayuki Ogata (Tokyo Metropolitan University)

Introduction

The Ministry of Health, Labour and Welfare's (Japan) Expert Meeting on Novel Coronavirus Infectious Disease Control[1)] listed "closed space with poor ventilation" as a space at risk of infection. In response to this, the Society of Heating, Air-Conditioning and Sanitary Engineers of Japan and Architectural Institute of Japan released an emergency presidential discourse, "Role of ventilation in the control of the COVID-19 infection"[2)], on March 23, 2020, which outlined the characteristics of this virus infection and ventilation methods. Furthermore, Q&A about ventilation, "Role of ventilation in the control of the COVID-19 infection"[3)], was released on March 30, 2020, which provided a general commentary on ventilation to the public.

Table A.1 comparison of the main strategies

	ASHRAE	REHVA	SHASE	Related Society of China
Outdoor air	1. Increase the amount of outdoor air. 2. Open outdoor air dampers, as high as 100% if possible.	1. Supply as much outdoor air as reasonably possible. Switch the terminal devices to 100% outdoor air if possible. 2. Open windows regularly.	1. Supply as much outdoor air as reasonably possible. Switch the terminal devices to 100% outdoor air if possible. 2. Open windows regularly.	1. Supply as much outdoor air as reasonably possible. Switch the terminal devices to 100% outdoor air if possible. 2. The ratio of outdoor air should be greater than 40%.
Operation of HVAC systems	1. Operate HVAC related devices to provide flushing 2 hours before and post occupancies. 2. Keep the system on for 24 h a day, 7 days a week if possible. 3. Disable DCV.	1. Run ventilation at the nominal speed for at least 2 h before occupancies and at a lower speed 2 h after occupancies. 2. Run toilet ventilation system for 24 h a day, 7 days a week. 3. In DCV systems, change the CO_2 setpoint to 400 ppm.	1. Increase the running time of HVAC equipment, running it continuously for 24 h if possible. 2. Run the exhaust system in toilets continuously. 3. Lower the CO_2 setpoint.	1. Increase the air supply temperature in heating mode and decrease the temperature in cooling mode.
Temperature and humidity setpoint	1. Control the temperature and humidity is beneficial. But the temperature and relative humidity setpoint should be considered on a case-by-case basis.	1. There is no need to adjust the temperature and humidity setpoint.	1. The temperature should be controlled between 17 and 28 °C, and the relative humidity should be controlled between 40 and 70%.	Haven't mentioned.
Pressure differential	1. The air should flow from safe areas to unsafe areas, from personal use areas to public areas.	1. Ensure the negative pressure in the toilets.	1. Ensure the negative pressure in the toilets.	1. A slight positive pressure should be maintained in the kitchen. 2. Keep negative pressure in toilets.
Filters equipped in the HVAC system	1. Improve the level of the central air filter as much as possible, at least to the grade of MERV-13.	1. Filters should be replaced and maintained as usual.	1. For a system with 100% outdoor air, the filter can be operated as usual. 2. For return air operation, check the differential pressure of the filter more often and replace the filter sooner than usual.	1. Maintain filters as usual.
Air cleaning	1. HEPA filters and UVGI are recommended.	1. It is recommended to locate the air-cleaning device close to the breathing zone. 2. Special UV cleaning equipments installed for the supply air or room air treatment are also effective.	1. Air cleaners are effective as auxiliary devices. 2. Ventilation is more effective than air cleaners.	1. Indoor air cleaners should be operated. 2. UV devices shouldn't be installed in the HVAC system.
Heat recovery equipment	1. Check the status of heat recovery wheels in the systems for leakage.	1. If heat exchangers with leakage below 5%, operate with increasing amount of outdoor air ventilation.	1. For the static total heat exchanger, operate in heat exchange mode.	1. Indirect heat exchangers and other heat exchangers can operate as usual.

Guo M, et al. Review and comparison of HVAC operation guidelines in different countries during the COVID-19 pandemic. *Building and Environment*. 2020. https://doi.org/10.1016/j.buildenv.2020.107368

Technical Committee on Countermeasures Against the SARS-CoV-2

=Announcements=

- Role of ventilation in the control of the COVID-19 infection:Emergency presidential discourse
- Operation of air-conditioning equipment and other facilities as SARS-CoV-2 infectious disease control
- It was cited in a review article in the international journal Building and Environment.
- Operation of air-conditioning and sanitary equipment for SARS-CoV-2 infectious disease control

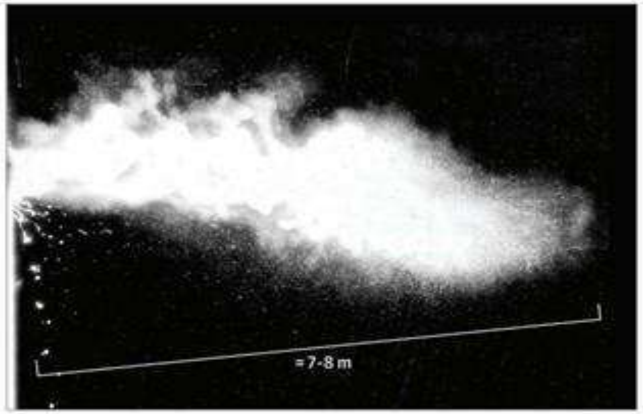
空氣中SASR-CoV-2的物理和生物的特徵

※**氣溶膠** 固體或液體顆粒在氣體中的懸浮物。氣溶膠這一術語包括顆 粒和懸浮氣體，通常是空氣。顆粒大小從0.002到超過100微米。 (William C. Hinds. Aerosol Technology, Second Edition, 1999)
(CEN/TS 16976:2016: 0.001 - 100 µm)

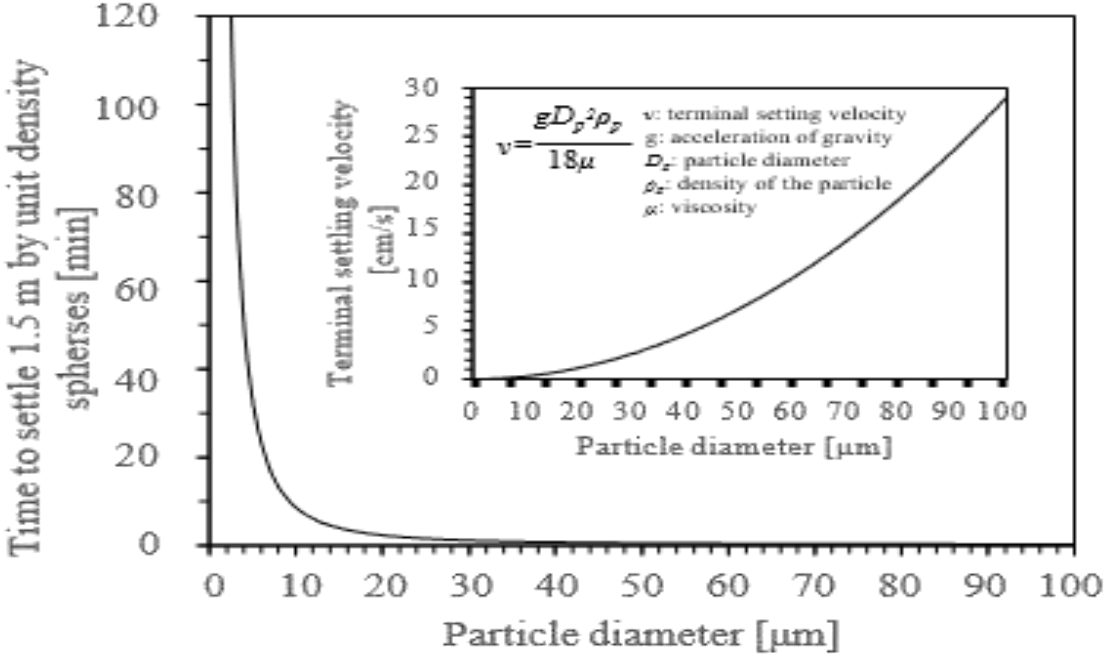
※**生物氣溶膠** 是一種由生物來源或活動的顆粒組成的氣溶膠，可能通 過感染性、過敏性、毒性、藥理學或其他過程影響生物體。顆粒大小 可從空氣動力學直徑約0.5至100微米。
(Christopher MW. and Christopher SC. Bioaerosols handbook. Lewis publishers. 1995

※由於SARS-CoV-2是隨著空氣從口中釋放出來的，所以它在環境中處於氣溶膠狀態。

Figure. Multiphase Turbulent Gas Cloud From a Human Sneeze



← Source
Turbulent Gas Clouds and Respiratory Pathogen Emissions Potential Implications for Reducing Transmission of COVID-19. *JAMA*.2020;323(18):1837- 1838. https://doi.org/10.1001/jama.2020.4756



事實證明，≤10微米的顆粒在靜止的空氣中懸浮的時間較長（1微米為14.4小時；5微米為35分鐘；而10微米為9分鐘）。
現場測量結果顯示，居住空間的最高速度和平均速度分別為0.4米/秒和0.1米/秒，0.1-0.4米/秒（10～40釐米/秒）。因此，在空調和/或通風設備運行過程中，≤10微米的氣溶膠顆粒很容易在室內氣流中被長距離傳輸（甚至到回風口）。

Hayashi M, Yanagi U, Azuma K, Kagi N, Ogata M, Morimoto S, et al. Measures against COVID-19 concerning Summer Indoor Environment in Japan. *Jpn Archit Rev.* 3(4):423–434, 2020. https://doi.org/10.1002/2475-8876.12183

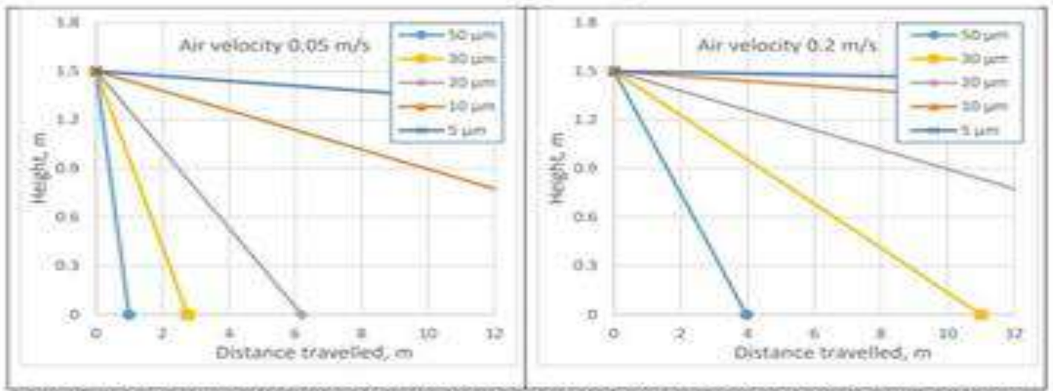
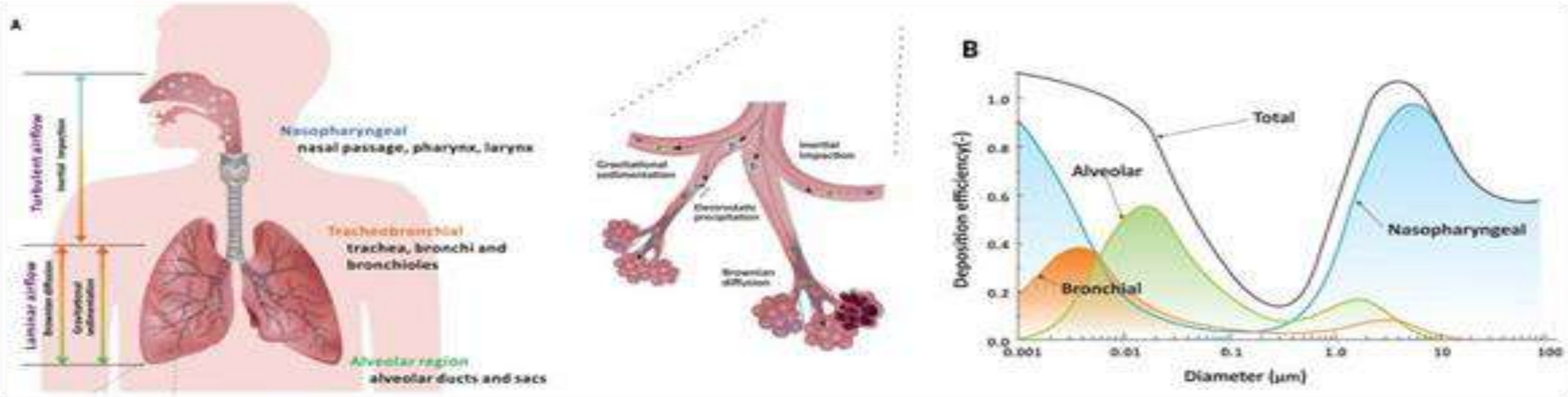


Figure 2. Traveling distance estimates for different sizes of droplets to be carried by room air velocities of 0.05 and 0.2 m/s before settling 1.5 m under the influence of gravity. The travelled distance accounts for movement after the initial jet has relaxed and is calculated with the equilibrium diameter of completely desiccated respiratory droplets (µm values in the figure refer to equilibrium diameters). With turbulence distance travelled is less, but settling time is longer.

REHVA COVID-19 guidance document, Ver 4.1, How to operate HVAC and other building service systems to prevent the spread of the coronavirus (SARS-CoV-2) disease (COVID-19) in workplaces, 20210415.



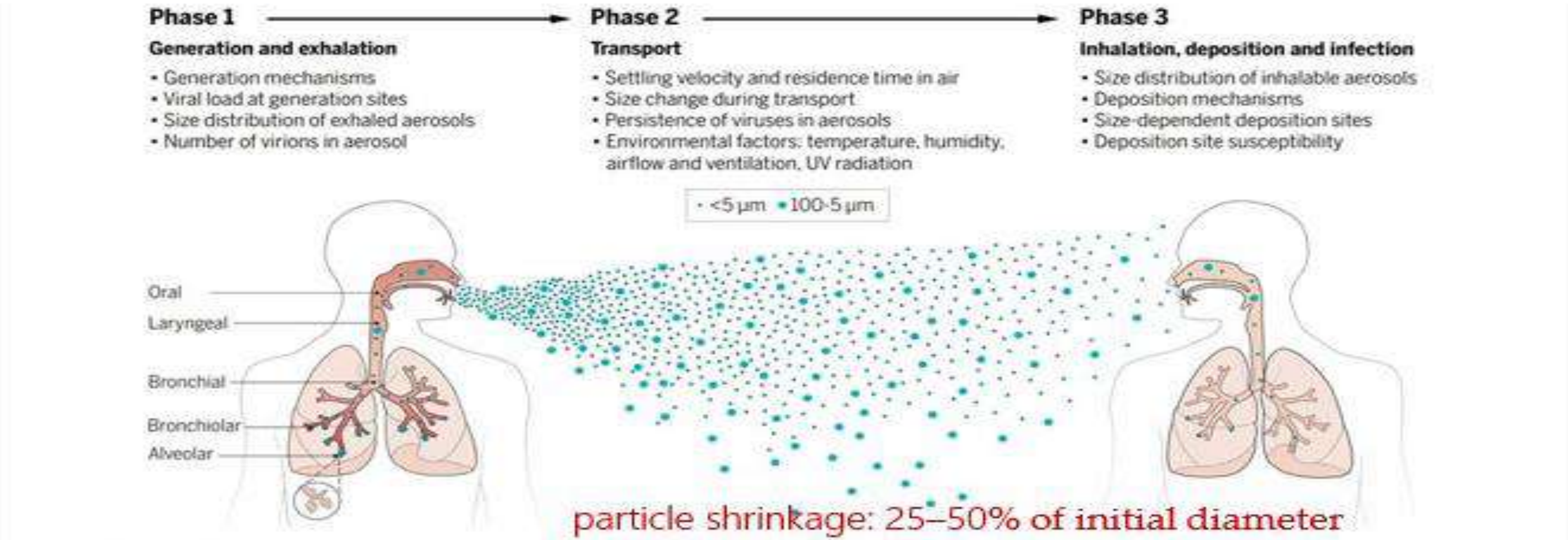
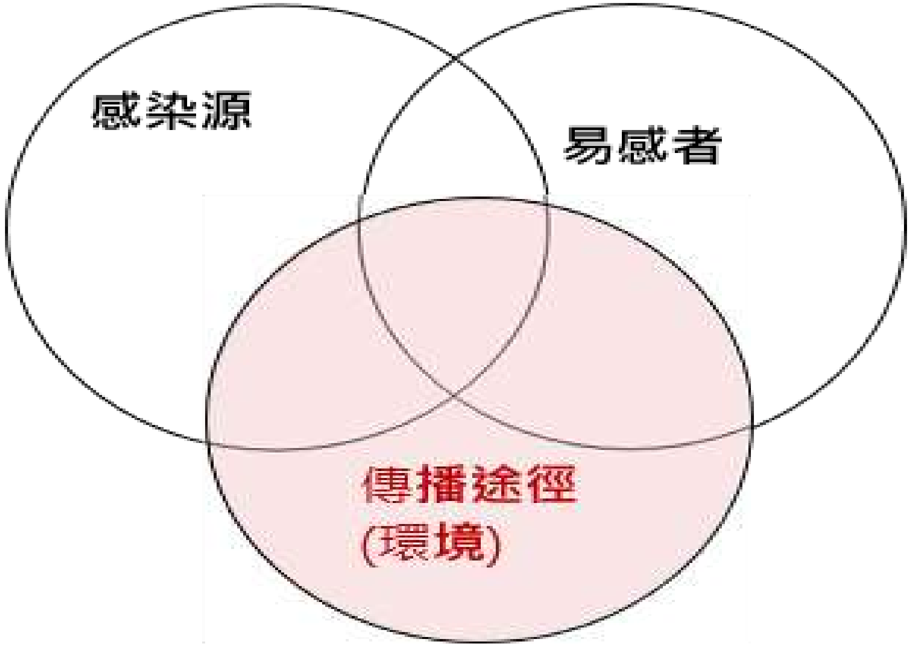
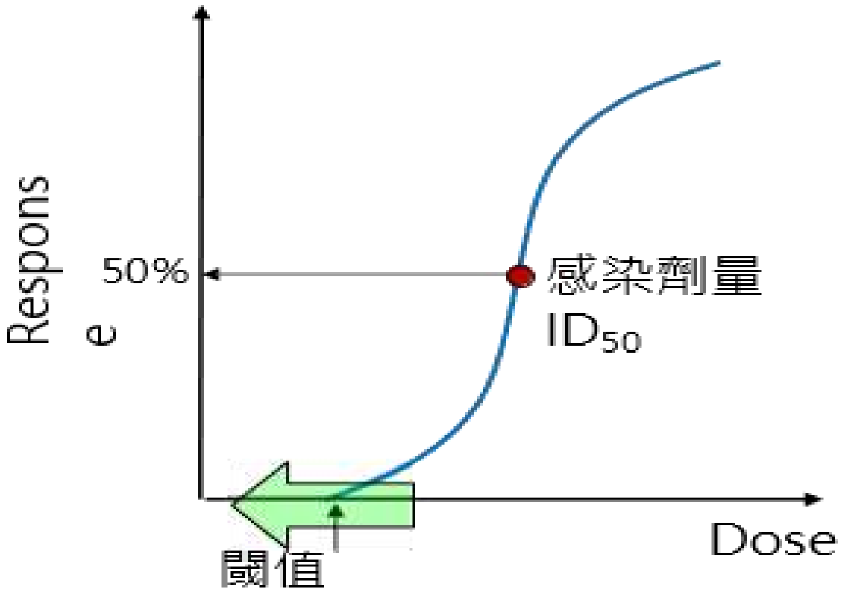


Fig. 1. Airborne transmission of respiratory viruses. Phases involved in the airborne transmission of virus-laden aerosols include (i) generation and exhalation; (ii) transport; and (iii) inhalation, deposition, and infection. Each phase is influenced by a combination of aerodynamic, anatomical, and environmental factors. (The sizes of virus-containing aerosols are not to scale.)

Source: Wang CC, et al. Airborne transmission of respiratory viruses, *Science* 373, 981 (2021). https://doi.org/10.1126/science.abd9149

呼吸道感染的主要緩解策略





三個要素；傳染源、易受感染人和環境

按傳播途徑緩解呼吸道感染的策略

接觸（直接、間接）

- 手部衛生
- 表面清潔

飛沫, >100μm

- 避免3Cs的發生
- 戴上口罩
- 確保距離

氣溶膠, < 100μm

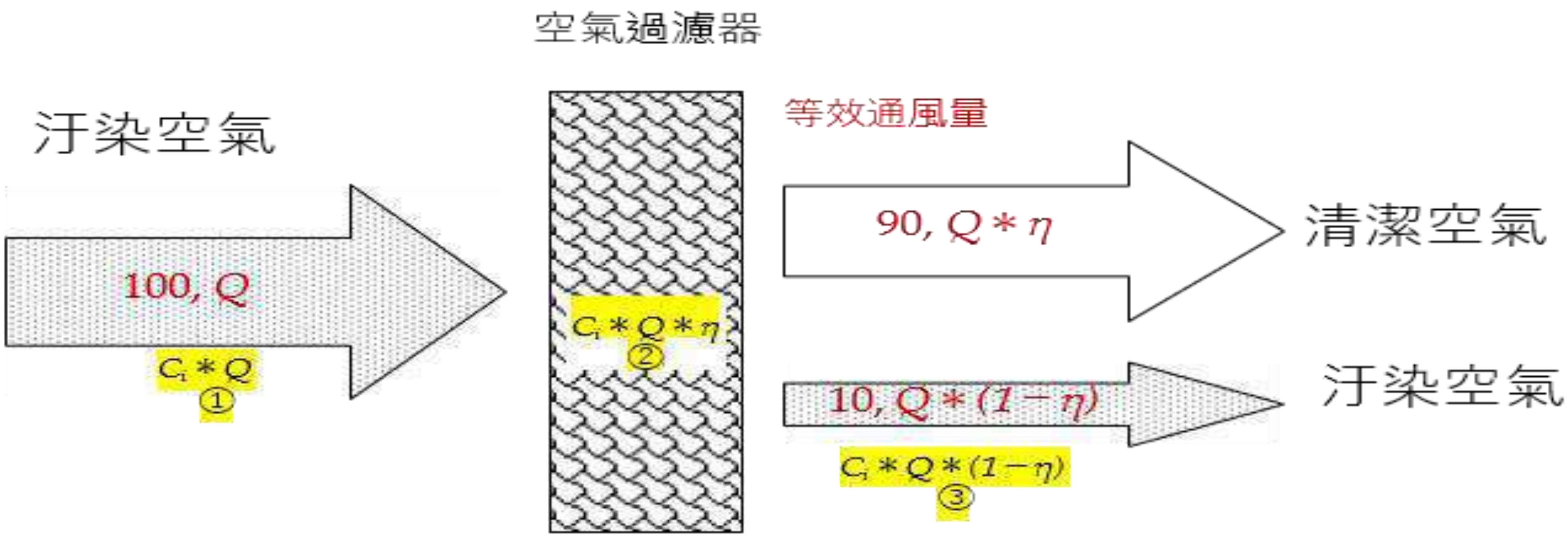
- 行為改變（避免3C、戴口罩）
- 通風
- 空氣淨化（中央系統空氣過濾、局部空氣過濾）。
- 紫外線殺菌照射

在我的演講中，<100μm的顆粒被歸類為氣溶膠；氣溶膠包含液滴。
>100μm的顆粒被悄鵯鞢沫。
在醫學領域，<5μm的顆粒被稱鵯鞢沫核。

>100μm；末端沉降速度>0.3m/s
顆粒從1.5米的高度落到地上只需要5秒鐘左右。 室內氣流速度0.1m/s：預測行駛距離
100μm：0.5m；50μm：2m；
10μm：52m；5μm：324m

等效通風量(換氣率)

在空氣過濾器的收集效率為90%的情況下



質量平衡: $C_i*Q-C_i*Q*\eta=C_i*Q*(1-\eta)$

C:濃度，病毒/m³; Q:通量, m³/h

Azuma et al. Environmental Health and Preventive Medicine (2020) 25:66
https://doi.org/10.1186/s12199-020-00904-2

Environmental Health and Preventive Medicine

REVIEW ARTICLE Open Access

Environmental factors involved in SARS-CoV-2 transmission: effect and role of indoor environmental quality in the strategy for COVID-19 infection control

Kenichi Azuma[1*], U Yanagi[2], Naoki Kagi[3], Hoon Kim[4], Masayuki Ogata[5] and Motoya Hayashi[6]

$$P_I = \frac{C}{S} = 1 - e^{-\frac{Iqpt}{Q}}$$

P_I = probability of infection (-)
C = the number of infection cases (p)
S = number of susceptible individuals (p)
I = number of infector individuals
p = pulmonary ventilation rate of a person (m^3/hr)
q = quanta generation rate (1/hr)
t = exposure time (hr)
Q = room ventilation rate with clean air (m^3/hr)

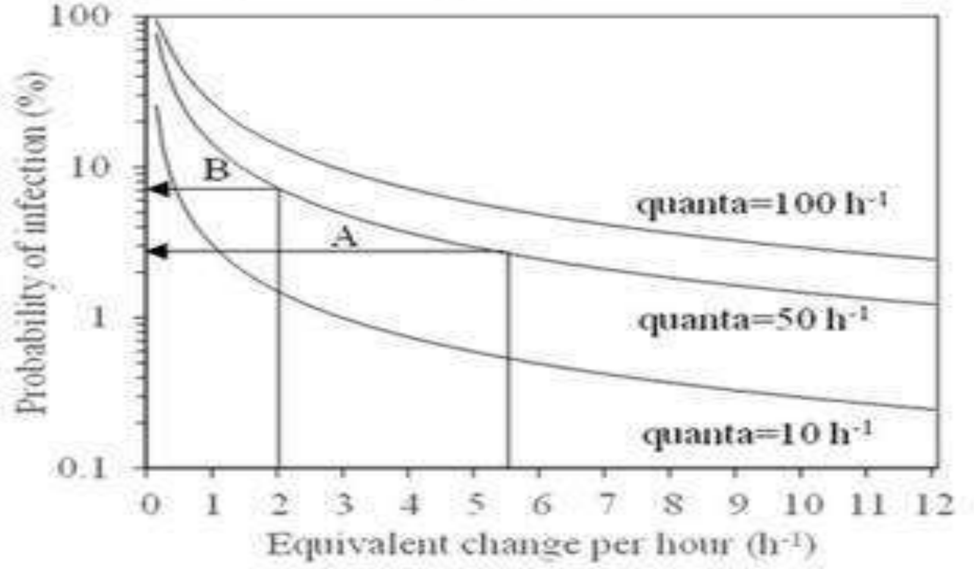
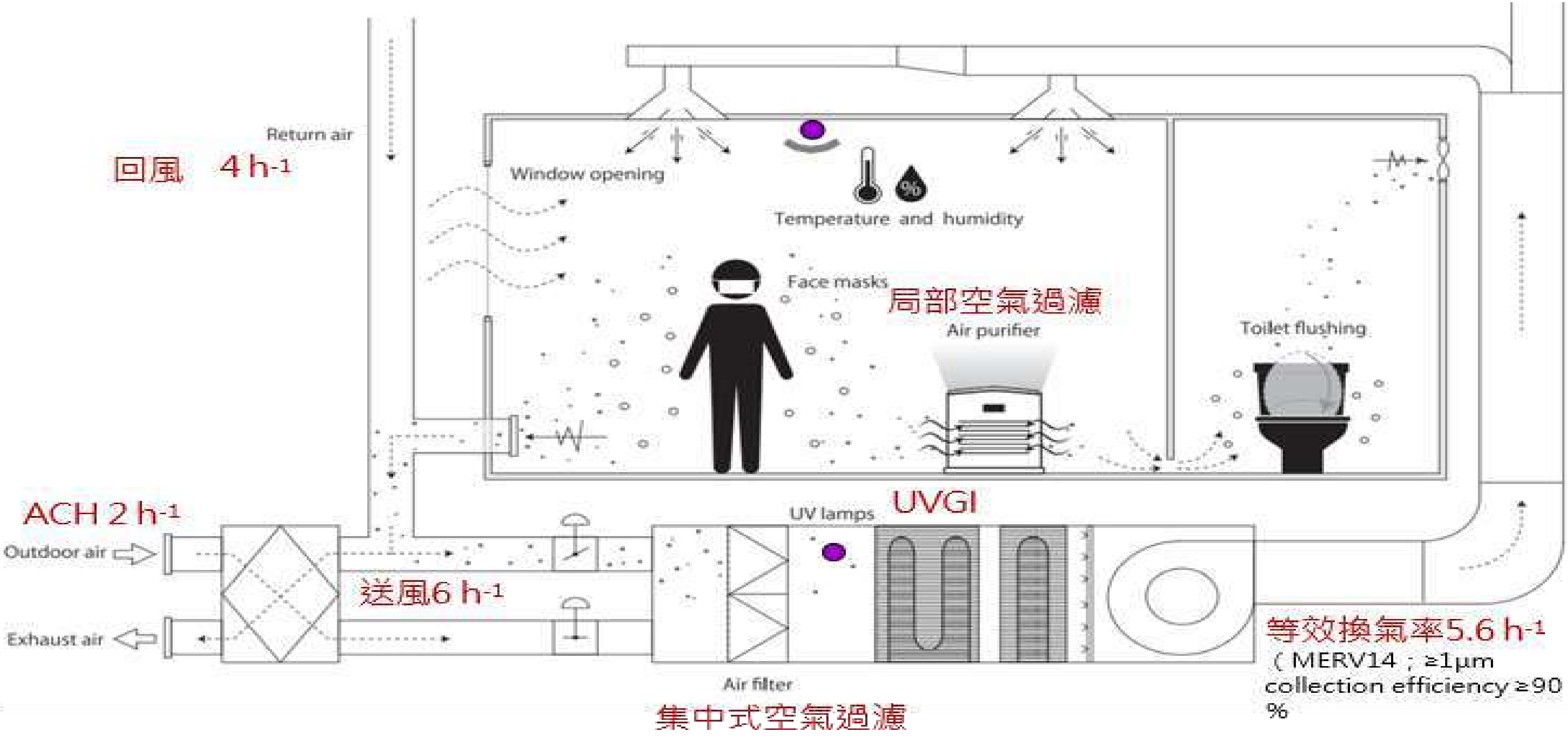


Figure 2. Probability of infection vs. equivalent change per hour
Conditions: I = 1 person; p = 0.48 m^3/hr; t = 8 hours; floor aera = 500 m^2; room volume =1,300 m_3

中央空調系統

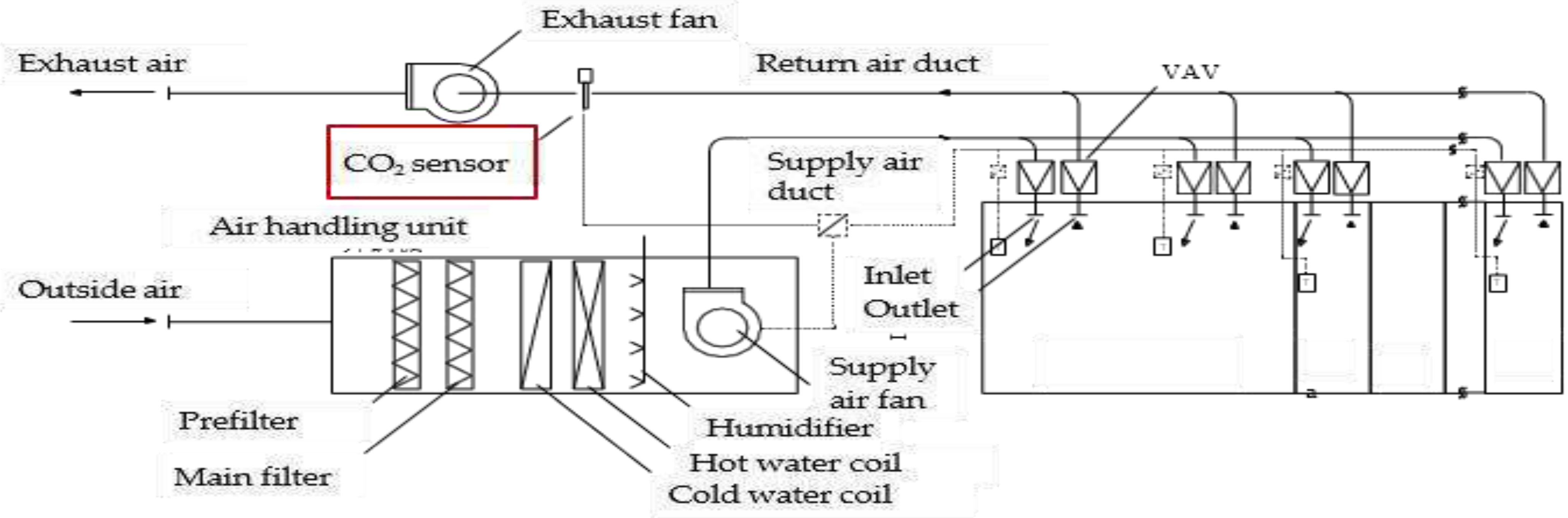
Joseph G. Allen; Andrew M. Ibrahim. Indoor Air Changes and Potential Implications for SARS-CoV-2 Transmission. JAMA May 25, 2021 Volume 325, Number 20



Takashi Kurabuchi, U Yanagi, Masayuki Ogata, Masayuki Otsuka, Naoki Kagi, Yoshihide Yamamoto, Motoya Hayashi, Shinichi Tanabe, 2021. Operation of air-conditioning and sanitary equipment for SARS-CoV-2 infectious disease control. *Japan Architectural Review*. 4(4): 608–620.2021. https://doi.org/10.1002/2475-8876.12238

For ventilation equipment in a building with CO_2 concentration control, the ventilation rate increases when the indoor CO_2 concentration setting value (generally around 1000 ppm) is lowered (the ventilation rate reaches a maximum when it is lower than the outside air concentration). When outside air-cooling

Takashi Kurabuchi, U Yanagi, Masayuki Ogata, Masayuki Otsuka, Naoki Kagi, Yoshihide Yamamoto, Motoya Hayashi, Shinichi Tanabe, 2021. Operation of air-conditioning and sanitary equipment for SARS-CoV-2 infectious disease control. *Japan Architectural Review*. 4(4): 608–620.2021. https://doi.org/10.1002/2475-8876.12238



必要的通風量&二氧化碳濃度

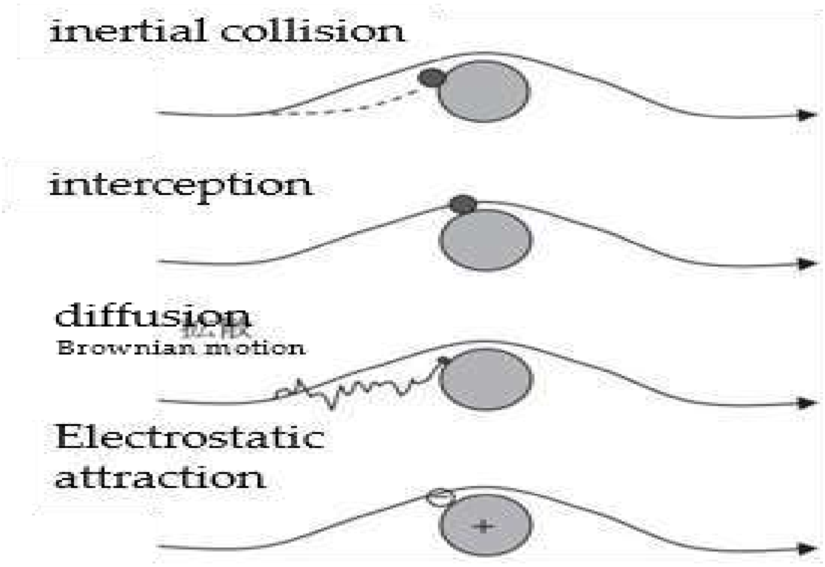
世界衛生組織建議每人每小時36立方米（10ℓ/p・h）。(WHO. Roadmap to improve and ensure good indoor ventilation in the context of COVID-19; 2021)

日本厚生勞動省指出，如果每人每小時有30立方米，並不適用於通風不良的空間

根據計算，如果每人每小時吸入30立方米的外部空氣，室內 的二氧化碳濃度將達到1000ppm或更低。 因此，通過在室內 設置一個二氧化碳傳感器來可視化通風率是有效的。

然而，應該注意的是，即使二氧化碳濃度是室外空氣量的指標，它也不是等效通風量的指標。二氧化碳濃度不能作為感 染風險的直接指標。

集中式空氣過濾



空氣過濾器通過慣性碰撞、攔截、擴散和靜電吸引等機制將懸浮顆粒收集到過濾介質附近。
除此之外，還有一種重力沉降

Minimum Efficiency Reporting Values(MERVs) and Filter Efficiencies by Particle Size

MERV	0.3-1.0 μm	1.0-3.0 μm	3.0-10 μm	Colorimetric method
1	n/a	n/a	E3<20	-
2	n/a	n/a	E3<20	-
3	n/a	n/a	E3<20	-
4	n/a	n/a	E3<20	-
5	n/a	n/a	20≦E3	-
6	n/a	n/a	35≦E3	-
7	n/a	n/a	50≦E3	40
8	n/a	20≦E_2	70≦E3	40
9	n/a	35≦E_2	75≦E3	50
10	n/a	50≦E_2	80≦E3	50
11	20≦E_1	65≦E_2	85≦E3	60
12	35≦E_1	80≦E_2	90≦E3	75
13	50≦E_1	85≦E_2	90≦E3	90
14	75≦E_1	90≦E_2	95≦E3	95
15	85≦E_1	90≦E_2	95≦E3	98
16	95≦E_1	95≦E_2	95≦E3	-

n/a: not available,
Source: ASHRAE Standard 52.2-2017.

Takashi Kurabuchi, U Yanagi, Masayuki Ogata, Masayuki Otsuka, Naoki Kagi, Yoshihide Yamamoto, Motoya Hayashi, Shinichi Tanabe, 2021. Operation of air-conditioning and sanitary equipment for SARS-CoV-2 infectious disease control. *Japan Architectural Review*. 4(4): 608–620.2021. https://doi.org/10.1002/2475-8876.12238

SARS-CoV-2:測試結果1

<1μm ND
1-4μm 1384 RNA copies/m^3 (40%)
>4μm 2000 RNA copies/m^3 (60%)

當使用MERV12過濾器時
＝40%×80%＋60%×90%
＝86%

當使用MERV13過濾器時
＝40%×85%＋60%×90%
＝88%

SARS-CoV-2:測試結果2

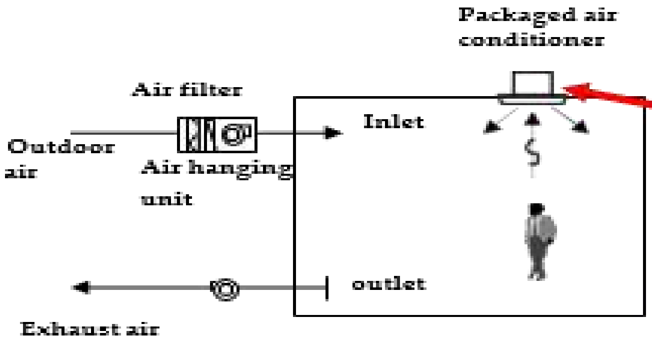
<1μm ND
1-4μm 916 RNA copies/m^3 (50%)
>4μm 927 RNA copies/m^3 (50%)

當使用MERV12過濾器時
＝50%×90%＋50%×95%
＝85%

當使用MERV13過濾器時
＝50%×85%＋50%×95%
＝88%

Source: Chia PY, et al. Detection of air and surface contamination by SARS-CoV-2 in hospital rooms of infected patients. *Nature Communications* (2020) 11:2800 https://doi.org/10.1038/s41467-020-16670-2

獨立空調系統



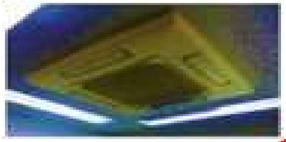


Figure 1. A centralized ventilation system with an individual air-conditioning system

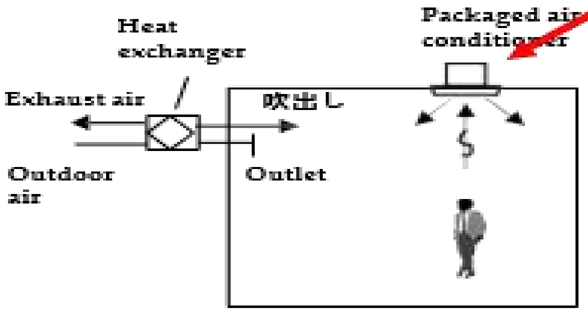


Fig ure 2. An individual ventilation system with an individual air-conditioning system

Minimum Efficiency Reporting Values(MERVs) and Filter Efficiencies by Particle Size

MERV	0.3-1.0 µm	1.0-3.0 µm	3.0-10 µm	Colorimetric method
1	n/a	n/a	E3<20	-
2	n/a	n/a	E3<20	-
3	n/a	n/a	E3<20	-
4	n/a	n/a	E3<20	-
5	n/a	n/a	20≦E3	-
6	n/a	n/a	35≦E3	-
7	n/a	n/a	50≦E3	40
8	n/a	20≦E_2	70≦E3	40
9	n/a	35≦E_2	75≦E3	50
10	n/a	50≦E_2	80≦E3	50
11	20≦E_1	65≦E_2	85≦E3	60
12	35≦E_1	80≦E_2	90≦E3	75
13	50≦E_1	85≦E_2	90≦E3	90
14	75≦E_1	90≦E_2	95≦E3	95
15	85≦E_1	90≦E_2	95≦E3	98
16	95≦E_1	95≦E_2	95≦E3	-

n/a: not available,
Source: ASHRAE Standard 52.2-2017.

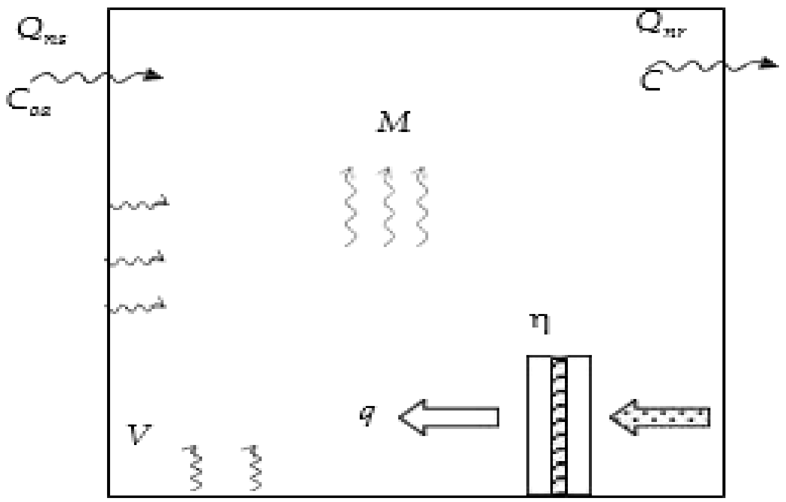
出典:（公社）空気調和・衛生工学会新型コロナウイルス対策特別委員会：商業施設，事務所に関係する皆様へ、2020年12月9日
http://www.shasej.org/recommendation/covid-19/2020.12.09%20syougyo.pdf

局部空氣過濾

The purification performance of a purifier is determined by the airflow rate, collection efficiency of a filter, and room volume.
This is proportional to the airflow rate and collection efficiency, and is inversely proportional to the volume of the room; $q\eta/V$

The value obtained by multiplying the airflow rate by the collection efficiency is sometimes called CADR (Clean Air Delivery Rate).
Items surrounded by a read line indicate the purification performance of an air purifier.

$$C = C_{o}e^{-\left(\frac{q\eta}{V}+\frac{Q_{nr}}{V}\right)t} + \frac{Q_{ns}C_{oa}}{q\eta + Q_{nr}}\left[1 - e^{-\left(\frac{q\eta}{V}+\frac{Q_{nr}}{V}\right)t}\right] + \frac{M}{q\eta + Q_{nr}}\left[1 - e^{-\left(\frac{q\eta}{V}+\frac{Q_{nr}}{V}\right)t}\right]$$



M : pollutants amount generated [mg/h]
V : room volume [m³]
Q_{oa} : supply air [m³/h]
Q_{nr} : exhaust air [m³/h]
C : concentration at time t [mg/m³] C_{ns} : outdoor pollutant concentration [mg/m³] C_o : concentration at time t=0 [mg/m³] η : collection efficiency [-]
t : elapsed time [h]

出典
柳　宇：日本空気清浄協会編：室内空気清浄便覧、p.242、オーム社、2000

WHO

醫院，包括檢疫設施
如果不能採取其他（短期）策略，考慮使用帶有HEPA過濾器的獨立空氣淨化器。 非住宅環境和住宅環境，包括家庭和家中的自我隔離
如果不能採取其他策略，考慮使用帶有MERV 14/F8過濾器的獨立式空氣淨化器。
(WHO. Roadmap to improve and ensure good indoor ventilation in the context of COVID-19. 2020)

ASHRAE

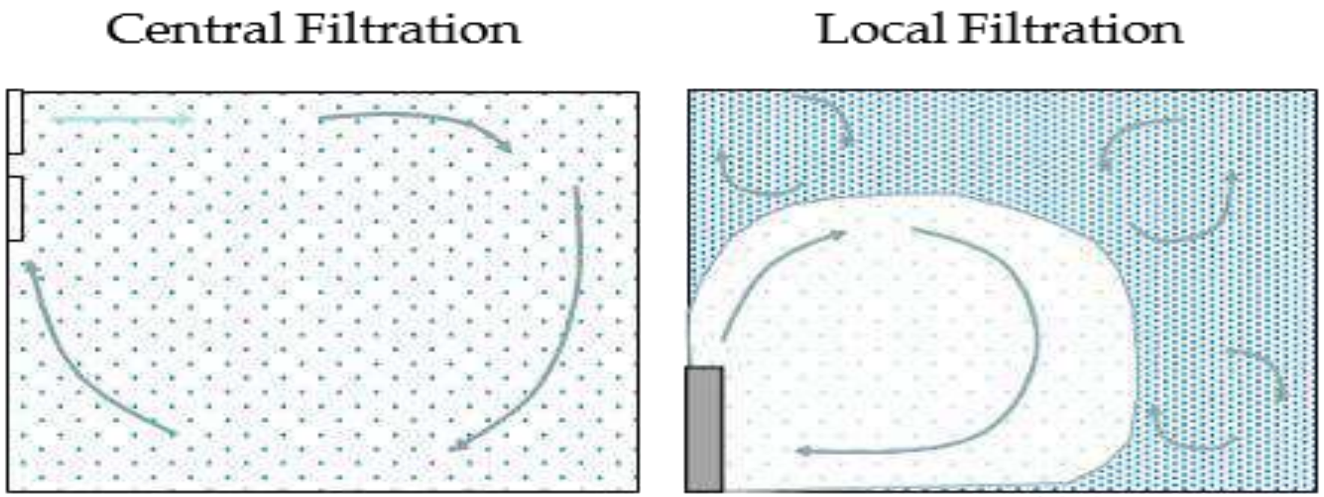
增加帶有HEPA或高MERV過濾器的移動式室內空氣淨化器，並適當考慮清潔空氣的輸送 量（CADR）。
(AHAM 2015).
(ASHARE. ASHRAE Position Document on Infectious Aerosols. April 14, 2020）

CDC

使用可攜式高效微粒空氣（HEPA）風扇/過濾系統來加強空氣清潔。
（CDC. Ventilation in Buildings. Update Jun 2, 2021.
https://www.who.int/publications/i/item/9789240021280）

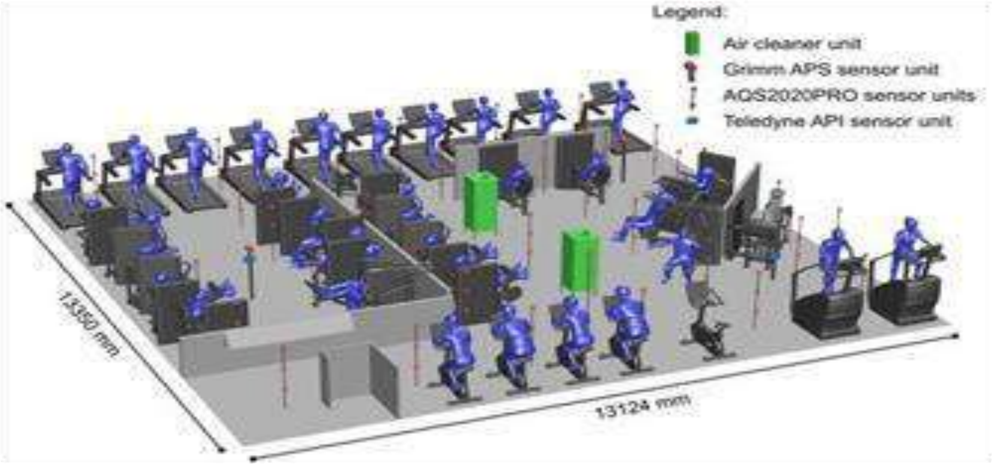
日本衛生、勞動和福利部

使用用HEPA過濾器過濾的空氣淨化器，其氣流速度約為5立方米/分鐘或以上。將空氣淨化 器安裝在離人的地方約10平方米的範圍內。
(MHLW. https://www.mhlw.go.jp/content/10900000/000640917.pdf)



出典
柳　宇：エアフィルタ，空気清浄機，紫外線殺菌照射（UVGI）、Environment and Building Services No.173

健身房測試表明，換氣率ACH=2.2 h- 1的通風不足以阻止氣溶膠濃度在30分鐘內大幅上升。



單獨的空氣清潔（ACH=1.39 h- 1）與單獨的通風有類似的效果。

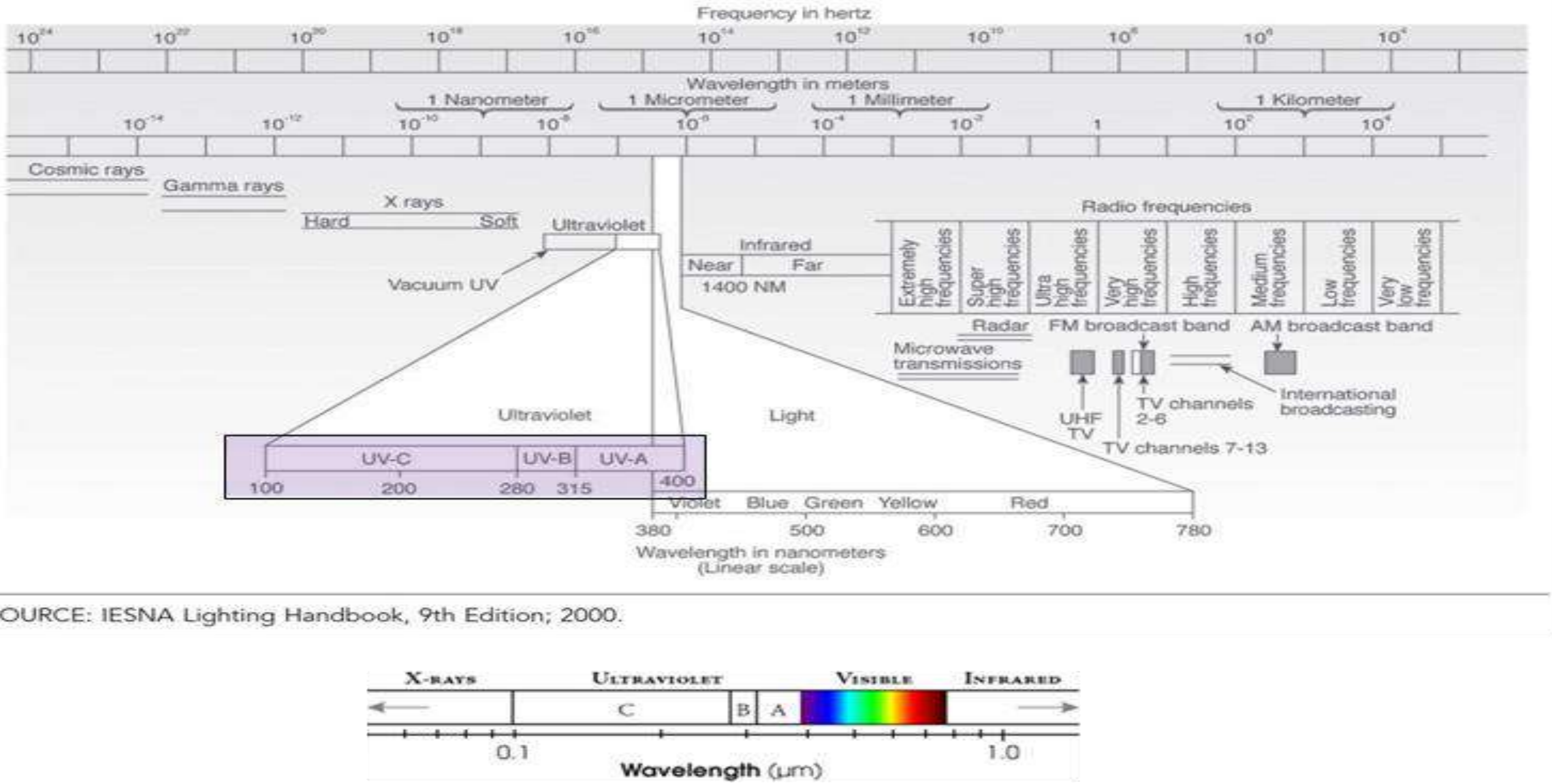
研究表明，結合上述的通風和空氣清潔，可以減少氣溶膠顆粒濃度的80-90%，這取決於氣溶膠的 大小。

將淨化器與通風系統結合使用是有效的。

Source: Blocken B, et al, 2021. Ventilation and air cleaning to limit aerosol particle concentrations in a gym during the COVID-19 pandemic. *Building and Environment*, Volume 193, 15 April 2021, 107659.

UVGI（紫外線殺菌照射）

Figure 1. Electromagnetic spectrum illustrating UV-C in relation to other UV-bandwidths and visible light.



SOURCE: IESNA Lighting Handbook, 9th Edition; 2000.

Figure 1. Overview of selected key events in the history of UVGI air disinfection

1877	Downes and Blunt[a] discover the ability of sunlight to prevent microbial growth. It is later shown that the ability of light to inactivate microorganisms is dependent on the dose (intensity × time) and wavelength of radiation and the sensitivity of the specific type of microorganism.
1930	Gates[b] publishes the first analytical bactericidal action spectrum with peak effectiveness at 265 nm, very near the 254 nm output of low-pressure Hg germicidal lamps.
1933	Wells[c] presents the concept of airborne infection via "droplet nuclei"—evaporated droplets containing infectious organisms that can remain suspended in the air for extended durations.
1935	Wells and Fair[d] demonstrate the ability of UVGI to efficiently inactivate airborne microorganisms and prove the concept of infection via the airborne route.
1937	Wells et al.[e] use upper-room UVGI to prevent the epidemic spread of measles in suburban Philadelphia day schools where infection outside the school is unlikely.
1940s to 1950s	Several studies[f-g] are unable to reproduce Wells et al.'s success in using UVGI to prevent the spread of measles in schoolchildren, contributing to the disillusionment with and abandonment of UVGI for air disinfection. These failures have since been attributed to infections occurring outside the irradiated schools.
1956–1962	Riley[h] exposes guinea pigs to air originating from an occupied TB ward and proves that TB is spread via the airborne route. A group of guinea pigs receiving infected air via a UVGI irradiated duct were not infected, while a group receiving air via a non-irradiated duct were infected.
1969–1972	Riley and colleagues[i-l] conduct model room studies evaluating the use of upper-room UVGI to reduce the concentration of aerosolized test organisms in the lower room. They also show that air mixing between the upper and lower room is imperative for effective disinfection and confirm that UVGI is less effective at high humidity.
1974–1975	Riley et al.[m] determine virulent tubercle bacilli and BCG to be equally susceptible to UVGI and measure the disappearance rate of aerosolized BCG in a model room with and without upper-room UVGI. Upper-room UVGI is shown to be highly effective in disinfecting the lower room, quantitatively demonstrating the potential of upper-room UVGI to reduce TB infection.
1985–1992	After decades of decline, there is an unexpected rise in TB in the United States, leading to a renewed interest in UVGI for air disinfection.[n,o]
1990s to present	New in-depth efforts are undertaken, aimed toward quantitatively examining UVGI efficacy and safety and providing guidance for the proper use of UVGI.

Source: Reeda NG, 2010. The History of Ultraviolet Germicidal Irradiation for Air Disinfection. Public Health Reports / January–February 2010 / Volume 125

微生物對UVGI暴露的反應可以建模為單階段指數衰減或兩階段指數衰減，反應可能包括一個肩部。
圖5.1說明瞭完整的微生物衰減曲線。

complete microbial decay curve. The mathematics for each of these components and a complete combined model are presented here.

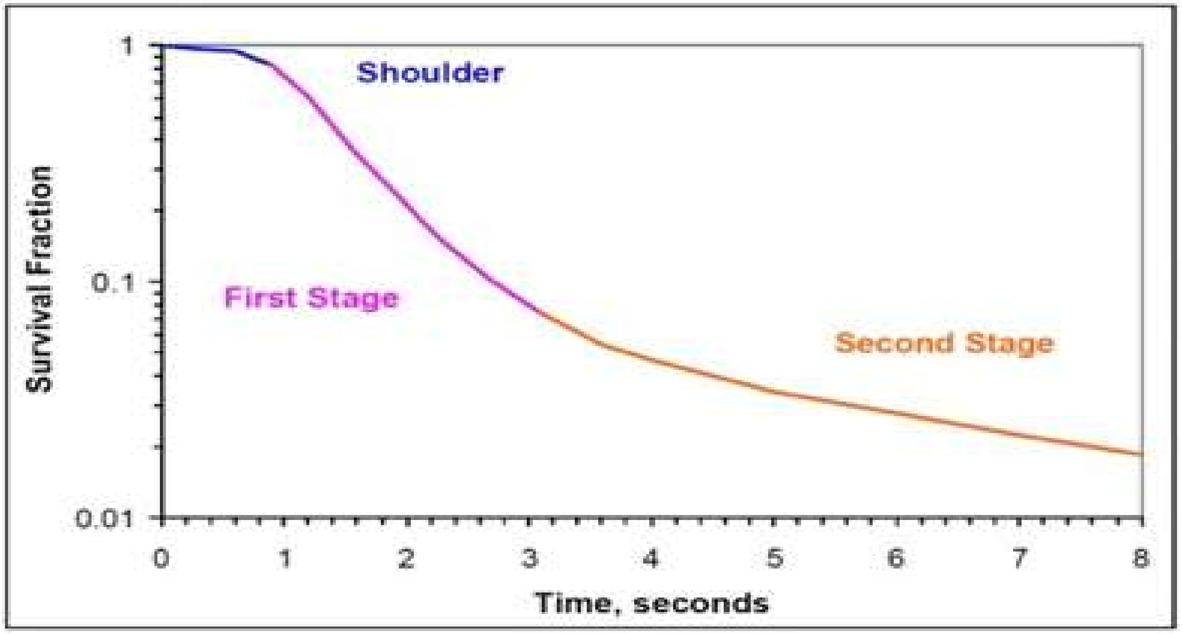


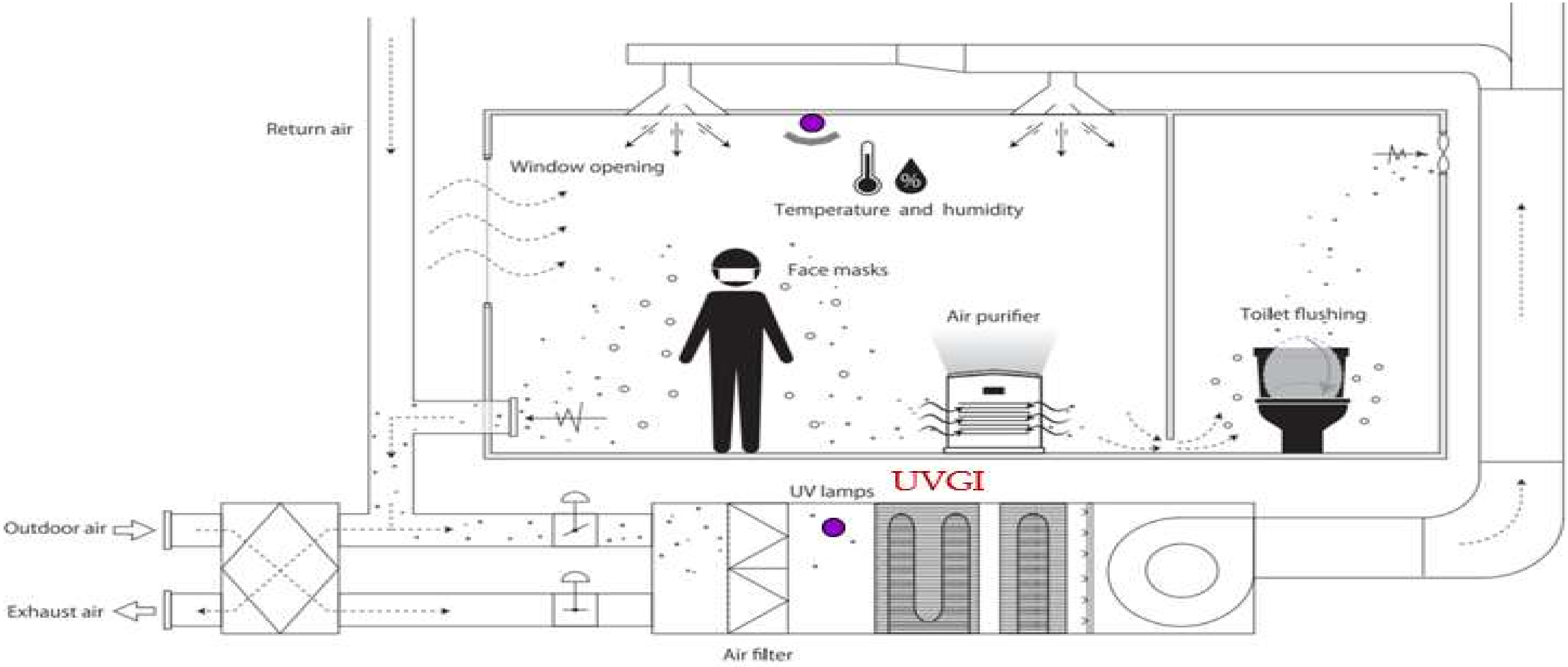
Figure 5.1: Two-stage Decay Curve with Shoulder for *Staphylococcus aureus*. Based on data from Sharp (1939).

Kowalski WJ, 2001. Design and Optimization of UVGI Air Disinfection Systems. A Thesis in Architectural Engineering. The Pennsylvania State University The Graduate School College of Engineering

$$S_t = e^{-kIt}$$

S_t：surviving fraction of initial microbial population（−）
k：standard rate constant（cm²/μW-s） I：intensity of UVGI irradiation（μW/cm²） t：time of exposure（s）

Central air conditioning system



Takashi Kurabuchi, U Yanagi, Masayuki Ogata, Masayuki Otsuka, Naoki Kagi, Yoshihide Yamamoto, Motoya Hayashi, Shinichi Tanabe, 2021. Operation of air-conditioning and sanitary equipment for SARS-CoV-2 infectious disease control. *Japan Architectural Review*. 4(4): 608–620.2021. https://doi.org/10.1002/2475-8876.12238

Upper-Room Ultraviolet Germicidal Irradiation (UVGI)

Source
https://www.cdc.gov/coronavirus/2019-ncov/community/ventilation/uvgi.html

VIEWPOINT

Airborne Spread of SARS-CoV-2 and a Potential Role for Air Disinfection

Edward A. Nardell, MD
Brigham and Women's Hospital, Division of Global Health Equity, Harvard Medical School, Boston, Massachusetts.

Ruvandhi R. Nathavitharana, MD, MPH
Beth Israel Deaconess Medical Center, Division of Infectious Diseases, Harvard Medical School, Boston, Massachusetts.

Supplemental content

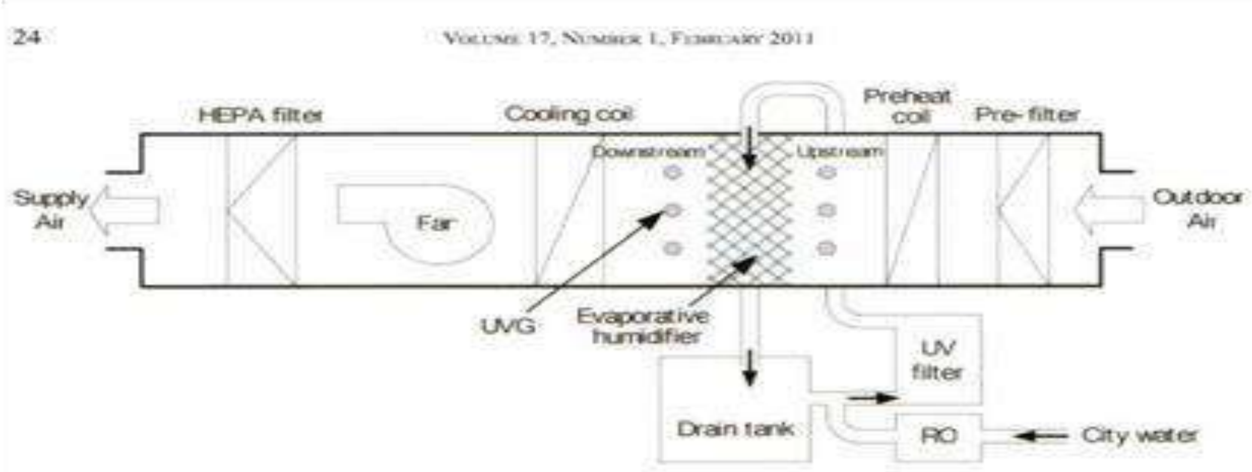
An April 2, 2020, expert consultation from the National Academies of Sciences, Engineering, and Medicine to the White House Office of Science and Technology Policy concluded that available studies are consistent with the potential aerosol spread of severe acute respiratory syndrome coronavirus 2 (SARS-CoV-2), not only through coughing and sneezing, but by normal breathing.[1] This response to a White House request for a rapid review of the literature likely contributed to the recommendation from the US Centers for Disease Control and Prevention (CDC) that healthy persons wear nonmedical face coverings, when in public, to reduce virus spread from undiagnosed infectious cases.

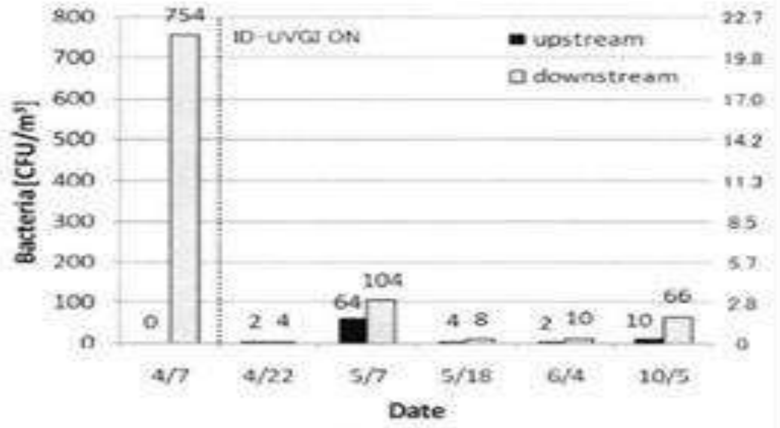
Although clear evidence of person-to-person airborne transmission of SARS-CoV-2 has not been published, an airborne component of transmission is likely based on other respiratory viruses such as SARS, Middle East respiratory syndrome, and influenza. While air sampling for SARS-CoV-2, in a clinical setting, has demonstrated detectable viral RNA, the extent of transmis-

ing costs when intake air must be heated or cooled and dehumidified. Portable room air cleaners may be a potential solution, but depending on room volume, their specified clean air delivery rates generally add too few equivalent air changes per hour to provide adequate protection against airborne infection. In contrast, commercially available upper-room GUV air disinfection (with an effective rate of air mixing) has been shown, in clinical settings, to reduce airborne tuberculosis transmission by 80%, equivalent to adding 24 room air changes per hour.[3]

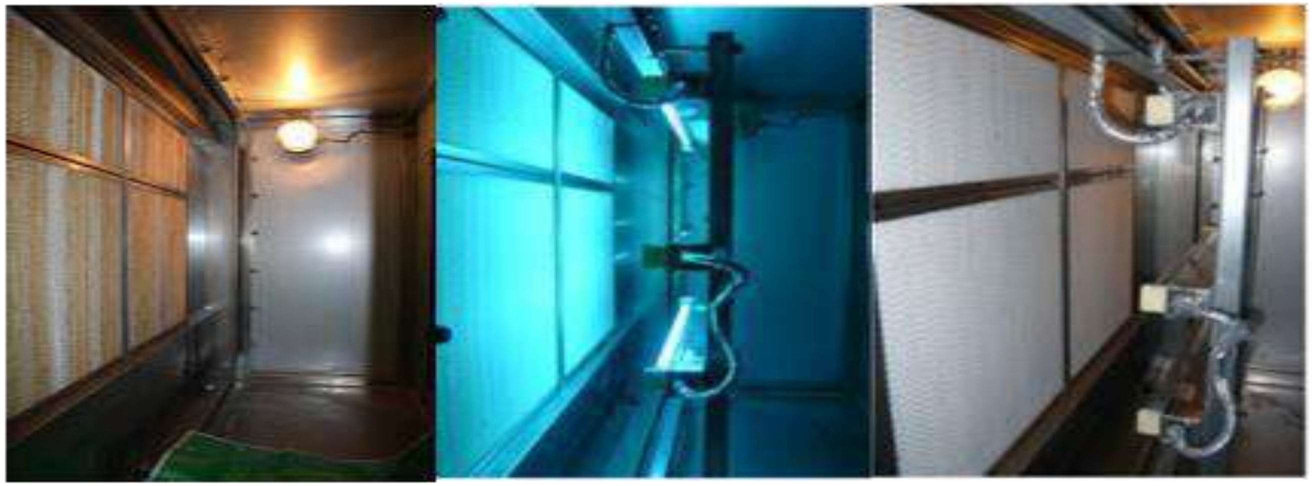
In resource-limited settings, where air disinfection depends on natural ventilation, upper-room GUV may be increasingly important as windows are closed due to use of ductless air conditioners in response to global warming and severe outdoor air pollution. In resource-rich settings, upper-room GUV can be retrofitted into most areas with sufficient ceiling height. GUV technology is effective against viruses that have been tested, including influenza and SARS-CoV-1.[4,5]

JAMA July 14, 2020 Volume 324, Number 2



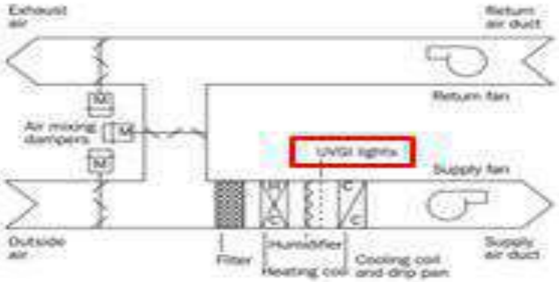


(a) Bacteria



Source: Minki Sung, Shinsuke Kato, U Yanagi, Minsik Kim, Mitsuo Harada, Disinfection performance of ultraviolet germicidal irradiation systems for the microbial contamination on an evaporative humidifier, *HVAC&R RESEARCH*, 17 1 22-30, 2011

Effect of ultraviolet germicidal lights installed in office ventilation systems on workers' health and wellbeing: double-blind multiple crossover trial



Dick Menzies, Julia Popa, James A Hanley, Thomas Rand, Donald K Milton

Summary

Background Workers in modern office buildings frequently have unexplained work-related symptoms or combinations of symptoms. We assessed whether ultraviolet germicidal irradiation (UVGI) of drip pans and cooling coils within ventilation systems of office buildings would reduce microbial contamination, and thus occupants' work-related symptoms.

Methods We undertook a double blind, multiple crossover trial of 771 participants. In office buildings in Montreal, Canada, UVGI was alternately off for 12 weeks, then turned on for 4 weeks. We did this three times with UVGI on and three times with it off, for 48 consecutive weeks. Primary outcomes of self-reported work-related symptoms, and secondary outcomes of endotoxin and viable microbial concentrations in air and on surfaces, and other environmental covariates were measured six times.

Introduction

The office or office-like indoor environment is now the workplace for more than 70% of the work force in North America and western Europe.[1,2] Most of these people work in buildings with sealed exterior shells, in which highly automated heating, ventilation, and air conditioning systems, run by only one or two operators, control the indoor environment.[3] Many reports have documented health problems related to this work environment;[2-4] their resolution could result in health benefits for as many as 15 million workers, and economic benefits of $5–75 billion per year, in the USA alone.[2]

Most occurrences of illnesses in workers in these buildings, which are termed non-specific building-related illnesses[3] or symptoms[2], remain unexplained,[2,3] but evidence suggests that microbial contamination of building air-conditioning systems plays a part. Cross-sectional studies have consistently detected increased

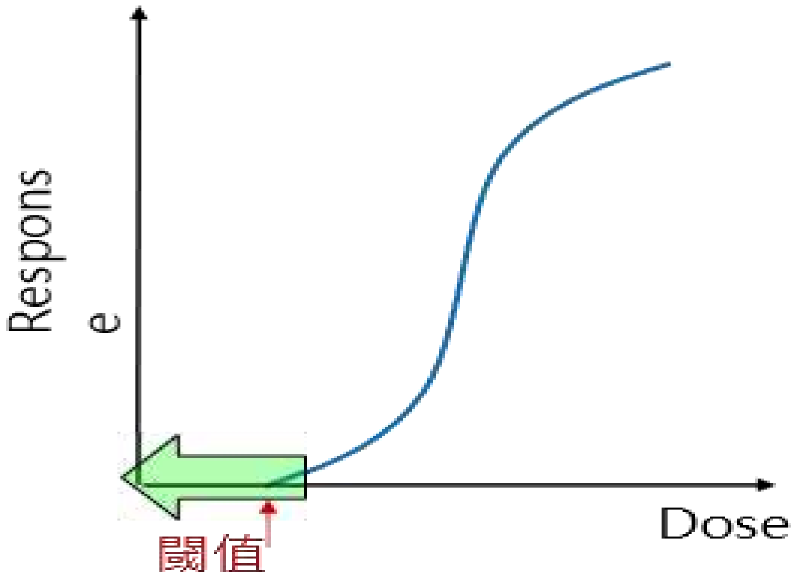
Table 7
The impact of UV radiation on coronaviruses.

UV type	Virus	UV irradiance	Distance	Time	Log reduction	Reference
UV-C (254 nm)	CCoV	7.1 µW/cm²	1 m	72 h	4.8	Pratelli (2008)
UV LED (267 nm)	HCoV-OC43	6–7 mJ/cm²	No data	60 s	3	Gerchman et al. (2020)
UV LED (297 nm)	HCoV-OC43	32 mJ/cm²	No data	60 s	3	Gerchman et al. (2020)
UV LED (286 nm)	HCoV-OC43	13 mJ/cm²	No data	90 s	3	Gerchman et al. (2020)
UV-C (254 nm)	MERS-CoV	–	1.22 m	5 min	5.91	Bedell et al. (2016)
UV-C (254 nm)	MERS-CoV	0.2 J/cm²	No data		>3.8	Eickmann et al. (2018)
UV-C (254 nm)	MERS-CoV	0.05 J/cm²	No data		2.9	Eickmann et al. (2018)
UV-A (365 nm)	SARS-CoV-1	2133 µW/cm²	3 cm	15 min	0	Darnell et al. (2004)
UV-C (254 nm)	SARS-CoV-1	134 µW/cm²	No data	15 min	5.3	Kariwa et al. (2006)
UV-C (254 nm)	SARS-CoV-1	134 µW/cm²	No data	60 min	6.3	Kariwa et al. (2006)
UV-C (254 nm)	SARS-CoV-1	4016 µW/cm²	3 cm	6 min	4 (below detection limit)	Darnell et al. (2004)
UV-C (260 nm)	SARS-CoV-1 (strain P9)	>90 µW/cm²	80 cm	60 min	6	Duan et al. (2003)
UV-A (365 nm)	SARS-CoV-2	540 mW/cm²	3 cm	9 min	1	Heilingloh et al. (2020)
UV-C (222 nm)	SARS-CoV-2	0.1 mW/cm²	24 cm	10 s	0.94	Kitagawa et al. (2020)
UV-C (222 nm)	SARS-CoV-2	0.1 mW/cm²	24 cm	30 s	2.51	Kitagawa et al. (2020)
UV-C (222 nm)	SARS-CoV-2	0.1 mW/cm²	24 cm	60 s	2.51	Kitagawa et al. (2020)
UV-C (222 nm)	SARS-CoV-2	0.1 mW/cm²	24 cm	300 s	2.51	Kitagawa et al. (2020)
UV-C (254 nm)	SARS-CoV-2	1940 mW/cm²	3 cm	9 min	Complete virus inactivation	Heilingloh et al. (2020)
UV-C (254 nm)	SARS-CoV-2	3.7 mJ/cm²	220 mm	–	3	Bianco et al. (2020)
UV-C (254 nm)	SARS-CoV-2	0.849 mW/cm²	No data	0.8 s	Reduced below a detectable level	Storm et al. (2020)
PX-UV	SARS-CoV-2	–	1 m	1 min	3.53	Simmons et al. (2020)
PX-UV	SARS-CoV-2	–	1 m	2 min	>4.52	Simmons et al. (2020)
PX-UV	SARS-CoV-2	–	1 m	5 min	>4.12	Simmons et al. (2020)
DUV LED	SARS-CoV-2	3.75 mJ/cm²	20 mm	1 s	0.9	Inagaki et al. (2020)
DUV LED	SARS-CoV-2	37.5 mJ/cm²	20 mm	10 s	3.1	Inagaki et al. (2020)
DUV LED	SARS-CoV-2	225 mJ/cm²	20 mm	60 s	>3.3	Inagaki et al. (2020)

CCoV — canine coronavirus, HCoV-OC43 — human coronavirus OC43, MERS-CoV — Middle Eastern respiratory syndrome coronavirus, SARS-CoV-1 — severe acute respiratory syndrome coronavirus 1, SARS-CoV-2 — severe acute respiratory syndrome coronavirus 2, PX-UV — pulsed-xenon ultraviolet light, UV LED — UV light-emitting diodes, DUV LED — deep ultraviolet light-emitting diode.

Source
Science of the Total Environment 770 (2021) 145260. https://doi.org/10.1016/j.scitotenv.2021.145260

摘要



劑量-反應關係

呼吸道感染的主要工學緩解策略是將暴露負荷控制在閾值以下，也就是降低室內有活力病毒的濃度。

1) 通過通風稀釋。提高空氣稀釋率也 意味著可以縮短與病毒的接觸時 間。

2) 通過過濾去除汙染物或增加每小時的等效換氣量。

3) 通過紫外線（UVGI）進行消毒。

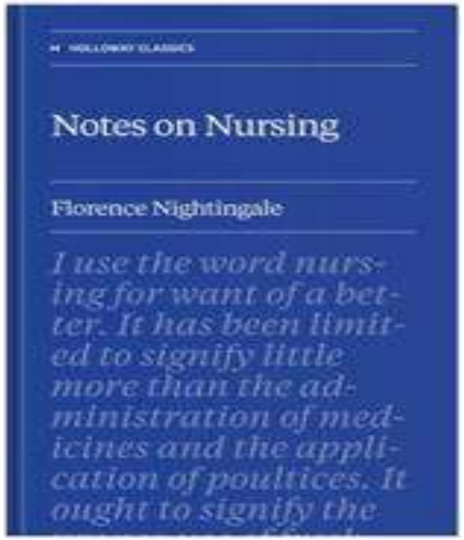
健康的居住;五項基本要點

健康的居住;五項基本要點
在確保房屋健康方面有五個基本點:
1. 純淨的空氣　通風
2. 純淨的水。
3. 有效的排水。
4. 潔淨。　過濾
5. 光線。　GUV
沒有這些，房子就不會健康。而他們越是缺乏，就越是不健康。

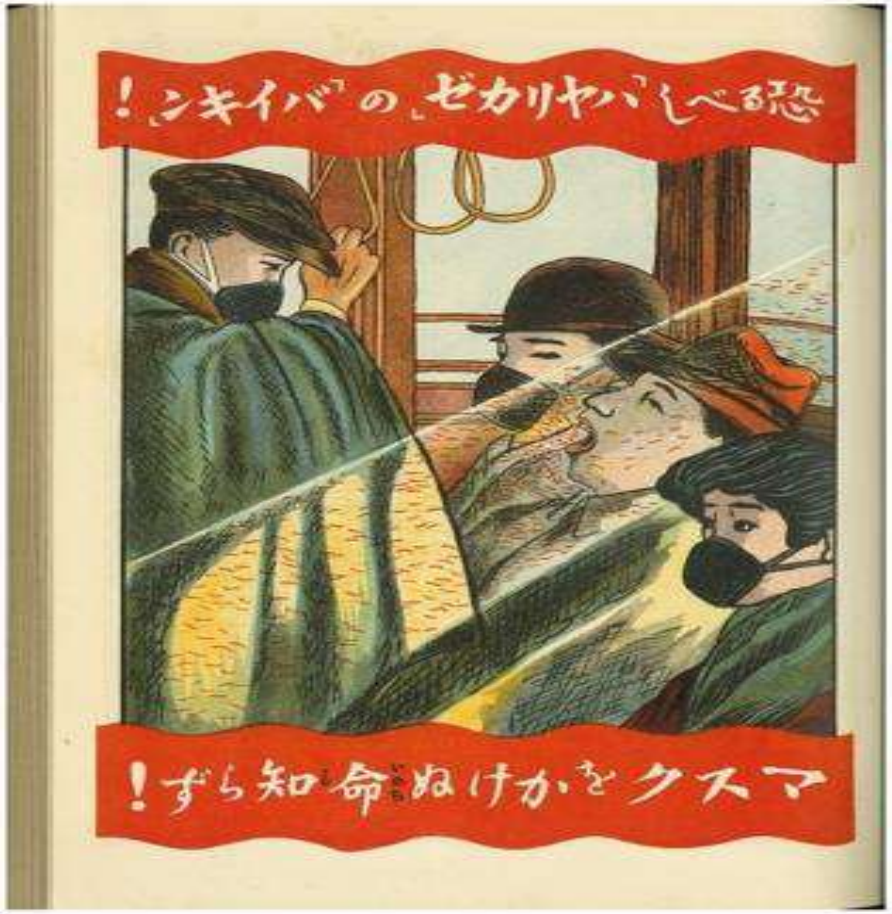
Florence Nightingale

1820.5.12～1910.8.13

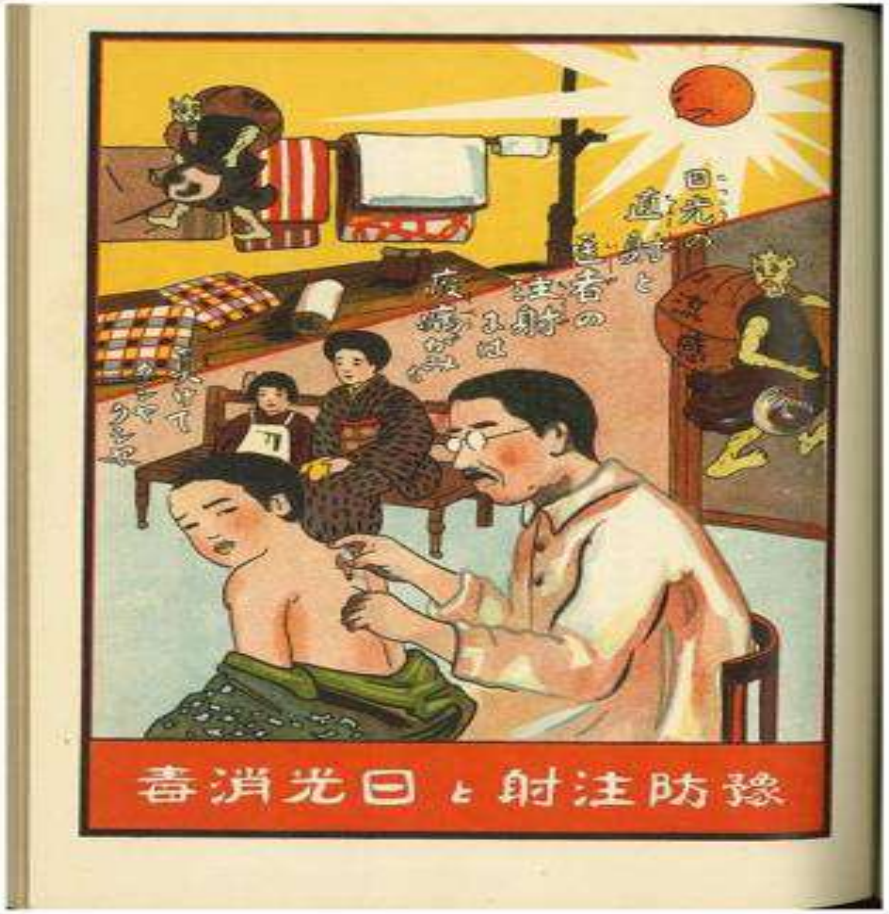
Notes on Nursung, 1859



Mask: air filtration



Sunlight: UV sterilization



「Influenza」Japanese government (March, 1922)

一個世紀以來沒有變化的事情

- 傳染病的三要素和基本對策.

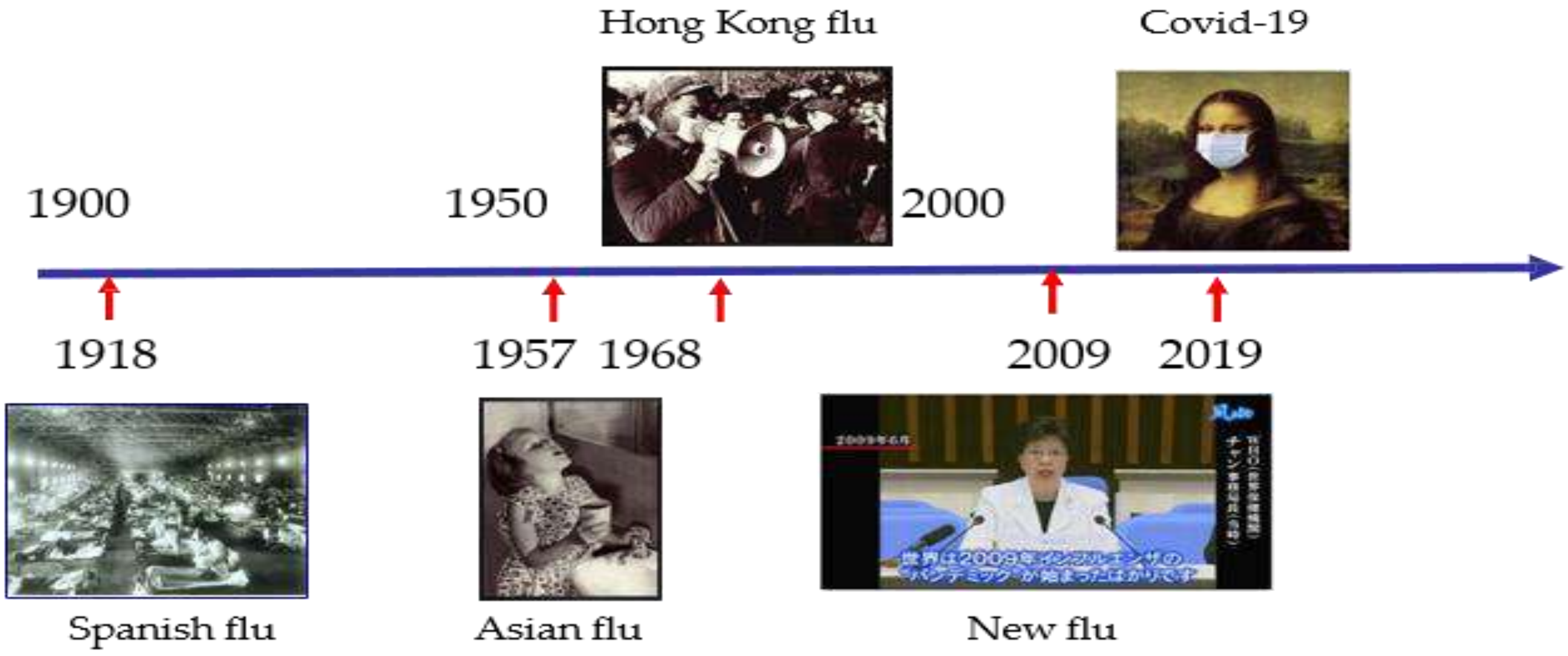
在過去的100年裡，有哪些進展

- 病原體檢測和分析技術的進步。
隨著下一代測序儀的商業化，我們現在可以對一切進行測序。
- 病原體控制技術的進步。
- 詳細的氣流分析技術可以找到有效的通風方法。
- 高性能的過濾器已經投入實際使用。
- 紫外線技術的實際應用。

為未來的傳染病做准備

針對Covid-19大流行病的工學上的對策將幫助我們控制未來發生的新傳染病。

20世紀後發生的大流行病



日本講座
結束

台灣講座講者介紹

許媛婷 副秘書長/博士後研究員

台灣講座

楊崑德 教授/醫師

演講主題

抗老!抗疫!!免疫最給力

【現職】

馬偕紀念醫院淡水院區兒童過敏免疫風濕科主治醫師
馬偕兒童醫院兒童醫學研究部主任
馬偕醫學院長期照護研究所兼任教授
國立陽明大學臨床醫學研究所兼任教授
國防醫學院微生物免疫所合聘教授
曾任高雄長庚紀念醫院副院長
曾任秀傳醫療體系副營運長

【學歷】

國防醫學院National Defense Medical Center, Ph.D.
猶他大學醫學院病理科博士後研究
哈佛醫學院分子藥理實驗室博士後研究
國防醫學院醫學系

【參與學會】

台灣過敏氣喘暨臨床免疫學會 理事長
中華民國免疫學會 常務監事
台灣胎幼兒期防治成人疾病學會

歡迎台灣講座

楊崑德 教授/醫師

15:20~16:10

抗老!抗疫!！免疫最給力
(樂齡免疫力與免疫治療)

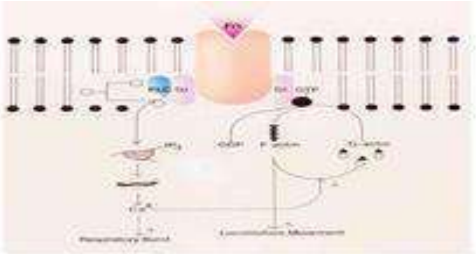
報告人 楊崑德

馬偕兒童醫院研究室主任
馬偕醫學院長照所
陽明交通大學臨醫所　兼任教授
國防醫學院微免所
台灣過敏氣喘暨臨床免疫學會理事長

闖蕩國內外著名醫學中心跨領域修得40年功夫

話說“抗老!!免疫最給力” 我的貴人/貴單位

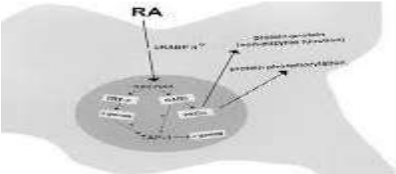
1) University of Utah: Infection Immunity 1987-1989



Yang KD, et al. (Dissertation)
J Infect Dis. 1988;158:823-30.
J Infect Dis. 1990;161:236-41.
Pediatr Infect Dis J. 1993;12:234-9.
J Cell Physiol. 1994;158:347-53.

貴單位/貴人的教導:
韓紹華、朱夢麟
丁明哲、蕭孟芳
University Of Utah:
Harry R. Hill

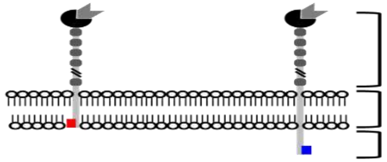
2) Harvard University: Dana-Farber Cancer Institute 1991-1992



Blood 1994;83(2):490-6.
Exp Cell Res. 1994;211(1):1-5
BBRC. 1994; 200(3):1650-7
Acta Hematol 1998;99(4):191-9

Harvard University:
Mentors: Donald Kufe
Richard M. Stone

3) Johns Hopkins University: Glycobiology 2007-2008



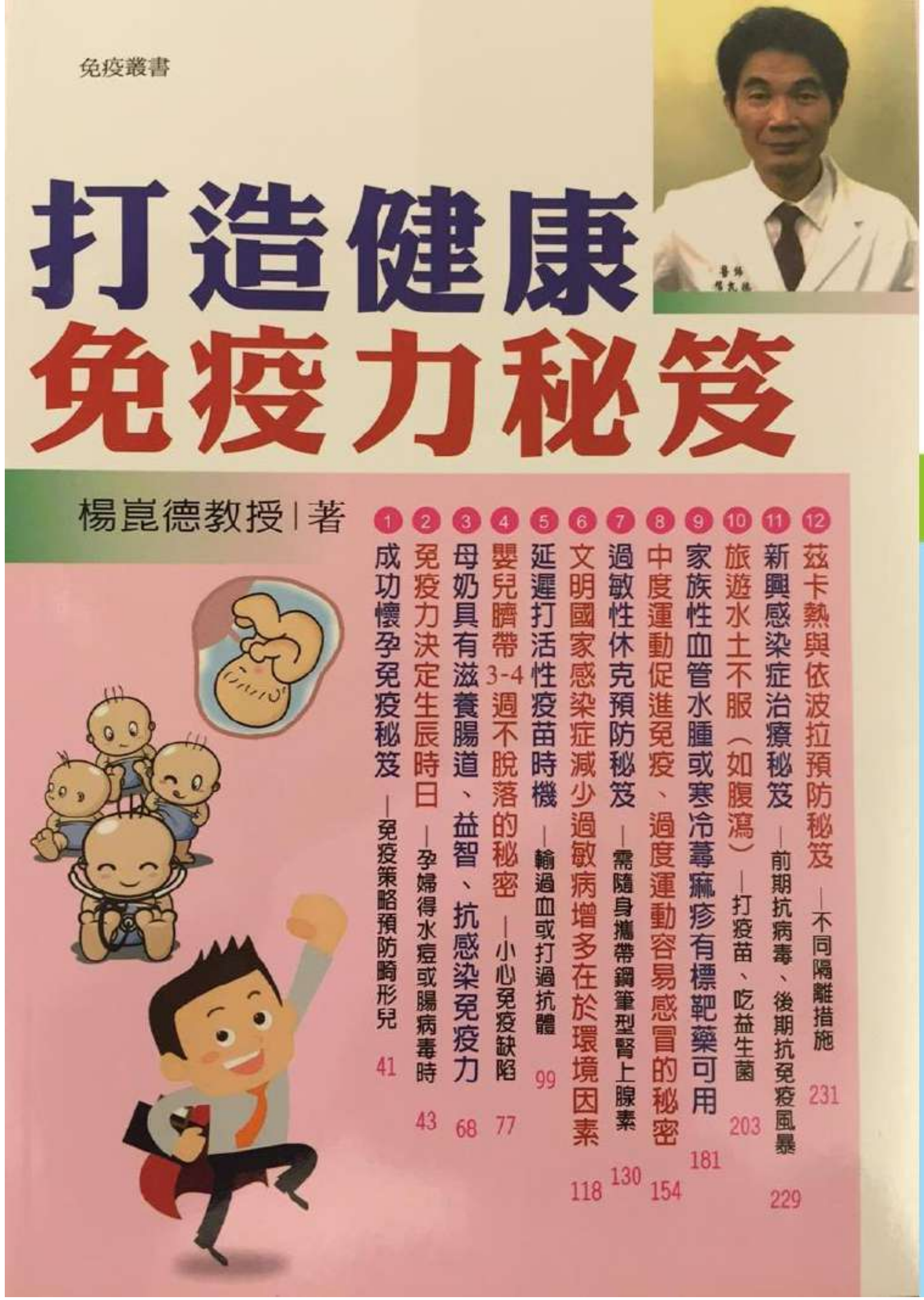
Nat Med. 2010; 16(10):1128-33
J Proteome Res. 2011;10(3):1305-15
Am J Pathol. 2012;180(2):862-71
Virulence. 2014;5(6):673-9.

擔任高雄長庚副院長1997-2003:
謝貴雄、黃嘯谷
王清貞、李英雄

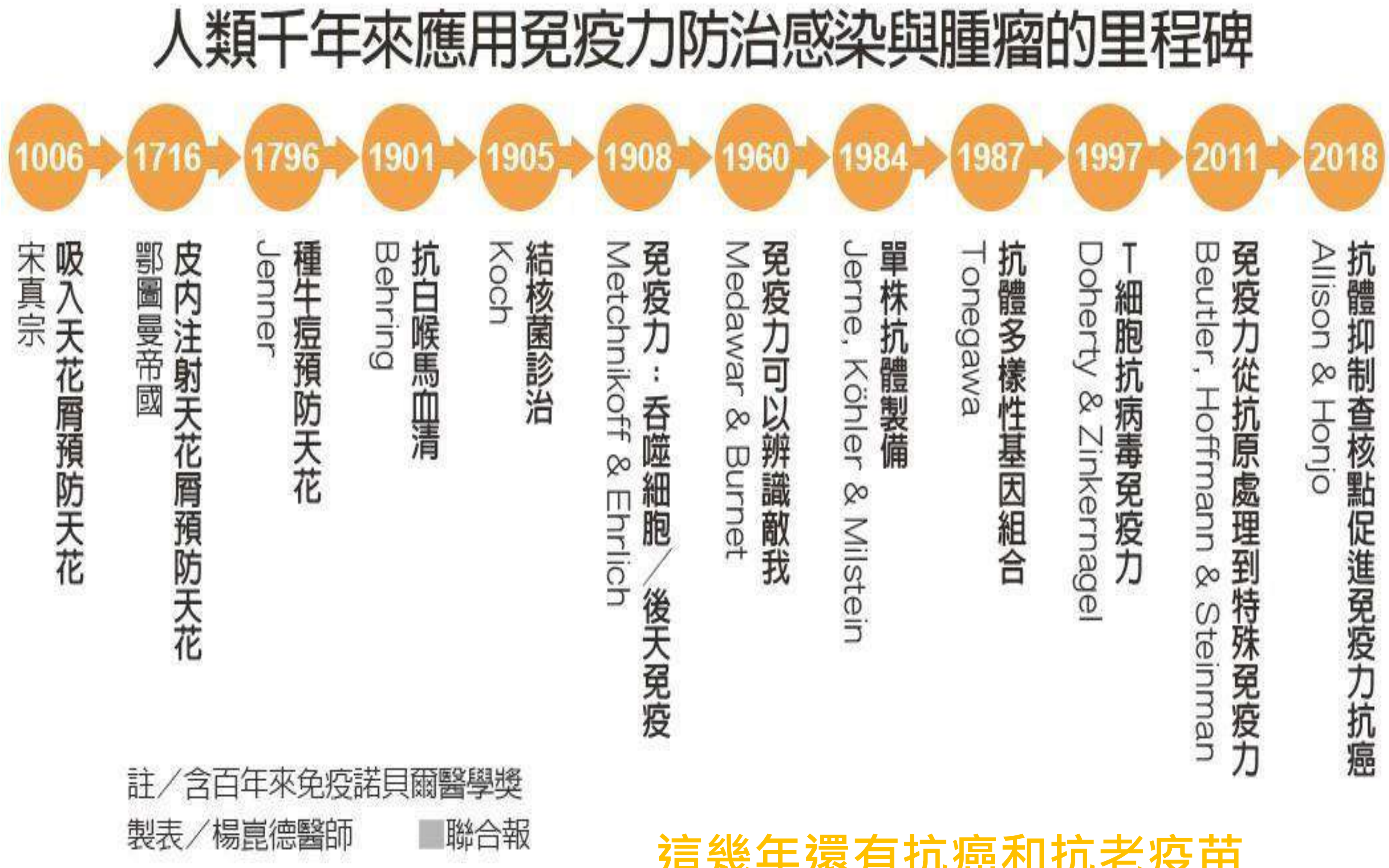
4) Mackay Memorial Hospital/Medical College, 2015-

Allergy. 2015;70(11):1477-84.; Front Immunol. 2016;7:615. ; Front Immunol. 2017 Apr 25;8:487.; Pain. 2018;160:210-223.; Front Genet. 2019 May 31;10:471.; Pediatr Blood Cancer. 2020 Feb;67(2):e28075.; IJMS. 2021 June 20.; Children. March. 2022.

馬偕醫院/醫學院


免疫叢書
打造健康
免疫力秘笈
醫師 楊崑德
楊崑德教授｜著
1 成功懷孕免疫秘笈—免疫策略預防畸形兒 41
2 免疫力決定生辰時日—孕婦得水痘或腸病毒時 43
3 母奶具有滋養腸道、益智、抗感染免疫力 68
4 嬰兒臍帶3-4週不脫落的秘密—小心免疫缺陷 77
5 延遲打活性疫苗時機—輸過血或打過抗體 99
6 文明國家感染症減少過敏病增多在於環境因素 118
7 過敏性休克預防秘笈—需隨身攜帶鋼筆型腎上腺素 130
8 中度運動促進免疫、過度運動容易感冒的秘密 154
9 家族性血管水腫或寒冷蕁痲疹有標靶藥可用 181
10 旅遊水土不服（如腹瀉）—打疫苗、吃益生菌 203
11 新興感染症治療秘笈—前期抗病毒、後期抗免疫風暴 229
12 茲卡熱與依波拉預防秘笈—不同隔離措施 231

248 健康世界叢書
抗老!!
免疫最給力
增訂版
楊崑德教授｜著
1 老人免疫退化—造就感染／發炎／癌症三大天敵
2 老人記憶細胞多原始細胞少—蘊藏感染與炎症溫床
3 預防老人感染老化與腫瘤—打抗老、抗癌、抗感染疫苗
4 提升老人免疫力—運動、荷爾蒙、維生素、返老食物
5 延年益壽之道—在早期儲備免疫力
6 腫瘤坐大的秘密—免疫監控失序(剎車過度)
7 抗體標靶免疫失序—可治療腫瘤、抗老化
8 根治腫瘤—期盼免疫細胞治療
9 抗老—疫苗和幹細胞扮演重要角色
10 回春的機會—補充(restore)、替代(replace)與重塑(reprogram)
11 免疫小分子「攻核心為上」—調節細胞核訊息促進免疫力
12 免疫力始於「第一類接觸」—環境上皮互動先於免疫細胞

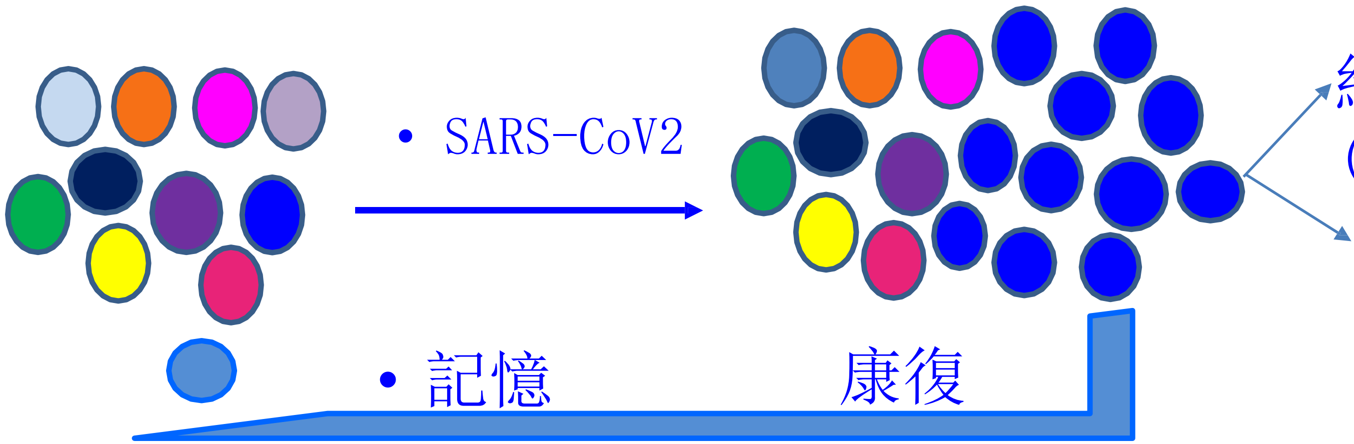


這幾年還有抗癌和抗老疫苗
–請閱讀「抗老!!免疫最給力」

免疫力靜如線民/動如特殊作戰

- 血中免疫細胞50億顆
(5000/mm³隨機分佈)

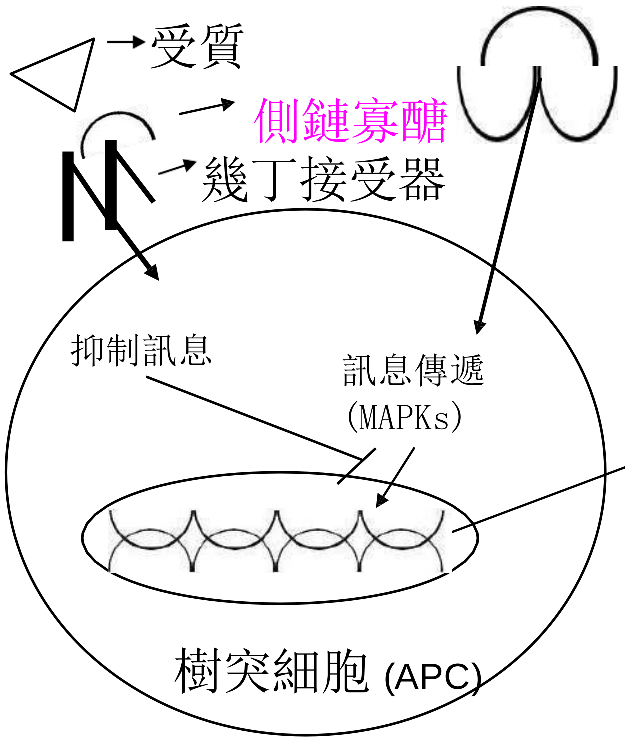
感染後擴增50億顆
(特殊軍事行動專一)



細胞素風暴
(ARDS/MIS-C)
長新冠
(Long Covid)

- 老人很多記憶(但模糊) 年輕人記憶好(經驗少)

免疫力是靜動(陰陽)五行分化調和為用



←受質(醣蛋白/側鏈寡醣)

← 幾丁(醣質)接受器

PAMI

PRRs

細胞素; 干擾素等
(IL-12; IFN α;
IL-17; CCL17;
IL-10; TGFβ)

免疫陽性(Th1)反應
(抗感染/腫瘤,具自體攻擊性)

免疫陰性(Th2)反應
(親過敏,也具抗體增加)

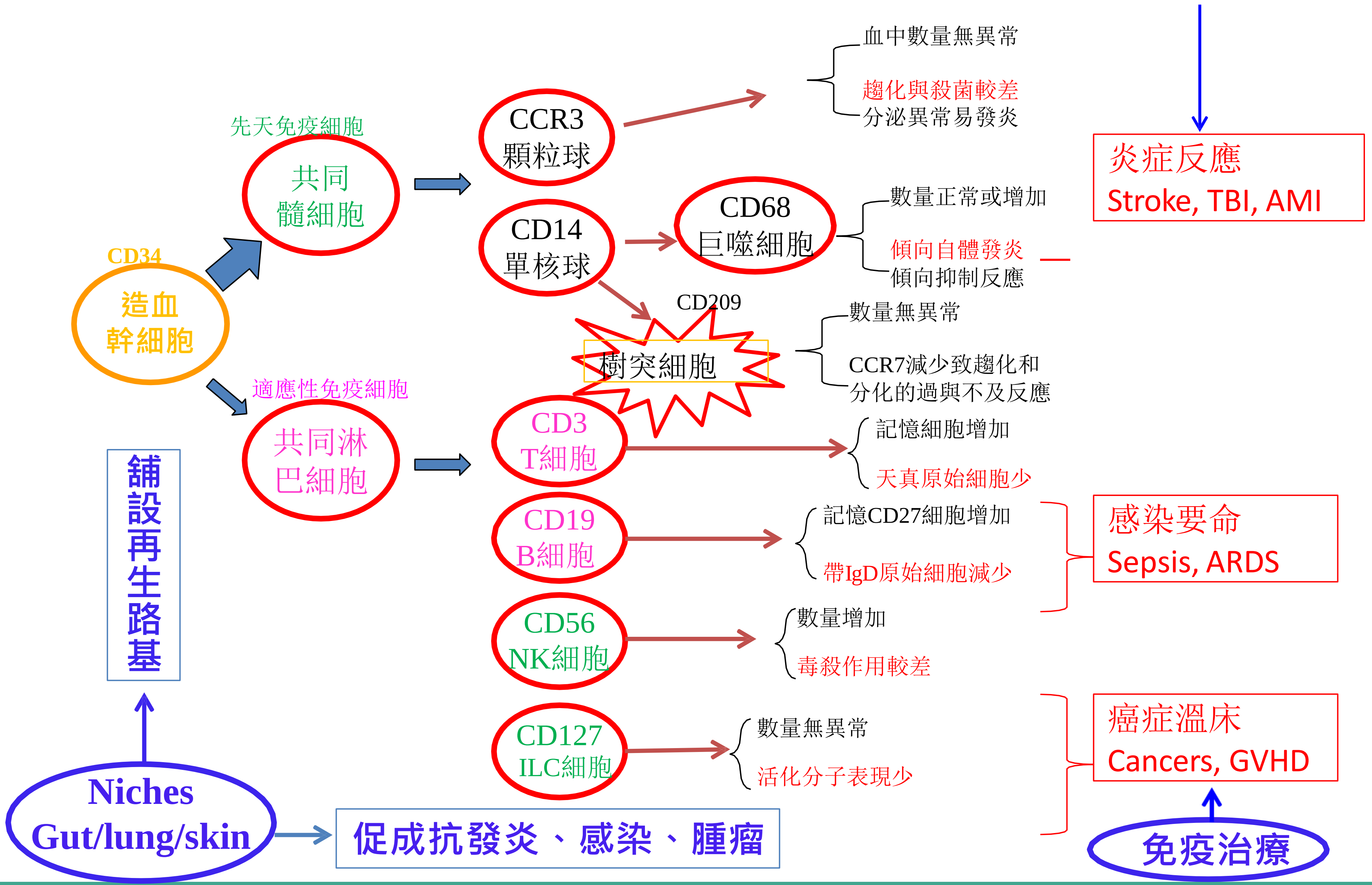
免疫第三管道(Th3,Tr1,Treg)
反應(抗過敏,抗風濕、抗發炎

自體免疫管道(Th17)反應(風
濕、發炎,抗過敏)

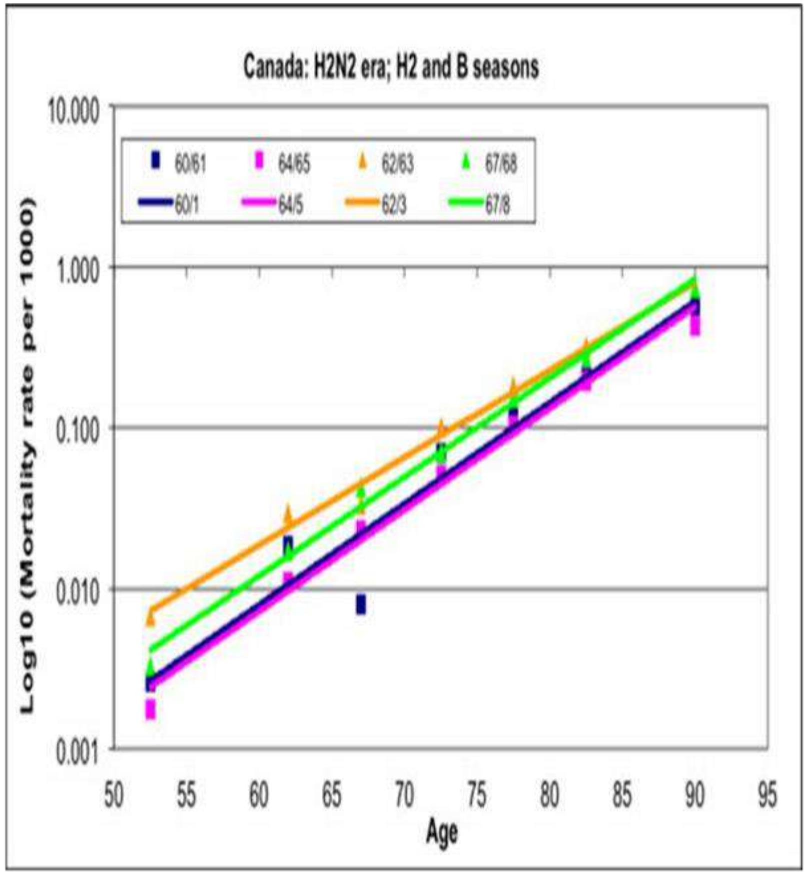
早期免疫反應: 抗原處理白血
球 (Innate immunity)

適應性特殊免疫反應
(Adaptive immunity)

老人免疫力失序造就老人3大天敵



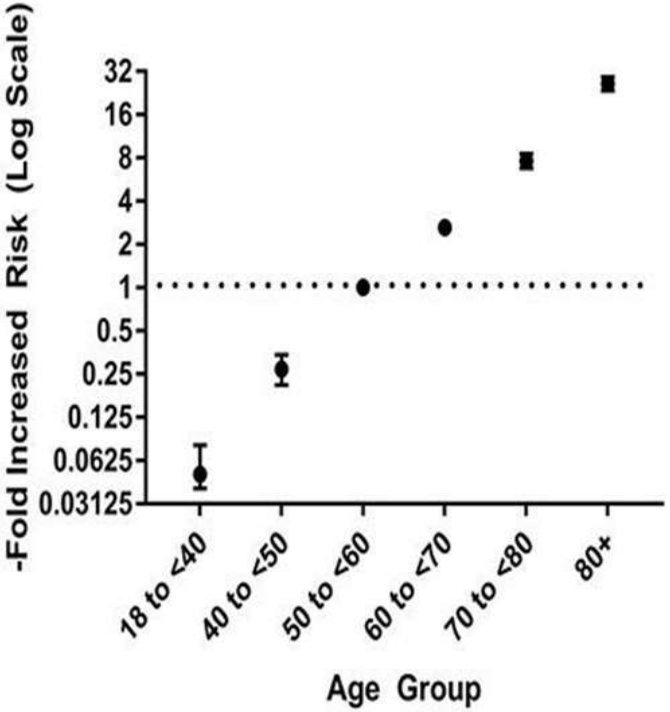
新興感染老人死亡率直線上升



Reichert, et al. *BMC Medicine* 2012, **10**:162

UK derived from 5683 Deaths

1/2020.05.06.20092999v1.full.pdf+html



老人三大天敵的免疫對策

1. 3大天敵都有疫苗
2. 疫苗也會被突破
3. 早期保養:運動/飲食/環保/維生素
4. 早期診療: 慧中秀外
5. 再生醫療: 補充/替換/調整/破門而入

1. 老人免疫退化—造就感染／發炎／癌症三大天敵
2. 老人記憶細胞多原始細胞少—蘊藏感染與炎症溫床
3. 預防老人感染老化與腫瘤—打抗老、抗癌、抗感染疫苗
4. 提升老人免疫力—運動、荷爾蒙、維生素、返老食物
5. 延年益壽之道—在早期儲備免疫力
6. 腫瘤坐大的秘密—免疫監控失序(剎車過度)
7. 抗體標靶免疫失序—可治療腫瘤、抗老化
8. 根治腫瘤—期盼免疫細胞治療
9. 抗老—疫苗和幹細胞扮演重要角色
10. 回春的機會—補充(restore)、替代(replace)與重塑(reprogram)
11. 免疫小分子「攻核心為上」—調節細胞核訊息促進免疫力
12. 免疫力始於「第一類接觸」—環境上皮互動先於免疫細胞

老人需要的疫苗

VACCINE ▼ AGE GROUP ▶	19–21 years	22–26 years	27–49 years	50–59 years	60–64 years	≥65 years
Influenza[2,*]	1 dose annually					
Tetanus, diphtheria, pertussis (Td/Tdap)[3,*]	Substitute 1-time dose of Tdap for Td booster; then boost with Td every 10 years					Td/Tdap[3]
Varicella[4,*]	2 doses					
Human papillomavirus (HPV)[5,*] Female	3 doses					
Human papillomavirus (HPV)[5,*] Male	3 doses					
Zoster[6]					1 dose	
Measles, mumps, rubella (MMR)[7,*]	1 or 2 doses			1 or 2 doses		
Pneumococcal (polysaccharide)[8,9]	1 or 2 doses					1 dose
Meningococcal[10,*]	1 or more doses					
Hepatitis A[11,*]	2 doses					
Hepatitis B[12,*]	3 doses					

*Covered by the Vaccine Injury Compensation Program

- (Yellow) For all persons in this category who meet the age requirements and who lack documentation of vaccination or have no evidence of previous infection
- (Purple) Recommended if some other risk factor is present (e.g., on the basis of medical, occupational, lifestyle, or other indications)
- (Striped) Tdap recommended for ≥65 if contact with <12 month old child. Either Td or Tdap can be used if no infant contact
- (White) No recommendation

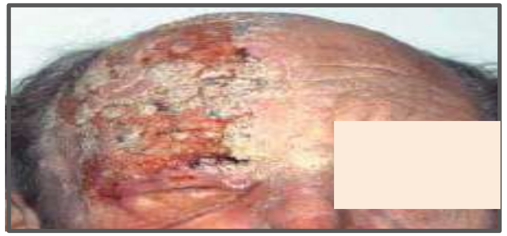
流感, 每年

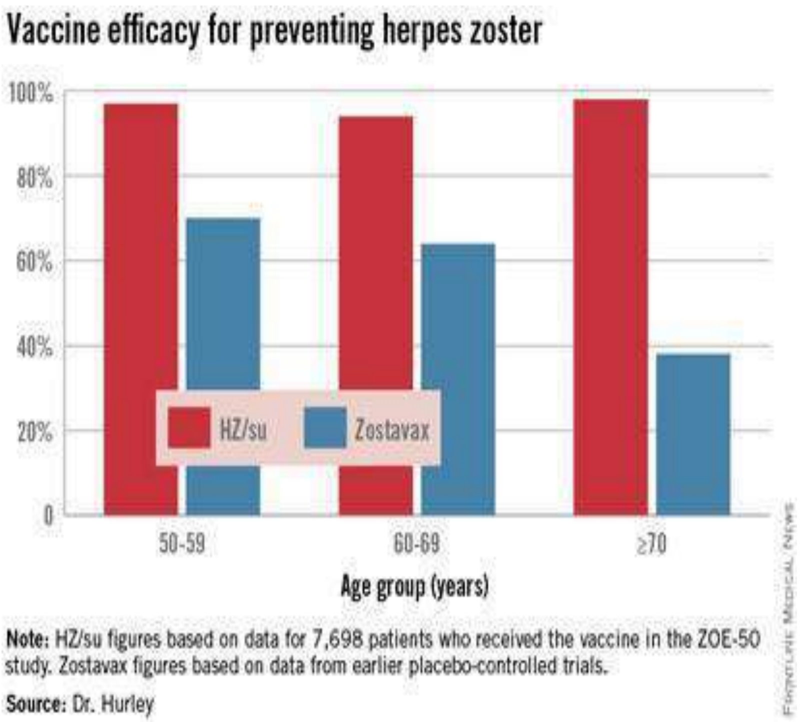
百日咳, 每10年

帶狀泡疹, 1劑

肺炎鏈球菌

帶狀疱疹是一種令人痛苦的疾病，可能會產生嚴重而持久的併發症





(N Engl J Med. 2015 May 28;372[22]:2087-96

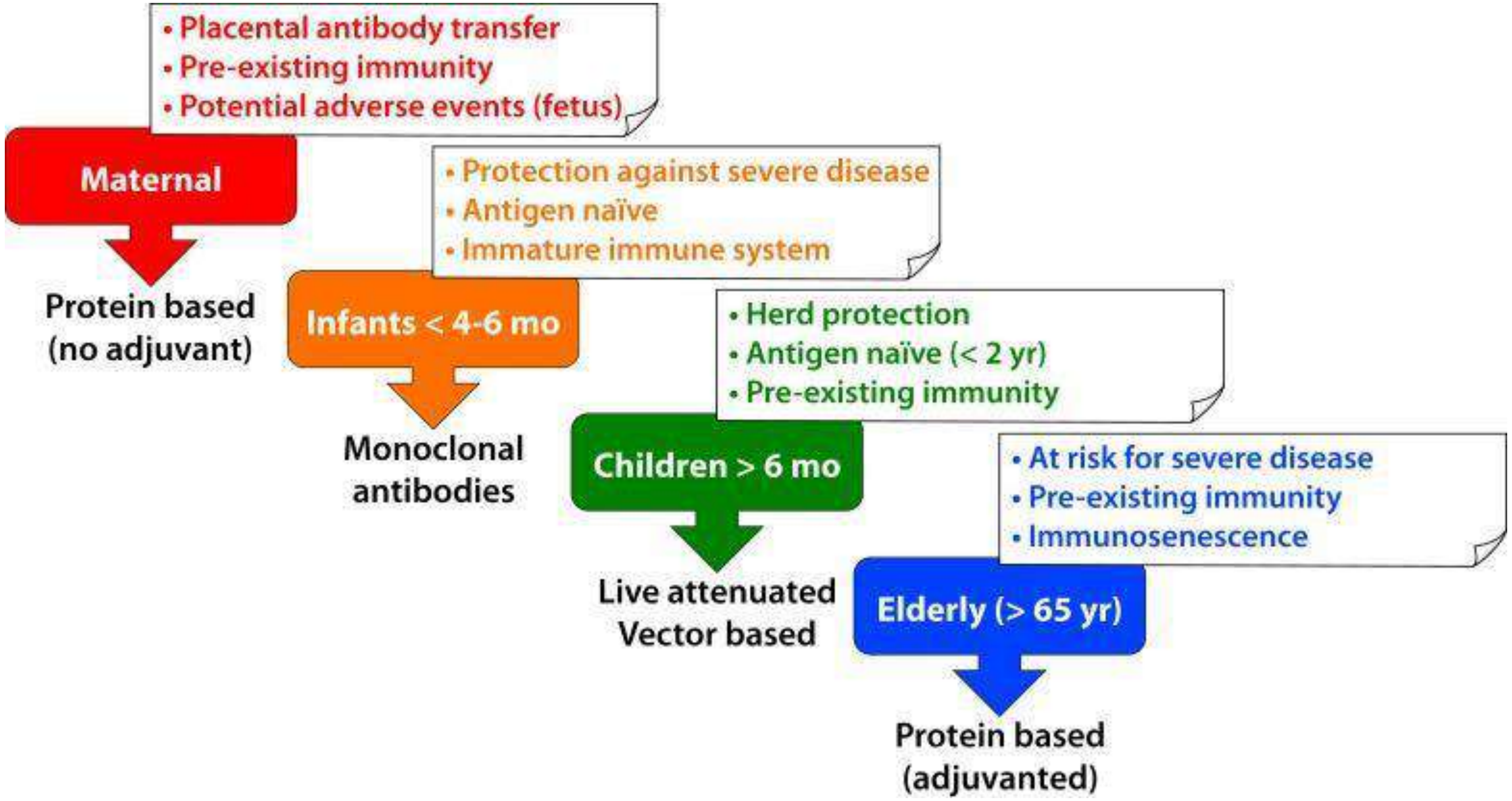
Shingrix TFDA License Approval (December 2021); 9月開打!!

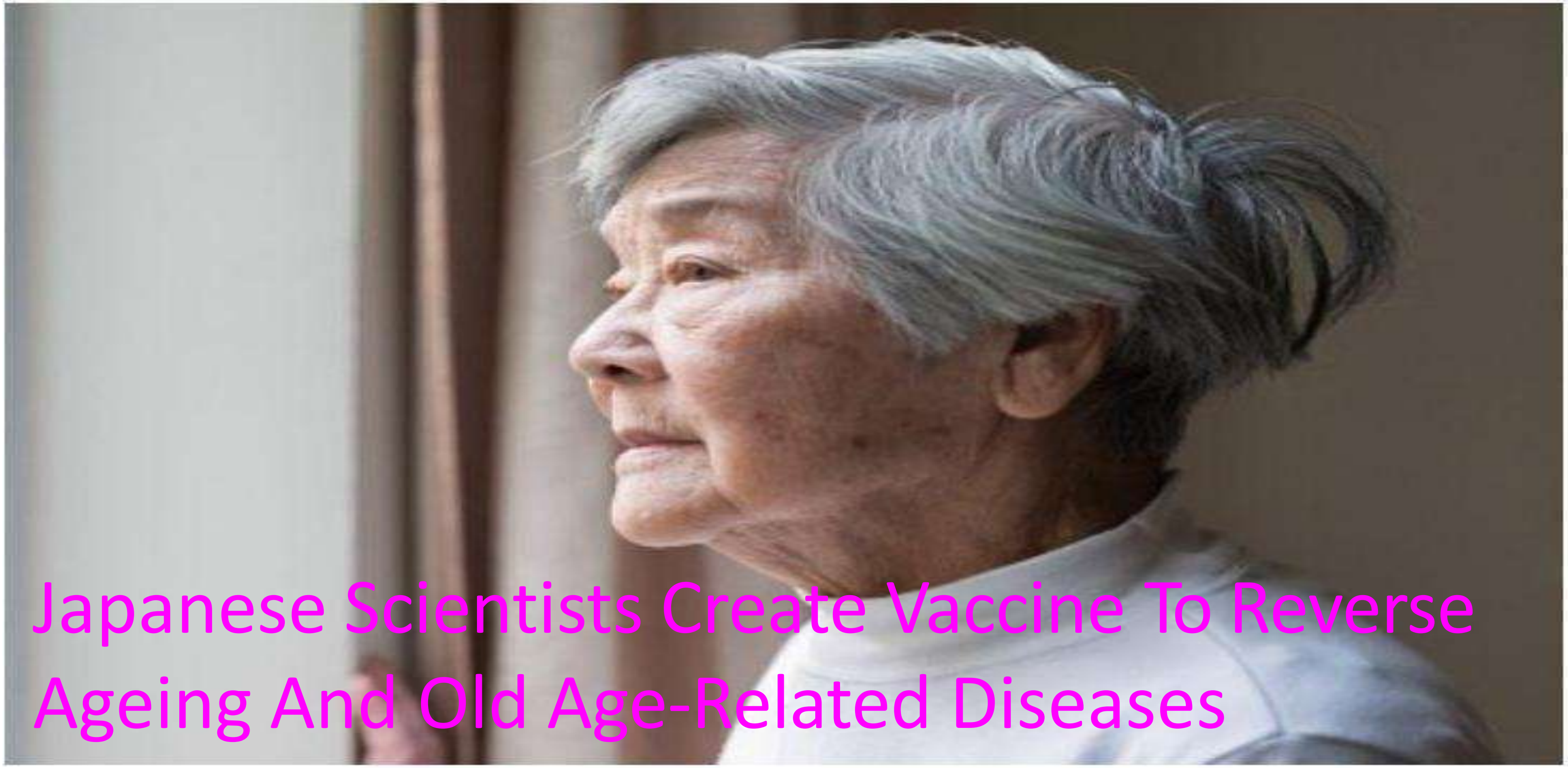
- **禁忌症**
  - ✓ 對本疫苗的活性成份或任何組成嚴重過敏。

    (Recombinant vs. Live vaccines: No immune compromised)
- **與其他疫苗併用:**
  - ✓ Shingrix 可與未使用佐劑的季節性流感疫苗、23 價肺炎鏈球菌多醣體疫苗(23-valent pneumococcal polysaccharide vaccine, PPV23)或抗原減量的白喉-破傷風-無細胞性百日咳疫苗(diphtheria-tetanus-acellular pertussis vaccine, dTpa)同時施打。
  - ✓ 如果要將Shingrix 和另一種注射型疫苗同時施打，一定要將兩種疫苗施打於不同的注射部位。
  - ✓ 如果已打過Zostavax，何時打Shingrix: 5 年、3年、1年、6個月or 2個月?
  - ✓ 如果得到Zoster，何時可以打Zostarax 或 Shingrix: 1年、6個月、2個月or 1個月?
  - ✓ 如果50歲打Zostarax 或 Shingrix: 幾年後再打? 10 年 or 15 年?

老人呼吸道融合病毒疫苗也將問世

The Journey to A Respiratory Syncytial Virus Vaccine
Mejias A, et al. AAAI 2020;125: 36-46.





Japanese Scientists Create Vaccine To Reverse Ageing And Old Age-Related Diseases

iStock

Killing "zombie cells"

[*Japanese scientists develop vaccine to eliminate cells behind aging*. (2021,](#) December 13). The Japan Times.

The anti-ageing vaccine was administered in mice to decrease senescent cells or zombie cells. According to Minamino, the vaccine may be useful in treating arterial stiffening, diabetes, and other age-related diseases. Findings were from the study were published in Nature Aging on Friday.

新興感染黃金早期治療定律　Covid-19免疫治療3步曲

避免重症或死亡的關鍵:
1)對(禽)流感3天內給克流感
2)*Covid-19在3~4天內給抗病毒藥或高效價抗體(血漿)
3)伊波拉在3天內使用單株抗 體和匡列接觸者在暴露後 接種疫苗

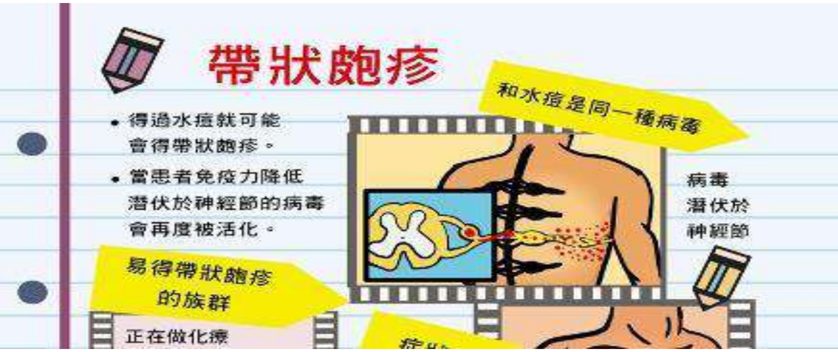
1)主動免疫(疫苗)籌備 ←

2) 被動免疫抗體或是藥物使用 →

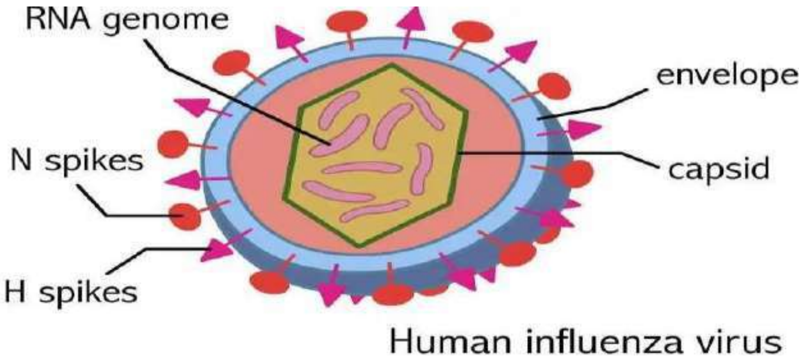
3) 抗細胞素風暴 →

這個道理類似新生兒預防B型肝炎: 出生1天內打高效價抗體比3天打好; 3天內打比7天內打好!!

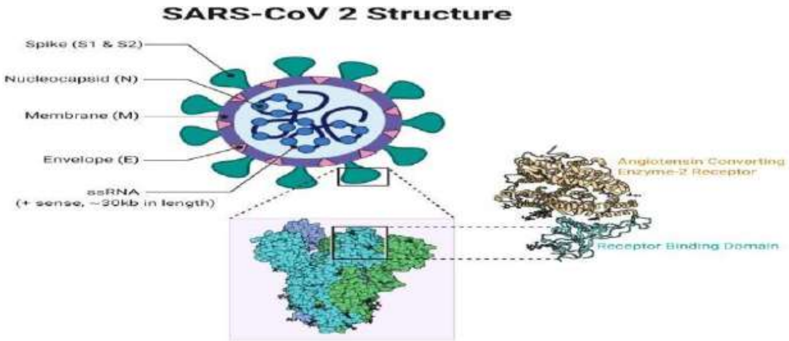
帶狀泡疹/Covid-19 /流感; 請早期3天內治療



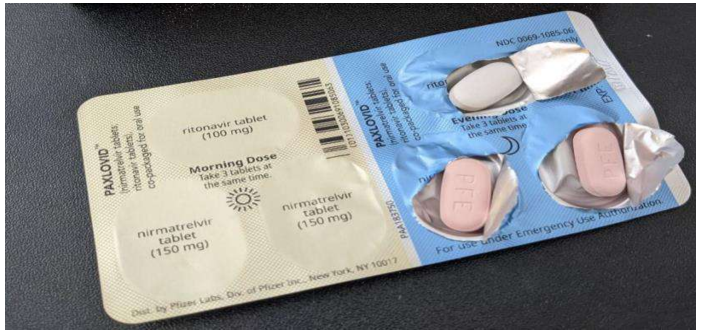
>>



>>



>>



防治新興感染的致死率: 針對毒性/免疫/環境

1. 病毒擴散 (感染源毒性)

1 快速診斷: 核酸/抗原檢測　早期診斷
2 樣本液態切片
3 病原與宿主基因型分析　早期治療

2. 免疫風暴 (宿主免疫異常)

1 暴露後疫苗注射/克流感
2 被動免疫(MoAbs, 高價血漿)
3 類固醇, anti-IL6, Anti-IL-1, 持續血液透析, 葉克膜…

3. 醫療合併症 (環境與資源的失調)

1 防疫裝備, 保護免疫缺乏者,
2 藥物交叉反應, 管路/設備維護,
3 醫院過度負荷, 併發症…etc.


REVIEW article

Front. Immunol., 15 July 2021 | https://doi.org/10.3389/fimmu.2021.690976

Immunopathogenesis of Different Emerging Viral Infections: Evasion, Fatal Mechanism, and Prevention

Betsy Yang[1] and Kuender D. Yang[2,3,4*]

[1]Department of Medicine, Kaiser Permanente Oakland Medical Center, Oakland, CA, United States
[2]Division of Medical Research, Mackay Children's Hospital, Taipei, Taiwan
[3]Institute of Clinical Medicine, National Yang Ming University, Taipei, Taiwan
[4]Department of Microbiology & Immunology, National Defense Medical Center, Taipei, Taiwan

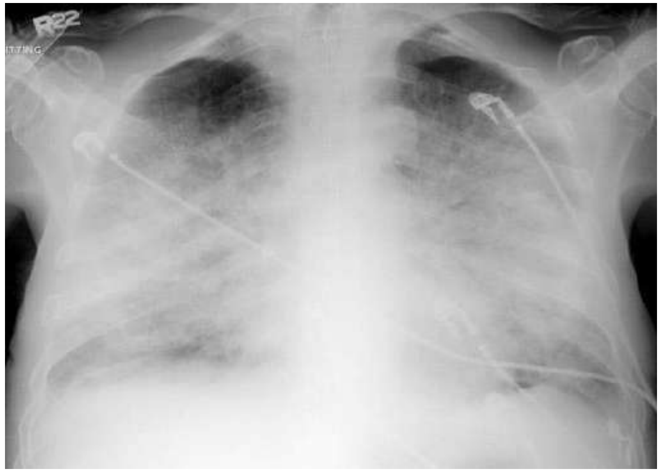
Different emerging viral infections may emerge in different regions of the world and pose a global pandemic threat with high fatality. Clarification of the

Download Article　Export citation

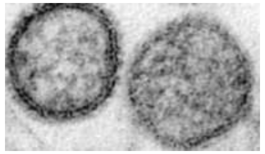
928 TOTAL VIEWS

View Article Impact

病毒直接殺人不多;
大多是自己傷害或是被人傷害

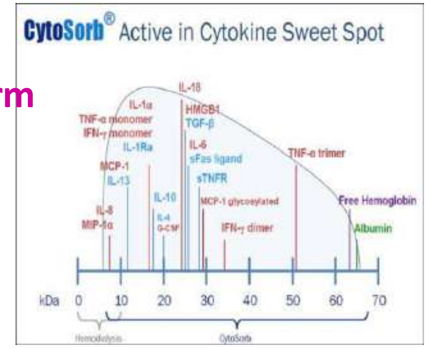


病毒
Virus



醫療合併症
Sepsis, comorbid

細胞素風暴
Cytokine storm



Early Dx & Biomarkers for Rx

Differential diagnosis (Triple rapid tests)

早期治療、不如早期保養

運動: 中等運動

飲食: 益生菌/抗老食物/8分飽

環保: 口罩/空污/好接觸

陽光/維生素D

賀爾蒙/小分子

運動促進免疫力

Customized exercise for stroke patients

https://www.hindawi.com › journals › bmri ▾ 翻譯這個網頁

Effects of Music Aerobic Exercise on Depression and Brain ...

由 SH Yeh 著作 · 被引用 42 次 —]. We found that the combination of music and exercise enhanced immunity, induced the release of beneficial hormones such as BDNF, and decrease...

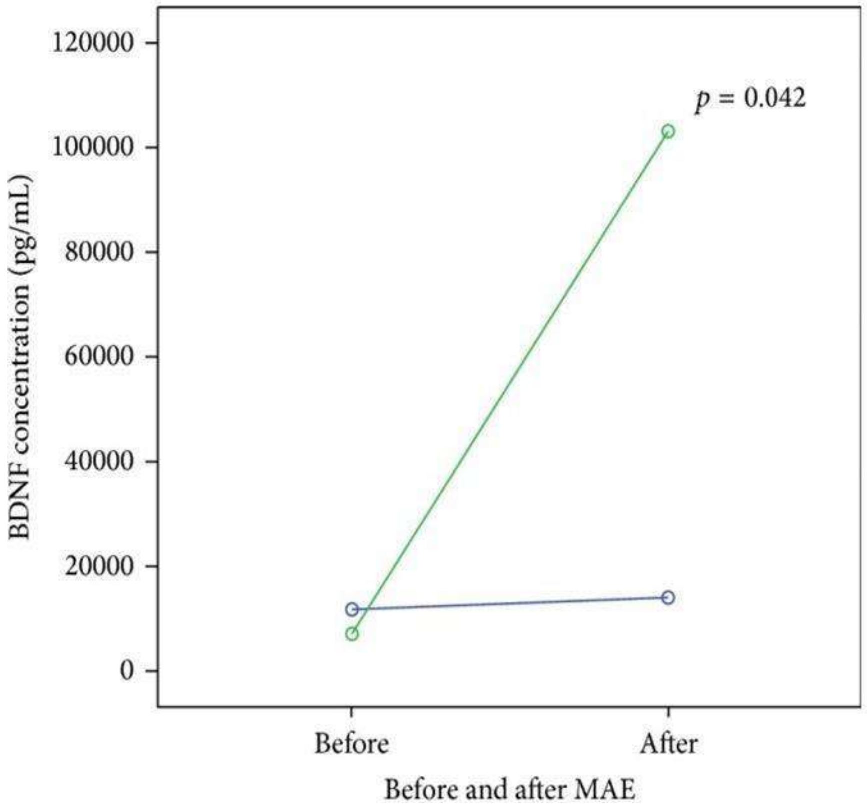
Abstract · Introduction · Methods · Discussion

中等度運動: 年齡最高心律70-80%

心律(HR)/220-年齡(Age)x100% = 70-80%

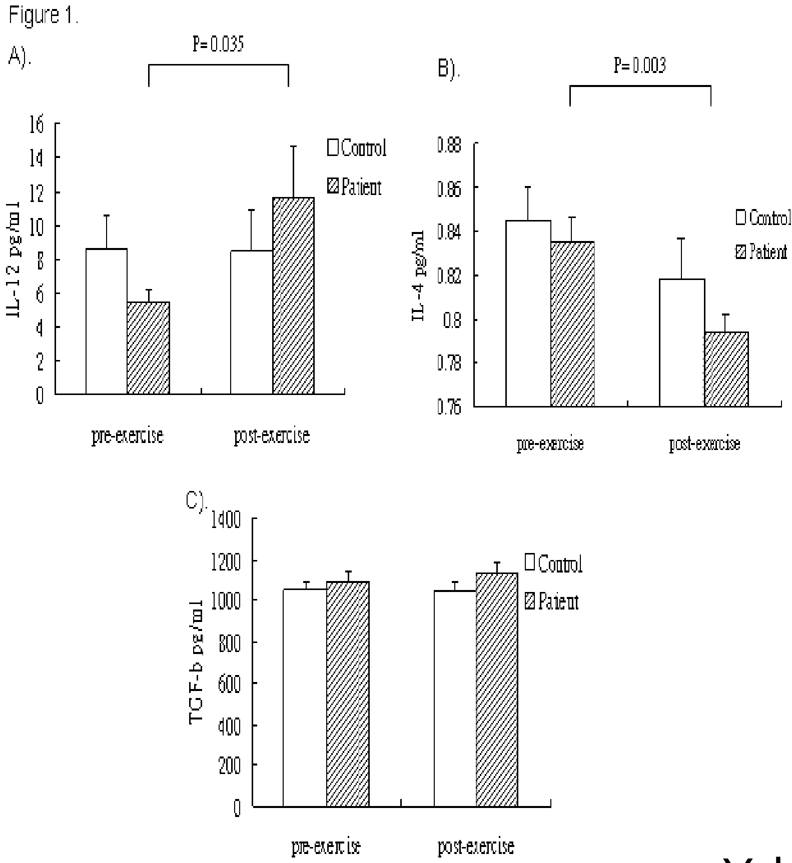
例如60歲運動HR=120, 120/220-60=75%

每週3日、每次1小時;
12週後促進BDNF增加

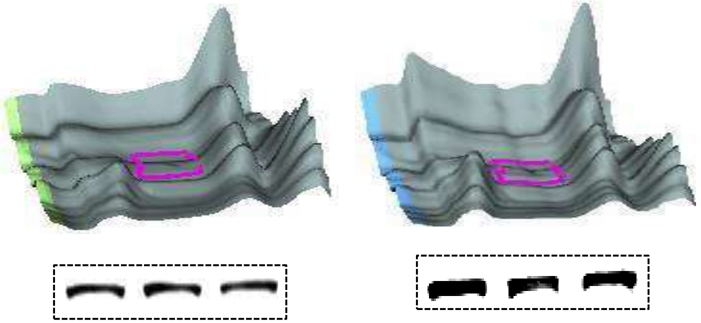


銀髮族/運動增強免疫

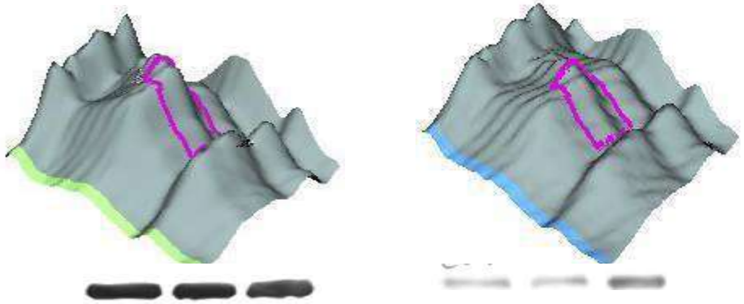
太極拳增強免疫陽性(Th1)



太極拳(TCC)增加 H 因子



太極拳(TCC)減少αAT 因子

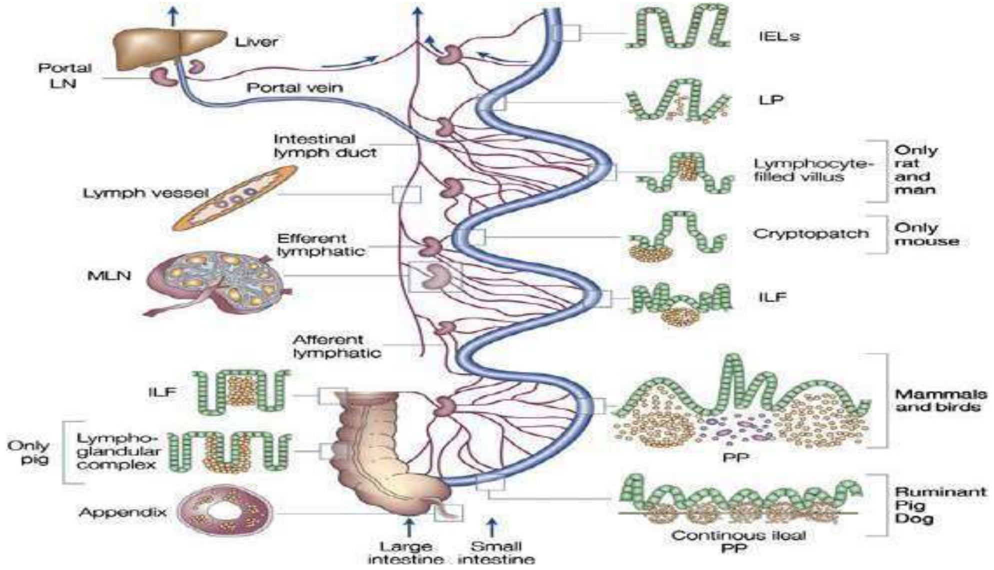


Yeh & Yang, Br J Sports Med. 2008 Apr 2

Yeh & Yang, Diabetes Care. 2007;30:716-8

益生菌、維生素、賀爾蒙

1. 益生菌



2. 魚油//維生素D:
抗感染調免疫

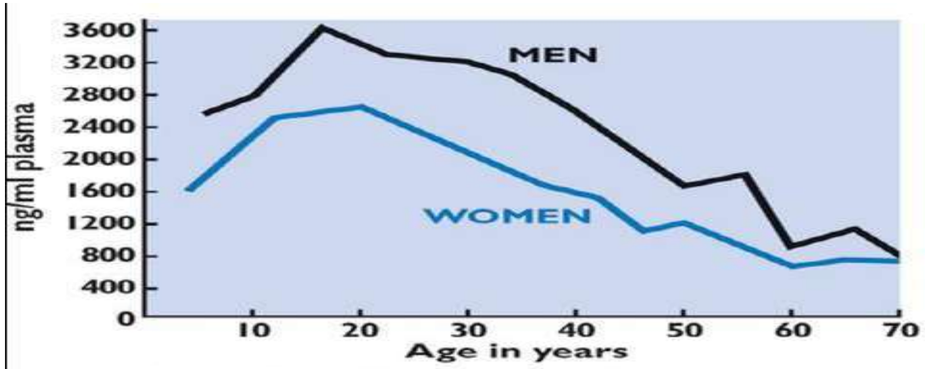
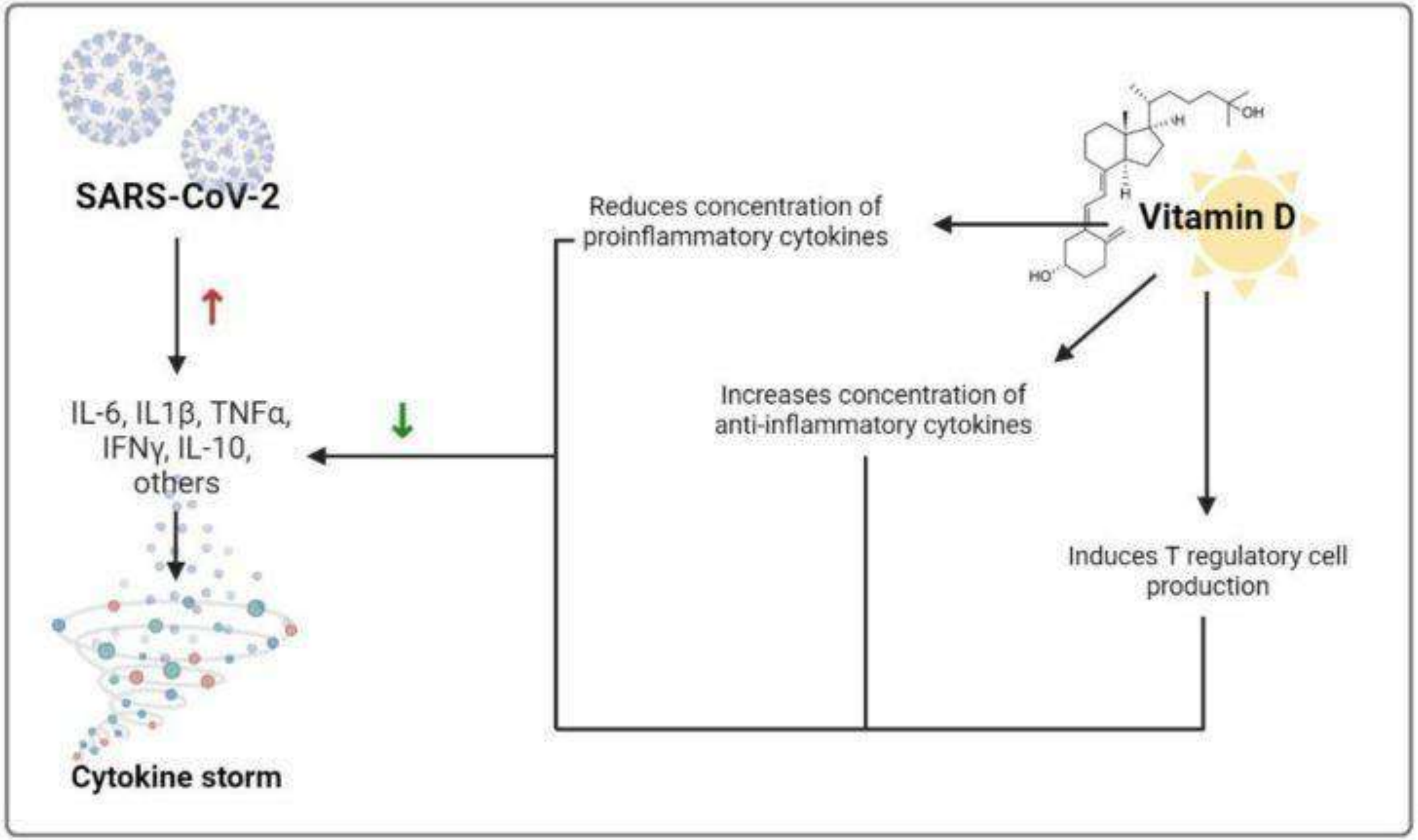


Fig 1. Decline of DHEA-S with age.[3]

3. 補充DHEA(脫氫表雄酮)
有助老人性賀爾蒙提升
男性DHEA小於2μg/ml
女性小於1μg /ml
考慮DHEA25mg/天

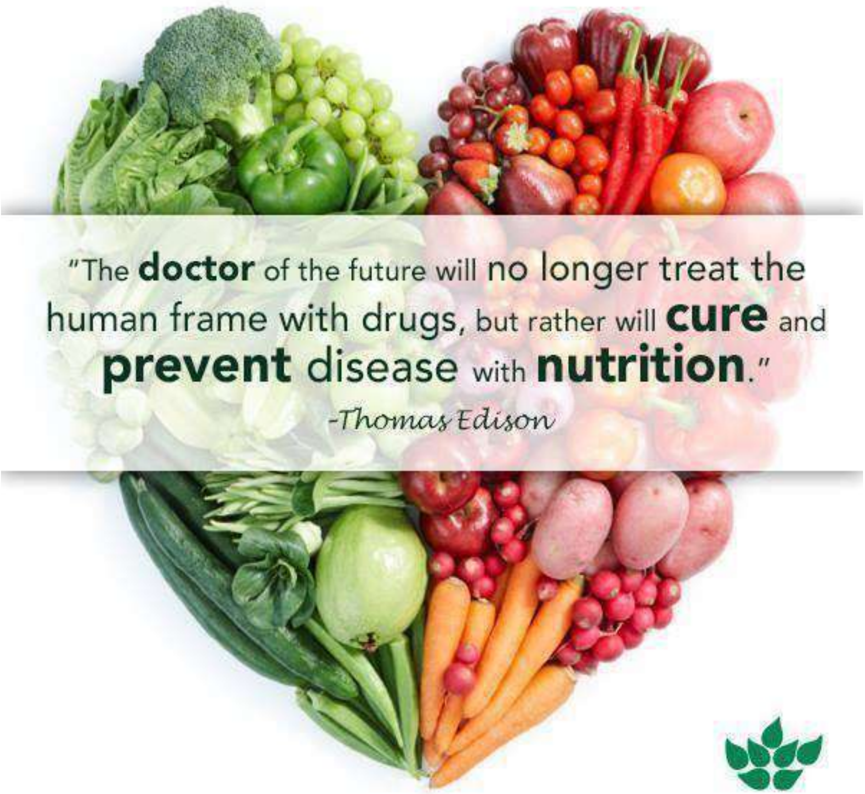
Vitamin D: A Role Also in Long COVID-19?

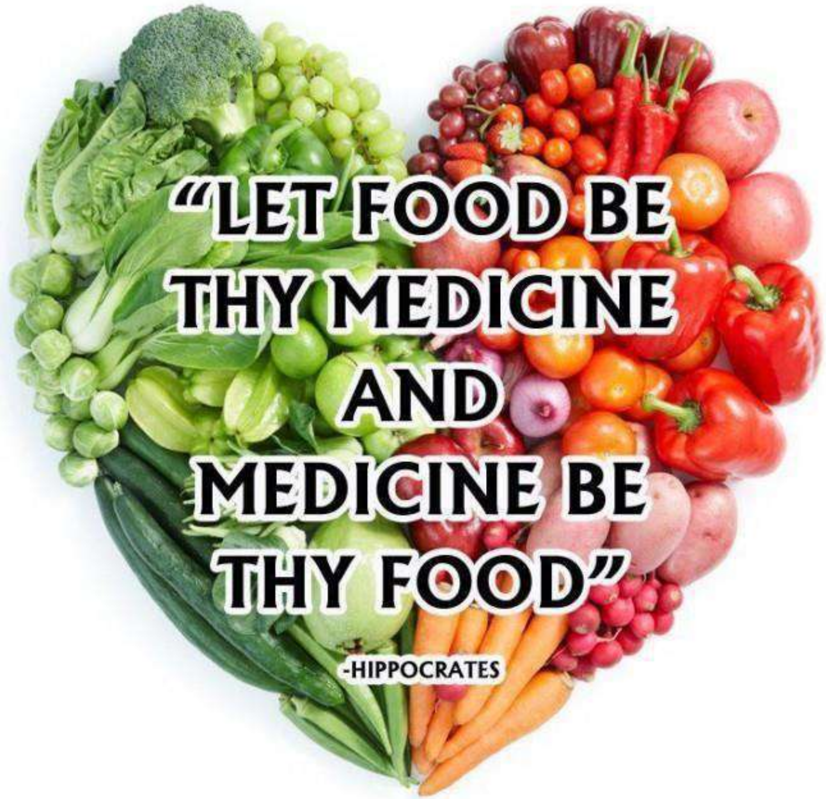
Nutrients. 2022 Apr 13;14(8):1625. doi: 10.3390/nu14081625.



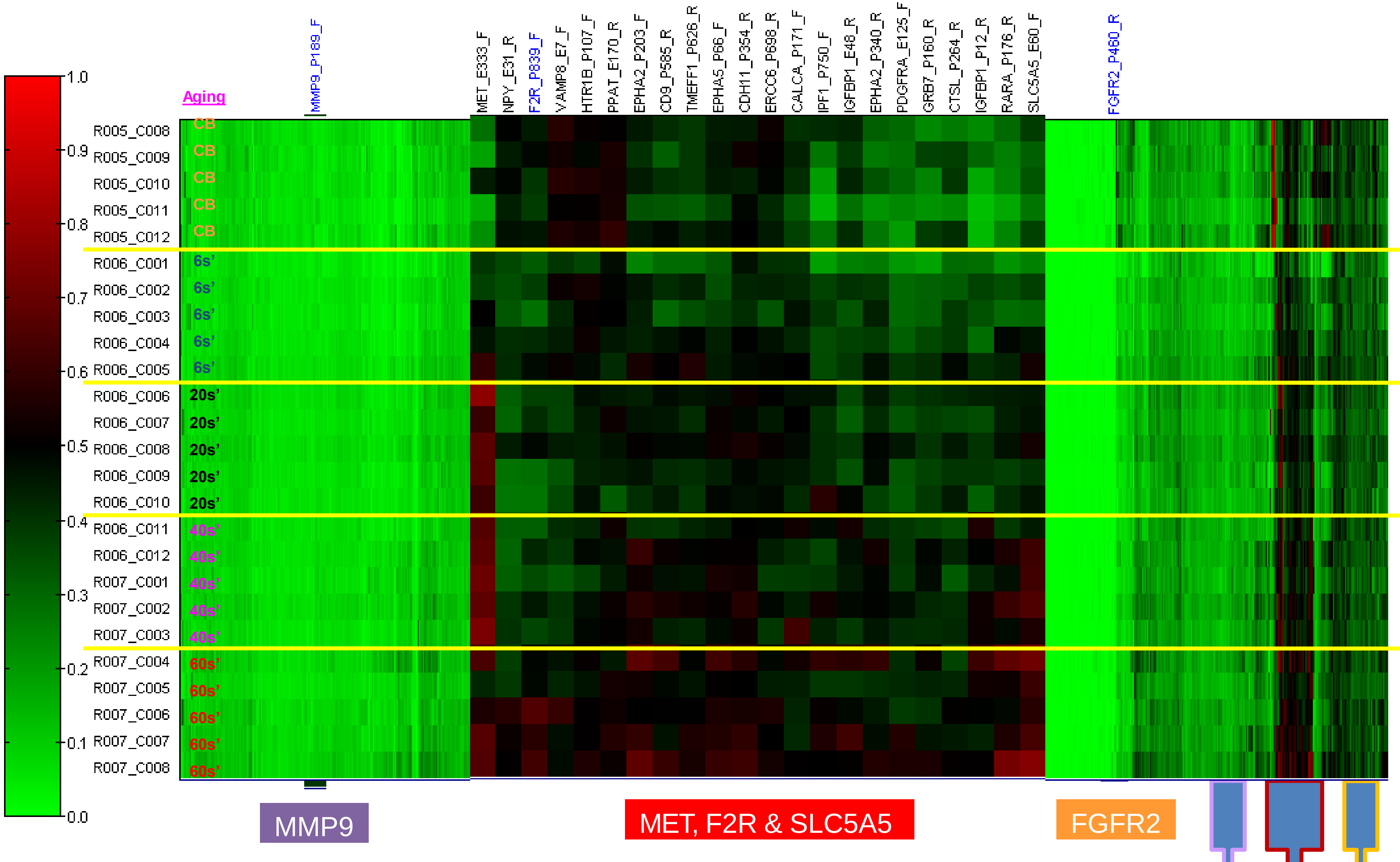
健康在於多元自然食物

-無毒(安全)、多元(自然)、健康(代謝)





老化與DNA甲基化有關(紅色是甲基化關閉的基因)



一群基因(抗氧化與賀爾蒙)在60歲(60s)的人有甲基化

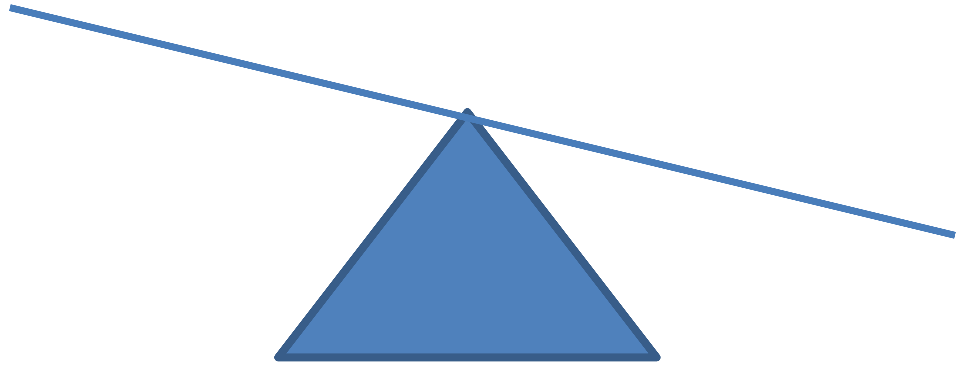
老人旅遊衛教

1. 流感/新冠: 洗手、疫苗、口罩、早用藥
2. 登革熱: 18C ~ 30C 地區
3. 依波拉/猴痘: 洗手、避免接觸
4. MERS: 不接觸動物(例如駱駝)
5. 旅遊腹瀉: 益生菌、小酌

免疫再替代、再補充、再調控

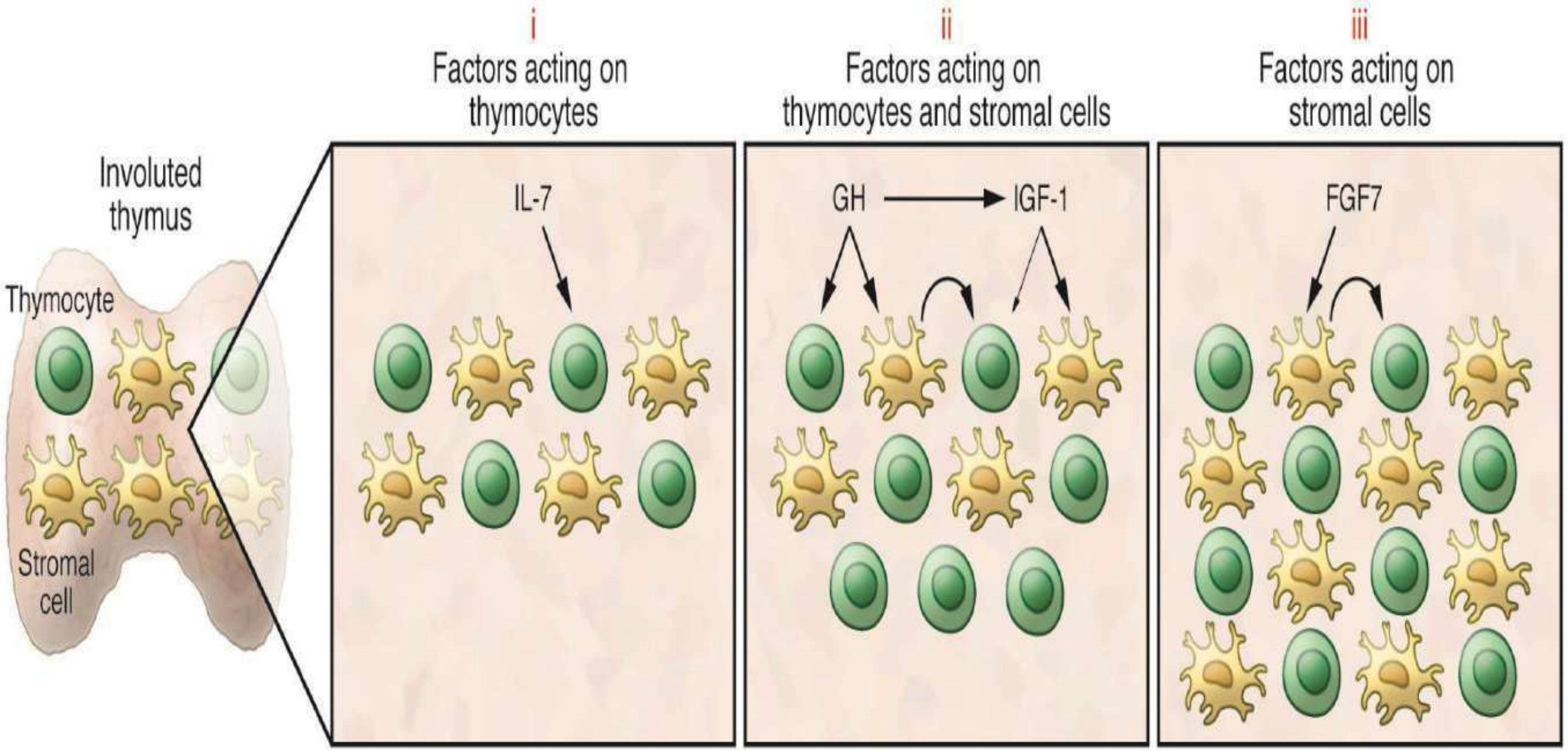
原始細胞減少
(CD62L CD45RA)
滋養分子減少
(IL7, FGF7 etc.)
活力細胞減少
(CD8/CD28)

- 炎症細胞增多
- (IL17, IL33)
- 炎症反應失調
- (Ink4a, Arf)
- 記憶細胞增多
- (CD45RO)



- 補充替代細胞
- (CD62L CD45RA)
- 補充滋養分子
- (IL7, FGF7 etc.)
- 調節發炎反應
- (signal inhibitors)

那些因子可以反轉老化免疫力
(ETP, DN, stromal cells: hormones, CAR etc.)

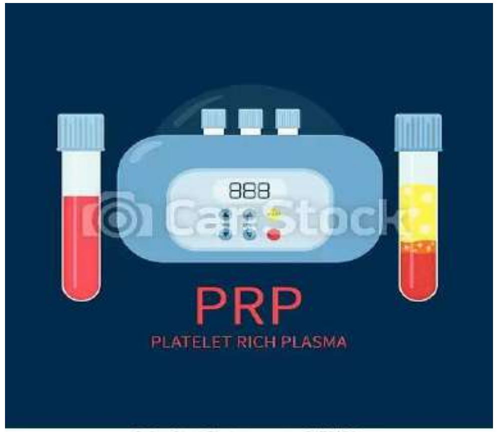


Factors acting on thymocytes	Factors acting on thymocytes and stromal cells	Factors acting on stromal cells
Increase in DN thymocytes	Increase in thymus size	Rejuvenation of thymic epithelium
No effects on stromal cells	IGF-1 primarily acts via stromal cells	Increase in ETP proliferation
Modest increase in thymus size	Increase in ETPs and DN cells	Increase in ETPs and DN cells
Peripheral T cell effects	Peripheral T cell effects	Downregulation of *Ink4a* in ETPs

美容藥妝不是年輕人的專利; 銀髮族更需要免疫保養

https://plasticdazenking.pixnet.net/blog/post/328864479

水光槍注射風險副作用與術後保養方式



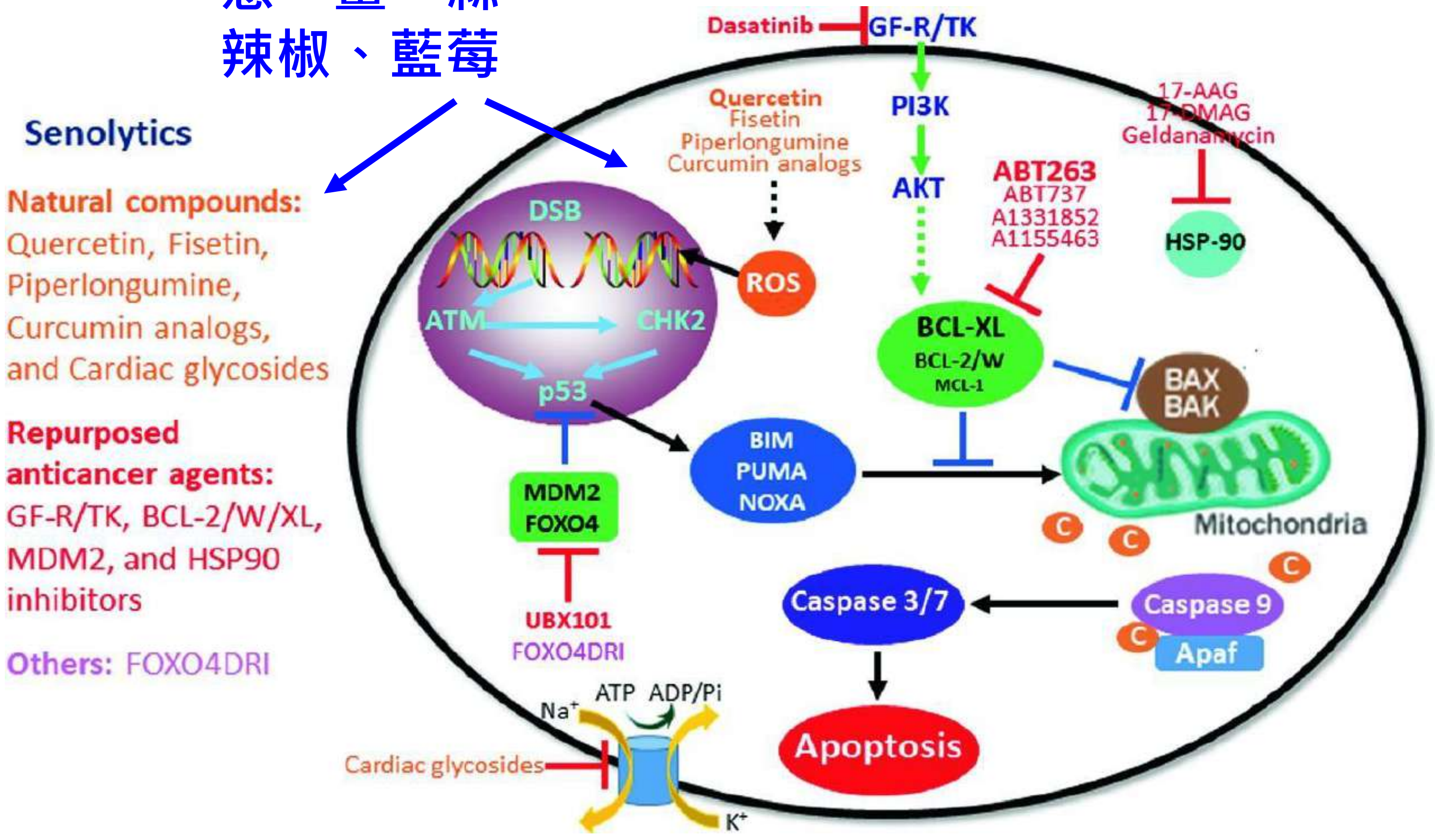
© CanStockPhoto.com - csp54761534

https://www.ikcells.com/product-service/grpgfs/0917-2/

抗老食物/小分子有譜！！

He Y, Zheng G, Zhou D. (2020) Senolytic Food & Drug
https://doi.org/10.1007/978-3-030-44903-2_1

蔥、薑、蒜
辣椒、藍莓



從頭到腳急性損傷疾病使用

Monsel A, et al. Anesthesiology 2014;121: 1099-1121.

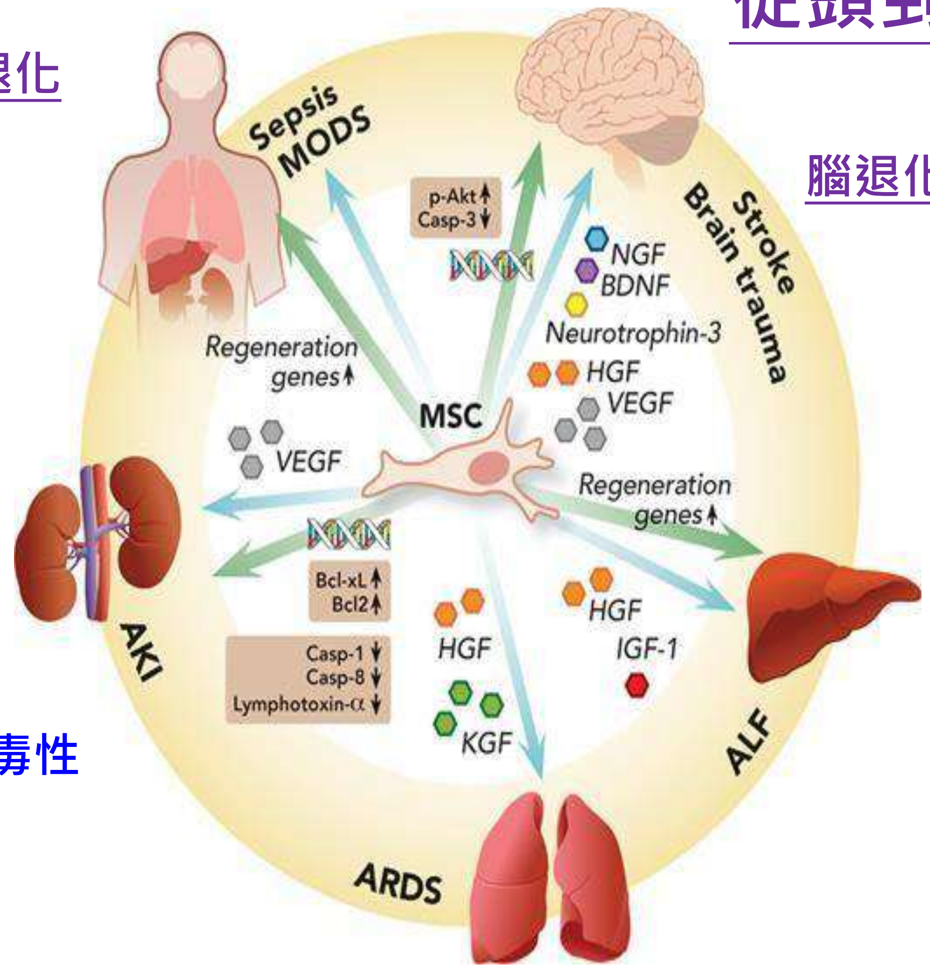
從頭到腳再生醫學使用

視網膜退化

腦退化/疼痛

老年性重聽

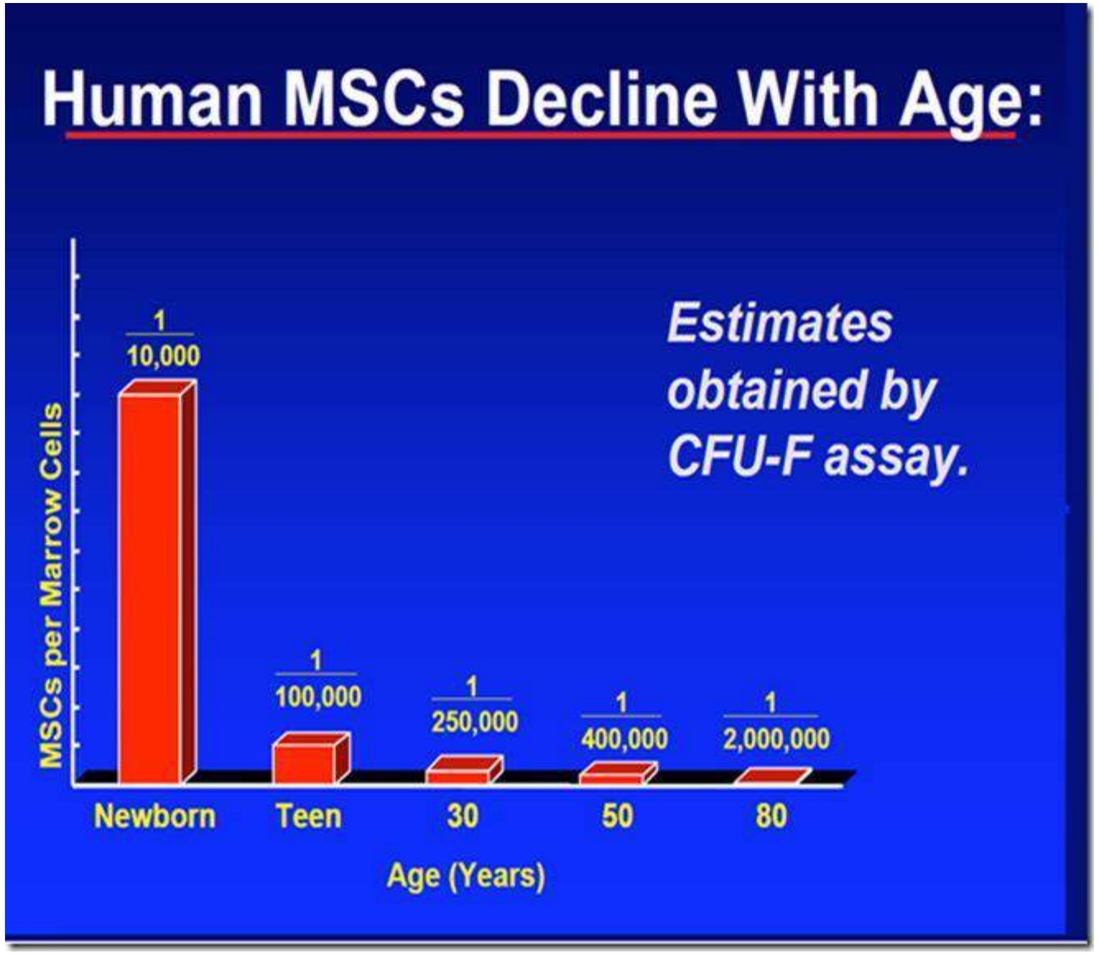
抗生素腎毒性



禽流感肺窘迫

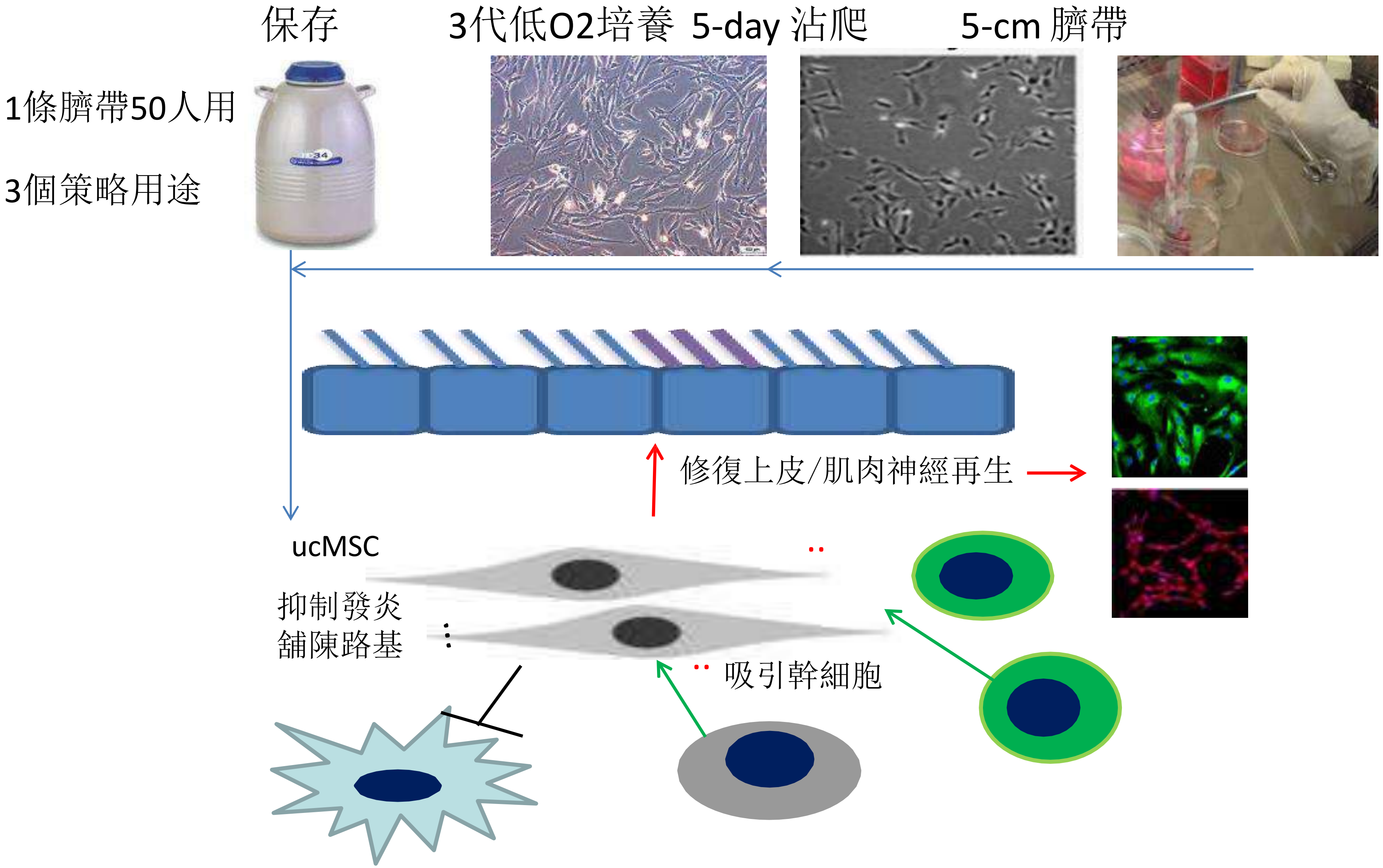
More than 130 clinical trials using WJ-MSCs in a registered Website. Promising uses are Radioprotection, Pain control, Combined HSC + MSC & Anti-Aging …

臍帶間質幹細胞是最早最好間質幹細胞
(低氧培養1條臍帶可供50個人使用)



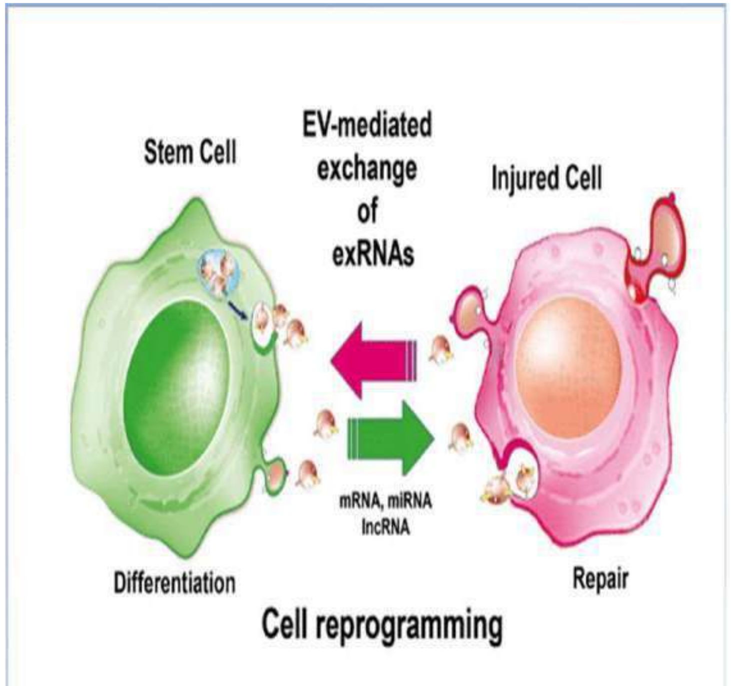
http://drbradstreet.org/category/autism/page/5/

間質幹細胞舖陳路基重塑修復與再生機致



更具破壞性的細胞治療:胞外囊泡替代細胞的治療

- 幹細胞(Stem Cell)的胞外囊泡(Extracellular Vesicle/EV)具備母細
- 胞特性，可傳遞分化和修復訊息。被譽為治癌抗退化防治新星



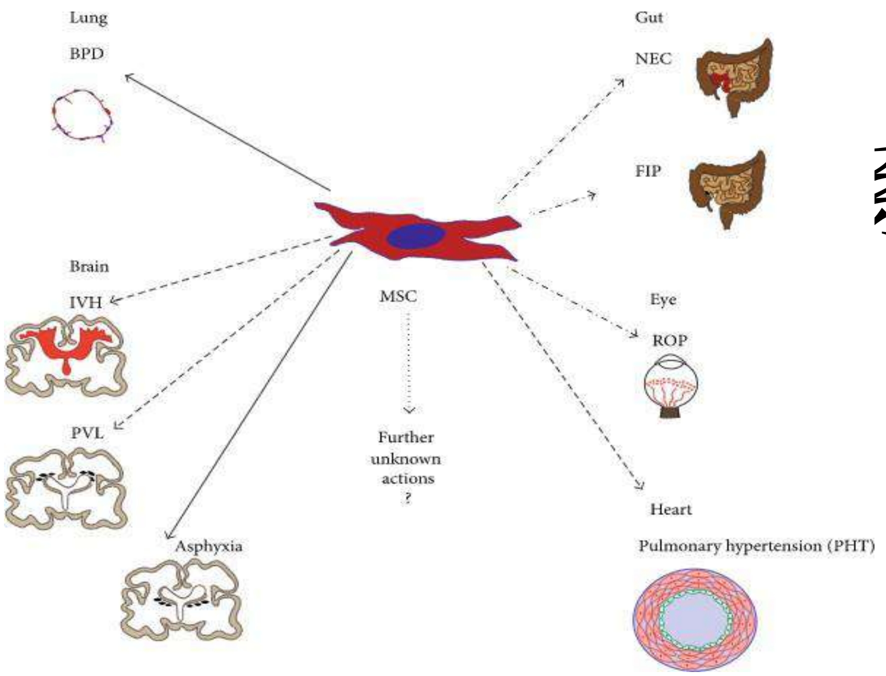
Austin J Clin Pathol. 2014;1(1): 1001.

- Zhang Z, Duan Y, Bei Y. Cardiac Progenitor Cell-Derived **Extracellular Vesicles: A Rising Star** for Cardiac Repair and Regeneration. *J Cardiovasc Transl Res.* 2019 Feb;12(1):3-4.
- Wang S, Wang J, Wei W, Ma G.
- **Exosomes:** The indispensable messenger in tumor pathogenesis and the **Rising Star in Antitumor Applications**. *Adv Biosystems*. 13 March 2019

Vilaça-Faria H, Salgado AJ, Teixeira FG.
Mesenchymal stem cells-derived Exosomes:
A new possible therapeutic strategy for
Parkinson's disease? *Cells*. 2019 Feb 2;8(2).
pii: E118.

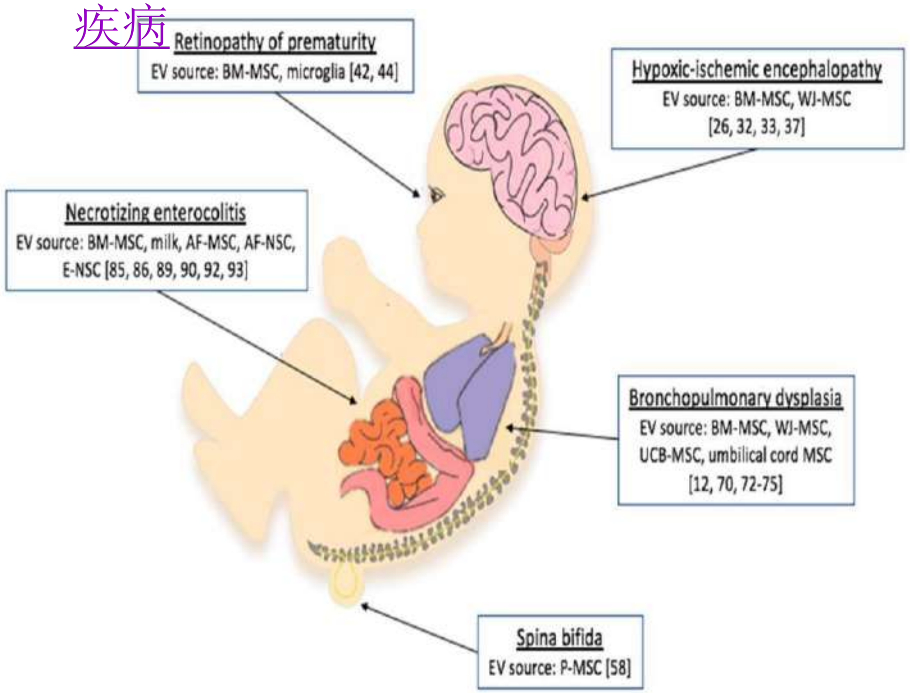
ucMSC Therapies in the preterm infants (Stem Cell Int. https://www.hindawi.com/journals/sci/2018/9652897/)

臍帶間質幹細胞治療早產兒疾病



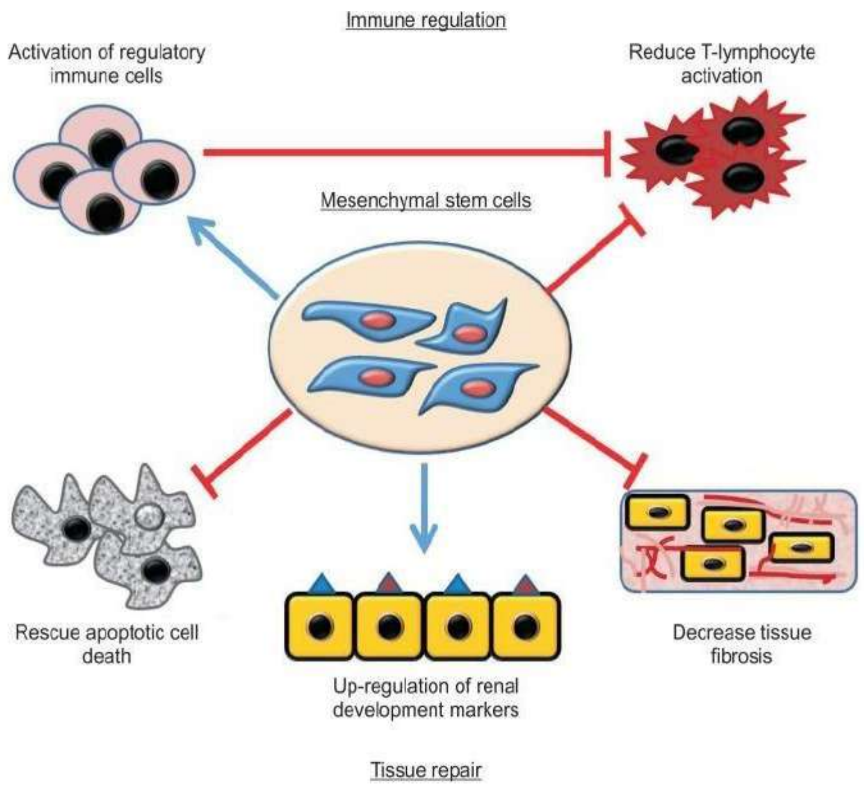
ucMSC-Exosomes for the preterm infants (*Pharmaceutics* **2019**;*11*(8):404)

臍帶間質幹細胞胞外體治療早產兒疾病

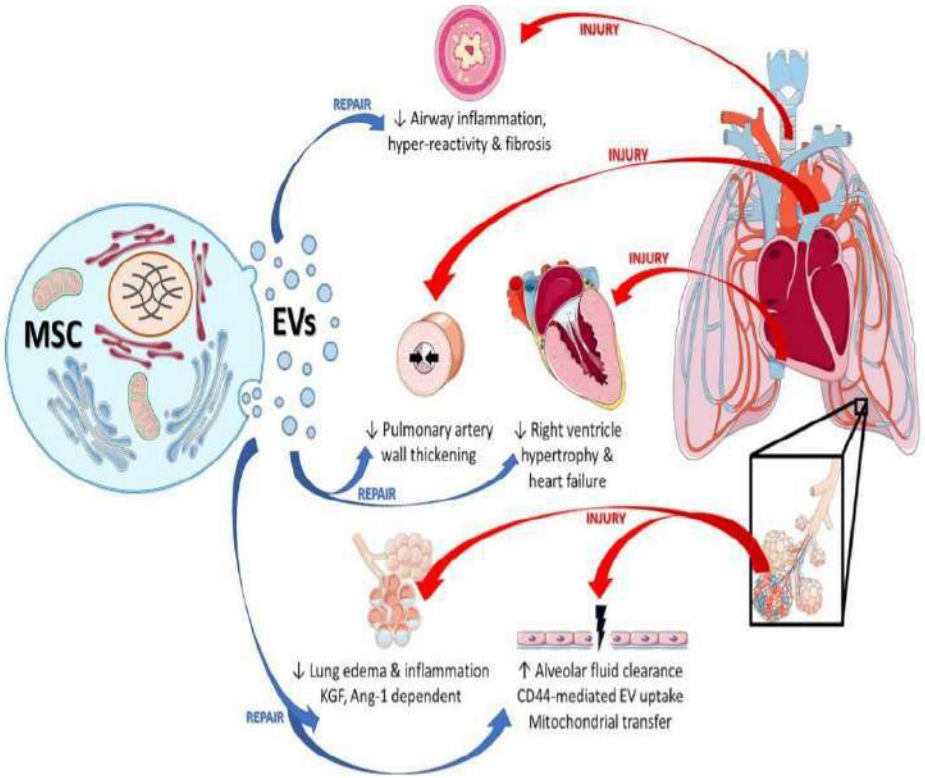


臍帶間質幹細胞治療早產兒缺氧和炎症疾病自體使用

臍帶間質幹細胞與胞外體防治成人肺部或腎臟纖維化

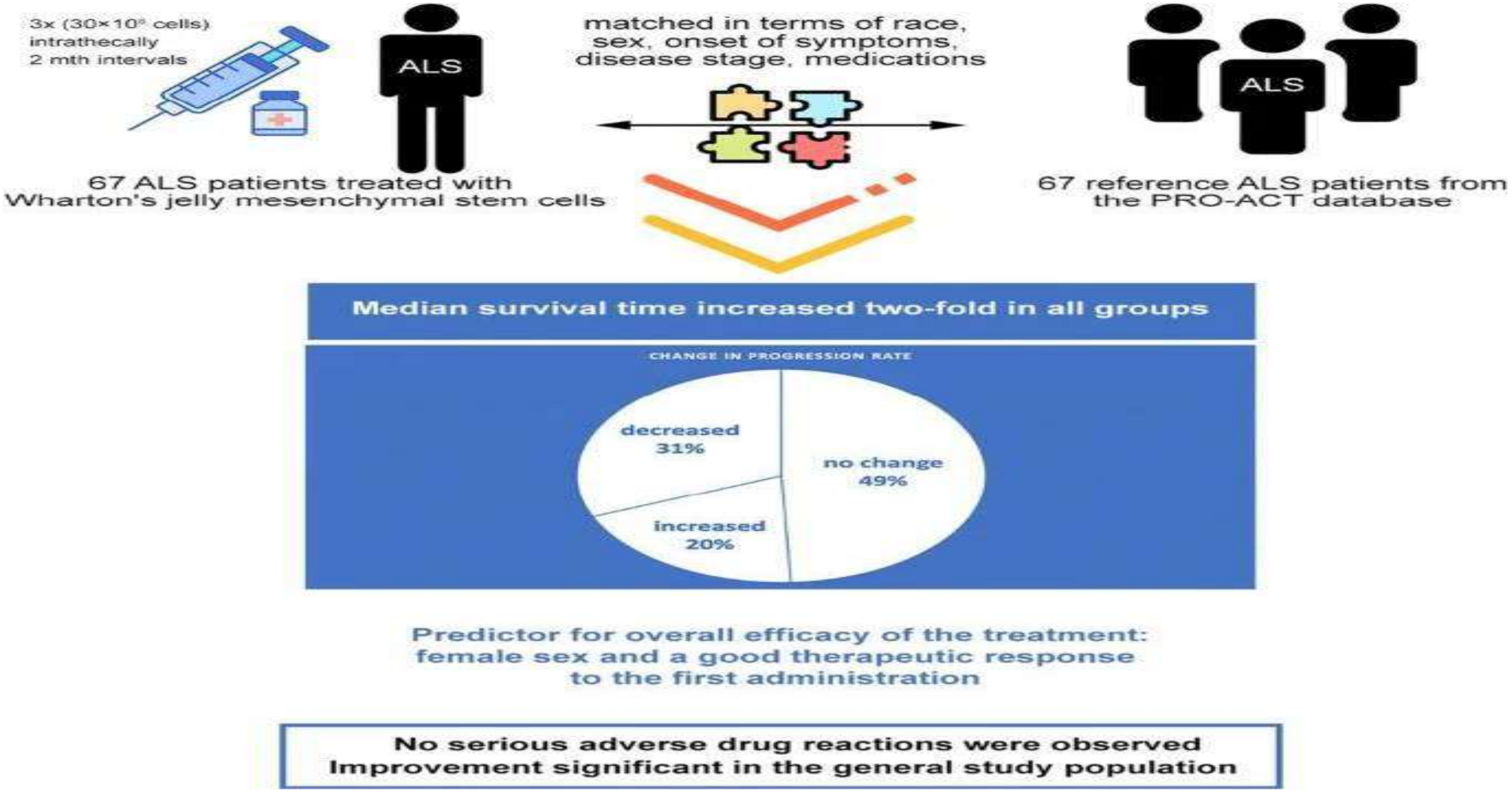


(Kidney Res Clin Pract. 2019;38:131-134)



(Am J Physiol Lung Cell Mol Physiol 2019; 316: L977–89)

臍帶間質幹細胞治療退化疾病：例如治療漸凍人(Stem Cell Reviews and Reports. 2020; 16:922–932)



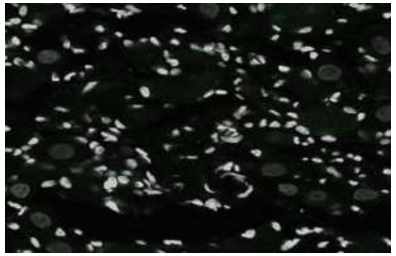
台灣研發技術成果與國際同步

- 未來藉由鼻噴劑給予之MSC衍生胞外囊泡，可通過血腦障壁，並Homing至腦部神經發炎區域，成為治療神經退化性疾病之藥物載體。

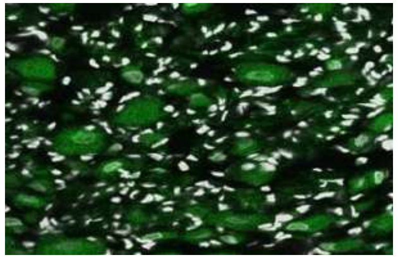
相互應證

本計畫團隊成果

- 硬腦膜下腔給囊泡(綠色)只進損傷神經節



正常神經節

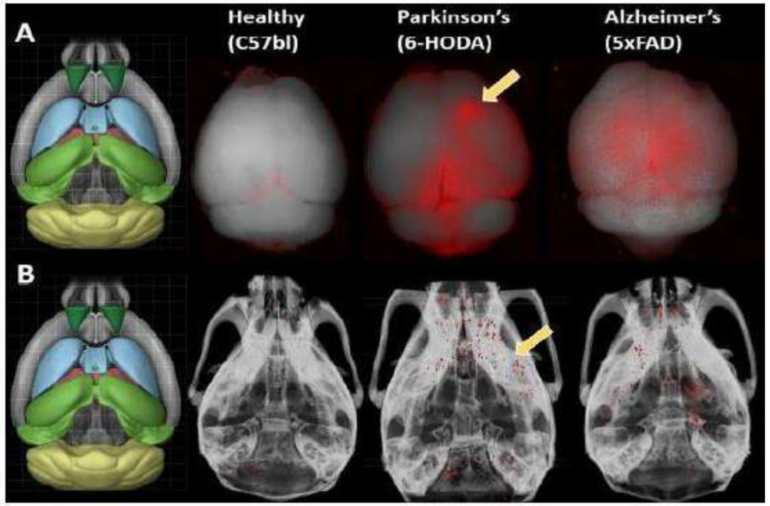


神經損傷性疼痛神經節

Shiue SJ, Rau RH, Shiue HS, Hung YW, Li ZX, **Yang KD**, Cheng JK. Mesenchymal stem cell exosomes as a cell-free therapy for nerve injury-induced pain in rats. Pain. 2019, 160(1):210-223.

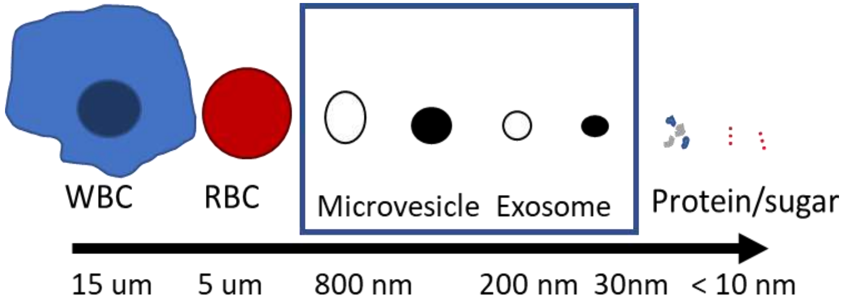
國際研究成果

- 鼻噴劑奈米金囊泡造影集中在腦部疾病病灶

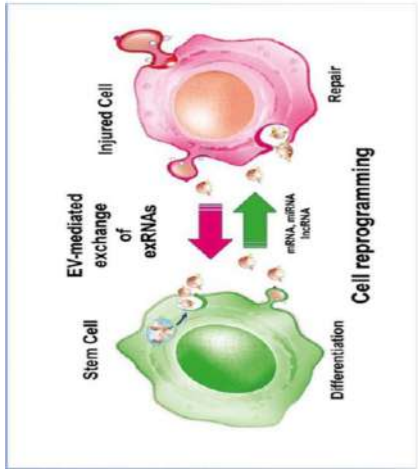


Golden Exosomes Selectively Target Brain Pathologies in Neurodegenerative and Neurodevelopmental Disorders *Nano Lett. 2019, 19(6):3422-3431.*

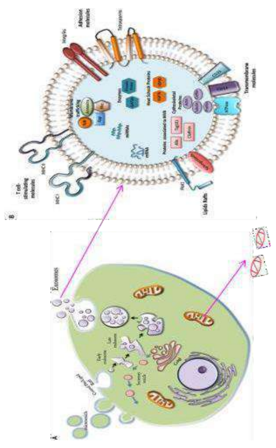
被遺忘2個世紀的胞外體是精準診斷治療的尖兵



分離不同囊泡
用 試紙(ICT)
晶片(Chips)
測定
1. 感染±併發症預測
2. 高危選懷孕與早產
3. 老化±退化症預測
…… 回饋幹細胞胞外體

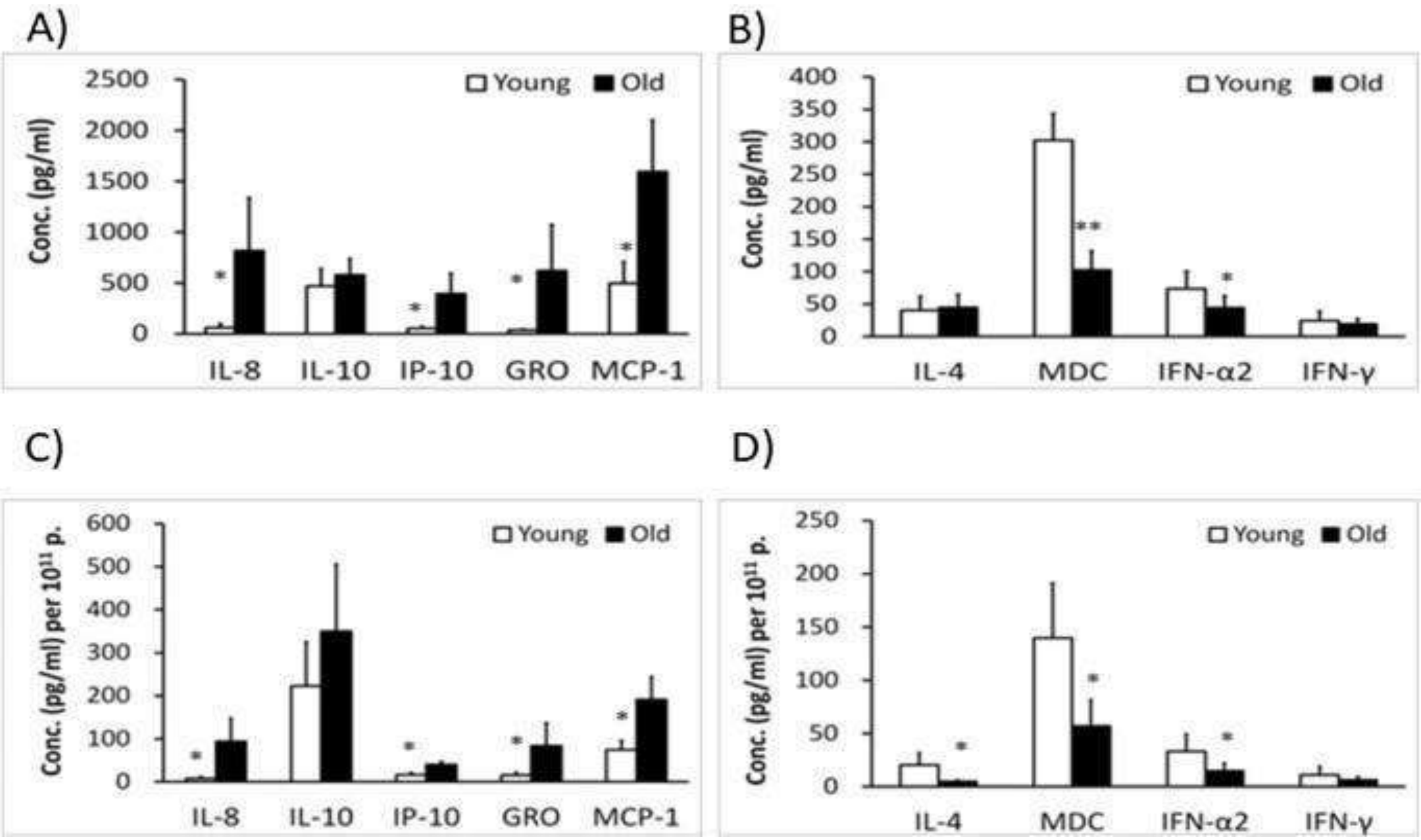


Austin J Clin Pathol. 2014;1(1): 1001.

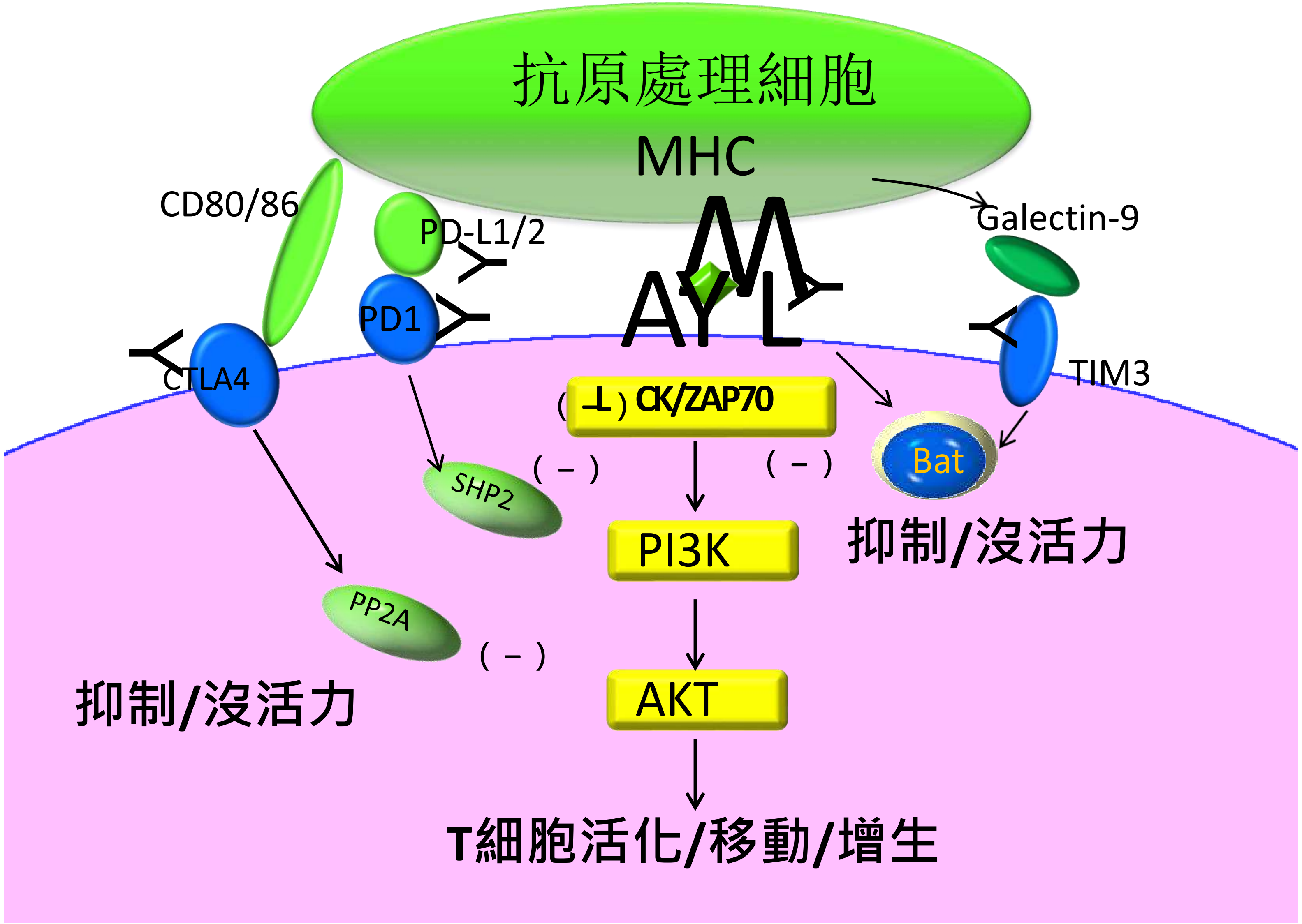


發明	標題	國別	獲證號	年限	發明人	所有權人
1	包含胞外囊泡之製劑、用以製備該製劑之方法及其用途	台灣(ROC)	I704923	202009-203806	楊崑德, 陳治平, 曹友平	馬偕醫院
2	利用胞外囊泡診斷疾病的方法及用途	台灣(ROC)	I724521	202104-203908	楊崑德, 陳治平	馬偕醫院
3	用於分離物質的裝置和方法	台灣(ROC)	I734414	202107-204003	楊崑德	楊崑德
4	細胞外小胞指標對疾病診斷的方法	日本	19-158951	202108-204008	楊崑德, 陳治平	馬偕醫院
5	FORMULATION COMPRISING EXTRACELLULAR VESICLES DERIVED FROM WHARTON'S JELLY MESENCHYMAL STEM CELLS, METHOD FOR PRODUCING THE SAME, AND USES THEREOF	中國、美國	審查中	Priority June, 2018	楊崑德, 陳治平, 曹友平	馬偕醫院

Yeh, Sh., Lin, CH., Yang, YJ. et al. Higher senescence associated secretory phenotype and lower defense mediator in urinary extracellular vesicles of elders with and without Parkinson disease. Sci Rep **11**, 15783 (2021).



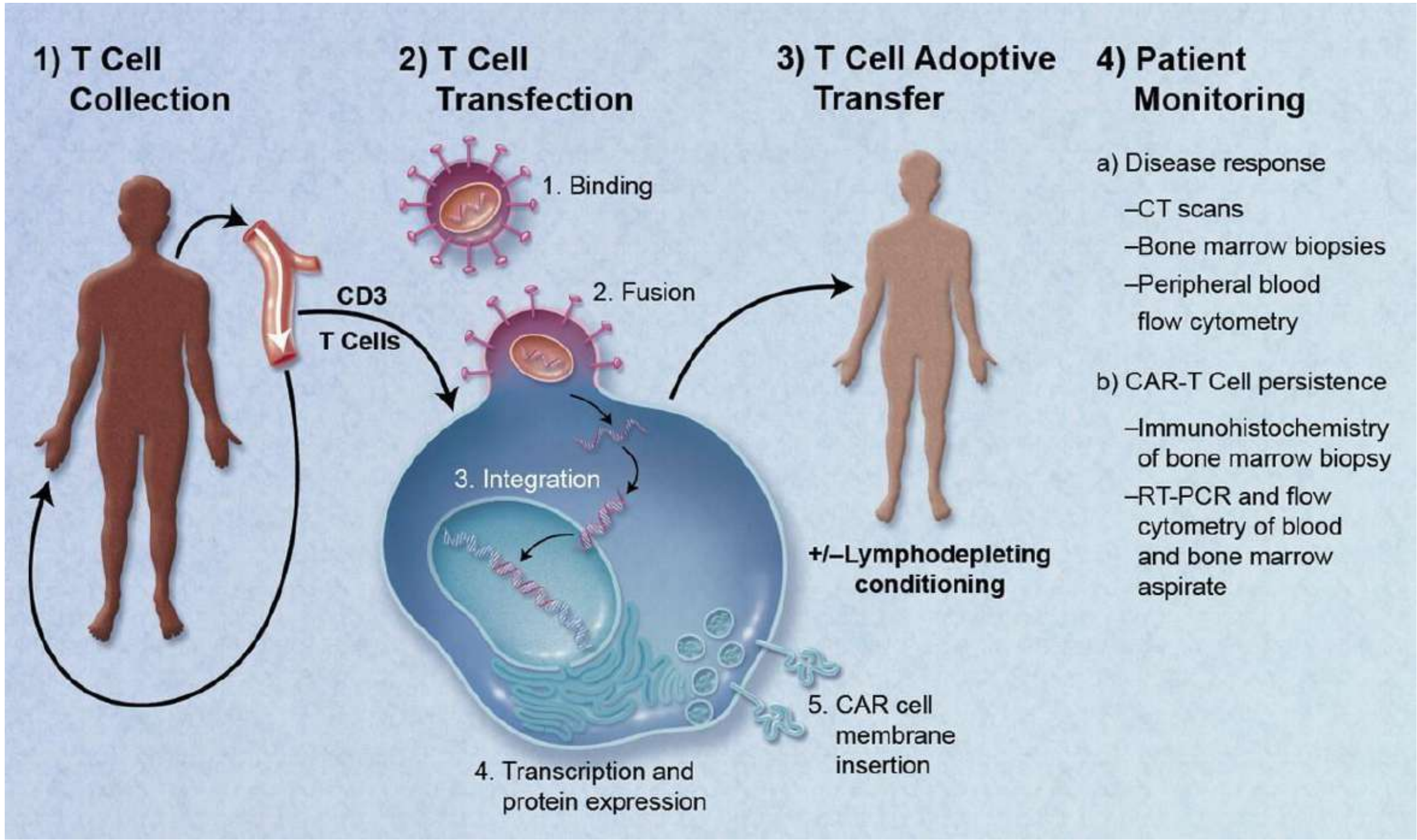
腫瘤免疫逃避與免疫治療



重塑自我T細胞抗癌抗感染

Nature Reviews Clinical Oncology 10, 267-276 (May 2013)

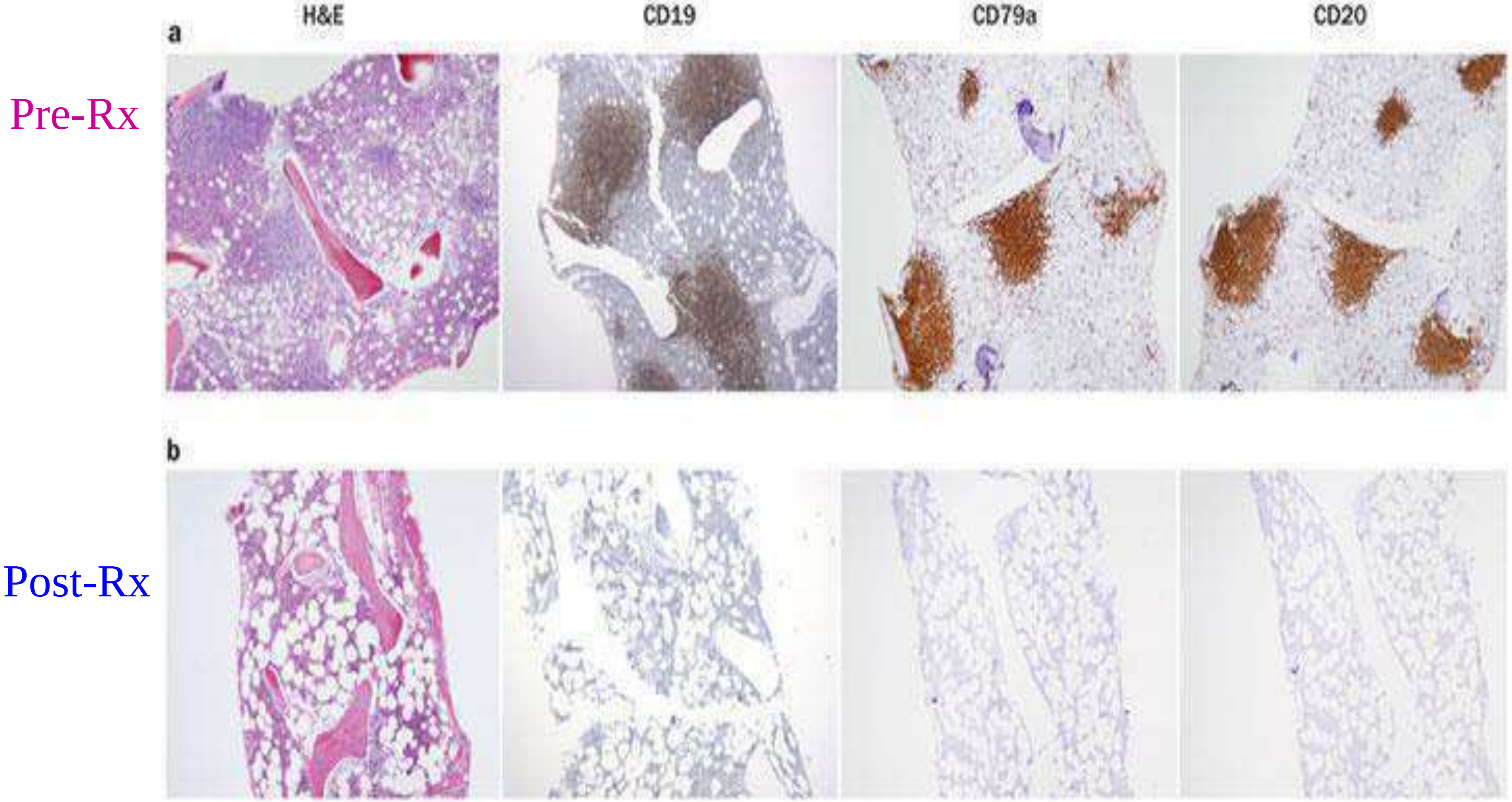
收T個人細胞 + CAR抗體轉植 2wks擴增後自體移植或凍存



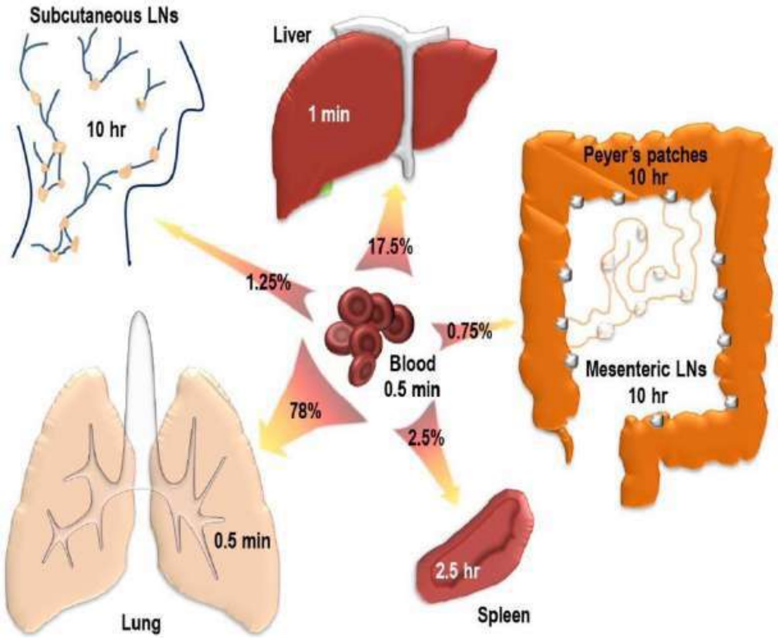
人類體內(癌症)與外來(新興感染)的剋星

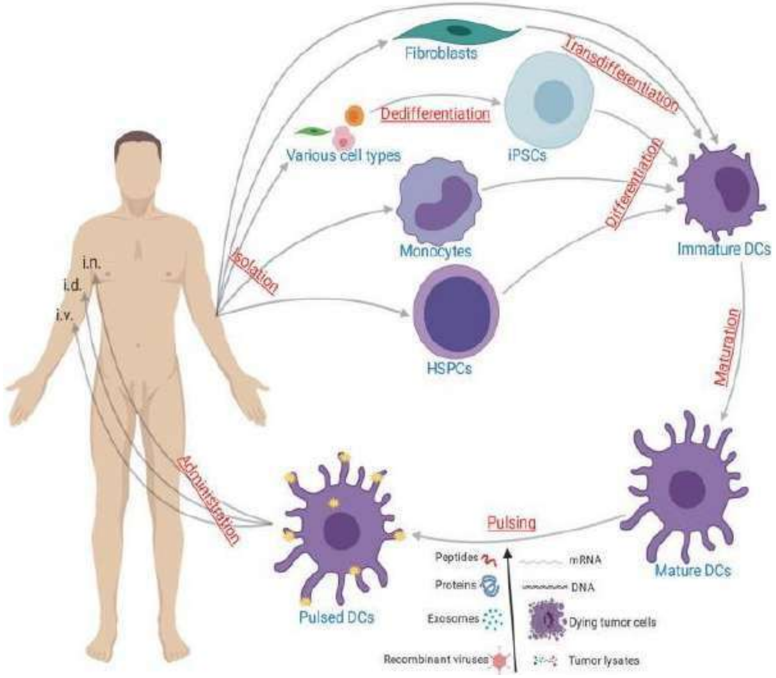
重塑自我T細胞清除血癌淋巴瘤

Nat Rev Clin Oncol 2013; 10:267-76



Cancer immunotherapies with iv, id or in
(Now, 合作it (intra-tumor)可以解決很多問題)



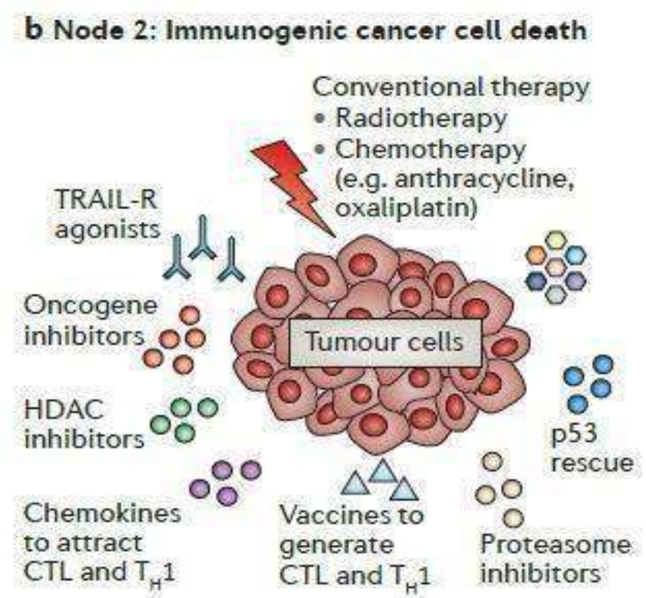


https://www.biorxiv.org/content/biorxiv/early/2018/08/20/268326.full.pdf

https://www.nature.com/articles/s41401-020-0415-5.pdf?origin=ppub

免疫細胞治療:新興世代核心醫療

腫瘤具有銅牆鐵壁;不得其門而入　只得培養放大免疫細胞;破門而入



http://news.medlive.cn/cancer/info-progress/show-88263_53.html

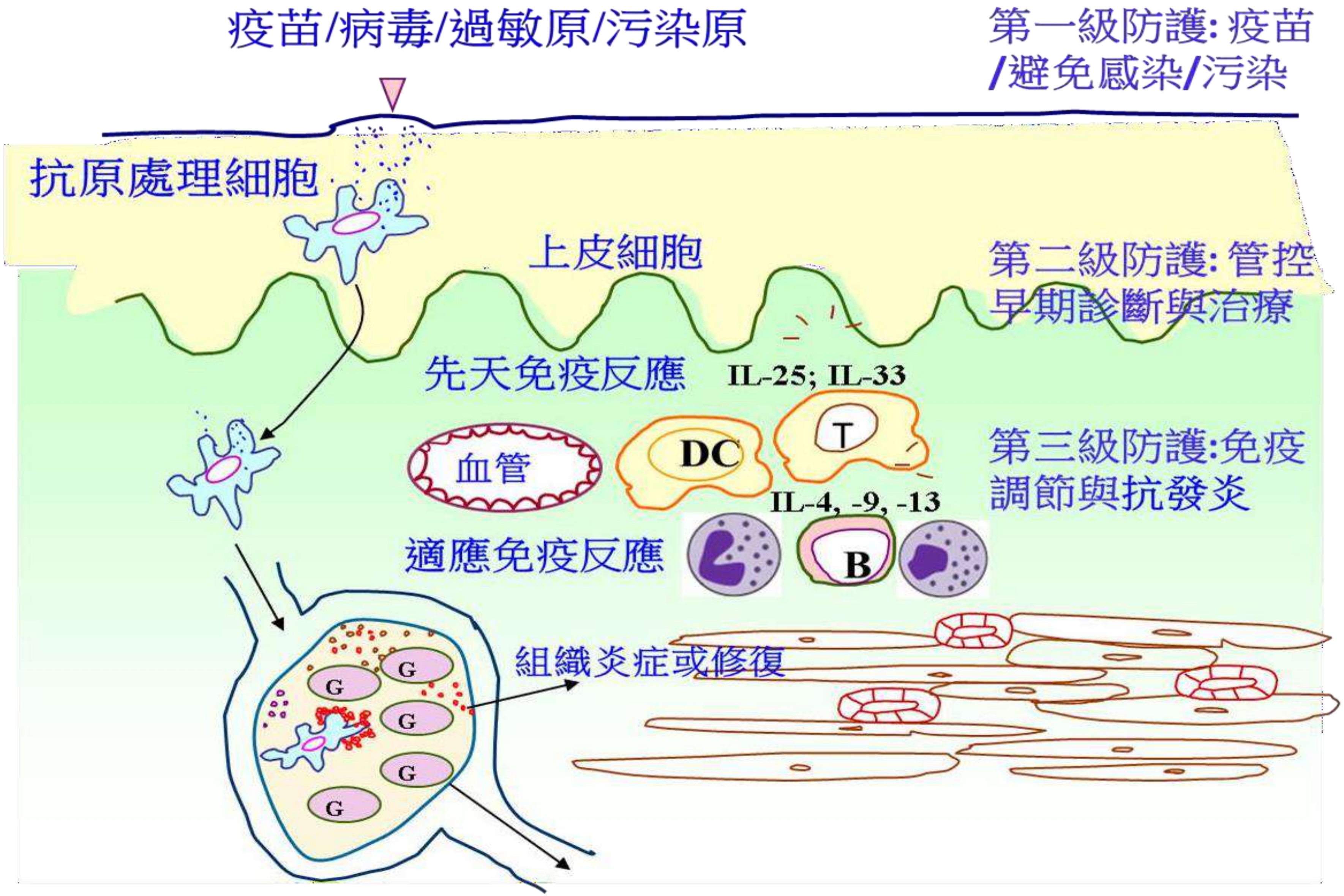
Hasumi L, et al. Oncoimmunology. 2013 Oct 1;2(10):e26381.

病毒、化療或放射治療減腫瘤釋抗原 + 免疫細胞併佐劑注射

腫瘤免疫細胞治療分類與現況

細胞分類	適應症	使用方式與效用
自體自然殺手 異體自然殺手	多種癌症 多種癌症	體外擴充、靜脈注射:效用有限 體外擴充、靜脈注射:沒毒性
樹突細胞	多種癌症 胃癌/腎癌	沒毒性; 效用15% WT1/MUC1抗原+樹突細胞
活化白血球	黑色素瘤/腎癌 LAK（IL-2）	週邊白血球體外細胞素刺激 副作用大於作用
腫瘤侵入細胞 (TILs)	黑色素瘤/乳癌	腫瘤侵潤淋巴球體外加 IL-2 擴充後注射回去有約50%反應率
腫瘤微環境治療	重塑周遭環境	標靶腫瘤生長環境與其滋養因子
CAR-T	淋巴瘤/血癌/黑色素瘤	抗體轉換成活化T細胞治療 治療效能佳、需注意細胞素風暴
多潛能幹細胞 iPSC	樹突/T/巨噬細胞 實驗性胃癌	多潛能幹細胞分化成需要細胞 動物腹腔注射
組合治療	疫苗+查核抗體 化療+免疫治療	突變腫瘤疫苗+T細胞+PD1抗體 化療+查核抗體+突變腫瘤疫苗

老人生態免疫學


疫苗/病毒/過敏原/污染原
第一級防護: 疫苗
/避免感染/污染
抗原處理細胞
上皮細胞
第二級防護: 管控
早期診斷與治療
先天免疫反應
IL-25; IL-33
血管
DC
T
第三級防護:免疫
調節與抗發炎
IL-4, -9, -13
適應免疫反應
B
G
組織炎症或修復

台灣講座
結束

合照留影


Shau-Ku Huang
Jun-Hong Shen
kuender yang
Yimaun Subeq
kuender yang (...
逢甲大學 資電...
曾曉米
張寶明
薛丞宏
Chun-Jung Lin
張哲豪Jerhao
6006王淨儀
社團法人台灣建...
Guu Debby
楊淑君
社團法人台灣建...
jasmine
林佩妮
Mu-Yen Chen
賴宗鼎
還有另外 33 位使用者
你

Google

★ ★ ★ ★ ★

學會官方網站

http://www.tsam.org.tw/

學會臉書專頁

https://www.facebook.com/TSAM20080509

學會IG

tsam.org.tw2019

講座結束

感謝聆聽