Severe acute respiratory syndrome (SARS): breath-taking disease and research progress

SARS was first described in 2002 in Guangdong province, China, where patients developed flu-like illness often followed by acute atypical pneumonia, respiratory failure, and death.

It took 5 weeks to nail the agent, a virus from the family Coronaviridae
Poetically enough, Chinese doctors described the pulmonary infiltrates that appear on X-rays of SARS patients as the ‘blossoming flower’ lesions…
From index case, around the globe
An aftermath of the SARS outbreak: 8,000 reported cases, 774 reported deaths

In the end, it wasn’t science that brought SARS under control

Centuries-old measures, such as strict isolation of patients, eventually cornered the virus

Where it came from?

Will it come back?
Containment of SARS in Vietnam and Toronto

Vietnam

Canada
Structure of the coronavirus particle

S, spike; M, membrane; 
E, envelope (ion channel, virus budding and release) 
glycoproteins; 
S mediates both attachment 
and membrane fusion 
N, nucleocapsid protein 
(also acts as interferon antagonist)

corona = crown

~30,000 nt, positive-strand RNA, the largest known RNA genomes
SARS-CoV receptor is the cell-surface zinc peptidase, angiotensin-converting enzyme 2 (ACE2) that is an important component of the system, which controls blood pressure. It is also believed to protect lungs during inflammation. Just two amino acid changes in S resulted in efficient binding of human receptor and cross-species transmission of SARS-CoV.
Variation in genome sizes among +RNA viruses
SCoV genome structure, a simple version

Replication and transcription; proteinases, -1 frameshift

Virion; sg mRNAs
SARS-CoV genome, a bioinformaticist’s view

RNA synthesis and processing
SARS-CoV is almost invisible to innate immunity (interferon response); N-protein also contributes to its evasion. Because of this, viral clearance is delayed and followed by cytokine storm causing immunopathology and systemic disease.
Phylogenetic analysis of coronavirus replicase genes
Human and animal SARS-CoVs (S gene)

Dr. Yi Guan

Palm civet

Racoon dog
There are different ways of dealing with palm civets...
The horseshoe bats as a natural reservoir of SARS-CoV

Phylogenetic tree for RdRps of coronaviruses

Colony of bats. Some bats are considered a delicacy; Can be found on ‘wet’ markets
Global risk distribution of an emerging infectious disease event

After SARS that invigorated coronovirology, ~100 novel coronaviruses were found in bats, birds (similar viruses were found in wild leopard cats and badgers indicating cross-species transmission), and even beluga whales.

So far, there is no effective treatment for SARS; vaccines tend to be inefficient…
Enter Novel Coronavirus, or ‘Saudi-SARS’

On February 11, 2013, WHO stated that there had been 11 laboratory-confirmed cases, 5 cases (3 fatal) from Saudi Arabia, 2 cases (both fatal) from Jordan, 2 cases from Qatar, and 2 from the UK.