Avian/Swine Flu: the dangerous link between Science and Hype

Ernesto Burgio
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After the two recent pandemic alerts – the first “virtual” for a truly dangerous avian flu orthomyxovirus: H5N1/Avian Flu/1997-2003, the second “formalized” by the WHO for a mild pig flu virus – most of the world’s media and therefore most of people seem to believe in a sort of global media hoax – heavily conditioned by Big Pharma (Aventis, Baxter, GlaxoSmithKline, Novartis, Pfizer, Roche, Sanofi) interested in selling their own medicines and vaccines. To better understand the situation we should bear in mind some key points.
The first point is that influenza viruses are the only ones with a relatively constant and predictable behaviour. In fact flu follows a dual epidemic trend:

- **seasonal epidemics**: when the influenza virus prevalent in the human reservoir, showing minimal mutations (*genetic drift*), affects hundreds of millions of people (with significant economic and social costs) and causes a large number of deaths (in average 3-500,000/year), usually in the elderly and those with weak immune systems;
- **pandemics**: when, following very irregular cycles, a "new" virus coming out from the avian-flu-virus reservoir and/or recombined with human isolates in pigs (mixing vessel) spreads rapidly around the world, hard hitting and killing a significantly larger number of people, often young and in full health (up to 40 million deaths in a few months - 4 times more numerous than the victims of the Great War - during the Spanish Flu pandemic of 1918-19).
This should provide better predictability for surveillance and more effective prevention strategies by the national and international health and political institutions and a better planning of research and production of medicines and vaccines from the pharmaceutical companies. But this is a delicate point; to deal with a possible pandemic, the pharmaceutical companies should be able to produce and distribute medicines and especially vaccines in a very short time (in a globalized world, the virus can travel around the world in a few weeks): a billion doses of vaccines against a virus which is relatively "new" for our immune systems. Furthermore, these vaccines should give guarantees of effectiveness higher than usual (it is known that influenza vaccines are not generally considered, for many reasons, particularly effective, especially in children. Hence the need to find, especially in the field of vaccines, new and sophisticated production strategies (mock-up, reverse genetics) and new formulations (adjuvants), and to test their efficacy in vivo (directly on populations)...
The team's new method turns to insect cell based technology to create recombinant influenza virus-like particles (VLPs), which resemble virus particles but lack the viral nucleic acid, so they are not infectious. The Austrian team took just ten weeks to produce swine-origin pandemic H1N1 influenza VLPs for immunological study in mice. This shows that production of a mock-up vaccine is feasible in this time range, outcompeting conventional production methods which take months.
Inevitably the first question that comes to mind is: can we draw the line between the necessary and legitimate experiments aimed at improving the effectiveness of medicines (and especially vaccines) and mass experimentation in situations where the need of an early intervention may appear a global priority?
The second question, closely related to the first one, is: is it correct to affect the development of the immune system in hundreds of millions people (particularly in children!) with new (experimental) adjuvants acting (with mechanisms still unknown) by stimulating both the natural (TLRs) and the adaptive immunity?

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The path to a successful vaccine adjuvant – ‘The long and winding road’

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The safety issues surrounding adjuvants have been with us for a long time and were discussed knowledgeably back in 1980 [102]. Most of the concerns raised almost 30 years ago still remain valid today, although perhaps we now know a little more about how the adjuvants work. Even back in 1980, it was highlighted that there were concerns that potent immune stimulators could potentially trigger autoimmune diseases, because this had been seen with Freund’s adjuvants in animal models. Recently, this has been discussed in the literature as a concern for TLR agonists [103]. Unfortunately, this will remain a challenging issue, particularly because the available animal models are unlikely to be predictive.

Most of the concerns raised almost 30 years ago still remain valid today, although perhaps we now know a little more about how the adjuvants work. Even back in 1980, it was highlighted that there were concerns that potent immune stimulators could potentially trigger autoimmune diseases.
Mechanism of action of licensed vaccine adjuvants

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**A R T I C L E   I N F O**

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Despite the fact that alum and oil-in-water emulsions have been used for decades as human vaccine adjuvants in a large number of individuals, their mechanism of action is not completely understood. It has been reported that these particulate adjuvants act by increasing antigen availability and uptake by immune cells. However, recent work on alum and on the squalene-based emulsion MF59, has demonstrated that besides antigen delivery functions, these classes of adjuvants can also activate innate immunity pathways in vivo, generating an immunocompetent environment at injection site. Interestingly, it has been demonstrated that alum adjuvanticity depends on the activation of a protein complex called NLRP3 inflammasome, which is required for the correct processing of a number of pro-inflammatory cytokines, including IL1β. More work needs to be performed to investigate if the inflammasome is also required for the activity of MF59 and of other particulate vaccine adjuvants.

...recent work on **alum** and on the **squalene-based emulsion MF59**, for example, stimulates human macrophages, monocytes and granulocytes ..attracting **chemokines like CCL2, CCL3 and CCL4 and CXCL8**
The *third question*, which follows the first two, is: *are we truly convinced that the best way* - the most effective and, at the same time, surer - to tackle the flu-problem in its dual form (seasonal epidemic / pandemic) is *mass-active immunoprophylaxis*?

Or there are better possibilities for a true *primary prevention*, right there (large pig farms, wet markets etc...) where many different strains can easily exchange genetic material, producing new flu-viruses?

a great problem are: *chicken and turkey breedings*. *swine farming*... and *wet markets*
At this point I’ll try to **summarize** the public hearing of PACE’s Committee on Social, Health and Family Affairs, which examined the management of the pandemic H1N1

(at the first public hearing in January, Strasbourg 26 01 10, the WHO flu chief defended his organization, saying his advice was not improperly influenced by the pharmaceutical industries)

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Swine Flu: 'the next time someone cries wolf on a pandemic, it will not be taken seriously'

Paris, 29.03.2010 - “The next time someone cries wolf over a pandemic, the overwhelming majority will not take it seriously,” participants were told today at a parliamentary hearing on the handling of the H1N1 pandemic, organised in Paris by PACE’s Social, Health and Family Affairs Committee.

“A pandemic cannot be whatever the WHO declares it is. If it turns out that former PACE member Wolfgang Wodarg was right when he said the pandemic was decided to help the pharmaceutical industry make bigger profits, this might well turn out to be one of the biggest health scandals ever,” said Paul Flynn (United Kingdom, SOC), PACE rapporteur on this issue.

Participants also expressed regret at the WHO’s failure to revise its position on the pandemic, and warned against a possible repetition of events if no lessons were learnt. “The world no longer trusts the WHO, but we need a body of this kind and it must therefore restore its own credibility,” Mr Flynn added.

He paid tribute to the rare courage of the Polish Health Minister Ewa Kopacz, who had refused to be held hostage by the pharmaceutical industry and did not order vaccines. She said that drug company profit should not be more important than people.

She urged the WHO to urgently re-examine their position and decrease the pandemic alert level. She also denounced the lack of solidarity among European states when the pandemic was declared and the lack of co-ordination at EU level. Marc Gentilini, an expert in infectious diseases who is a former President of the French Red Cross, regretted that there was no such thing as a European health policy and called for the building of what he called a Europe of Health: “The precautionary principle is not a political umbrella to be abused,” he said.

Health researcher Tom Jefferson, of the independently-funded Cochrane Collaboration, stressed that parliamentary democracy was the best means of ensuring that private interests do not prevail over the sovereignty of states: “We trust democracy to have a surveillance system that works. The public health sector may not rely on privatized expertise,” he warned, underlining that so-called experts did not emerge like daisies but
We were told this was a 'flu which would threaten humanity, and millions would fall ill....millions of dollars of medications were bought. The WHO basically had a key role to play in deciding on the pandemic. Around 18 billion dollars was spent on this pandemic worldwide. The definition of a pandemic was changed by the WHO last May. It was only this change of definition which made it possible to transform a run-of-the-mill 'flu into a worldwide pandemic – and made it possible for the pharmaceutical industry to transform this opportunity into cash.
The H1N1 pandemic is not the same as seasonal influenza and differs in major respects. Large outbreaks occurred outside the usual season for influenza. The virus caused a striking and unusual pattern of severe illness and deaths in younger people, with many deaths caused by viral pneumonia. This pattern is not typically seen during seasonal influenza.

The pandemic is not over, but to date, more than 14,000 laboratory confirmed deaths have been reported. We often see the number of deaths compared with figures from seasonal influenza. This is comparing apples with oranges. Deaths from seasonal influenza are based on statistical models. Deaths from the pandemic have been confirmed one by one through laboratory tests and unquestionably are much lower than the true number...

The 'flu pandemic policies were not improperly influenced by the pharmaceutical industry.
The EVM rejects this motion, particularly the accusation of inappropriate response of vaccine manufacturers in their response to H1N1. The vaccine industry did what it was asked to do. Pandemic vaccines were properly developed and tested – for the first time in history, vaccines were available shortly after the declaration of a pandemic. Thanks to a decade of research and development and 60 years of experience, the H1N1 virus is not a new virus, but has been known to us for decades. Only a very small number of deaths, namely 187, can be attributed to the H1N1 virus in Germany – and many of those are dubious. We are witnessing a gigantic misallocation of resources in terms of public health, investing in pandemic diseases whose evidence base is weak.

Dr Luc Hessel, European Vaccine Manufacturers:

The EVM rejects this motion, particularly the accusation of inappropriate response of vaccine manufacturers in their response to H1N1. The vaccine industry did what it was asked to do. The industry’s role is to produce safe vaccines in a timely manner and respond to government’s requests. It is governed by stringent international health regulations and rigorous safeguards against conflict of interest. Decision-making regarding vaccine needs can only be based on the best available data at the time.

The industry responded quickly effectively and was able to deliver the vaccines ordered by governments. Our industry responded to requests from WHO and governments who wanted to have fast access to a large quantity of vaccines. It is too early to speculate on the overall return for the industry, but in my view, the industry has been a responsible and reliable partner.

Professor Dr Ulrich Keil, Director of the WHO Collaborating Centre for Epidemiology at the University of Munster:

A number of scientists and others are questioning the decision of the WHO to declare an international pandemic. The H1N1 virus is not a new virus, but has been known to us for decades. The H1N1 vaccination campaign was stopped abruptly when it was realised that the effects were milder than anticipated. I am asking for a reconsideration of this pandemic announcement by the WHO.

In Germany, about 100,000 older people, some frail people, and 10,000 people with health issues, were vaccinated with the H1N1 virus in 2009. The Director General of WHO declared the H1N1 pandemic in June 2009, triggering a cascade of actions by individual countries who were prepared for this by the SARS and Avian Flu scares.

Only a very small number of deaths, namely 187, can be attributed to the H1N1 virus in Germany – and many of those are dubious... We are witnessing a gigantic misallocation of resources...
The warning given out by the WHO resulted in a *calamity*.. in the *waste of huge sums of public money.*

We were also frightened by the unnecessary idea that there were going to be ten of thousands or even hundred thousands of deaths. We also know that the priorities of many health services in many countries were distorted, money was being spent at defending against a formal flu...

*We are trying to find out the truth, what really happened and why and which was the role of the WHO.*

In *Strasbourg* the evidence was not convincing and the representatives of the WHO still wanted to rely on secrecy and the privacy of the people involved...

so we don’t really know who actually took the decisions, who decided that this was going to be defined as a *phase six pandemic* resulting in a great alarm all over the world...

*A pandemic cannot be whatever the WHO declares it is.*
The world no longer trusts the WHO but we need a body of this kind and it must therefore restore its own credibility.

The great danger is if the trust in WHO is undermined by false alarms such as SARS, CJD, Millennium Bug, Avian Flu, Swine Flu, warning about announced calamities that have not occurred.

I think that the danger is that having cried wolf so often, next time there might be a real scare, a virus that mutates, very few people would take notice of it.

So it’s necessary to make sure that the trust will be reconstructed.
Polish Health Minister Ewa Kopacz who refused to be held hostage by the pharmaceutical industry and didn’t order vaccines

- Our government analyzed the situation, kept in touch with the CDC of Atlanta, tried to take the appropriate measures as well as controlling the panic of the population.
- It’s very important to know that the quick alarm by the WHO about the phase six of the pandemic caused a lot of interest in the media which didn’t really verify the significance of the figures and started to talk about a coming apocalypse, reminding the famous Spanish flu and the more recent avian flu.
• The *Polish Flu Pandemic Committee* defined a high risk group and the *Government* set aside the resources to buy the appropriate number of vaccines.

• but the *conditions of purchase of these vaccines proposed by the producers were very dubious* for the Polish government.

• The *producers of the vaccines* refused to take the responsibility for the possible undesirable side effects…

• moreover the *vaccines were two or three times more expensive that those against the seasonal flu*.

For these reasons the *Polish government decided not to purchase the vaccines* under the conditions offered by the producers.
Influenza and influenza-like illness are not the same thing

... what most people are not told is that the influenza viruses only account for a minority (7-15%) of these episodes. Instead, the world seems to believe that all flu is influenza and ignores the role of some 200 other agents.

The starting point is that few (if any) national and international surveillance systems make the distinction between influenza and influenza-like illness.

So we have no idea how much ILI/flu there is and as consequence we cannot say for certain how much influenza is circulating as influenza is an unknown proportion of an unknown whole (influenza-like illness/flu).

In conclusion the currently available evidence does not allow us to know in a reliable way how many cases of influenza there are, nor its impact in terms of death and disability with any degree of certainty...

if we cannot describe the ordinary (i.e. the seasonal) in any satisfactory way, we certainly cannot describe the extraordinary (i.e. pandemic)...

Dr Tom Jefferson Influenzae Reviewer of the Cochrane Vaccines Field..said

.. Influenza and influenza-like illness are not the same thing..
On one hundred people in a year seven will have a FLU. One is caused by an influenza A or B virus. This is an exaggeration as well, because many of these BLUE GUYS are infected by more than one bug.
WHO spokeswoman Natalie Boudou justified the change by saying that the “old” definition was in “error”.

The definition before May 4, 2009 (which has since disappeared from the WHO website) was as follows:

“An influenza pandemic occurs when a new influenza virus appears against which the human population has no immunity... resulting in epidemics worldwide with enormous numbers of deaths and illness.”

Paris, 29.03.2010

Change of pandemic influenza definition (around 1 May 09)

“...resulting in epidemics worldwide with enormous numbers of deaths and illness” vanishes.

“Current” definition emphasis on new virus and spread.

Why change? “It was a mistake, and we apologize for the confusion.”

“(That definition) was put up a while ago and paints a rather bleak picture and could be very scary.” The correct definition is that "pandemic" indicates outbreaks in at least two of the regions into which WHO divides the world, but has nothing to do with the severity of the illnesses or the number of deaths” (Natalie Boudou 4th of May 2009)

- And: “We wrote that definition [i.e. the one pre-dating the 4th of May 2009] with avian flu in mind” (Dr Hartl 7 Feb 2010)

- Strange mistake since all WHO pandemic docs (20004-2009) report the pre-4th of May 09 definition and it makes no mention of avian influenza.
Much has been said about the role of experts in advising policymakers on both seasonal and pandemic influenza. We know that some of them have been parsimonious with declaring their interests and their role as members of lobbying organizations which are financed by industry and some did not think it important to disclose pretty hefty industry funding of their institutions. We know that transparency is probably not taken very seriously by WHO. However, few people realize that even experts with no ties to industry or government civil servants have career motivations, especially if they make policy and evaluate its effects.
Key opinion leaders
(Czech puppet picture courtesy of the BMJ)

“We are supposed to be prepared for a pandemic of some kind of influenza
Because the flu watchers, the people
who make a living out of studying the virus
and who need to attract continued grant funding to keep
studying it, must persuade the funding agencies of the urgency of fighting a coming plague.”

I conclude that the **results of the expert system** (in which selection is on the basis of **fame** or **sponsorship**, with **transparency** being the exception) are plain for all to see:

- **catastrophic predictions** that have failed to materialize, poor science, a thriving pandemic industry and the reputation of public health structures in tatters…
- Then we have the **media** (whose role is plain for all to see) and the **scientific media**, the **scientific journalists**, who also **had a major role to play**, as I shall demonstrate shortly.
- **The media, like everyone else, are cashing in the whole circus.**
"This one is my own favourite..."
Vaccines and antivirals are useless against the majority of cases of influenza-like illness/flu, as one would expect. In fact, vaccines and antivirals have a weak or non-existent evidence base against influenza.

The quality of influenza vaccines studies is so bad that our systematic review of 274 vaccines studies which had published between 1948 and 2007 found major discrepancies between data presented, conclusions and the recommendations made by the authors of these studies.

Conclusions favourable to the use of influenza vaccines were associated with lower quality studies, with the authors making claims and drawing conclusions unsupported by the data they presented. In addition, industry funded studies were more likely to have favourable conclusions, be published in significantly higher impact factor journals (ie the more prestigious journals) and have higher citation rates than non-industry funded studies. This difference is not explained by either the size or the methodological quality of the studies.

So, we have little reliable evidence on the effects of influenza vaccines. What we do have is evidence of widespread manipulation of conclusions and spurious notoriety of the studies.
On average, perhaps 1 adult out of a 100 vaccinated will get influenza symptoms compared to 2 out of 100 in the unvaccinated group. To put it another way, we need to vaccinate 100 healthy adults to prevent one set of symptoms. However, our Cochrane review found no credible evidence that there is an effect against complications such as pneumonia or death.

Effectiveness of influenza vaccine in healthy adults (real world conditions)

Vaccinated n=100
In children under 2 years inactivated vaccines had the same field efficacy as placebo, and in healthy people under 65 vaccination did not affect hospital stay, time off work, or death from influenza and its complications. Reviews found no evidence of an effect in patients with asthma or cystic fibrosis.
Are antiviral drugs effective?

- Our Cochrane reviews found that antiviral drugs are effective against symptoms, but they are toxic, some are expensive and may not prevent complications.
- In other words, the publicly available evidence suggests that drugs like aspirin may be just as good, and less dangerous, than the drugs on which billions of Euros have been spent to create stockpiles.
- This is, of course, not the way they have usually been portrayed in the media. In addition it seems that no one wants to test the performance of antivirals against antipyretic and anti-inflammatory drugs and physical interventions (such as masks or handwashing) to have a definitive answer.
- Public health interventions such as hygiene measures and barriers have a much better evidence base than vaccines. They are also cheaper and socially acceptable, as well as being life savers in poor countries, yet they are almost ignored… in the most recent 62-page guidance document on planning for pandemic influenza from the WHO… handwashing and masks were mentioned only twice and gloves and gowns once each, but vaccines and antivirals appeared 24 and 18 times, respectively.

As a matter of fact Aspirin has been linked with Reye’s syndrome: we should use caution when giving aspirin to children or teenagers.
• In conclusion, I cannot predict the future but if it repeats the past it will be full of continuous alarms and possible declarations of pandemics.
• If the complex interplay of poor science, “opinion leaders”, media business, pharma business, pandemic business and unaccountable decision-making is not interrupted, we will have many more similar episodes.
• Scientific evidence, systematically and independently assembled and weighted by its quality, needs to be centre-stage and not simply a “pretty maiden” whose services are called upon on demand
Among the findings are that the volume of official development assistance for health is frequently inflated; and that data on private sources of global health finance are inadequate but indicate a large and important role of private actors.

Global health funding: how much, where it comes from and where it goes

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Global health funding has increased in recent years. This has been accompanied by a proliferation in the number of global health actors and initiatives. This paper describes the state of global health finance, taking into account government and private sources of finance, and raises and discusses a number of policy issues related to global health governance. A schematic describing the different actors and three global health finance functions is used to organize the data presented, most of which are secondary data from the published literature and annual reports of relevant actors. In two cases, we also refer to currently unpublished primary data that have been collected by authors of this paper. These findings indicate that the volume of official development assistance is frequently inflated, and that data on private sources of global health finance are inadequate but indicate a large and important role of private actors. The fragmented, complicated, messy and inadequately tracked state of global health finance requires immediate attention. In particular it is necessary to track and monitor global health finance that is channelled by and through private sources, and to critically examine who benefits from the rise in global health spending.

Inter-governmental organizations such as WHO and UNICEF tend to be mainly government-funded. However, private foundations are not a negligible source of funding for the WHO. In 2006, the Gates Foundation was the third equal largest funder of the WHO (Global Health Watch 2008).
The \textit{S-OIV/2009 Flu Pandemic} probably was a \textit{false alarm} or even a \textit{hoax}.. All these \textit{interviews seem quite reassuring}.. but they do not help us in clarifying the \textit{real situation in the perpetually changing world of orthomyxoviruses}... After the \textbf{emerging of H5N1} (in 1997) virologists signaled many other \textit{avian strains} that, having acquired some mutations, have “jumped” into human beings, causing \textit{concern}..

The extent of infection into host organism is determined by \textit{Hemagglutinin} (HA).

\textit{The single greatest threat to man’s continued existence on earth is the virus.}  
Joshua Lederberg, Nobel Laureate

\textbf{HAs of H5, H7, (H9) pantropic avian viruses} subtypes can be cleaved by furin and subtilisin-type enzymes, allowing the virus to \textit{grow in other organs than lungs} (\(\rightarrow\) \textit{systemic diseases})

\textbf{How should we orient ourselves between \textit{scaremongers} and \textit{deniers}?}

\textbf{Figure 4} Documented human infections with avian influenza viruses, 1997–2004. Sporadic cases of mild human illness associated with avian influenza viruses were reported before 1997. See http://www.who.int/csr/disease/influenza/en and ref. 76.
The Influenza A virus **genome is contained on eight single (non-paired) RNA strands** that code for eleven proteins (HA, NA, NP, M1, M2, NS1, NEP, PA, PB1, PB1-F2, PB2). The total genome size is 13,588 bases. The **segmented nature of the genome allows for the exchange of entire genes between different viral strains** during cellular cohabitation.

**Ribonucleoprotein complex**: viral RNA + nucleoprotein (NP) + 3 polymerase proteins (PA, PB1 and PB2).

**Non-Structural proteins 1-2**

(HA) (NA), and M2 **ion-channel** protein embedded in the viral envelope, **derived from the host** plasma membrane.

Matrix (M1) protein

**RNA polymerases**
Occasionally orthomyxoviruses are transmitted from these birds to other species and may then cause devastating outbreaks in domestic poultry. In nature, avian influenza A viruses seem to exist as transient complexes of eight genes that assemble and reasssemble... in an enormous global avian reservoir... stably adapted to the enteric tracts of hundreds of avian species, single members of which are often simultaneously infected by multiple viruses that engage in prolific gene reassortment. Because of this continual reassortment, a seemingly endless variety of new viruses with potentially new properties are continually being engineered (NEJM 2009; 361:225-229)
Human trachea expresses sialyl 2-6 Gal significantly, while duck intestinal mucosa express 2-3. In contrast, pig trachea expresses both 2-3 and 2-6 linkages. Due to their ability to support replication of both avian and human influenza viruses, pigs have been implicated as intermediate hosts, serving as mixing vessels for avian and human viruses (since 1957, asian flu pandemics).
Timeline of emergence of Influenza A viruses in humans. The viruses isolated from pandemics in the last century are indicated by time of origin and subtype. Virus subtypes with pandemic potential are circled.

1. **1918 H1N1** was responsible for the **Spanish flu** pandemic and became adapted to mammals.

2. The **Asian Flu** was a pandemic outbreak of **H2N2** avian-human virus influenza that originated in China in **1957**.

3. **H3N2** evolved from **H2N2** by antigenic shift and caused the **Hong Kong Flu** pandemicis 1968-69. It is currently endemic in both human (since 1968) and pig populations (since 1997-8).

4. **In 1976**, a novel swine influenza A (H1N1) caused the swine hoax in US: 40 millions vaccinated → 500 G.Barré syndrome (35 deaths ?). The 1977–1978 Russian flu was caused by a lab strain.

5. In the last 13 years many **H5.. H7.. H9 pantropic avian viruses** emerged from avian reservoirs and provoked some clusters of human flu which cause concern.

Timeline of emergence of Influenza A viruses in humans. The viruses isolated from pandemics in the last century are indicated by time of origin and subtype. Virus subtypes with pandemic potential are circled.
The Persistent Legacy of the 1918 Influenza Virus

David M. Morens, M.D., Jeffrey K. Taubenberger, M.D., Ph.D., and Anthony S. Fauci, M.D.

It is not generally appreciated that descendants of the H1N1 influenza A virus that caused the catastrophic and historic pandemic of 1918–1919 have persisted in humans for more than 90 years and have continued to contribute their genes to new viruses, causing new pandemics, epidemics, and epizootics (see table). The current international pandemic caused by a novel influenza A (H1N1) virus derived from two unrelated swine viruses, one of them a derivative of the 1918 human virus, adds to the complexity surrounding this persistent progenitor virus, its descendants, and its several lineages (see diagram).

A useful way to think about influenza A events of the past 91 years is to recognize that we are living in a pandemic era that began around 1918. At that time, a presumably new founding virus, containing a novel set of eight influenza genes and probably derived from an unidentified avian-like precursor virus, became adapted to mammals; the molecular and virologic events responsible for that adaptation remain unclear. This virus caused an explosive and historic pandemic, during which humans also transmitted the virus to pigs, in which it remains in circulation. Ever since 1918, this tenacious virus has drawn on a variety of evolutionary tricks to survive in one form or another, in both humans and pigs, and to spawn a host of novel progeny viruses with novel gene constellations, through the periodic importation or exportation of viral genes (see Zimmer and Burke, pages 279–285). The 2009 H1N1 pandemic virus represents yet another genetic product in the still-growing family tree of this remarkable 1918 virus.

.. we are living in a pandemic era that began around 1918... At that time, a presumably "new virus"...probably derived from an unidentified avian-like precursor virus, became adapted to mammals...causing an explosive and historic pandemic, during which humans also transmitted the virus to pigs, in which it remains in circulation. Ever since 1918, this tenacious virus has survived...in both humans and pigs...

The 2009 H1N1 pandemic virus represents yet another genetic product in the still-growing family tree of this remarkable 1918 virus. To understand what has been happening since 1918, it is helpful to think of influenza viruses not as distinct entities but as eight-member "gene teams" that work together.
In his paper Taubenberger showed that the theory of 3(4) pandemics (due to antigenic shift) in the twentieth century is an oversimplification. ... sometimes a simple drift (last time in 1997-99) caused a large number of deaths
It seems that orthomyxoviruses are expanding their range of infection. H5N1 has been shown to be transmitted to tigers, leopards, and domestic cats that were fed uncooked chickens with the virus.
.. if 2009/swine flu was a hoax or a fake alarm....
we shouldn't say the same about H5N1.. which is a dangerous virus.. perhaps the major pandemic threat of the next years
The H5N1 bird flu virus that infected humans in 1997 acquired all eight gene segments from Eurasian avian sources ... fortunately it retained a preference for binding to (2,3) sialic acid receptors, a feature typical of avian influenza viruses.

Contemporary human H3N2 influenza viruses are now endemic in pigs in southern China (Peiris et al., 2001) and can reassort with avian H5N1 viruses in this 'intermediate host.
In fact the “pandemic strains” (as HPAI viruses in birds) kill through an indirect mechanism, triggering an inflammatory, systemic response: the so called cytokine-storm.
This paper, for example, shows a “typical cluster” of H5N1 cases.

Avian Influenza A (H5N1) in 10 Patients in Vietnam

Tran Tinh Hien, M.D., Nguyen Thanh Liem, M.D., Nguyen Thi Dung, M.D., Luong Thi San, M.D., Pham Phuong Mai, M.D., Nguyen van Vinh Chau, M.D., Pham Thi Suu, M.D., Vo Cong Dong, M.D., Le Thi Quynh Mai, M.D., Ph.D., Ngo Thi Thi, M.D., Dao Bach Khoa, M.D., Le Phuc Phat, M.D., Nguyen Thanh Truong, M.D., Hoang Thuy Long, M.D., Ph.D., Cao Viet Tung, M.D., Le Truong Giang, M.D., Ph.D., Nguyen Duc Tho, M.D., Le Hong Nga, M.D., Nguyen Thi Kim Tien, M.D., Ph.D., Le Hoang San, M.D., Le Van Tuan, M.P.H., Christiane Dolecek, M.D., Tran Tan Thanh, B.Sc., Menno de Jong, M.D., Ph.D., Constance Schultsz, M.D., Ph.D., Peter Cheng, M.Sc., Wilina Lim, M.B., B.S., Peter Horby, M.B., B.S., for the World Health Organization International Avian Influenza Investigative Team,* and Jeremy Farrar, F.R.C.P., D.Phil.

Influenza A (H5N1) infection, characterized by fever, respiratory symptoms, and lymphopenia, carries a high risk of death. Although in all 10 cases the infection appears to have been acquired directly from infected poultry, the potential exists for genetic reassortment with human influenza viruses and the evolution of human-to-human transmission. Containment of influenza A (H5N1) in poultry throughout Asia is therefore urgently required.
All patients were young another typical feature of potentially pandemic strains

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<td>to poultry and onset of illness</td>
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<td>Respiratory rate (breaths/min)</td>
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<td>Other</td>
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<td>Bleeding gums</td>
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...8 patients out of 10 died from a severe *haemorrhagic viral-pneumonia*

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<th>Variable</th>
<th>Patient 1</th>
<th>Patient 2</th>
<th>Patient 3</th>
<th>Patient 4</th>
<th>Patient 5</th>
<th>Patient 6</th>
<th>Patient 7</th>
<th>Patient 8</th>
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<td>900</td>
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<td>Neutrophil count (per mm³)</td>
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<td>780</td>
<td>700</td>
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<td>174,000</td>
<td>135,000</td>
<td>91,000</td>
<td>117,000</td>
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<td>NA</td>
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<td>NA</td>
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<td>254</td>
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<td>NA</td>
<td>89</td>
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<td>AST level (U/liter)</td>
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<td>NA</td>
<td>1,217</td>
<td>320</td>
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<td>Serum creatinine (μmol/liter)</td>
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<td>64</td>
<td>NA</td>
<td>27</td>
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<td>14</td>
<td>71</td>
<td>89</td>
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<td>Serum glucose (mmol/liter)</td>
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<td>NA</td>
<td>NA</td>
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<td>NA</td>
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<td>Oxygen saturation during receipt of 40% oxygen (%)</td>
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<td>70</td>
<td>86</td>
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<td>95</td>
<td>85</td>
<td>67</td>
<td>81</td>
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<td>90</td>
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<td>Day of illness on which PCR for H5N1 was performed</td>
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<td>7</td>
<td>9</td>
<td>6</td>
<td>12</td>
<td>6</td>
<td>5</td>
<td>6</td>
<td>5</td>
<td>7</td>
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<td>Viral culture</td>
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<td>+</td>
<td>NA</td>
<td>NA</td>
<td>Pending</td>
<td>Pending</td>
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<td>Influenza antigens</td>
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<td>NA</td>
<td>NA</td>
<td>NA</td>
<td>+</td>
<td>-</td>
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<td>+</td>
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<td>Blood culture</td>
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<tr>
<td>Outcome</td>
<td>Died</td>
<td>Died</td>
<td>Died</td>
<td>Died</td>
<td>Recovered</td>
<td>Died</td>
<td>Died</td>
<td>Died</td>
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</tr>
<tr>
<td>(day 6)</td>
<td>(day 17)</td>
<td>(day 14)</td>
<td>(day 7)</td>
<td>(day 5)</td>
<td>(day 9)</td>
<td>(day 14)</td>
<td>(day 9)</td>
<td>(day 14)</td>
<td>(day 9)</td>
<td>(day 6)</td>
</tr>
</tbody>
</table>

* Normal ranges are as follows: hemoglobin concentration, 13 to 18 g per deciliter; leukocyte count, 4000 to 11,000 per cubic millimeter; neutrophil count, 2200 to 8250 per cubic millimeter; lymphocyte count, 1500 to 4000 per cubic millimeter; CD4:CD8 ratio, 1.4 to 2.0; platelet count, 150,000 to 400,000 per cubic millimeter; alanine aminotransferase (ALT) level, below 37 U per liter; aspartate aminotransferase (AST) level, below 40 U per liter; serum creatinine concentration, 82 to 106 μmol per liter; and serum glucose concentration, 3.9 to 6.4 mmol per liter. NA denotes not available, a plus sign positive, and a minus sign negative. To convert the values for creatinine to milligrams per deciliter, divide by 88.4. To convert the values for glucose to milligrams per deciliter, divide by 0.05551.
By 10 April 2010, there had been 493 confirmed clinical cases of H5N1 influenza of which 292 had been fatal (WHO, 2010). So, even if few cases have been “Lab-Certified”, H5N1 should be considered cautiously.
The history of the “swine flu pandemic” looks quite different… The outbreak in Mexico started in March 2009 or perhaps even earlier, peaked during the last week of April and seems to have quickly burned out!! Epidemic curves in other countries all over the world are not very different.
But the true problem is: where did the S-OIV/2009 come from?

Origins and evolutionary genomics of the 2009 swine-origin H1N1 influenza A epidemic

Gavin J. D. Smith¹, Dhanasekaran Vijaykrishna¹, Justin Bahl¹, Samantha J. Lycett², Michael Worobey³, Oliver G. Pybus³, Siu Kit Ma¹, Chung Lam Cheung¹, Jayna Raghwani², Samir Bhatt¹, J. S. Malik Peiris¹, Yi Guan¹ & Andrew Rambaut²

In March and early April 2009, a new swine-origin influenza A (H1N1) virus (S-OIV) emerged in Mexico and the United States. During the first few weeks of surveillance, the virus spread worldwide to 30 countries (as of May 11) by human-to-human transmission, causing the World Health Organization to raise its pandemic alert to level 5 of 6. This virus has the potential to develop into the first influenza pandemic of the twenty-first century.

Here we use evolutionary analysis to estimate the timescale of the origins and the early development of the S-OIV epidemic. We show that it was derived from several viruses circulating in swine, and that the initial transmission to humans occurred several months before recognition of the outbreak. A phylogenetic estimate of the gaps in genetic surveillance indicates a long period of unsampled ancestry before the S-OIV outbreak, suggesting that the reassortment of swine lineages may have occurred years before emergence in humans, and that the multiple genetic ancestry of S-OIV is not indicative of an artificial origin.

Furthermore, the unsampled history of the epidemic means that the nature and location of the genetically closest swine virus: reveal little about the immediate origin of the epidemic, despite the fact that we included a panel of closely related and previously unpublished swine influenza isolates. Our results highlight the need for systematic surveillance of influenza in swine, and provide evidence that the mixing of new genetic elements in swine can result in the emergence of viruses with pandemic potential in humans.
Except for the classical swine H1N1 virus, most of these contemporary H1 and H3 strains are triple reassortant viruses, containing genes of avian, human, and swine flu-virus origin.

Key Points

- The mechanisms of influenza virus evolution—antigenic drift and antigenic shift—rest within the fundamental properties of the virus itself.
- The respiratory tract of swine possesses both avian and human receptors for influenza viruses.
- Genetic reassortments can occur within swine cells co-infected with two or more influenza viruses.
- Currently four clusters of H1 and four clusters of H3 swine influenza viruses (SIVs) have been identified in the US swine population.¹
- The genetic diversity of SIVs sets the stage for the emergence of additional viruses that potentially could make diagnosis and successful vaccination problematic.
From when it was first isolated in 1930 until 1998, the classical H1N1 (cH1N1) subtype of SIV was essentially the only SIV lineage circulating in the US swine population. Genetically and antigenically, the cH1N1 SIV and the human influenza virus implicated in the 1918 Spanish Flu pandemic are similar.

Beginning in 1998, however, clinical disease caused by H3N2 subtypes was recognized in a few states and soon spread throughout the entire country. Described as reassortant viruses, the original H3N2 strain had three genes from a human H3N2 influenza virus that circulated in the human population during 1995, as well as five genes from the cH1N1 SIV. The initial outbreak of influenza attributed to H3N2 occurred during August of 1998 in a North Carolina pig farm.
Subsequent to the emergence of the H3N2 viruses, genetic changes in both H1 and H3 SIV subtypes were detected with increasing frequency in the US. The dynamics of clinical disease and prevention of outbreaks also changed dramatically. Reassortant H1N1 viruses (reassortants contain genes from swine, avian, and/or human influenza viruses), for example, were reported to infect and cause disease in herds that had been routinely vaccinated with commercial vaccines containing cH1N1 SIV. Such findings raised concerns among some investigators that vaccines in swine may need to be continually updated as in human medicine.

Antigenic and genetic studies conducted with SIV field isolates since the dramatic appearance of the H3N2 subtype in 1998 have confirmed that the H1N1 subtype, which had remained essentially stable in US swine for 80 years, was now evolving through antigenic drift and reassortment. As the timeline in Figure 4 illustrates, four new variant H1 strains emerged in rapid succession in the US during the years 1999-2003.
In this **diagram** the genetic evolution of the H1N1 virus is well represented. We can see (on the left) the **1918/H1N1** which is the **common ancestor** of all the human (and swine) flu-viruses of the last century. Then we can see how, through some mutations, the **triple reassortants** were created (1998-2009).

The **real question** is the origin of the **new genes**...

.. it is significant that one of the **North American H1N2** **‘triple reassortants’ closest to S-OIV** is probably used in **commercial multivalent pig vaccines in North America**.
What is really striking in the genetic sequences published by *Lancet* in Aug 2009 is the reappearance of the Neuramidase gene after many years (in these cases the main possibilities are that these genes come from a virus kept in a laboratory, or employed in some animal vaccines).

The six gene segments (PB2, PB1, PA, HA, NP, and NS1) of circulating H1N1 viruses probably came from swine influenza H1N2 viruses circulating in the USA from 1999 to 2001 and two gene segments (NA and M1) possibly originated from swine influenza H1N1 viruses circulating in Europe from 1985–98. Important questions are when, where, and how the swine influenza viruses circulating in the USA 8 years ago were mixed with the swine influenza viruses circulating in Europe 11 years ago and mutated to form the current reassortant H1N1 viruses? These events established that the future pandemic influenza could potentially come from reassortant viruses originating from birds, animals, or people in different areas of the world.
Experiments are underway to determine whether currently available vaccines may be able to provide pigs with a certain immunity to stop a potential spread of the virus. In fact, the frequent use of vaccines in swine farming is striking. And no one seems to take into account the possible dangers of this practice.
High genetic and antigenic similarity between a swine H3N2 influenza A virus and a prior human influenza vaccine virus: A possible immune pressure-driven cross-species transmission

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Genetic similarity
Antigen drift
Immune pressure
Cross-species transmission

ABSTRACT
In late April of 2009, a global outbreak of human influenza was reported. The causative agent is a highly unusual reassortant H1N1 influenza virus carrying genetic segments derived from swine, human and avian influenza viruses. In this study, we compared the HA, NA and other gene segments of a swine H3N2 influenza A virus, A/Swine/Guangdong/z5/2003, which was isolated from pigs in 2003 in Guangdong Province, China, to the predominant human and swine H3N2 viruses. We found that the similarity of gene segments of A/Swine/Guangdong/z5/2003 was closer to Moscow/99-like human H3N2 virus than Europe swine H3N2 viruses during 1999–2002. These results suggest that A/Swine/Guangdong/z5/2003 may be porcine in origin, possibly being driven by human immune pressure induced by either natural H3N2 virus infection or use of A/Moscow/10/99 (H3N2)-based human influenza vaccine.

...the similarity of gene segments of A/Swine/Guangdong/z5/2003 was closer to Moscow/99-like human H3N2 virus than Europe swine H3N2 viruses during 1999–2002. These results suggest that A/Swine/Guangdong/z5/2003 may be porcine in origin, possibly being driven by human immune pressure induced by either natural H3N2 virus infection or use of A/Moscow/10/99 (H3N2)-based human influenza vaccine.
**Novel H3N1 Swine Influenza Virus Identified In Pigs In Korea**

*ScienceDaily (Nov. 20, 2006) — For the first time, researchers from the U.S. and abroad have identified the H3N1 swine influenza virus in domestic pigs in Korea. They report their findings in the November 2006 issue of the Journal of Clinical Microbiology.*

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**See Also:**

- Plants & Animals
  - Bird Flu Research
  - Virology
  - Microbes and More
  - Veterinary Medicine
  - Animals
  - Cows, Sheep, Pigs

- Reference
  - Avian flu
  - Transmission (medicine)

A highly infectious respiratory pathogen, the H3N1 influenza A virus is a new genetic reassortment of influenza viruses first identified in pigs in the U.S. in 2004. The virus can be found in birds and mammals (including humans and pigs), but is not generally transmissible between birds and humans. Pigs are believed to be susceptible to both origins resulting in them being deemed "mixing vessels" for the virus and ultimately reinforcing concerns of zoonosis and pandemic outbreaks.

Given the evidence that pigs can support the reassortment of influenza viruses from humans and other species, it is prudent that we enhance surveillance for atypical influenza viruses in pigs as part of overall pandemic preparedness efforts."


Related Stories
The first isolation and characterization of the novel subtype H3N1 in Europe was described.

Short communication

Novel swine influenza virus subtype H3N1 in Italy

Ana Moreno *, Ilaria Barbieri, Enrica Sozzi, Andrea Luppi, Davide Lelli, Guerino Lombardi, Maria Grazia Zanoni, Paolo Cordioli

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ABSTRACT

To date, three subtypes of swine influenza viruses, H1N1, H1N2, and H3N2 have been isolated in Italy. In 2006, a novel swine influenza virus subtype (H3N1) was isolated from coughing pigs. RT-PCR performed on lung tissues, experimental infection in pigs with the novel isolate, and cloning the virus by plaque assay confirmed this unique H and N combination. The novel isolate was also antigenically and genetically characterized.

The complete HA gene presented the highest identity to three Italian H3N2 SIVs isolated in 2001 and 2004, whereas the NA gene was instead closely related to three Italian H1N1 SIVs isolated in 2004. The deduced aa sequence of the HA gene showed the aa residues (L226 and S228) responsible for the receptor specificity typical of swine and human influenza viruses. This suggested that the novel SIV was a reassortant between the H3N2 and H1N1 SIVs circulating in Italy.
Two years ago, we published a case–control study with the surprising finding that influenza immunization reduced the risk of recurrent myocardial infarction by 66%. Simultaneously, Siscovick and colleagues reported that influenza immunization was associated with a 49% reduction in the risk of sudden cardiac death. A subsequent report described a 50% reduction in the risk of stroke in association with influenza immunization, and later a randomized control trial pointed to a 50–75% reduction in the risk of adverse endpoints and cardiovascular death. Furthermore, an ecological study suggests that the 1918 influenza pandemic may have contributed to the epidemic of coronary heart disease mortality registered in the 20th century.
Influenza as a bioweapon

Mohammad Majdidi MD,1,3,4 Scott Lillibridge MD,1 Parsa Mirhaji MD,2 Ward Casscells MD,2,3,4

These data caused us to re-examine the usual estimate that, in the USA, influenza kills 20,000 a year. From more recent studies of all-cause mortality, we suspect that the total is closer to 90,000.

The Spanish flu epidemic in 1918 killed 20–40 million people. Less severe epidemics were the Asian flu in 1957, Russian flu in 1977, and Hong Kong flu in 1978 (?).

In addition to such spontaneous mutations, we must, since the terrorist attacks of September and October 2001, consider the possibility of malicious genetic engineering to create more virulent strains.

Recently, the possibility of synthesizing an infectious agent solely by following instructions from a written sequence has moved from theory to practice. Sequencing of the genome of the 1918 Spanish influenza virus is nearly complete; once it is published, unscrupulous scientists could presumably utilize candidate virulence sequences.

Recently, the possibility of synthesizing an infectious agent solely by following instructions from a written sequence has moved from theory to practice.

President G.W. Bush announced on February 22, 2007 his intention to nominate S. Ward Casscells III, M.D. (vice president for biotechnology at The University of Texas Health Science Center at Houston) to be Assistant Secretary of Defense (Health Affairs)... Sworn in on 16 April, 2007, Secretary Casscells administered the $45 billion Military Health System (MHS) and was principal advisor to the United States Secretary of Defense for health issues.
The Indonesian Health Minister has said the US and the WHO are part of a global conspiracy to profit from the spread of bird flu and use samples to produce biological weapons.

The views of Dr Siti Fadilah Supari, outlined in her new book, threaten to undermine efforts to control the spread of avian influenza. With 104 deaths, nearly half the world total, Indonesia is the new hotspot for the virus.

Despite claims by the minister that she has agreed to share virus samples and allow all nations access to resulting vaccines, Indonesia is still blocking sharing samples from human victims.

Applications to send more than 200 samples from chickens to an Australian laboratory had also been refused, inquiries by the Herald have revealed.
The current state of Synthetic Biology raises concern

The current alliances around Synthetic Biology involve energy companies, chemical companies, drugs companies and biotech and IT companies.... today, in hundreds of labs worldwide, it is also possible to transform common intestinal microbes into killers. Or to make deadly strains even more lethal. Or to resurrect bygone killers, such the 1918 influenza. Or to manipulate a person's hormones by switching genes on or off. Or to craft cheap, efficient delivery systems that can infect large numbers of people

Finally I want to touch on concentration, meaning corporate concentration. With the development of synthetic chemicals we saw the chemical industry begin to play a major role in agriculture and agricultural policy. With transgenic genetic engineering agrochemical companies joined up with the biotech industry and even pharmaceutical companies so that even larger corporate entities - so called life sciences companies - were born casting disproportionate influence over farming, food and health policy all at once. With synthetic biology that concentration will get far worse. The current alliances around Synthetic biology involve energy companies, chemical companies, drugs companies and biotech and IT companies. This is an embryonic industry that already involves not only the likes of Syngenta (no 1 in pesticides), Cargill (no1 in grains) and DuPont (no1 in seeds and 2 in chemicals) but also Microsoft (no1 in software), Shell (no2 in oil) and Pfizer (no 1 in pharma). Imagine if all those monopolies became joined in one godawful corporate alliance. I don't what we would call it:

 Microsynccargildeshellzerosoftpont or something? I do know it would be a formidable corporate oligopoly with unprecedented power and yet in effect that is exactly what is coming into being around synthetic biology and it will dictating the terms of agriculture as we move into this next phase.

Jim Thomas, ETC Group (Montreal) Jim@etcgroup.org
So I think we can safely conclude that no one has now any firm idea of how to define an influenza pandemic (Tom Jeffereson)

Conclusion

An influenza pandemic is whatever WHO decides it is

At this point a final thought is quite obvious: it is “normal” (and perhaps inevitable) that Big Pharma is lobbying to address the problem according to its economic advantages, even to the point, as some say, to influence major political and international health institutions (the changed definition of a pandemic on the official WHO-site in conjunction with the S-OIV/2009 pandemic alert is, for many, a clear evidence of this conditioning)...
A risk we run is that crying "wolf.. wolf " if the wolf really comes people will not believe us .. But perhaps the greatest risk we must face comes from Someone’s project to use such alarms for a large mass experimentation.

But it is important that we move towards strengthening the supervision and strict hygiene regulations upstream: in Asian wet markets, where birds, mammals and people live in unacceptable degree of promiscuity, in large avian flocks (where for several years the avian epidemics have multiplied), in industrial pig farms, because, in fact, it is in these places that emerge the new strains, potentially dangerous to humans... probably due to the artificial selection pressure generated by the use of experimental drugs and vaccines (a very dangerous habit to be avoided, as preventive use of antibiotics).. as some recent studies show that the "new sequences" of the S-OIV/2009 were not entirely new... one of the possible hypotheses is that these come from weakened viruses employed in veterinary immuno-prophylaxis...
Emerging diseases go global

Mark E. J. Woolhouse

Novel human infections continue to appear all over the world, but the risk is higher in some regions than others. Identification of emerging-disease ‘hotspots’ will help target surveillance work.

Box 1 | Emerging diseases: the pathogens and the places

In general, most reports of emerging-disease events come from developed countries; the bar chart shows the five countries with the most reports in red, with selected others in blue. In the United States alone, there have been more than 100 events reported (almost one-third of the total). Examples
POST SCRIPTUM
Perhaps a reason why we talked so much about PANDEMIC FLU
In the last few years is because SOMEONE does not want people talking
about a SILENT PANDEMIC that threatens millions of children

EDCs (Dioxines like molecules), PCBs, Bisphenol A, Phthalates
Heavy Metals
UParticles

BodyBurden
The Pollution in Newborns
A benchmark investigation of industrial chemicals, pollutants, and pesticides in human umbilical cord blood

The gift our mothers never wanted to give us

http://www.ewg.org/reports/generations/
Developmental neurotoxicity of industrial chemicals

P. Grandjean, P.J. Landrigan

Department of Environmental Health, Harvard School of Public Health, Boston, MA, USA
Department of Pediatrics, Mount Sinai School of Medicine, New York, NY, USA

Neurodevelopmental disorders such as autism, attention-deficit disorder, mental retardation, and cerebral palsy are common, costly, and can cause lifelong disability. Their causes are mostly unknown. A few industrial chemicals (e.g., lead, methylmercury, polychlorinated biphenyls [PCBs], arsenic, and toluene) are recognised causes of neurodevelopmental disorders and subclinical brain dysfunction. Exposure to these chemicals during early fetal development can cause brain injury at doses much lower than those affecting adult brain function. Recognition of these risks has led to evidence-based programmes of prevention, such as elimination of lead additives in petrol. Although these prevention campaigns are highly successful, most were initiated only after substantial delays. Another 200 chemicals are known to cause clinical neurotoxic effects in adults. Despite an absence of systematic testing, many additional chemicals have been shown to be neurotoxic in laboratory models. The toxic effects of such chemicals in the developing human brain are not known and they are not regulated to protect children. The two main impediments to prevention of neurodevelopmental deficits of chemical origin are the great gaps in testing chemicals for developmental neurotoxicity and the high level of proof required for regulation. New, precautionary approaches that recognise the unique vulnerability of the developing brain are needed for testing and control of chemicals.

A few industrial chemicals (e.g., lead, methylmercury, polychlorinated biphenyls [PCBs], arsenic, and toluene) are recognised causes of neurodevelopmental disorders and subclinical brain dysfunction.

Exposure to these chemicals during early fetal development can cause brain injury at doses much lower than those affecting adult brain function.

Another 200 chemicals are known to cause clinical neurotoxic effects in adults...

The toxic effects of such chemicals in the developing human brain are not known and they are not regulated to protect children.
Industrial chemicals are responsible for a silent pandemic that has caused impaired brain development in millions of children worldwide. It’s silent because the subclinical effects of individual toxic chemicals are not apparent in available health statistics...
To adopt the *precautionary* and the *responsibility* principles also means
to accept a duty to inform
to prevent the concealment of information about possible health risks
to prevent anyone who continues to regard the whole human species as a group of guinea pigs
to test everything *technological progress*
is capable of inventing
*(Lorenzo Tomatis *)

The 1976 swine flu scare: President Gerald Ford setting the example by getting a swine flu inoculation.

Thank you very much for your attention.