

# The Good, the Bad and the Ugly: a review of SARS Lab Escapes

Research by DRASTIC, a group of researchers working together to investigate the origins of SARS-CoV-2, starting from facts and not bending to any pressure. DRASTIC was one of the first two groups to discover the Mojiang ‘miners’ case.

Gilles Demaneuf - [contact@demaneuf.com](mailto:contact@demaneuf.com). More articles: <https://gillesdemaneuf.medium.com/>

In 2003–04, in the wake of the SARS epidemics, there were multiple cases of laboratory acquired infection (LAI) with SARS in just a few months: first in a P3 in Singapore, then in a military P4 in Taipei and last a protracted case in a P3 in Beijing. The [‘WHO SARS Risk Assessment and Preparedness Framework’](#) has a good summary of these lab accidents:

*Since July 2003, there have been four occasions when SARS has reappeared. Three of these incidents [note: Singapore, Taipei and Beijing] were attributed to breaches in laboratory biosafety and resulted in one or more cases of SARS. The most recent laboratory incident [note: in Beijing] resulted in 9 cases, 7 of which were associated with one chain of transmission and with hospital spread. Two additional cases at the same laboratory with a history of illness compatible with SARS in February 2004 were detected as part of a survey of contacts at the facility. [i.1]*

This article reviews some of these cases and discusses briefly some of the insights that were gained from these at the time.

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## 1. The Good: Singapore P3 — Aug 2003

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**In a few words:** This first SARS LAI accident (in Singapore) exposed some serious structural biosafety issues but the investigation was very thorough and transparent, and even extended into a review of all BSL-3s in the city-state. The Singapore government used it as an opportunity to fundamentally redesign its biosafety approach, just at the time when more BSL-3s were due to come in line. We also note that the (strongly controlled) local media do not seem to have contributed any additional details to the story.

### 1.1 The Accident:

In September 2003, a 27-year-old student from the National University of Singapore (**NUS**) was infected with the SARS virus due to improper experimental procedures . [s.1]

The student was in his third year of a doctoral program in microbiology and was studying the replication of flaviviruses such as the West Nile Virus (which was just causing a peak of infection in the US at the time) in cells using electron microscopy. So far he had worked at the NUS BSL- 2 with the attenuated Sarafend strain of the West Nile virus. Because he wanted to compare this attenuated train with the more pathogenic New York strain of the virus (that one a BSL-3 pathogen), and since NUS had no BSL-3, an agreement was made for him to do this work at the BSL-3 facility of Institute of the Environmental Health Institute (**EHI**) of Singapore.

The BSL-3 of the EHI had been heavily involved in SARS research during the recent outbreak and was continuing that work at the time [s.6].

The student had no previous experience working in a BSL-3. On his first visit to the EHI, he was given only 20 minutes training with BSL-3 procedures before entering the BSL-3 lab.

On his second and last visit to the institute (Saturday 23 Aug 2003) he entered the lab 3 times:

- The first time, he went in with the technician, wearing only street clothes, and did not engage in any work.
- The second time, staff of the EHI were meeting. Before going to that staff meeting, the virology technician had grown up a stock of the New York isolate and centrifuged the supernatant from infected cells. The technician had then placed the centrifuge tubes in the Class II biological safety cabinet for the student to ampoules as a seed stock for his research. Accordingly the student put on a gown and two sets of gloves before entering the laboratory alone, where he spent 20 minutes unsupervised, transferring the cell supernatant into pre-labelled cryovials under the Class II biosafety hood. [s.6]
- The third time he re-entered the lab with the technician who was back from her meeting and transferred the cryovials to a  $-70^{\circ}\text{C}$  freezer located in the BSL-2 facility, as no such freezer existed inside the BSL-3 laboratory, so that all frozen BSL-3 virus strains were effectively stored in the in the BSL-2 freezer.

The student did not engage in any more work with these before falling ill 3 days later on Aug 26, developing mild SARS symptoms. He sought outpatient medical care from his general practitioner, Singapore General Hospital (SGH) emergency room and a Chinese physician. He eventually returned to the SGH with persistent fevers and was admitted to the hospital on Sep 3. Fortunately he recovered and there were no secondary cases.

## 1.2 The Investigation:

Analysis of the ampoules of seed West Nile virus that the student stored on that 23rd Aug showed that the vials contained SARS-CoV as well as West Nile virus. That SARS-CoV matched the SARS isolate that was handled at the EHI.

Poor record keeping made it difficult to ascertain if there was a live SARS virus in the BSL-3 laboratory on that exact 23rd Aug, but it was established that there was some there 2 days before. [s.8]

In other words there had been a SARS-contamination within the BSL-3.

A 11-member review panel led by [Antony Della-Porta](#), Biosafety Expert for the WHO [t.3], produced a report for the Ministry of Health in Singapore. The panel concluded that a combination of

***“inappropriate laboratory standards and a cross-contamination of West Nile virus samples with SARS coronavirus in the laboratory led to the infection of the doctoral student”.***

[s.8]

The investigators also documented a variety of shortcomings within the EHI BSL-3 lab that most likely contributed to the incident. These included inadequate record-keeping procedures, totally inadequate training, inexistent virus stock inventory, patchy maintenance records plus a variety of structural problems including the absence of gauges to indicate the pressure differentials, the lack of a freezer to store samples, problems with HEPA filters and air supply, and other equipment deficiencies. [s.5, s.8].

Accordingly they first recommended that all BSL-3 work cease there *‘until the laboratory deficiencies have been addressed and subjected to external audit’*. [s.8]

**Note:** While many circumstantial evidences pointed to a real risk of SARS contamination of the EHI BSL-3 lab, the exact causes of this particular accident — such as a precise bad manipulation or the failure of a precise piece of equipment — was never precisely identified.

## 1.3 Structural Issues:

At the invitation of the Singapore Ministry of Health, the investigation team went further than the EHI P3 lab and looked also at overall biosafety practices in other Singapore institutions. This was both a very courageous and very useful initiative, especially in view of the large number of new Singapore BSL-3 labs that were supposed to come in line soon at the time.

The Singapore General Hospital BSL-3, the NUS BSL-2 and the Defence Science Organisation were reviewed. The panel found deficiencies at the Singapore General Hospital as well as at the NUS BSL-2. [s.8] and made recommendations to improve biosecurity in each institution they visited.

More generally, the panel concluded that there were no appropriate standards, regulations or guidelines on biosafety in Singapore, and [offered some recommendations](#) [s.8] as to what could be done to rectify the situation:

### ***Biological Standards***

*Recommendation 7.1: Need for a National Legislative basis for Standards in Biosafety Laboratories for Singapore.[..].*

*Recommendation 7.2: A structure should be created for laboratory certification covering both structure integrity and operating procedures. [..]*

*Recommendation 7.3: Creation of the tracking system for importation, exportation to and from Singapore. [..]*

## 1.4 The Aftermath:

At the end of September, Lim Ruisheng, Minister of Environment of Singapore, apologised to the people of Singapore for the SARS infection incident in the laboratory of the Institute of Environmental Health. Lin Ruisheng said:

***“The Environmental Health Research Institute must take responsibility, and the National Environmental Administration must also take responsibility. As the Minister of Environment, I should be more responsible. Because the investigation results of the investigation team show that our laboratory is indeed not safe enough.”***

[s.3]

Since 2003, Singapore has introduced legislation and regulations to cover the handling of high risk infectious agents and developed a laboratory accreditation system. Aligning incentives with regulation and training, they have also taken a number of initiatives to reward outstanding safety practices.[s.6]

## 2. The Bad: Taiwan Military P4 — December 2003

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**In a few words:** The second SARS LAI accident (Taiwan) was a less straightforward affair. First the human factor played a big role in delaying notification to the authorities. Then the accident had a large epidemic potential as it involved international air-travelling shortly after infection. Also, while the official reporting of the accident was generally transparent, a few aspects of the story remained somewhat opaque due to the military setting.

Taiwanese media, and interestingly also mainland China media, have contributed circumstantial details to the story. Generally, the reaction of the authority seems to have been earnest and constructive.

## 2. 1 The Accident:

Oddly most references to this lab accident simply fail to mention that it happened in a P4. The fact that it was a P4 is particularly important and should be better publicised.

This lab escape involved the Taiwan Military Institute of Preventive Medical Research (IPMR) of the National Defence University. It is located in Baiji Mountain, Sanxia (or Sanhsia, 三峡, Three Georges), on the outskirts of Taipei Town, and is allegedly partly dug into the hill. The laboratory is known as the centre of Taiwan's biochemical capacities. The facility was [allegedly](#) capable of producing weapons-grade biological agents [t.1] and may have done so in the past [t.18], although Taiwanese officials claim it exists only to research ways of preventing biological attacks from mainland China.

According to unverified Chinese sources, Taiwan purchased the IPMR [from France in 1983](#) [t.2]. A more recent [Western source](#) described it as being '*full of advanced French-made equipment*' [t.18]



[IPMR entrance](#)

As the top biosafety lab in Taiwan, the IPMR has been racing against the clock to analyze the characteristics of the virus since the SARS outbreak. In May 2003 President Chen Shui-Bian had announced that he had ordered the IPMR to work on a vaccine for SARS. [t.18, t.20]

On December 6th 2003, 44-year-old Lieutenant-Colonel Chan Jiacong , a Ph.D. in pathology from Johns Hopkins University (US), contracted SARS at the IPMR due to negligence.

The researcher worked with SARS. He was cleaning his Taipei lab when he

found a ripped bag [t.7] in the negative-pressure transport cabinet of the laboratory. He assumed that the bag had been leaking for several days and may have thought the virus had already lost its effectiveness. In any case the researcher was working alone and had to travel to Singapore the next day to address a meeting about his SARS research, so he was in a rush t.4, t.10]. **[Note: we were unable to identify a suitable conference in Singapore on those days — suggestions welcome]**

The proper way of cleaning that spill was to use vaporised hydrogen peroxide, but this would have taken hours. Instead he decided to use a shortcut in the form of 70% ethanol which he could spray on the spill before wiping it out [t.17].

As he could not reach the spot with the gloves attached to the cabinet, he instead wore a “normal mask” and surgical gloves, no protective gown, opened the transport cabinet, tried to reach the spill — but because he still could not reach it, he then put his head inside the cabinet pass-through to spray the spill with the ethanol mix. After spraying it and waiting for 10 minutes, he wiped the spill out.

In the process it seems that he then simply dumped the leaking bag on his trash cart.[t.2, t.7, t.8, t17].

***“He was [in a hurry](#) to get ready for a conference in Singapore, so he was rushing to finish his disinfection work and was careless”***

Su Ih-jen, chief of Taiwan’s Center for Disease Control [t.5]

Another source [notes that](#):

*[The] laboratory was also found to have violated many safety and record-keeping standards. For example, this researcher regularly worked long shifts (12 to 14 hours) usually alone and there was no timely procedure in place for reporting incidents. In addition, there **was no record of him actually working in the laboratory** since he had recently lost his building access card and was using a borrowed card on the date of the incident.*

*Della-Porta explains that the recommended procedure for decontamination of the safety cabinets used in the Taiwan facility is the use of a hydrogen peroxide generator, which takes several hours. He adds that a shortcut of 70 percent ethanol for 10 minutes is **completely inadequate**. In addition, there were inadequate standard operating procedures and Taiwan was without guidelines or regulations related to biological safety.’*

[t.10]



[Example of a mobile Class III BSC \(Biosafety Cabinet\) — suitable for a BSL-4](#)

On the following day, Dec. 7, he flew to Singapore with six laboratory colleagues on a China Airlines flight. He complained of fatigue and muscle pain on Dec. 8 while in Singapore but had no fever until the night of Dec. 10 after he returned to Taipei. He later had diarrhoea.

Soon after returning from Singapore, he reported to the Defence University clinic that he had developed influenza. Among many issues, the WHO investigation team recorded a failure to have a medical monitoring programme in place. Indeed senior management could not explain why, after Chan had reported to the Defence University clinic with a respiratory disease, he was not followed up for the next 6 days when he was absent from work. [t.16]

## 2.2 Fear of Losing face and bringing shame:

Faced with the standard symptoms of SARS, Lieutenant-Colonel Chan was very aware that he may have caught SARS. However he decided to self-isolate at home, relying on his father to care for him, as he was unwilling to seek medical care because he dreaded bringing disgrace to himself and his institution.

His father [eventually persuaded him](#) [t.6] to seek medical attention by threatening to commit suicide. He checked into Taiwan Heping Hospital only on **Dec 16** by which time he had developed other SARS symptoms, such as a cough and signs of pneumonia. He was readily diagnosed as having SARS [t.16].

*His father said in a television interview that his son knew early on that he might have SARS. But he delayed going to the hospital because he didn't want to panic the public and disgrace Taiwan. He quarantined himself at home until Dec. 16 and relied on his father for food and other care.*

*His father told CTI cable TV that his son: "wanted to die at home because he feared his illness would bring shame to his lab and the country".*

*The father said he pleaded with his son to seek treatment. As the scientist's condition worsened, his father said he threatened to commit suicide if he didn't get help. **"He finally agreed to go to the hospital after I threatened to kill myself,"** his father said. **"He was thinking of the country. He's a military man, and military men are bound by a natural duty,"** [t.6]*

## 2.3 Reaction from the Authorities

A chest x-ray showed pneumonia in his right lung and polymerase chain reaction tests of throat and blood samples were positive for the SARS virus. The finding was further confirmed on multiple samples in two laboratories in Taipei.

Six colleagues were ordered to suspend work at the laboratory and start self-isolation at home for 21 days. The four family members of the officer self-isolated at home for 21 days, although they had not displayed fever or any other SARS-like symptoms.

Although Chan was not in the contagious phase when he travelled, around 95 people who had been in contact with him were quarantined until Dec. 23, including 19 that were on his flights and 79 in Singapore. None of them were infected. It is worth noting that officials were having difficulty contacting three Americans, a Japanese and a Singaporean who had been on the flight. Additionally two of his colleagues went to Singapore with the researcher on Dec. 7 and later traveled to the United States.[t.6, t.14]

*Five foreigners — three Americans, one Japanese and a Singaporean \_who sat near him on the return flight from Singapore have been located and told to monitor their health, officials said on Friday. The Japanese traveler was located in Taiwan where he lives, two of the Americans went to Hong Kong and the other is in the United States, said Shih Wen-yi, a spokesman for Taiwan's Center for Disease Control. They were told to be on alert for SARS symptoms, like a fever.*

[t.6]



[Lieutenant Colonel Chan leaving hospital](#)

The Taiwan Science Council closed the IPMR temporarily and issued a resolution stating that Lieutenant Colonel Chan violated the “Laboratory Safety Guidelines and Norms” of the SARS project research plan and was given a sanction not to apply for research project funding.

*The laboratory conducting severe acute respiratory syndrome (SARS) research at the Institute of Preventive Medicine Research (IPMR) of the National Defence Medical College was closed down temporarily Wednesday after one of its researchers was confirmed to have contracted the flu-like disease, military sources said.*

[t.6]

*“All SARS research work in the military has also been halted”*

Chang Sheng-yuan, director-general of Taiwan’s Military Medicine Bureau

The CDC conducted two complete environmental disinfections. All equipment was inspected in detail, and all personnel were retrained. [t.2, t.13]

Separately in China, authorities ordered all researchers to hand in SARS samples as a precaution. China’s Health Ministry told laboratories to send samples to “designated places for storage” and “demanded that all regions strengthen management of the SARS virus,” the official Xinhua News Agency said. [t.6]

## 2.4 WHO enquiry and international cooperation:

A WHO Team was invited to investigate the case. Anthony Della-Porta, who had earlier headed the WHO investigation of the SARS LAI assisted with the investigation.

As far as we can tell, the WHO investigation seems to have been rather comprehensive and transparent, finding and reporting quite a few failures, with the exact circumstances of the accident well delineated [t.13]. The international cooperation effort that followed seems to have been constructive and certainly helped rebuild trust in the Taiwanese capacity to manage their BSL3/4s:

*In January 2004, the World Health Organization (WHO) dispatched an expert team [of 3] led by Dr. Antony Della-Porta to Taiwan because of the SARS case (Figure 1). They visited five existing and new constructions of BSL-3 laboratories during their short stay. In addition to the advice given to those individual laboratories, four major measures in terms of general management of biological safety were suggested.*

*Soon after, CDC invited two world-class experts in the field, Dr. Thomas Ksiazek from U.S. CDC and Dr. Kazuyoshi Sugiyama from National Institute of Infectious Diseases (NIID) of Japan, respectively, in March and November 2004, to give [Taiwan CDC] us a helping hand in inspecting current safety and management of equipment in laboratories of Biosafety Level 3 or above across Taiwan (Figure 2).*

[t.9]

**Figure 1**

WHO expertise committee investigated BSL-3 virus laboratory of Taiwan CDC.



**Figure 2**

Taiwan CDC invited experts from USA CDC and Japan NIID to Taiwan to assist in appraising BSL-3 laboratories.



As the Taiwan CDC would later state,

*'The laboratory-acquired case of SARS in Taiwan sent a shockwave through the nation. However, this incident was a crucial turning point. It led to the seeking and adoption of advice from both national and international experts and scholars and, therefore, acquired invaluable learning experience in biological safety management'.*

[t.11]

## 2.5 Lessons to be learnt:

Henk Bekedam, the WHO representative in China, told reporters in Beijing that the case in Taiwan should alert scientists:

*"It's a clear reminder again that we have to be extremely cautious working with the SARS coronavirus and there are whole issues about whoever in the whole world is keeping a SARS specimen has to be very careful in dealing with this"*

[t.6]

Anthony Della-Porta was even more clear:

*"It hasn't been a disaster, but it could have been."*

[t.12]

As noted by Furmanski [t.15] (quoted here), this second outbreak further shook the virology communities in Asia, where many labs held and worked on SARS samples. On **December 18, 2003** WHO released a new protocol for handling SARS specimens in the post-outbreak period, with special emphasis on reducing risk of and performing surveillance to detect laboratory infections. Although this protocol was clearly created after the first (Singapore) escape, the WHO chose its words carefully so as to avoid offending members but resolutely highlighted the laboratory risk-factor in its introduction:

*"The possibility that a SARS outbreak could occur following a laboratory accident is a risk of considerable importance, given the relatively large number of laboratories currently conducting research using the SARS-CoV or retaining specimens from SARS patients. **These laboratories currently represent the greatest threat for renewed SARS-CoV transmission through accidental exposure associated with breaches in laboratory biosafety.**"*

WHO [t.16]

### 3. The Ugly: Beijing P3 — February and April 2004

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**In a few words:** The 3rd accident is a very unsatisfactory affair. It happened in the context of a rather toxic ivory-tower academic system leading to unchallenged bad practices. Very limited official information was released when it ever was; effectively the Chinese government, and consequently the WHO investigation, provided very little insights or simply did not discuss key issues.

There are also some reasons to suspect an internal cover up of the first two SARS cases, and last (and not least), the sanctions announced by the Chinese Ministry of Health seem to have been more symbolic than anything else.

Without exaggeration, this LAI accident seems very much to be a story of towering academic ego, shocking incompetence, obstruction of the truth and lack of accountability.

More importantly the unchallenged poor-handling of the investigation by the Chinese authorities may have set a bad precedent.

Partially redeeming this dark picture, it is worth noting that the mainland China media contributed some very good pieces of investigative journalism which can still be found today online and deliver many essential clues as to what actually happened.

#### 3.1 Setting the wrong expectations:

Following the Singapore SARS lab accident it became clear that laboratories handling SARS may not be as safe as one could expect, especially in nations rushing to build more P3 labs. This raised the question of the safety of the laboratories handling SARS in China.

Around the **13th Oct 2003** (so before the SARS accidents in Taiwan) the National Health and Family Planning Commission of the People's Republic published an [article](#) where it stated that:

***“The nation's SARS virus laboratories are safe. At present, no SARS patient has been infected from a research laboratory virus.”***

[b.4, b.13]

But the article went on to list reasons to be anxious and to make sure that the nation redoubles its effort to better control all risk factors:

*According to Professor Zhu Qingyu, a P3 qualification only refers to the laboratory's compliance with physical protection standards. In fact, the human factor comes first in terms of laboratory safety.*

***“Without good quality and sense of responsibility, (scientific research institutions) without strict and perfect management, being designated a P3 laboratory alone will not work.”***

[b.13]

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On **December 18 2003**, two days after the revelation of the Taiwan SARS lab accident, the WHO called for vigilance in P3 settings studying SARS and issued its '[biosafety guidelines for handling of SARS-CoV specimens and cultures](#)' [t.16].

On the **same day**, the Chinese Ministry of Health duly followed suite and issued an emergency notice requesting all localities to strengthen the centralised management of infectious SARS virus strains and human specimens to ensure the biological safety of virus laboratories and storage units [b.12]. The Ministry of Science and Technology and the Ministry of Health also conducted safety

inspections of the 15 to 20 P3 laboratories across the country **at the end of December** and started addressing the issue of labs that were handling SARS without approval. [b.1, b.12]

Incidentally, the CDC Institute of Virology in Beijing, being the most famous P3 lab handling SARS in the country, was explicitly mentioned in the press at the time:

*P3 laboratories have corresponding strict operating procedures. [ — ]. The current research on SARS by the Institute of Virology of the China Center for Disease Control and Prevention is under such a strict operation. SARS laboratories implement a dual access system: first, the procedures must be complete; second, entering the laboratory must be approved by management personnel.*

*It is reported that in the laboratory of the Institute of Virology of the Chinese Center for Disease Control and Prevention, there are six or seven researchers engaged in SARS research, and these people can be directly exposed to the SARS virus. According to Ruan Li [director of the institute], in accordance to the rules, when researchers enter the laboratory, they must first pass through a safety-gate, then through the anti-contamination area, and finally through another safety-gate. The same is true when one comes out.*

*All viruses are wiped out or removed in the process, and they cannot escape the laboratory. Therefore, the key lies in whether the staff strictly follow the procedures. [b.12]*



[Article from the 19th Dec 2003](#)

On the **19th Dec**, Qi Guoming, director of the Science and Education Department of the Ministry of Health of China, detailed the actions taken by his ministry in an interview with a reporter from CCTV:

*The Ministry of Health is now dealing with these problems. The laboratories that began to conduct SARS virus research without approval are being cleaned up and checked.*

*He explained that the review teams will examine the laboratory's hardware, personnel quality, and the management of virus samples. Those laboratories that do not meet the standards will immediately stop research. [ — ]*

**'If an accident occurs and infection is caused, it is a crime against the people and society'.**

[b.12]

### 3.2 Flagship role of the CDC Institute of Virology:

The National Institute for Viral Disease Control and Prevention (NIVDC) in Beijing ([病毒病预防控制所](#)), in short the **Institute of Virology**, is part of the Chinese Center for Disease Control and Prevention (China CDC, [中国疾病预防控制中心](#)).

The CDC itself had only been formed in early 2002 and had to immediately ride through the SARS epidemic. In June 2003, mainland China had no more new or active SARS cases and the SARS epidemic was officially declared as being over. The Institute of Virology was then designated by the Ministry of Health as one of the six storage units for the SARS virus. [b.1]

The Institute of Virology was effectively the **most prestigious viral research institution in the country** at the time. It had the first P3 in China, was the workplace of famous academicians and was part of the newly formed CDC, which very purpose was to prevent epidemics in the country.



Situated at №100 Yingxin Street, Xicheng District, the institute is 1km from the busy interchange station of Beijing metro lines 4 and 7. The main body of the virus institute was a five-story building (since rebuilt), the fifth floor was a dormitory for staff or visitors , and the remaining four floors were offices and laboratories [b.1].

From the appearance, the whole building was unremarkable. An old man who lived in the bungalow opposite the virus institute for more than 30 years told reporters that the virus centre was built in the 1950s [b1].

To this day the building is still standing. The Institute main buildings are now at 155 Changbai Rd, Changping Qu, Beijing. But the old building is still part of the Institute. [b517]

***'No.100 Yingxin Street, Beijing still stood stubbornly in that old crowded alley. The windows of the building were covered with grey dust, many were broken, and the exhaust vents jutting from the laboratory pointed at the residents' homes only a few meters apart.'***

[b.3]



Main entrance of the Institute, 100 Yingxin Street — 2020



Side alleys — source: Baidu

At the time there was no logo of the Institute of Virology at the front of the office building [b.1]. Its nondescript appearance clearly contrasted with its flagship role in viral research.



5-storey building of the Institute where the leak happened, source: Baidu

### 3.3 An academic ego got hurt

The director of the Diarrhoea Virus Department was Academician [Hong Tao](#) (洪涛) of the Chinese Academy of Engineering. 72 y-old at the time and a highly respected virus expert, he was one of the main pioneers in the field of medical electron microscopy, the main founder of the virus morphology discipline in China, the discoverer of diarrhoea rotavirus (“洪氏腹泻” Hong’s Diarrhoea) which caused a acute diarrhoea outbreak in North China in 1983, the discoverer of the intracellular morphology of epidemic hemorrhagic fever virus, and one of the founders of the Chinese Society of Electron Microscopy which he used extensively in his virus morphology work. He also had extensively studied chlamydia. [b.11]



[Academician Hong Tao, 72 at the time](#)

However recently his prestige had got rather badly damaged.

At the beginning of the 2003 SARS epidemic that started in Guangdong province, on the **13th Feb** 2003 precisely, Guangzhou Nanfang Hospital (on the SARS battlefield) issued an [autopsy report](#) of a SARS victim, stating that the cause of death was “viral pneumonia.” [b200]

At that very same time Hong Tao and an assistant at the Institute of Virology in Beijing were finding chlamydia particles from lungs tissues of two SARS victims, through electron microscopy.

On the **18th Feb** the Institute of Virology of the Chinese Center for Disease Research announced that the main pathogen of atypical pneumonia in Guangdong was likely to be **chlamydia**. [b.203, b.103]

In the afternoon of the same day, the Guangdong Provincial Department of Health held an emergency meeting. The expert group headed by **Zhong Nanshan**, a member of the Chinese Academy of Engineering (whose attitude and work during SARS would be exemplary) believed that chlamydia cannot be simply identified as the only pathogen and railed against the limitations of the electron microscope approach.

In effect Hong Tao had made a **basic mistake** by ignoring the golden rule of infectious disease pathogen identification: **Koch’s postulates**. More precisely he actually ignored 3 of the 4 Koch’s postulates — quite a feat for an academician. [b501]

*“If it is chlamydia, I will cut off my head and give it to you...”*

Dr Cai Weiping of the Guangdong expert group, from his hospital bed, after being infected while treating SARS patients [b102]

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Both Hong Tao and Zhong Nanshan were members of the elite Chinese Academy of Engineering, but Hong Tao was more senior, based in Beijing, had been in the CCP army back in 49 (very important for connections) and was working for the CDC not for some hospital in the province. Hence the Chlamydia hypothesis became the official theory in China for a while, and totally ineffective antibiotics treatments were formulated accordingly.

While the world scientific community raced ahead, Chinese researchers who disagreed with Dr. Hong couldn’t get their hands on tissue, blood and serum samples from SARS patients.

On March 17–18 the CDC and the Ministry of Health held a first national joint meeting of SARS experts. At that meeting China’s CDC was designated as the country’s leading institution for SARS scientific research, taking the lead back forcefully:

*“No unit or individual is allowed to publish research results in any form, including articles; if you want to publish, you must first report to the China CDC.”*

[b200]

Incapacitated by that incorrect official theory, Chinese scientists could not publish a single decent paper on the origins of SARS at that time [b301]. In particular it would later emerge that:

- Nanfang Hospital (Guangzhou) had found virus particles in lung tissue samples of SARS patients through electron microscopy as early as **February 20**, but their research was forced to stop after the “ban” issued at the meeting of the 17–18 March [b200]
- Researchers from the Chinese Academy of Military Medical Sciences (Beijing) also discovered virus particles in samples on **February 26**, which were identified as a coronavirus after being reviewed by 6 virus morphologists. On **March 21**, the Military Medical College reported to the relevant departments the discovery of the coronavirus. However, the findings were not officially announced until **April 9**. [b200, b103]

Eventually the Chlamydia theory was proven wrong by scientists abroad (mostly US and HK), by the beginning of April it was clear that a coronavirus was the cause of SARS.

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Defying that trend on the **1st Apr 2003**, Hong Tao and 20 other Chinese scientists published a paper defending the Chlamydia hypothesis [b207]. Nevertheless on the **3rd April 2003** the WHO declared SARS to be likely caused by a coronavirus [b.510], and on the **16th April 2003** it confirmed it to be the cause. [b509]

Even after the 16th April, an undeterred Hong Tao would tell reporters:

***“It does not mean that this virus is the only culprit. [...] We cannot be sure that chlamydia is an important cause of death for patients, but according to our research on previous cases, the coronavirus alone is not so serious.”***

[b.203]



Academician Zhong Nanshan, 66 at the time

### 3.4 Fighting back with more P3s doing SARS research

Prior to the SARS epidemic, in 2002 (as part of the important reforms of the CDC in January of that year), Hong Tao's Virus Morphology and Viral Diarrhoea Laboratory (病毒形态学与腹泻病毒实验室) at the CDC Institute of Virology was divided into three laboratories, all under his control: the [prion laboratory](#) (which can cause mad cow disease) department, the [viral diarrhoea laboratory](#) and Hong Tao's laboratory, designated as the [Academician Laboratory](#) (each of the 5 Academicians at the Institute traditionally have their own laboratory). [b.3, b.8]

As discussed above, Hong Tao had recently lost quite a bit of credibility in the “Chlamydia Incident” (“衣原体事件”). After that sorry episode, it was reported that Hong Tao did not go to work at the Institute of Virology often, but concentrated on books at home. Nevertheless he still had a voice on investment matters and reviewed work (as should be expected of any Chinese academician).

Under Hong Tao the CDC had 3 P3 labs. One was supposed to be working on SARS, but **what if these 3 laboratories could be made to work on SARS?** Then Hong Tao and the CDC could carve themselves a leading role again in SARS research.

Let's remember that at the beginning of 2004 the number of P3 labs in the country was still very limited, at around 15 to 20. Because of security concerns [b.4], the few SARS virus specimens that were necessary for experiments had become a “scarce resource” and were available only at the 6 designated storage institutions — which included the Institute of Virology [b.1]. So in effect very few P3 labs in the country could do SARS research on un-attenuated live strains, and with a bit of administrative flexibility three of them could be right under Hung Tao at the Institute.

**Wang Jianwei (王健伟)** who until then as an associate researcher at the Institute became the director of the viral diarrhoea department around Sep 2008. He was a former doctoral student of Academician Hong Tao and as an assistant, he was the one who with Hong Tao first discovered chlamydia in the lung tissues of deceased SARS patients. [b.3]

From his narrow field of viral diarrhoea Wang Jianwei could soon move to research on the much more critical SARS virus, with the encouragement of Hong Tao:

*“Wang Jianwei is my student and I have the responsibility of teaching. SARS still has too many mysteries.”*

Hong Tao, explaining his work on SARS after the Chlamydia Incident [b.3]

As one Chinese article would soon put it:

*This relation between Hong Tao and Wang Jianwei explains exactly why post-doctoral students in the diarrhoea virus lab could do “interdisciplinary research on SARS virus” and select SARS as a major. For young researchers, the mysterious SARS virus is not only a severe challenge, but also a rare opportunity.*

[b.3]

The source above [b.3] goes on by reporting an official description of these students as having no weekends and holidays, no day and night, and sometimes even working overnight in the BSL-3. Good traditional party-speak, but not actually the best advertisement for lab-safety if one thinks of it.

As a result of this ‘interdisciplinary research’ approach, while the virus emergency technology department and the virus resource centre department were technically responsible for the preservation of SARS strains, some SARS strains and potentially infectious materials were also kept in the diarrhoea virus and in the prion virus laboratories.

### 3.5 Lab contamination — Feb 2004

**Ren Xiaoli** (任小莉, pseudonym) is a Virus Morphology doctoral student at the Institute of Virology in his last year before graduation. Under the guidance of Hong Tao (founder of the Chinese Virus Morphology discipline) and Wang Jianwei (王健伟), then director of the Viral Diarrhoea Department of the Institute of Virology, Ren Xiaoli and 21 doctoral and master students such as **Yang** (杨某) and **Guo** (郭某) joined the frontline of SARS scientific research. [b.3]

To understand exactly what happened we need to understand the layout of the rooms accessible to the viral diarrhoea department members. Unfortunately the official reports are very opaque and somewhat confusing as to these essential aspects. Fortunately some key insights were provided by insiders to reporters of Caijing and Southern Weekly. Without these it would be impossible to make any sense of the limited official reports.

The viral diarrhoea department rooms seem to have been divided between P3 rooms and ‘normal’ rooms (possibly BSL2 [b505]). In particular one of the ordinary rooms held an electron microscope, a large apparatus that was the favourite investigation tool of Hong Tao and of his doctoral students.

**Rooms 106 and 107** (on the first floor of the main building of the Institute of Virology) were mentioned by insiders. Presumably one room was the P3 laboratory, while the other one next door was a P2 electron microscope room.[b.1]

A professor in the Department of Medicine at Peking University, who has repeatedly entered the China Center for Disease Control, told reporters that the management of the virus has not been strict enough. For example, the strain was originally required to be stored in a special safe in the laboratory, and locked, but here, the strain is even placed in the corridor. The overcrowding of laboratory personnel was very serious. According to his estimate, **the number of laboratory staff at that time was three times the reasonable load of the laboratory.** [b.4]

We are further told that:

*‘because the room was too crowded, the refrigerator containing the SARS virus was moved into into the aisle’*

[b.3]

In other words because the (likely newly established) P3 lab room of the viral diarrhoea department was too crowded, the samples fridge of the diarrhoea room was moved into the corridor, by the entrances to the 106 and 107 rooms. We are further told that *'There is a padlock on the refrigerator door, and the key is kept by two people. To be on the safe side, a seal was also affixed to the refrigerator.'* [b.1] which would be consistent with improvised security measures to keep that fridge safe despite having it standing in a corridor.

This interpretation is in line with one of the first notices issued by WHO when responding to the leak accident:

*'investigators have serious concerns about biosafety procedures at the Institute — including how and where procedures using SARS coronavirus were carried out, and how and where SARS coronavirus samples were stored.'*

WHO, May 18 [b503]

-o0o-

After the Spring Festival in 2004, Ren Xiaoli regularly [took out the kit](#) containing the normally attenuated SARS virus from the phosphate PH buffer solution in the fridge belonging to the P3 viral diarrhoea lab (but standing in the corridor) and directly walked into the ordinary Electron Microscope room next door [b.3], as she needed to use the electron microscope equipment there — a typical pathogen investigative approach of Hong Tao's students.

Some report states that [Ren actually prepared the deactivation solution](#) [b508]— but being a student the method itself would likely have been decided by a superior.

She never thought that the dangerous virus in her hand might still survive. Indeed, According to previous experience a solution formulation composed of detergents such as phosphate buffer and sodium lauryl sulfate can deactivate the active protein of the virus. However the SARS virus inactivation technology adopted by the viral diarrhoea department had not been effectively verified and it was not included in the SARS virus inactivation program recommended by the Ministry of Health. [b.3]

Unfortunately this would cause a contamination of the ordinary electron microscope room. **Ren and Cui** (a virus morphology student in the viral diarrhoea department) developed symptoms such as diarrhoea and high fever as early as the 8th February 2004 [b.1, b.8], and went to Union Hospital and Friendship Hospital successively. Fortunately, their condition improved later and they did not infect anybody. [b.3]

在此种情况下，对疫情感染源的调查会是一个复杂的过程。  
被感染者还有两人  
《财经》还从权威渠道获知，宋某和杨某并非该所仅有的两位SARS感染者。  
据《财经》查证，早在今年2月，该所就有另外两位研究人员出现SARS症状，并去医院就诊。在近日为该所研究人员所作的SARS抗体检测中，两人的抗体呈现阳性。  
这两位研究人员分别为任某和崔某，今年2月出现腹泻、高烧等症状。任某到协和医院门诊就诊，病情渐轻最后痊愈。崔某病情较为严重，曾在友谊医院接受住院治疗。所幸二人均未出现人对人的下传。  
据《财经》了解，中国CDC从未公开过此事。

['There are two more infected people'](#) — [Caijing, May 2004](#) [b.1]

At this point we must note that Ren and Cui cases only publically emerged when they were found to be positive for IgG and IgM SARS antibodies in May 2004 [b.1], during the investigation triggered by the April LAI when all employees were tested.

China only succinctly mentioned their cases and the role they played in early July 2004 [b58], so about 2 months after they were first disclosed by Caijing. Shortly after that short official mention, an investigation by Southern Weekend [b.3] added more details obtained from insiders.

That's all the information that was ever available on these two cases — despite them being essential for the rest of the story, and the names are pseudonyms.. Additionally these two crucial cases will not be included in the final Chinese report [b51]. Nor would the WHO ever mention them at the time [b501], thus mirroring the Chinese report.

In the end it is not clear whether the Institute of Virology itself actually knew about these cases before May when the Ministry of Health organized some systematic antibodies testing, but the question may be worth asking.

### 3.6 Community Transmission — Apr 2004

**On March 7th Song** (宋某 as given in the reports at the time), a 26 year-old graduate student of Anhui Medical University (安徽医科) started a short-term internship in the viral diarrhoea department of the Institute of Virology in Beijing, during which time she worked with adenovirus (腺病毒) and syncytial virus (合胞病毒). Her research has nothing to do with SARS. With her qualifications, she was not allowed to enter the P3 laboratory for SARS research and she always maintained that she never did. [b.1, b.4]

On the evening of March 23, she took the train back to Hefei (合肥, her hometown, a 1,000km train journey). On **March 25**, she felt body aches, fever, and physical discomfort, she took cold medicine and antibiotics by herself, but her symptoms did not alleviate. She returned to Beijing by train on **March 27**, and went for a consultation at Beijing Jian Gong Hospital (健宫医院) on **March 29** where she was admitted for pneumonia. [b.1]

Inadvertently, she has been infected with the SARS virus.

Her mother Wei (魏某) came over to Beijing from Anhui on **Mar 31** to be with her and if possible bring her back home. On **April 2**, Song and her mother returned to Hefei Huainan (Anhui) by train where Song was transferred to the Second Hospital of Huainan Mine (淮南矿二院). According to Caijing, the Virus Institute did not doubt Song's symptoms at the time, but "later her mother took her to Anhui" and the Institute did not continue to investigate [b.1].

*'She was actually very poor [ — ]. Sometimes I even recalled the way she was lying on the hospital bed, her fever was terrible, the expression on her face and the pain in her eyes. But I just feel that she was too stubborn and did not cooperate with our treatment, saying that she was going back to Anhui to continue treatment.'*

Nurse Li, [to a reporter](#) [b.6]

On **April 4**, Song was further transferred to the First Affiliated Hospital of Anhui Medical University (安徽医科大学附属第一医院) for viral pneumonia to continue treatment.

On **April 8**, Song's mother, Wei, who had now been with her for 8 days, began to develop fever and was admitted to the First Affiliated Hospital of Anhui Medical University with unexplained viral pneumonia. On April 19, Wei's condition suddenly worsened and despite efforts to save her she died (community case #1). [After receiving the report](#), the local health department immediately activated the SARS early warning mechanism. [b502]

Since she had never been exposed to this deadly virus, Song did not receive any warning. Even after the death of her mother, Song did not think of the word "SARS". From beginning to end, Song never suspected that he was infected with the SARS virus.

*"I have never been to a laboratory that stores the SARS virus."*

*"I still don't know when and where I was infected with the terrible SARS virus"*

As told by Song [b.2, b.14]

At Beijing Jiang Gong Hospital a 20y old nurse named **Li** (李某), whose job was to take care of fever patients not yet examined, had been in contact with Song [b.6]. On **April 5**, nurse **Li** began to experience chills while waiting for a bus. On Apr 7, she developed fever, cough and other symptoms, and was admitted to Jian Gong Hospital .

Because her condition did not improve after treatment, she was transferred to the intensive care unit of Peking University People's Hospital (北京大学人民医院) on the 14th. She first learnt that she had contracted SARS on the 21st April. [b.1]

Song was not the only primary case. Yang, a [postdoctoral fellow](#) at the institute [b502], fell ill after working in the viral diarrhoea department. He was hospitalized 23 days after Song (17th April) and then put in isolation on the 22nd April on confirmation of the SARS diagnostic.

### 3.7 The Response of the Authorities

China officially reported Li SARS case on the **22nd April**, then Song, Wei and **Yang** SARS cases on the **23rd April** [b502, b504]. The institute was temporarily closed and quarantined on the 23rd April. [b1, b513]



Staff of the Chinese Center for Disease Control and Prevention closing the gate of the Institute of Virology, [preparing for terminal disinfection](#) , 100 Yingxin Street [b.3]

An additional case was reported on the **28th April**, a 49y old female retired doctor who on the 12th April was in the same hospital ward as nurse Li. In total Li was linked to 5 confirmed cases. [b.7]

During the 2003 outbreak, the transmission of SARS was greatly amplified in hospital settings. As a risk reduction strategy all seven Beijing SARS cases were eventually treated in one selected hospital, Ditan Hospital (with Song being eventually treated in Anhui).

Nevertheless the patients were initially treated or assessed in open wards at seven hospitals (five in Beijing and 2 in Anhui) before suspicions of SARS were raised and procedures of isolation and infection control were introduced. In addition, the two patients in Anhui travelled long distances within China by train. As these events created opportunities for multiple exposures, Chinese authorities undertook extensive tracing and follow-up of contacts.

By the end of April, 700 people were medically quarantined. More than 260 people from the Institute of Virology, including scientific researchers, graduate students and their family members, were quarantined or dispersed, with 24 people being sent to the Beijing Chest Hospital. In the town of Xiaotangshan, Changping District, a resort received 145 people. [b1]

In total nearly 1,000 people would be quarantined (a figure never released by the Chinese CDC). [b106]



Supplies arrive for staff under quarantine at the National Institute of Virology in Beijing, China, 30 April 2004. A laboratory at the institute is thought to be the source of the recent SARS outbreak.

100 Yingxin Street, Source: [WHO \[t.21\]](#)

Two additional confirmed cases of SARS and three additional suspected cases were reported in Beijing on **1 May**, all related to the Viral Diarrhoea Department of the CDC's National Institute of Virology in Beijing.

*"The cases had been linked to experiments using live and inactive SARS coronavirus in the CDC's virology and diarrhoea institutes where interdisciplinary research on the SARS virus was conducted."*

China Daily, [b.59]

On **2 May**, China announced the three suspected cases as genuine cases of SARS, bringing the total cases in a recent outbreak to nine. 189 people were released from quarantine.

On **18 May**, after no new infections had been reported in a three-week period, WHO declared that that ["China's latest SARS outbreak has been contained, but biosafety concerns remain"](#). [b503]

On **May 21, Zhang**, the last SARS case in Beijing, was discharged from Beijing Ditan Hospital.

On **May 23**, all 747 close contacts in Beijing were lifted from quarantine, the treatment of SARS patients in Beijing and Anhui ended and the SARS transmission chain was considered as stopped. [b.54]

### 3.8 Summary of cases:

There were in total [11 cases](#) over four [generations](#). Note that the official report would only mention the 9 cases of the Song-contamination chain (April), ignoring the two February primary cases that are linked to the contamination of the diarrhoea lab and had been disclosed by Caijing since May. [b512, b513, b514]

#### a. February Lab contamination: 2 primary cases:

**Ren** (pseudonym) and **Cui** were found positive for antibodies in May. According to the official report Ren caused the contamination of the Viral diarrhoea department by taking the un-attenuated SARS virus from the sample fridge lab for observations under electron microscope.

Little is known about Cui beyond the fact that he worked in the viral diarrhoea department. It was established that he contracted SARS not from Ren but independently, making him another primary case.

For some reason, neither Ren or Cui are included in the list of patients in the official investigation and WHO reports at the time — which instead focuses on the April chain of contamination. They will eventually be mentioned by the WHO in [i.1].

#### b. April events: 1st generation: 2 primary cases from contaminated lab

**Song** (宋某), a 26-year-old female postgraduate student from Anhui Province. She had started an internship in the viral diarrhoea department on the 7th Mar. She did not return after the 22nd March as she soon fell ill.

**Yang**, a 31-year-old male post-doc researcher at the same virology institute who [was hospitalized on the 17 April](#), got independently infected. Indeed he started developing symptoms about 15 days after he last met Song, briefly in a corridor of the Institute, when the incubation period of SARS is 2 to 10 days. [b7, b516]

#### c. April events: 2nd generation.

The **two cases** in the second generation are both linked to close personal contact with the postgraduate student. These cases are her 53-year-old mother, **Wei** (魏某). The second case is a 20-year-old nurse in Beijing, **Li** (李某), who treated the postgraduate student, from 29 March to 2 April, during her initial hospitalization in Beijing. [b.7]

#### d. April events: 3rd generation.

**Five further cases** have all been linked to close contact with the nurse. [Three are relatives](#): her 45-year-old father, her 44-year-old mother, and a 36-year-old aunt who visited her in hospital [b515, b.7]. The fourth case linked to the nurse is a 49-year-old retired female doctor who was admitted to hospital because of another illness and shared a room with the nurse. The retired doctor's 23-year-old daughter-in-law, who accompanied her at the time of hospital admission, is the fifth case. [b.6]

附表一 “4·22”SARS 确认病例时间分布

分类	患者姓名	发病时间	疑似诊断时间	确诊时间
首发病例(确4州?)	宋某	3.25	4.22	4.23
宋某二代病例	李某	4.5	4.22	4.23
宋某二代病例	魏某	4.8	4.22	4.29
李某之父	李某	4.19	4.24	5.3
李某之母	邵某	4.17	4.24	4.28
李某之姑	李某	4.16	4.24	4.28
李某之病友	张某	4.19	4.27	5.3
李某之病友陪护	徐某	4.18	4.24	5.3
病毒所?	杨某	4.17	4.22	4.30

附表二 8名非典病例潜伏期均在理论最长潜伏期内

病例	代数	接触时间	发病时间	潜伏期	理论潜伏期
宋某	I	?	3月25日	?	14天
宋母魏某	II	4月3日	4月8日	5天	14天
李某	II	3月31日	4月5日	6天	14天
李父	III	4月8日	4月19日	11天	14天
李母邵某	III	4月8日	4月17日	9天	14天
李某姑母	III	4月8日	4月16日	8天	14天
李某同病室病友张某	III	4月12日	4月19日	7天	14天
李某陪护徐某	III	4月12日	4月18日	6天	14天
杨某	?	?	4月17日	?	14天

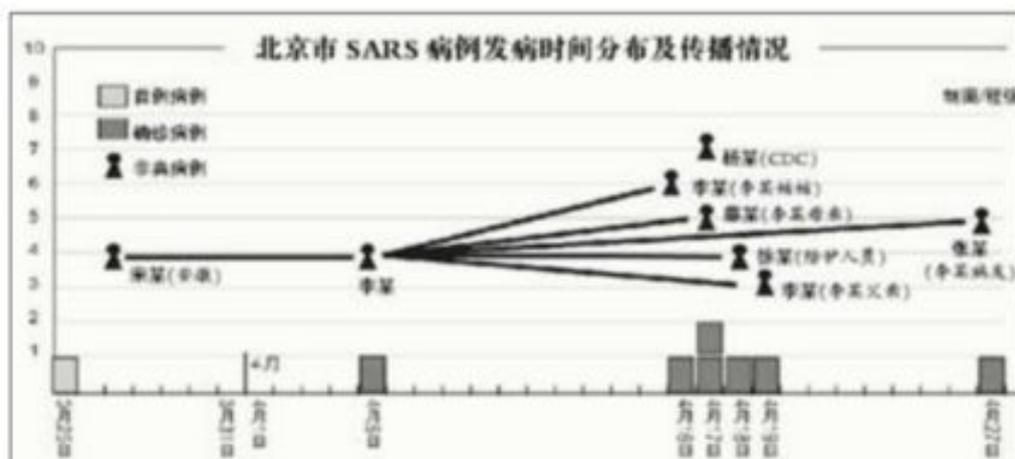
[Extract from Investigation Report — note that there were 2 additional Feb cases \(11 in total\)](#) [b.57]

### 3.9 The Official Investigation

On the 12th May an investigation team composed of 7 experts from the Academy of Military Medical Sciences, Beijing Municipal Center for Disease Control and Prevention, and CDC Institute for Infectious Disease Control and Prevention was formed. [b.1, b.3]

On May 14, it was learned from the representative office of the World Health Organization in China that the investigation team had confirmed that the SARS epidemic originated from a laboratory infection at the Viral Disease Control and Prevention Institute of the Chinese Center for Disease Control and Prevention (CDC), but the investigation team did not clarify the details. At about that time Caijing published the first article in the Chinese press mentioning the lab escape and the early February cases.

The Ministry of Health would produce its investigation report on the 1st July 2004 [b51]. The report covers the 9 April cases starting with Song. It briefly mentions Ren & Cui by stating that they had tested positive to IgG and IgM antibodies but does not include them with the 9 April cases and does not mention that their cases go back to early February. [b58]



[Summary of the 9 cases starting from Song](#) [b.7]

The investigation pointed out the six major problems of “illegal working procedures”: [b100, b58]

**First, research projects are interdisciplinary.** The viral diarrhoea department researches the gastrointestinal virus field, but has undertaken SARS research projects as a cross-disciplinary topic. The staff are not familiar with the topic, which has caused safety risks.

**Second, safety management is not paid attention to.** The staff adopted a new method of inactivation, without the academic committee’s validation, which scientific basis was insufficient, and the department director approved it without authorization. The inactivation effect had not been strictly verified, and there is no verification plan, record and content.

**Third, technical operations are not conform to the standard,** as per the absence of safety precautions in ordinary laboratory operation, thus violating the regulations of the Ministry of Health that the inactivation of SARS virus must be carried out in a laboratory with a biosafety level above P2 or in a biological safety cabinet.

**Fourth, the staffing is not strict.** A large number of graduate students and fellows who lack professional knowledge are used for high-risk research, and there is no strict biosafety knowledge training for relevant personnel.

**Fifth, health monitoring is not in place,** it violates the laboratory personnel health monitoring system, accident reporting system and other regulations formulated by the Ministry of Health, failed to promptly report abnormal conditions such as multiple fevers of laboratory personnel, and failed to take necessary measures. Two of the laboratory staff developed fever, and one was hospitalized for two weeks, without attention being paid to the cases and no reporting was made.

**Sixth, the implementation of the system was not serious** and violated the rules of the Ministry of Health and other four ministries regarding the implementation of two-person access to the P3 laboratory, as single-person operations occurred many times.

人民网  
people.cn

人民网·时政·综合报道

### 卫生部：今年北京安徽非典疫情来自实验室内感染

白剑峰

本报北京7月1日讯 记者白剑峰报道：卫生部今天公布北京、安徽发生非典疫情原因调查结果。

为查找2004年4月传染性非典型肺炎疫情在北京、安徽发生的原因，卫生部成立了由军事医学科学院、北京市疾病预防控制中心和中国疾病预防控制中心传染病预防控制所7位专家组成的调查组，对本次疫情的来源进行了专项调查。WHO的专家参与了部分调查工作。调查结果如下：

1. 本起疫情来自实验室内感染：（1）宋某和杨某两个原发病例发生在同一实验室。该实验室一直开展有关SARS冠状病毒（SARS-CoV）的科研工作。（2）封馆病毒所后，未再出现任何SARS病人。（3）从二代病例魏某（宋某之母）胸水分离到SARS-CoV，其全基因组序列与该室用于实验的毒株（HT-SCoV-2）高度同源。（4）没有发现宋某和杨某与野生动物接触感染的证据。（5）宋某和杨某发病潜伏期内没有任何其他SARS病例报告，没有实验室外接触其他SARS病人而被感染的可能。（6）杨某与宋某最后一次接触，到杨某发病相距15天，仅在走廊碰面，杨某发病不可能是宋某传染。
2. 感染来源局限在猴肾病毒室：（1）宋某和杨某两个原发病例都来自猴肾病毒室。此外，还发现该室另有二人（任某和崔某）抗SARS-CoV的IgG和IgM抗体阳性，感染具有明显的聚集性。（2）从二代病例魏某分离到的病毒全基因组序列与猴肾病毒室实验用毒株（HT-SCoV-2）高度同源。（3）对病毒所全部工作人员进行医学观察，血清流行病学调查未发现其他科室存在任何SARS-CoV感染者。
3. 没有三级生物安全防护实验室感染导致本次SARS疫情的证据：（1）宋某和杨某2004年以来都从未进入过三级生物安全防护实验室工作。（2）虽然猴肾病毒室进入三级生物安全防护实验室工作的任某血清抗体阳性，但没有其传染给宋某和杨某而导致本次SARS疫情的证据。（3）猴肾病毒室指定使用的三级生物安全防护实验室基本硬件设备和总体结构符合要求。
4. 引起实验室感染的环节：病毒灭活不彻底：2004年春节过后，任某多次从三级生物安全防护实验室带出未经严格验证效果的灭活SARS病毒在普通实验室进行实验，时间与宋某、杨某发病吻合。其采用的灭活方法（1%NP40+PBS+1%SDS冰浴60分钟）没有经过有效的评价，没有按规定对每一批病毒的灭活效果进行检测和质量控制。

调查认定，这次非典疫情源于实验室内感染，是一起因实验室安全管理不善，执行规章制度不严，技术人员违规操作，安全防护措施不力，导致实验室污染和工作人员感染的重大责任事故。

《人民日报》 2004年07月02日 第二版

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化学科学

Over about two months a few Chinese magazines and newspapers were able to add some crucial elements of this story (some acquired via insiders), such as the positive cases of Cui and Ren and the location of the fridge out of the P3 lab.

Caijing magazine also found out that, at that time, among the more than 200 people engaged in scientific research at the Institute of Virology, only 20 or 30 held P3 certificates, which clearly confirm point 4 of the conclusions above (*the staffing is not strict*).

Some international experts were disappointed that many details about the incident and the lab's operating procedures remain very opaque or simply hidden.

*"I was hoping for a full, more open account of what happened,"*

[Antony Della-Porta](#), the Australian biosafety expert who led the earlier WHO investigations of the SARS escapes in Singapore and Taiwan, but not Beijing. [b508]

### 3.10 The sanctions:

The Ministry of Health decided the [following sanctions](#): [b4]

**Ruan Li** (阮力), director of the Virus Disease Control Institute who has the main leadership responsibility, **Dong Xiaoping** (董小平), deputy director of the Institute, and **Wang Jianwei** (王健伟), director of the Viral Diarrhoea Department, received **administrative sanctions**. [b4]

**Li Liming** (李立明), the director of the Chinese Center for Disease Control and Prevention was given **administrative demerits** and resigned.[b4]

*"Neither Taiwan nor Singapore's laboratory infections caused second-generation cases, but this time our SARS incident not only caused transmission, but also third-generation cases. This is our failure to do a good job. Sorry to the government and people. We don't have any excuse on the issue. "*

Li Liming, May 8 2004, at a reorganization meeting held by the Institute of Virology

**Yang Xiaoguang** (杨晓光), his deputy director, who had important management responsibilities, was given **major demerits** and resigned. [b.4]

As for the student behind the pseudonym of **Ren Xiaoli**, **we are told that** s/he was not punished, being only a student and not directly responsible. This seems a bit odd and some questions are worth asking about the true identity of that person — given as the main proximal cause of the contamination of the lab — if the story concerning that person is true indeed.

Academician **Hong Tao**, director of the Institute, was not sanctioned. This triggered some rather vitriolic analysis of the nepotism of the Chinese scientific institutions:

*"The academician system has also set an example for new academics in China: Those who work hard and do research are idiots, and those who can get nothing, or get more with less, are "brilliant people with leadership skills."*

Yi Ming, The problems of Chinese academia and their way out (亦明, 中国学术界的问题及其出路), , Jul 2004 [b301]

### 3.11 The omissions

#### Ren and Cui

Ren and Cui had tested positive for antigens back in May, as disclosed by Caijing. The investigation simply confirms the positive tests but never mentions the February context.

Nor does it include them in the official count of the cases — something which could be explained away if necessary by pointing to the fact that the report is about the April infection, just as its official name indicates (“4.22’ SARS Epidemic in Beijing in 2004”). [b51]

### February inspection of the Institute

On July 12, 2004, shortly after the reorganisation meeting, according to media reports at the time, the Ministry of Health was rather sanguine about

the SARS virus leak. And they had good reasons.

The investigation report obtained by some reporters indicated that in February of that year (2004), following the the new SARS-samples handling protocol issue by the WHO on the 18th Dec 2003, the leaders of the Ministry of Health went to the Chinese Center for Disease Control and Prevention to inspect the P3 laboratory of the Institute of Virology and found problems with it. **They asked the CDC to propose a rectification plan and a plan to provide financial support, but the CDC did not implement it seriously.** [b106]

Possibly the inspection was just part of the Ministry review of P3 labs triggered by the new WHO guidelines following the Taiwan lab escape — however most P3 labs are understood to have been visited at the very end of December 2003 or early in January.

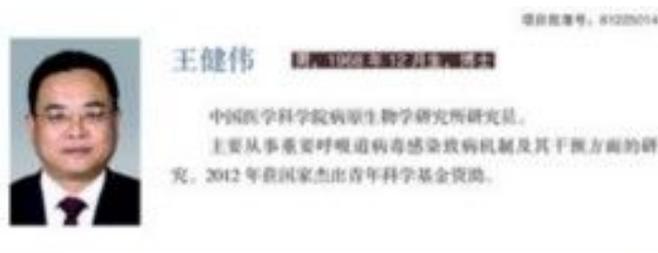
Alternatively it may have been triggered by the two suspected cases of SARS (Ren and Cui) who ended up in hospital in February.

Whatever the reason, the Ministry of health and Chinese Center for Disease Control and Prevention knew of some issues at the laboratory back in February.

### 3.12 All is well that ends well:

In any case the sanctions seem to have been more on paper than anything else:

**Wang Jianwei (王健伟)** [CV](#) states that he worked at the Institute until Feb 2006, then moved to be director of Merieux Laboratory in Beijing, He is today the director of the Chinese Academy of Medical Sciences & Beijing Union Medical College. He also served as a member of the Standing Committee of the Party Committee. Last, he was appointed executive editor of [Biosafety & Health magazine](#) [b303] and has produced a [manual on laboratory biosafety](#). [b304]



[Wang Jianwei](#)

**Dong Xiaoping (董小平)**, saw his job his job description change from ‘*Director of the Prion Division, Deputy Director, Institute of Viral Disease Control and Prevention, Chinese Center for Disease Control and Prevention*’ to ‘*Director of the Prion Department, Institute of Viral Disease Control and Prevention, Chinese Center for Disease Control and Prevention*’ — so basically dropping the ‘deputy director’ title. In 2012 he would reclaim that full title and is still in the same position. He enjoys special allowances from the State Council and is a member of the CPPCC National Committee (China top political advisory body).

He is also the deputy director of the State Key Laboratory of Infectious Disease Prevention and Control and the director of the Prion Department of the Viral Diseases Institute. He is also a member

and chief reviewer of the Biosafety Professional Committee of the National Accreditation Committee of Chinese Laboratories.



Dong Xiaoping

In February 2020 he [became an expert](#) of the “**WHO-China Coronavirus Disease Joint Expert Investigation Group**” and was part of the February 2020 joint-mission. [b305]

#### Annexes

##### A. WHO-China Joint Mission Members

<b>Bruce AYLWARD</b>	Team Lead WHO-China Joint Mission on COVID-19, Senior Advisor to the Director-General, World Health Organization, Geneva, Switzerland
<b>Wannian LIANG</b>	Team Lead WHO-China Joint Mission on COVID-19, Head of Expert Panel, National Health Commission
<b>Xiaoping DONG</b>	Director and Researcher, Center for Global Public Health, Chinese Center for Disease Control and Prevention

[Report of the WHO-China Joint Mission on Coronavirus Disease 2019–16–24 Feb 2020](#)

**Li Liming** (李立明) would later serve as Party Secretary and Executive Vice President of Beijing Association Medical. He is a professor at the Peking University School of Public Health.



Li Liming

**Ruan Li** is still a professor of the Institute of Virology.

**Hong Tao** is still a well respected academician and enjoys special allowances from the State Council. On the 7th Jan 2020, his student [Song Jingdong](#) (宋敬东), associate researcher at the Institute, took the first ever Electronic Microscope picture of SARS-CoV-2.

In 2016, Hong Tao, Wang Jianwei and Song Jingdong published the ‘[Medical Virus Atlas](#)’, compiled from nearly 50,000 electron microscope images of viruses.

In 2019 **Hong Tao** [received a commemorative medal](#) for the Celebration of the 70th Anniversary of the Founding of the People’s Republic of China, mentioning his significant contribution to the cause of medical virology and infectious disease prevention and control in China. [b306]

## References:

For a quick approximate translation of pages in Chinese, please use the Google Translate extension with Chrome. It works rather well.

It is fairly common for Chinese pages to be scrubbed from the internet. If you cannot find a page given in the references please try <https://web.archive.org/>. Most have been saved there. If one is still missing please let us know (via a comment to the article). We have kept copies and can put them online.

### Introduction:

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### Singapore:

[s.1] 'Laboratory-Acquired Severe Acute Respiratory Syndrome', NEJM, Apr 2004, <http://www.nejm.org/doi/full/10.1056/NEJMoa032565>

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[s.3] 'Review of SARS virus leakage accidents in laboratory', China Science News, Jul 2014, <http://news.sciencenet.cn/htmlnews/2014/7/299630.shtm>

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[s.5] 'International Consultant Della-Porta Challenges BSL-3 and BSL-4 Standards' <http://www.tradelineinc.com/reports/2004-9/international-consultant-della-porta-challenges-bsl-3-and-bsl-4-standards>

[s.6] Details of 3 lab visits: <https://www.publish.csiro.au/MA/pdf/MA08062>

[s.7] 17th August: <https://www.cidrap.umn.edu/news-perspective/2003/09/who-says-singapore-sars-case-not-big-concern>

[s.8] Official investigation panel report — a must-read: 'Biosafety and SARS Incident in Singapore September 2003': <https://www.nas.gov.sg/Farchivesonline/data/pdfdoc/20030923-MOH.pdf>

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[t.4] Long hours: <https://www.ncbi.nlm.nih.gov/pmc/articles/PMC7135754/>

[t.5]. In a hurry: <https://www.washingtonpost.com/archive/politics/2003/12/18/lab-rules-ignored-in-new-sars-case/91508154-b8dd-4ba3-a6f0-c7d002d28373/>

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[t.12] Disaster: <https://www.newscientist.com/article/dn4193-singapore-man-caught-sars-in-lab/>

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[t.14 ] [https://www.thelancet.com/journals/laninf/article/PIIS1473-3099\(04\)00911-9/fulltext](https://www.thelancet.com/journals/laninf/article/PIIS1473-3099(04)00911-9/fulltext)

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[b104] Review of "SARS Virus Leakage in China P3 Laboratory", blog entry: <https://archive.is/19WLI>

[b105] 2+3 labs: 'Did the laboratory of the Chinese Center for Disease Control and Prevention leak the SARS virus in 2004?', <https://zhuanlan.zhihu.com/p/107322222>

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[b503] WHO press release on the 18th April: [https://www.who.int/csr/don/2004\\_05\\_18a/en/](https://www.who.int/csr/don/2004_05_18a/en/)

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[www.the-scientist.com/news-analysis/sars-escaped-beijing-lab-twice-50137](http://www.the-scientist.com/news-analysis/sars-escaped-beijing-lab-twice-50137)

[b517] Article about a mobile P3 lab set in the old Institute building, 'Between "yin and yang", the reporter directly hit the laboratory test of the Institute for Disease Control and Virus Diseases', Jun 2020  
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*There was only one predecessor of these three laboratories, the laboratory of virus morphology and viral diarrhoea lab. In other words, yet another academician will not only create two more*

laboratories, but one of them is an “academician” laboratory showing that he does not even know what he is doing in it.

*“It is no wonder that these people not only fail to share the worries and alleviate problems for the country, but also add chaos to the country. I have seen with my own eyes that a so-called senior academician controls a laboratory worth millions of dollars, but there is no one inside. Just because he is an academician, others dare not speak up against him. It was also this academician, shaking a few pieces of paper with the genetic sequence that had been stored in GenBank long ago, declaring that it was a scientific secret.*

*In fact, those “authorities” who have long lost their creative ability (in fact, many of them have never had any creative ability), the most fearful thing is to be looked down upon by others, afraid of being overtaken by others, so they cultivate a direct line in academia, a gang, and the goal of competition between gangs is not who has a new academic achievements, but who wins the prize.*

*The director of the laboratory that released the SARS virus again this year, the viral diarrhoea laboratory of the Institute for Viral Disease Control and Prevention, is the proud student of Academician Hong Tao. It’s really “Where there is a teacher, there is a disciple” (有其师必有其徒)! The academician system has also set an example for new academics in China: Those who work hard and do research are idiots, and those who can get nothing, or get more with less, are “brilliant people with leadership skills.”*

[b302] For a good critic of the academic system in China, see ‘*The disease of science lies in culture*’, a discussion with Rao Yi, trained in the US (UCSF, Harvard) and known for his fight against corruption in academic system. [https://www.sohu.com/a/48091593\\_183834](https://www.sohu.com/a/48091593_183834)

[b303] Wang Jiangwei’s CV: <https://bit.ly/2IKIIZ6>, archived here: <https://bit.ly/3q4HHe9> (original), <https://bit.ly/3fMhg8A> (translation)

[b304] ‘*Introduction to Laboratory Biosafety -Wang Jianwei*’, <https://wenku.baidu.com/view/1caa674169eae009581beca8.html>, archived at <https://bit.ly/38KnWSW>

[b305] For Dong Xiaoping role on WHO-China Coronavirus Disease Joint Expert Investigation Group: see [https://www.who.int/docs/default-source/coronaviruse/who-china-joint-mission-on-covid-19---final-report-1100hr-28feb2020-11mar-update.pdf?sfvrsn=1a13fda0\\_2](https://www.who.int/docs/default-source/coronaviruse/who-china-joint-mission-on-covid-19---final-report-1100hr-28feb2020-11mar-update.pdf?sfvrsn=1a13fda0_2)

[b306] Hong Tao’s medal for his contribution to a healthy China and epidemics prevention <https://bit.ly/3q80Hsf> (translation), <https://bit.ly/3o16OwU> (original)