



# NCHC Biomedical Platforms & Applications

FROM ENABLER TO  
**ENHANCER**



2023/7/3

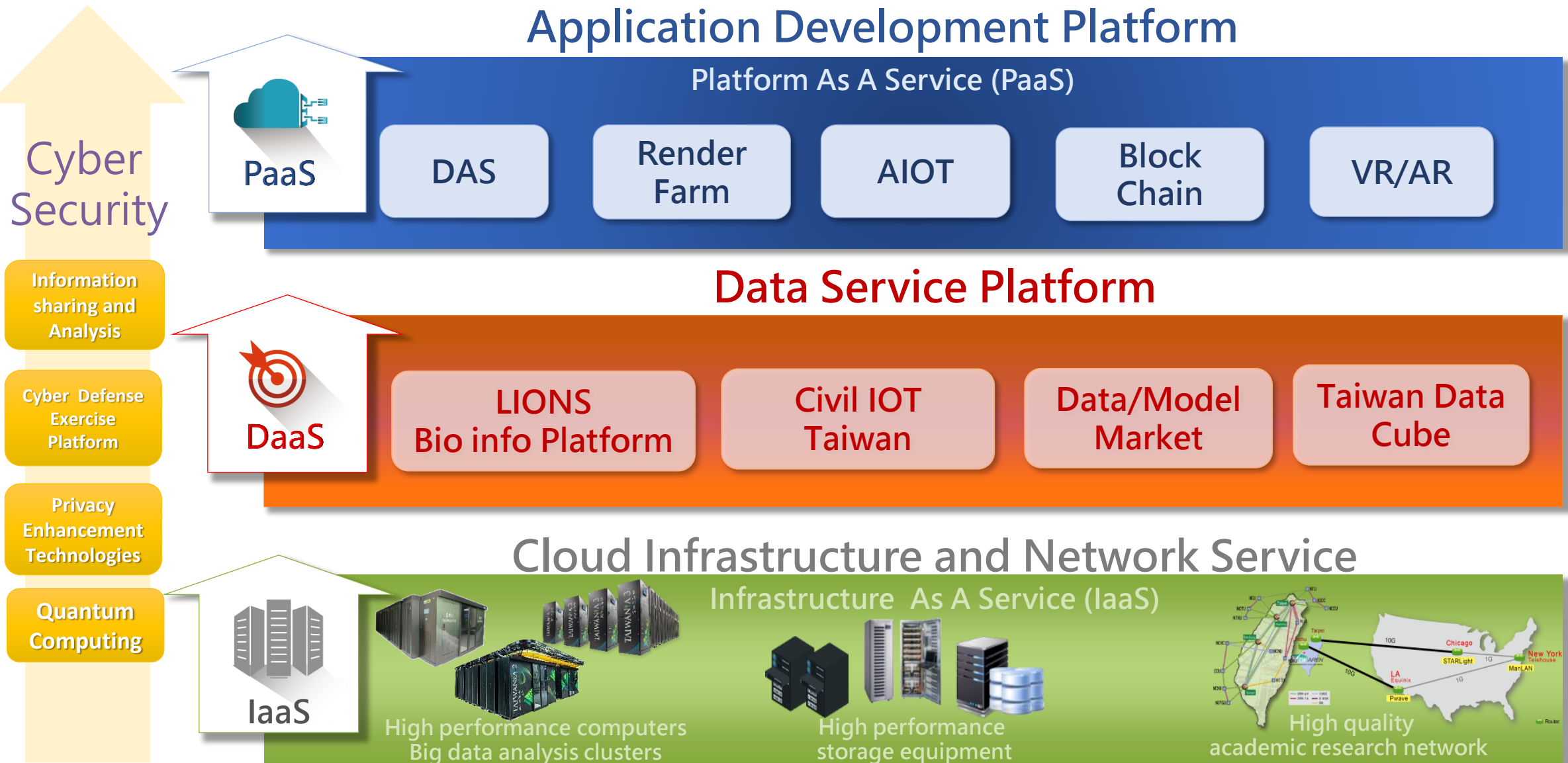
BioMed & HPC applications  
High Performance Computing Applications Division

# Outline

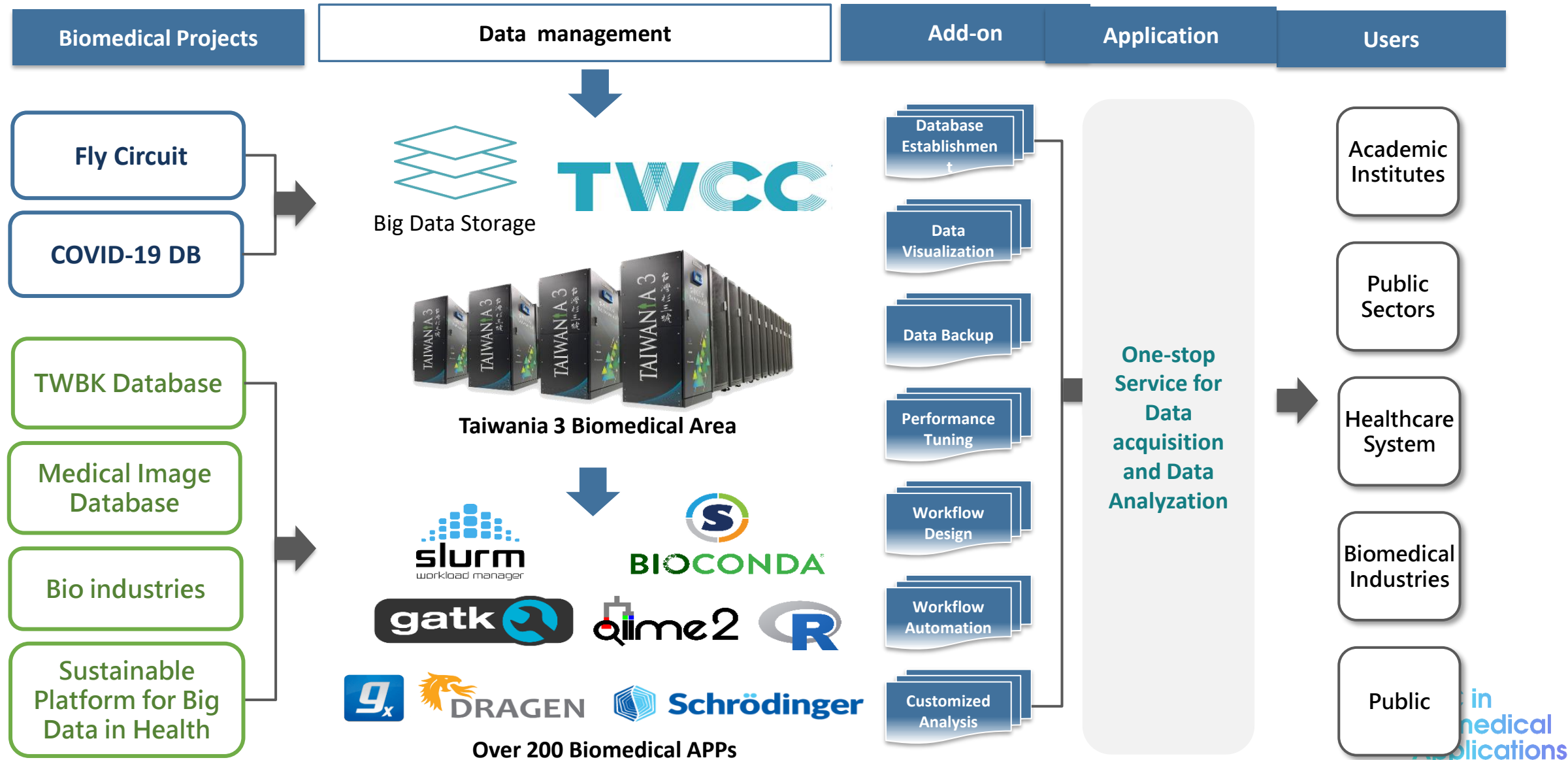
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- HPC for Biomed
- Brain Research via Partnership
- Biomed Platform
  - Taiwan Biobank
  - Sustainable Platform for  
Big Data in Health
  - NCHC COVID-19
  - Trusted Research Environment

# NCHC Core Service Structure



# When ICT meets BIO



# HPC Is Essential for Biomedical



Big Data



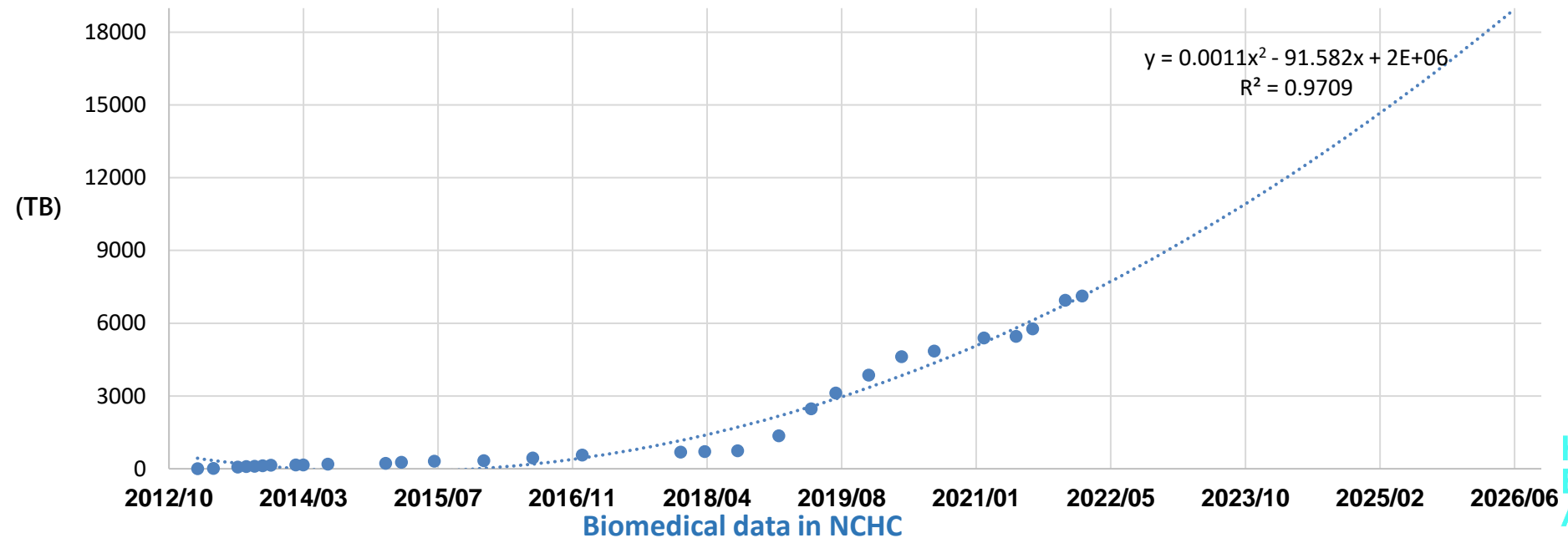
Standards

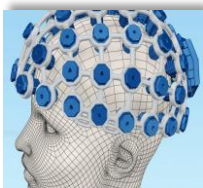


Sensitive



Regulated





## #1 & 2 Key technologies for brain-computer interface

**NAR Labs**

## #3 An epoch-making breakthrough-human brain mapping

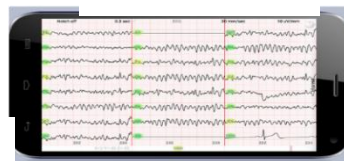
### #1 Non-invasive wireless Electro-Encephalography

wireless electrode hat



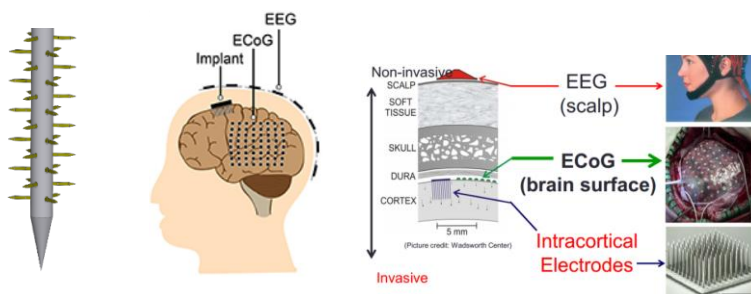
signal receiver

APP for EEG



- Could handle manually at home
- Application: sleep therapy, concentration enhancement, emotional management, VR and etc.

### #2 3D cactus neural probe and auto spike Sorting



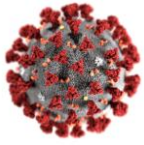
- With more electrodes, more accurate signals are recorded.
- Application: diagnosis of epilepsy, migraine & Alzheimer's; treatment of Parkinson's

### #3 Synchrotron for Neuroscience- An Asia Pacific Strategic Enterprise



- Team up with Singapore, China, Japan and Korea
- Aiming to complete the ultra-high resolution human brain mapping by 2024.
- Would decipher how neuronal signal transmits and integrates, as well as the pathogenesis of neurodegenerative diseases; shed on light on the diagnosis & cure.





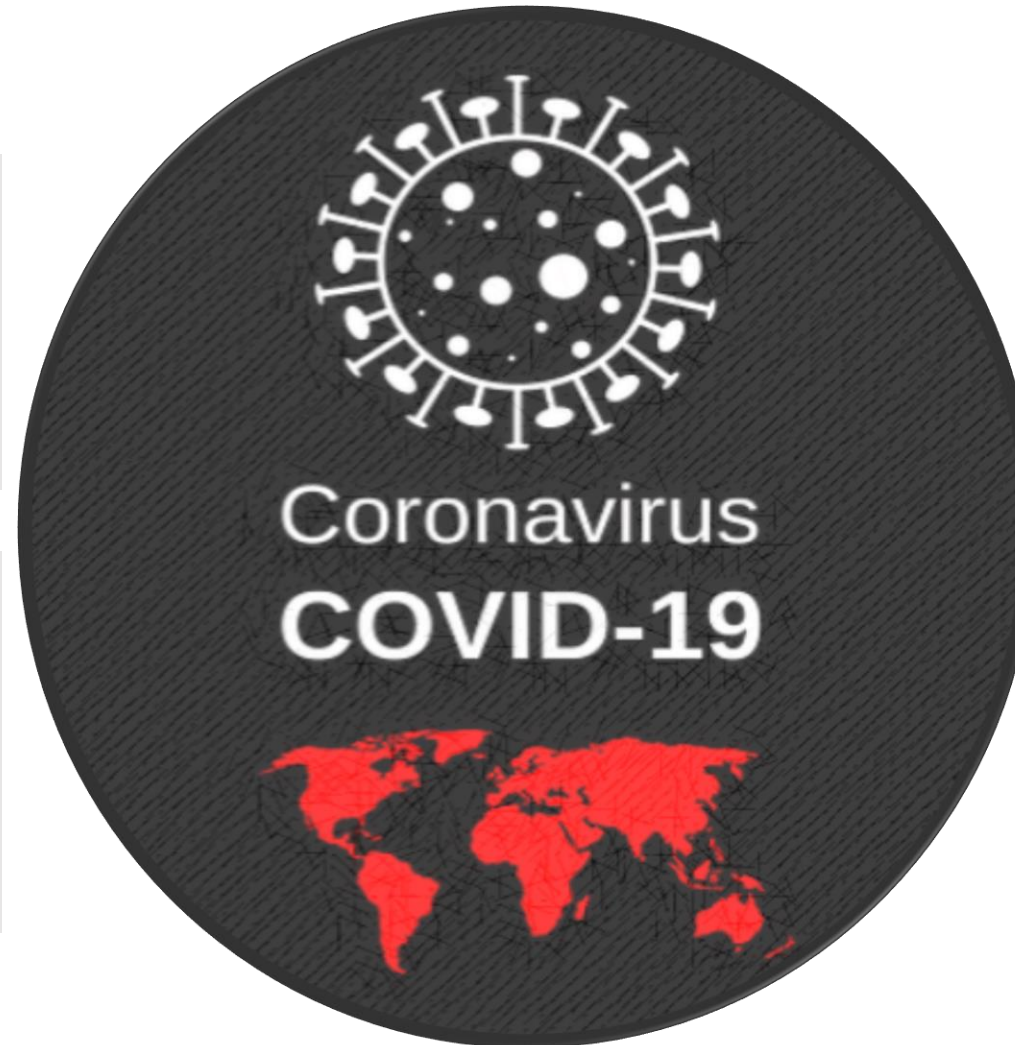
## Response to fight for COVID-19 pandemic

### Rapid Diagnostics for COVID-19

With the assistance of TIRI, a rapid diagnostic test will go into production by the end of 2020.

### COVID-19 Dashboard

Using the Databases from Johns Hopkins and Taiwan Ministry of Health and Welfare, NCHC provides the real-time update for every 5 minutes.



### COVID-19 Pandemic Prevention Platform

STPI, provides thoroughly daily update to the vast public, such as worldwide strategical actions, social and economic impacts, and R&D investment.

### hACE2 transgenic mice

Cooperated with Taiwan NIH, NLAC, successfully produce hACE2 transgenic mice, which is essential for efficacy verification for vaccine development.

## Taiwan Biobank

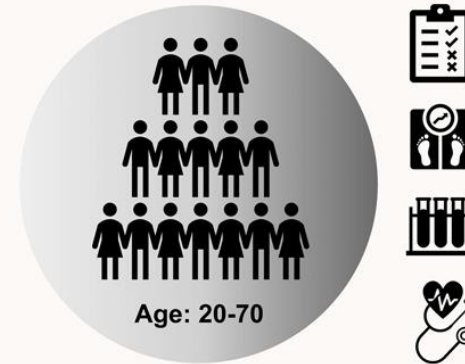


- Academia Sinica Taiwan Biobank (2012 – 2027)
- General Taiwanese Population 200,000( aged 20-70 yrs with no prior diagnosis of cancer)
- A prospective population cohort study
- Rich phenotypic and genetic data were collected in the Han-Chinese-based cohort
- Future linkage to national health registries will empower longitudinal genetic studies
- TWB studies contribute to population diversity in global genetics research

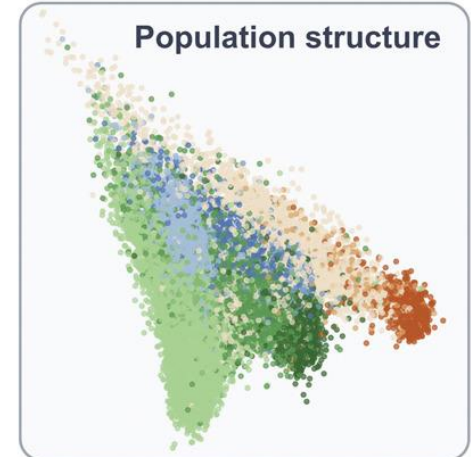
Feng, Yen-Chen Anne, et al. "Taiwan Biobank: a rich biomedical research database of the Taiwanese population." *Cell Genomics* (2022): 100197.

### Taiwan Biobank

#### Community-based phenotyping



#### Population structure



#### Registry data linkage



#### Omics data generation



#### Familial structure



2012

Recruitment began

Aug. 2021

N ≈ 150,000

Target size

N ≈ 200,000



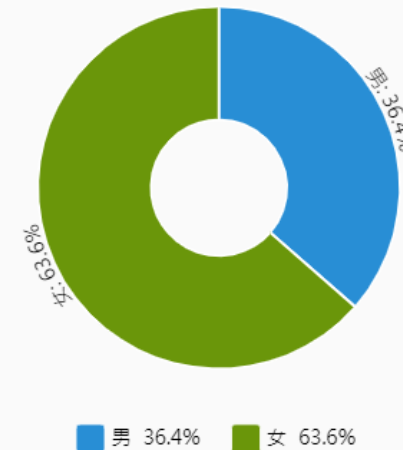
# Challenges of Taiwan Biobank

- Data volume increase rapidly >1.2PB
- Data types and sources variety :Questionnaires, physical tests, blood and urine tests > 150,000 pieces of data, continuously updated
- Complex Apply Process!!
- Biological/Statistical/Informatics Interdisciplinary Barriers!!
- TWB is available to all authorized researchers
- Scientists are facing the questions how to use them more efficiently

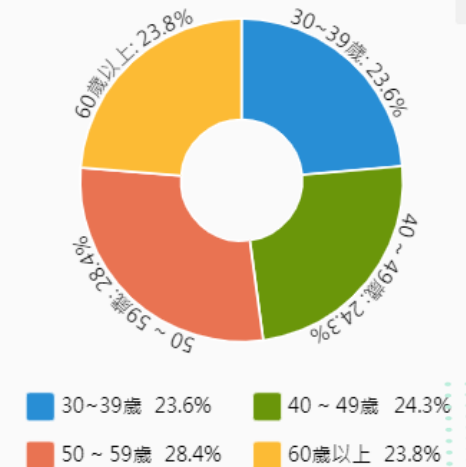
1. 基線收案 (Baseline) 共 163885 參與者

2. 追蹤收案 (Follow) 共 41292 參與者

01. 性別分布



02. 年齡分布



# Taiwan Biobank

## Easing the Burden on IT

- Big data storage w/ 321 rule
- 7\* 24 monitoring w/ ISO27000 series
- Data inquiry and sharing system
- Link to HPC account
- Notebook and Container Scheduling Platform for HPC
- Imputation service



COLLECT

ORGANIZE

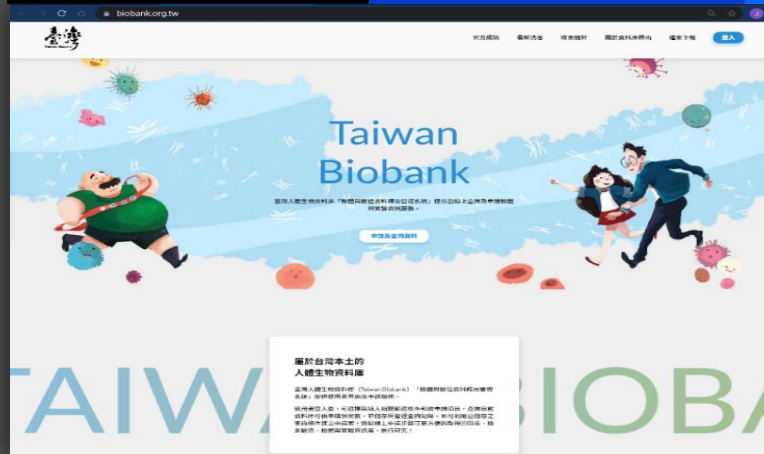
← ANALYZE →

Collect, Connect  
and Access Data

Govern, Search,  
and Find Data

Understand and  
Prepare Data  
for Analysis

Build Descriptive,  
Predictive, and  
Prescriptive  
Models



## Biobanking for a Healthier Future

我要參加



### 收案數

統計至2022年10月31日止

181,635

人參與

44,766 人完成第一輪追蹤

890 人完成第二輪追蹤



# Key Facts



130, 000 Questionnaires  
query and release online

- Reduce processing time by 1 - 2 weeks



1.2 PB Genome data

- 19 projects 9.2PB(136 accounts 42.1PB data)
- Reduced data transfer time and cost by 3 - 6 months

# Sustainable Platform for Big Data in Health

To promote Taiwan as an international benchmark for health big data applications and precision health innovation



衛生福利部  
Ministry of Health and Welfare



## Foundation establishment for big data in health

- Biomedical big data
- Data governance & standardization
- Regulatory guidance
- Health technology assessment
- Talent cultivation
- Inter-ministerial coordination

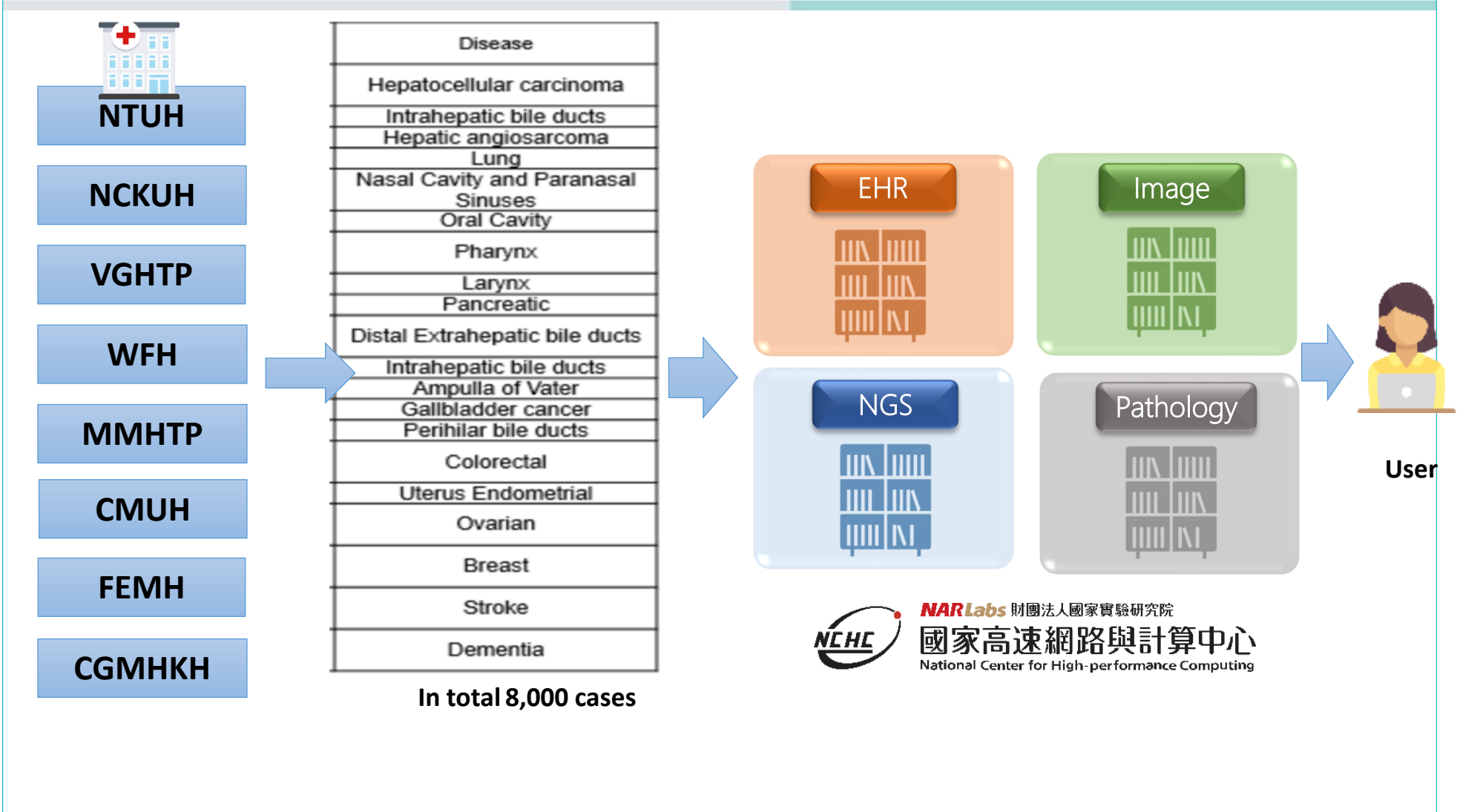
## Transnational research and industrial innovation

- Novel biomarkers
- Disease risk prediction
- Precision medicine development
- Big data guided New drug discovery
- Commercialization and Intelligentization
- Public-Private-Partnership



# Sustainable Platform for Big Data in Health Program

## Collecting prospective study data from MD centers



# Challenges for MD Data



**Standardization, MD  
Data Check**



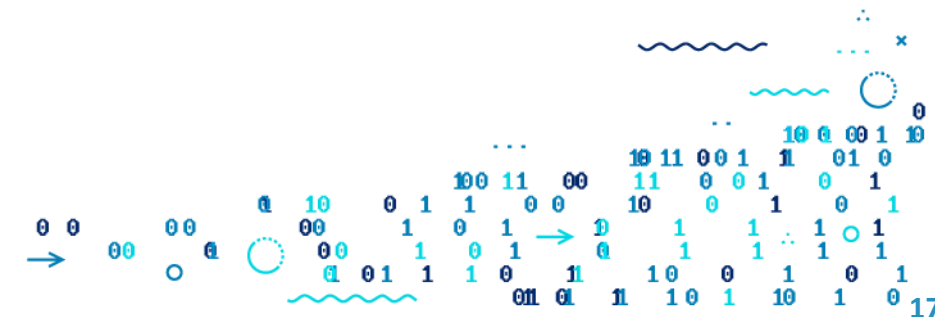
**Linkage to national  
health registries**



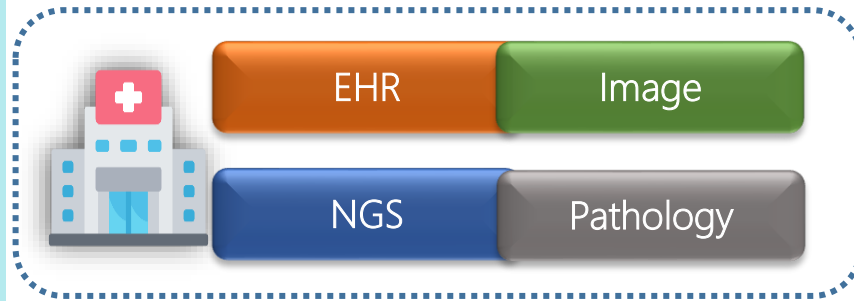
**Legal and Ethical  
Challenges**



**Operation costs for  
Keeping data safe**



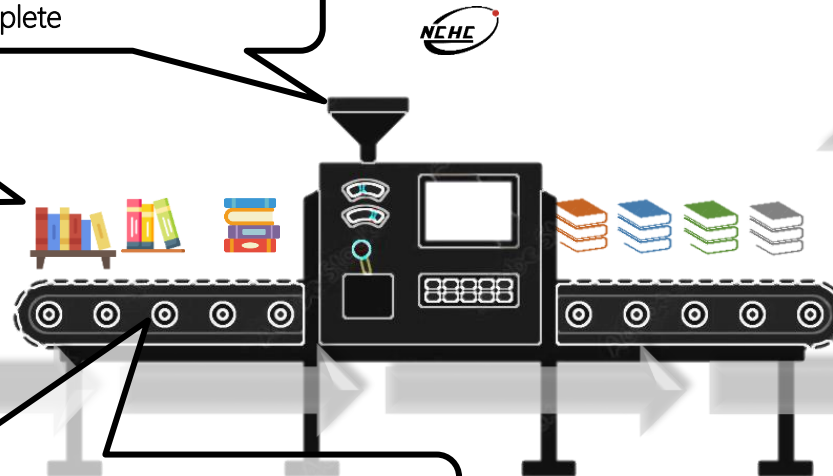
# Data Upload and QC



- IP/AC/PW
- Virus
- Complete

- Control IP
- SSL
- PW policy

- Windows, Mac, LINUX
- Log in
- Monitoring ( Log recode)



# NCHC COVID-19 Dashboard



## Key Facts



## Volunteers!!

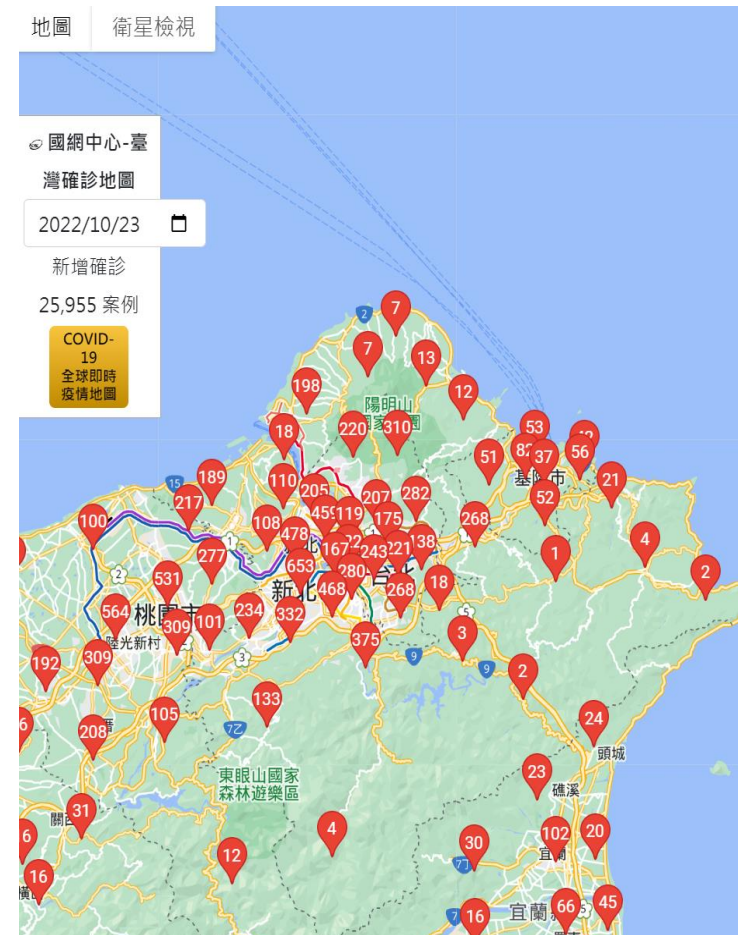
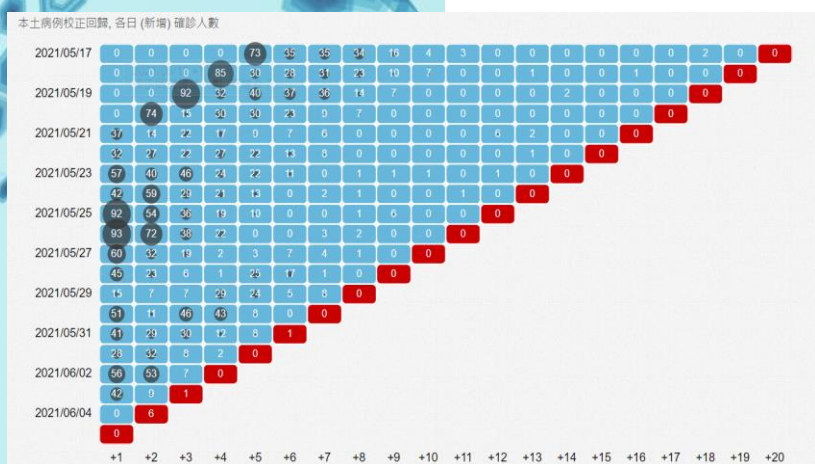
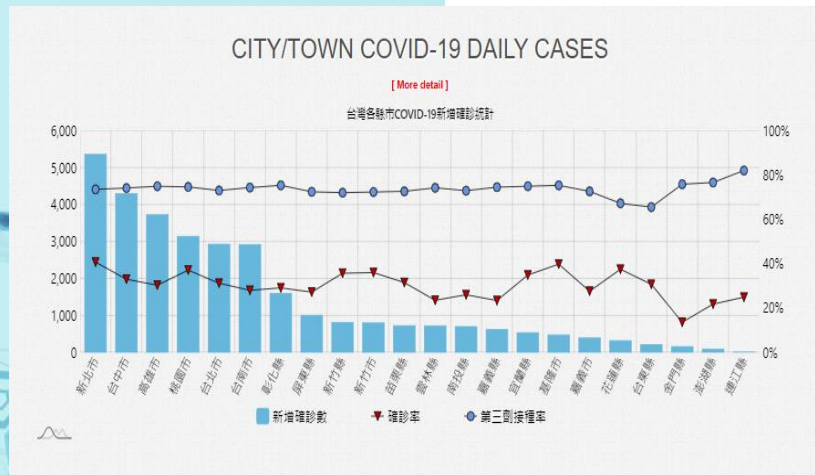


# Challenge of COVID-19 Data

- **The government's data reporting protocols have changed far too often**
- **No standard time**
- **Inconsistency in reporting of data formats**

- **No Data Accuracy and Integrity rule**
- **No raw data, No Science**
- **Call for Open Data and Scientific Cooperation**

# NCHC COVID-19 Dashboard





# NCHC COVID-19 Dashboard

- Health Bureau
- Fire station
- Hospital Dashboard
- Vaccine company

