

# MALADIES VIRALES PORCINES

Pathologie des maladies virales  
Chapitre 9

# MALADIES VIRALES RESPIRATOIRES

Pathologie des maladies virales,  
Chapitre 9.2.

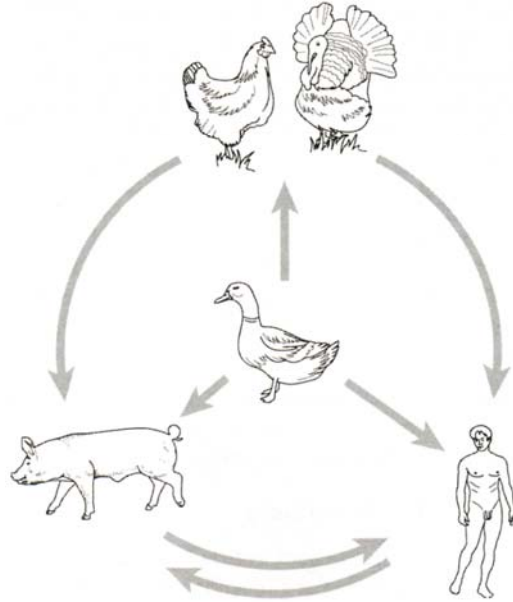
# GRIPPE PORCINE

## Etiologie

- Orthomyxovirus, virus influenza de type A
- Deux glycoprotéines importantes (sous-type)
  - hémagglutinine (HA)
  - neuraminidase (NA)
- Souches endémiques en Belgique
  - Influenza A/swine/Belg/79 (H1N1)
  - souche H3N2
  - réassortant récent : H1N2
- Souche américaine classique
  - A/New Jersey/1/76 (H1N1)
- Transmission à l'homme



## Virus influenza A : passage de la barrière d'espèce



## Evolution des virus influenza A

- Dérive antigénique
  - Accumulation de mutations ponctuelles dans l'hémagglutinine
  - Épidémies « limitées » de grippe saisonnière (influenza A humain)



## Evolution des virus influenza A

- Réassortiment de segments génomiques
  - Modifications profondes du virus influenza
  - Pour le virus influenza A humain
    - Cassure antigénique
    - Implication au moins d'un changement complet d'hémagglutinine
    - « Pandémies » ou grippe pandémique



### History of swine influenza



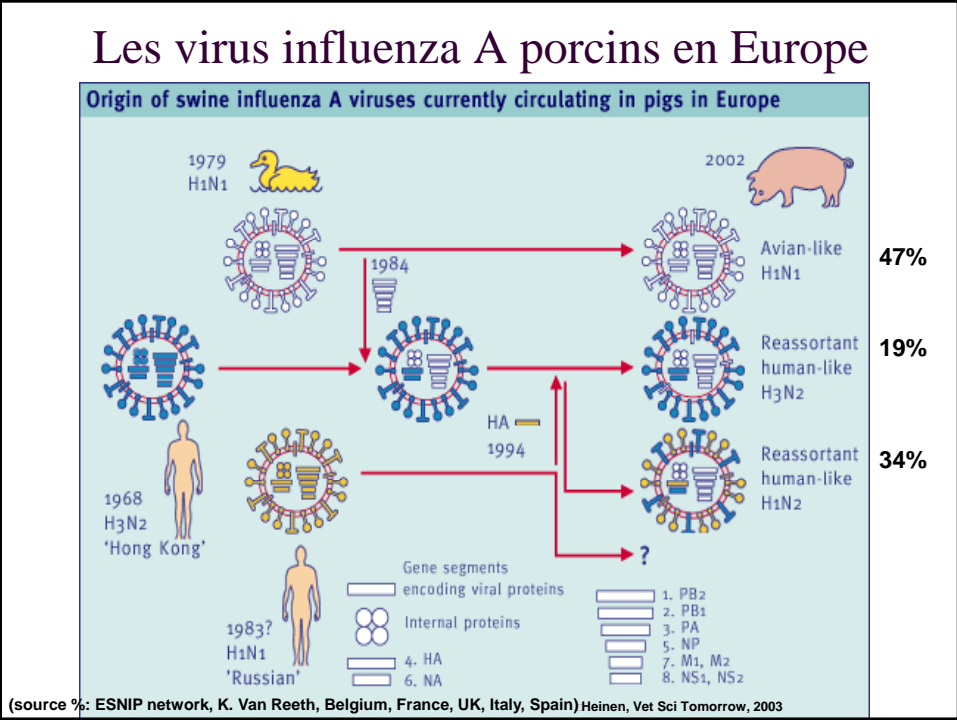
Heinen, 2003, Vet Sci Tomorrow

- |      |   |
|------|---|
| 1918 | Swine influenza H <sub>1</sub> N <sub>1</sub> described in north central USA, Hungary, and China. May have been cause of human pandemic [19], which resulted in 20-40 million human deaths.   |
| 1930 | Shope isolated influenza virus from pigs [33]. The prototype classic swine influenza H <sub>1</sub> N <sub>1</sub> strain (A/Swine/Iowa/30) transmitted experimentally to pigs.   |
| 1941 | Recognised in Europe and disappeared.   |
| 1970 | Transmission of human H <sub>3</sub> N <sub>2</sub> virus to pigs. Avian-like H <sub>3</sub> N <sub>2</sub> in pigs in Asia.  |
| 1976 | Classical H <sub>1</sub> N <sub>1</sub> reappears in European pigs.   |
| 1979 | Introduction of whole H <sub>1</sub> N <sub>1</sub> virus from birds to pigs. Antigenically distinguishable from classical strains. Still circulating today (2002).   |
| 1984 | Reassortment between human H <sub>3</sub> N <sub>2</sub> and avian H <sub>1</sub> N <sub>1</sub> in swine resulting in reassortant H <sub>3</sub> N <sub>2</sub> virus with avian internal gene segments [5]. H <sub>3</sub> N <sub>2</sub> strains first associated with respiratory epizootics. Still circulating today (2002). |
| 1986 | Classical H <sub>1</sub> N <sub>1</sub> reappears in UK, similar to classical H <sub>1</sub> N <sub>1</sub> in continental Europe.  |
| 1987 | Reassortant H <sub>3</sub> N <sub>2</sub> associated with respiratory epizootics in UK. Related to A/Port Chalmers/73(H <sub>3</sub> N <sub>2</sub> ).  |
| 1989 | Avian-like swine H <sub>1</sub> N <sub>1</sub> is dominant and widespread in Europe.  |



### History of swine influenza

- 1992-1993** • Avian-like H1N1 strains widespread in UK.
- 1993** • Infection of children with reassortant H3N2 virus from pigs and isolation of avian-like swine H1N1 virus from a pneumonia patient in the Netherlands.
- 1994** • H1N2 first isolated in pigs in UK, and later also in Belgium. Human-avian reassortant virus [3, 37].
- 1992-1998** • H3N1 (H3 human, N1 swine) and H1N7 (H1 human, N7 equine) also occurred in swine in the UK but failed to spread.
- 1998** • H9N2 in pigs and humans in Asia [17]. Apparently an avian virus that has adapted to pigs.
- 1998** • For the first time, H3N2 viruses cause severe disease in N. America. Viruses are triple (avian-human-classical swine) reassortants, distinct from earlier strains and European strains. H1N2 identical to H3N2, but with H1HA from classical swine H1N1, also isolated.
- 1999** • Single case of isolation of avian H4N6 from pigs with pneumonia in Canada.
- 2002** • Current situation in Europe: avian-like H1N1, and reassortant human-like H3N2 and H1N2. In North America: classical swine H1N1, triple reassortant H3N2.

## Les virus influenza A porcins aux Etats-Unis et en Chine

- États-Unis :
  - Jusqu'en 1998 : seulement H1N1 classique
  - Depuis 1998 : triple réassortant H3N2
  - 1999 : émergence de H1N2 et H1N1 avec une grande variabilité antigénique
  - H1N1 (45%), H3N2 (45%), H1N2 (10%)
- Chine:
  - H1N1 porcin classique (comme USA)
  - H3N2 de type humain



## Cas humains d'infection par un virus influenza A porcin

| Patient | Reference            | Exposure to swine | Nature of exposure                  | Age, years | Sex | Month    | Year | Residence         | Subtype |
|---------|----------------------|-------------------|-------------------------------------|------------|-----|----------|------|-------------------|---------|
| 1       | Kluska et al. [9]    | Yes               | Laboratory worker                   | 40         | F   | October  | 1958 | Czechoslovakia    | H1N1    |
| 2       | Kluska et al. [9]    | No                | None                                | 11         | M   | November | 1958 | Czechoslovakia    | H1N1    |
| 3       | Kluska et al. [9]    | No                | None                                | 3          | F   | November | 1958 | Czechoslovakia    | H1N1    |
| 4       | Kluska et al. [9]    | No                | None                                | 7          | F   | November | 1958 | Czechoslovakia    | H1N1    |
| 5       | Kluska et al. [9]    | No                | None                                | 72         | F   | December | 1958 | Czechoslovakia    | H1N1    |
| 6       | Kluska et al. [9]    | No                | None                                | 44         | M   | December | 1958 | Czechoslovakia    | H1N1    |
| 7       | Smith [4]            | Yes               | Lived on swine farm                 | 16         | M   | July     | 1974 | Minnesota         | H1N1    |
| 8       | O'Brien et al. [10]  | Yes               | Lived on swine farm                 | 8          | M   | October  | 1975 | Wisconsin         | H1N1    |
| 9       | Thompson et al. [11] | Yes               | Feeding pigs                        | 40         | F   | December | 1975 | Virginia          | H1N1    |
| 10      | Thompson et al. [11] | No                | No known swine exposure             | 55         | M   | December | 1975 | Virginia/New York | H1N1    |
| 11      | Smith [12]           | Yes               | Meat-packing house worker           | 17         | M   | December | 1975 | Tennessee         | H1N1    |
| 12      | CDC [13]             | No                | No known swine exposure             | 52         | M   | October  | 1976 | Missouri          | H1N1    |
| 13      | CDC [14]             | Yes               | Employed on swine farm              | 22         | M   | November | 1976 | Wisconsin         | H1N1    |
| 14      | CDC [15]             | Yes               | Lived on swine farm                 | 13         | M   | December | 1976 | Wisconsin         | H1N1    |
| 15      | Dowdle et al. [18]   | Yes               | Swine exposure                      | NA         | NA  | NA       | 1978 | Minnesota         | H1N1    |
| 16      | Dacso et al. [17]    | Yes               | Livestock show swine barn attendant | 20         | M   | February | 1979 | Texas             | H1N1    |
| 17      | Dacso [17]           | Yes               | Livestock show visitor              | 6          | M   | February | 1980 | Texas             | H1N1    |

### L'épisode de Fort-Dix en 1976

(Myers, 2007)

## Cas humains d'infection par un virus influenza A porcin

| Patient | Reference               | Exposure to swine | Nature of exposure                      | Age, years      | Sex | Month     | Year | Residence     | Subtype |
|---------|-------------------------|-------------------|---|-----------------|-----|-----------|------|---------------|---------|
| 18      | Patriarca et al. [18]   | No                | No known swine exposure                 | 4               | F   | February  | 1982 | Nevada        | H1N1    |
| 19      | Chuvakova et al. [19]   | Yes               | Occupational exposure                   | 65              | M   | November  | 1983 | Russia        | H1N1    |
| 20      | Chuvakova et al. [19]   | No                | No known swine exposure                 | 10              | F   | December  | 1983 | Russia        | H1N1    |
| 21      | Chuvakova et al. [19]   | No                | No known swine exposure                 | 27              | M   | December  | 1983 | Russia        | H1N1    |
| 22      | de Jong et al. [20]     | Yes               | Occupational exposure                   | 50              | M   | January   | 1986 | Switzerland   | H1N1    |
| 23      | de Jong et al. [20]     | No                | No known swine exposure                 | 3               | NA  | January   | 1986 | Switzerland   | H1N1    |
| 24      | de Jong et al. [20]     | Yes               | Occupational exposure                   | 29              | M   | March     | 1986 | Netherlands   | H1N1    |
| 25      | McKinney et al. [21]    | Yes               | Pigs (county fair)                      | 32              | F   | September | 1988 | Wisconsin     | H1N1    |
| 26      | Wentworth et al. [22]   | Yes               | Animal caretaker (swine exposure)       | 27              | M   | July      | 1991 | Maryland      | H1N1    |
| 27      | Claas et al. [23]       | No                | No known swine exposure                 | 1               | F   | November  | 1992 | Netherlands   | H3N2    |
| 28      | Claas et al. [23]       | No                | No known swine exposure                 | 2               | M   | January   | 1993 | Netherlands   | H3N2    |
| 29      | Rimmelzwaan et al. [24] | Yes               | Lived on swine farm                     | 5               | F   | Summer    | 1993 | Netherlands   | H1N1    |
| 30      | Wentworth et al. [25]   | Yes               | Laboratory workers exposed to sick pigs | 39              | M   | August    | 1994 | Wisconsin     | H1N1    |
| 31      | Wentworth et al. [25]   | Yes               | Laboratory workers exposed to sick pigs | 31              | F   | August    | 1994 | Wisconsin     | H1N1    |
| 32      | Kimura et al. [26]      | Yes               | Occupational exposure                   | 37              | F   | December  | 1995 | Minnesota     | H1N1    |
| 33      | Cooper et al. [27]      | NA                | NA                                      | NA              | M   | NA        | 1998 | United States | H1N1    |
| 34      | Gregory et al. [28]     | No                | No known swine exposure                 | <1 <sup>a</sup> | F   | September | 1999 | Hong Kong     | H2N2    |
| 35      | Gregory et al. [29]     | Yes               | Swine farmer                            | 50              | M   | February  | 2002 | Switzerland   | H1N1    |
| 36      | Gray et al. [8]         | Yes               | Swine farmer                            | 50              | M   | February  | 2005 | Iowa          | H1N1    |
| 37      | Olson et al. [30]       | Yes               | Swine farmer                            | NA              | M   | July      | 2005 | Canada        | H3N2    |

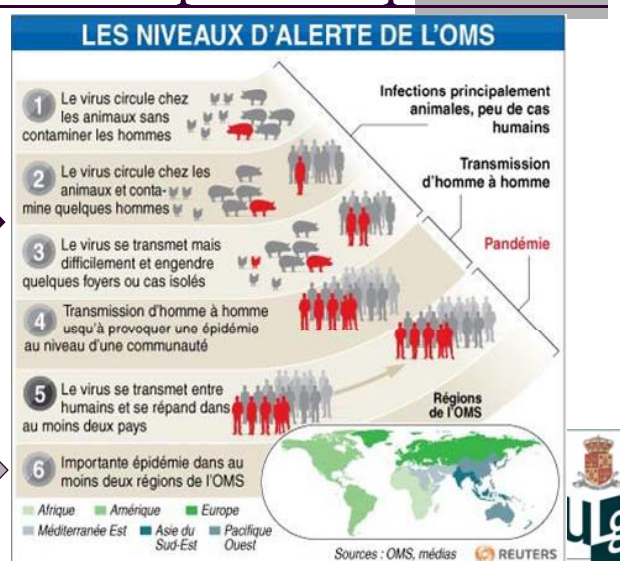
(Myers, 2007)

## Le virus influenza A H1N1 est un virus pandémique

Virologie vétérinaire – 2<sup>e</sup> GMV - E. Thiry

H5N1 →

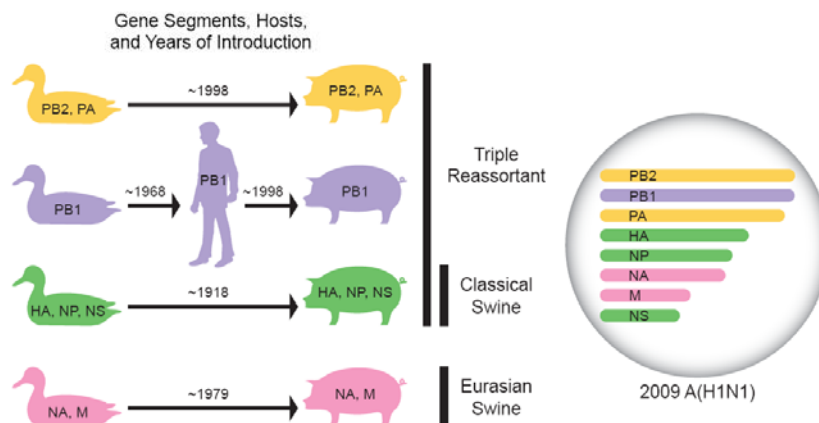
H1N1 →

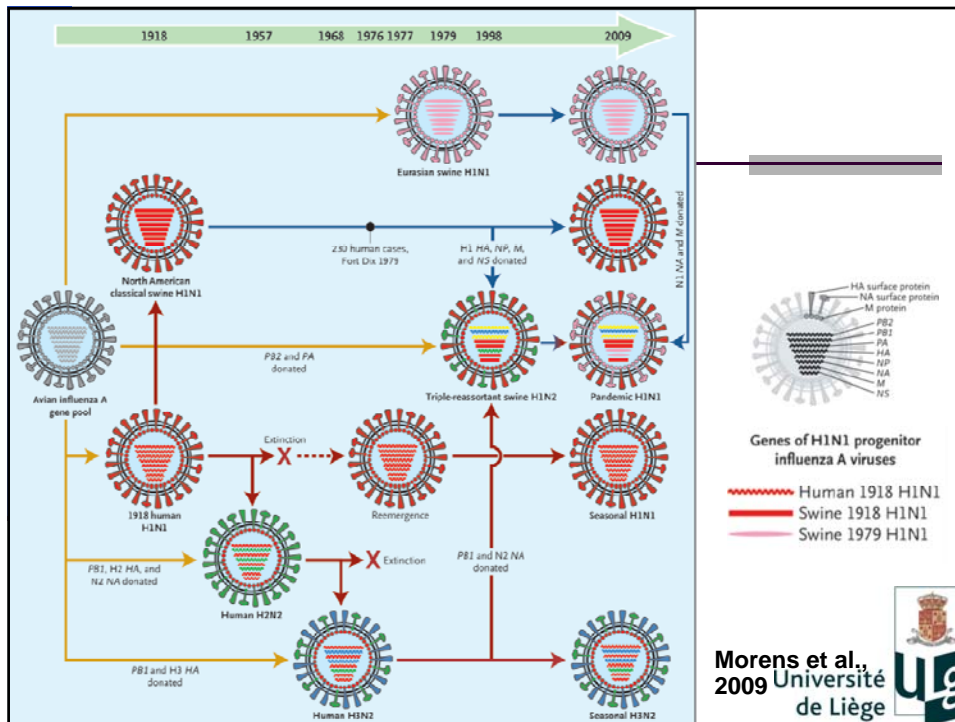


## Le virus influenza A H1N1

- H1N1 historique
  - à partir de 1918 chez l'homme
- H1N1 porcin
  - Amérique du Nord
  - Virus évoluant à partir du H1N1 humain
- H1N1 porcin
  - Eurasie
  - Virus aviaire qui s'est adapté au porc
  - Circulant avec H3N2 et H1N2

## Origine du virus influenza A H1N1 actuel : résultat de 4 réassortiments génétiques





## Influenza A H1N1 pandémique chez le porc

- Europe
  - Grande-Bretagne, Finlande, Irlande, Islande, Italie
- Amériques
  - Argentine, Canada, USA
- Asie
  - Chine, Hong Kong, Indonésie, Japon, Taiwan
- Australie

# Grippe porcine

## POINTS FORTS

- La grippe porcine est provoquée par le virus influenza A porcin.
- Il existe deux sous-types majeurs du virus : H1N1 et H3N2.
- Le sous-type H3N2 est moins virulent que H1N1.
- Le sous-type H1N2 a récemment émergé dans la population européenne.
- La grippe porcine se présente sous une forme épidémique dans une porcherie indemne.
- Les principaux signes cliniques sont l'apparition brutale, la fièvre et les signes respiratoires.
- Le virus influenza porcin est présent à l'état endémique dans de nombreuses exploitations.
- La vaccination est pratiquée à l'aide de vaccins inactivés adjuvés administrés par voie intramusculaire.
- Les vaccins doivent contenir les valences pertinentes, c'est à dire les sous-types H1N1 et H3N2.

# Pathogénie

- Le virus est excrété par les sécrétions nasales
- émission d'aérosol
- infections subcliniques: persistance de l'infection.
- pénètre dans les cavités nasales et infecte la muqueuse nasale, trachéale et bronchique.
- dissémination dans le tractus respiratoire (1 à 3 jours après l'infection) jusqu'aux alvéoles pulmonaires
- nécrose de la muqueuse
- débris cellulaires et de cellules mononucléées dans les exsudats
- pas de virémie

## Signes cliniques

- période d'incubation: 1 à 3 jours.
- maladie soudaine
- anorexie, abattement, température très élevée (41°C).
- toux, difficultés respiratoires (respiration abdominale)
- parfois: jetage, éternuement, conjonctivite
- faiblesse musculaire
- perte de poids.
- Après 3 à 6 jours de maladie, le porc guérit soudainement
- taux de mortalité très faible

## Lésions

- lobes antérieurs du poumon
- dégénérescence et nécrose de l'épithélium des bronches et bronchioles
- dilatation des capillaires et infiltration des septa alvéolaires
- atélectasie alvéolaire, pneumonie interstitielle et emphysème.

## Autres infections:

- Maladie d'Aujeszky
- Syndrome dysgénésique et respiratoire porcin
- Coronavirus respiratoire porcin
- Adénovirus porcin
- Cytomégalovirus porcin