



## ANTIVIRAUX ACTIFS SUR LES VIRUS RESPIRATOIRES

Enseignant : F. Van Bambeke

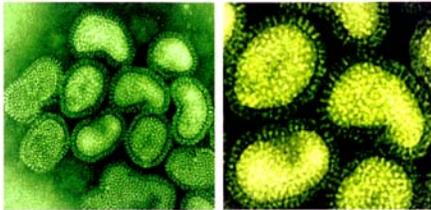
FARM2233 – année 2011-2012

### Médicaments des infections virales respiratoires

<b>Adenovirus</b>	-
<b>Picornavirus</b>	
<b>Entero</b>	-
<b>Rhino</b>	-
<b>Orthomyxovirus</b>	
<b>Influenza</b>	<b>inhibiteurs de neuraminidase :</b> <b>zanamivir, oseltamivir</b> <b>adamanatanes</b> <b>(influenza A)</b>
<b>Paramyxovirus</b>	
<b>Parainfluenza</b>	-
<b>Respiratory syncytial virus</b>	<b>ribavirine</b>
<b>SARS virus</b>	-

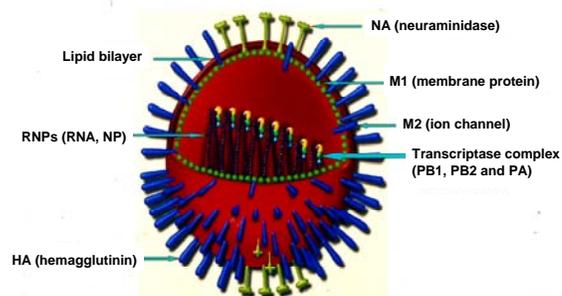
# ANTIVIRAUX ACTIFS SUR LE VIRUS INFLUENZA

## Le Virus de l'influenza: constituants

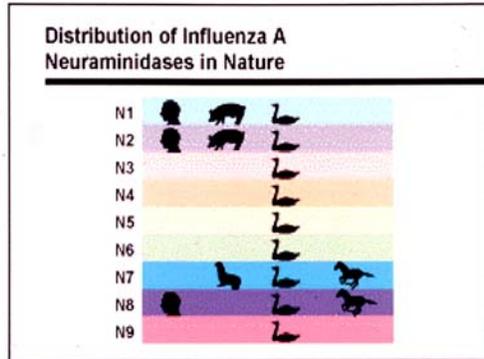
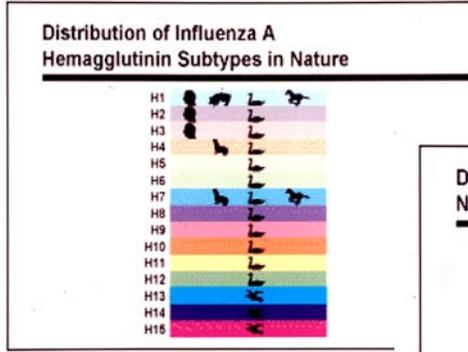


Electron micrographs of purified influenza virions. Hemagglutinin (HA) and neuraminidase (NA) can be seen on the envelope of viral particles. Ribonucleoproteins (RNPs) are located inside the virions.

Diagram of the influenza virus

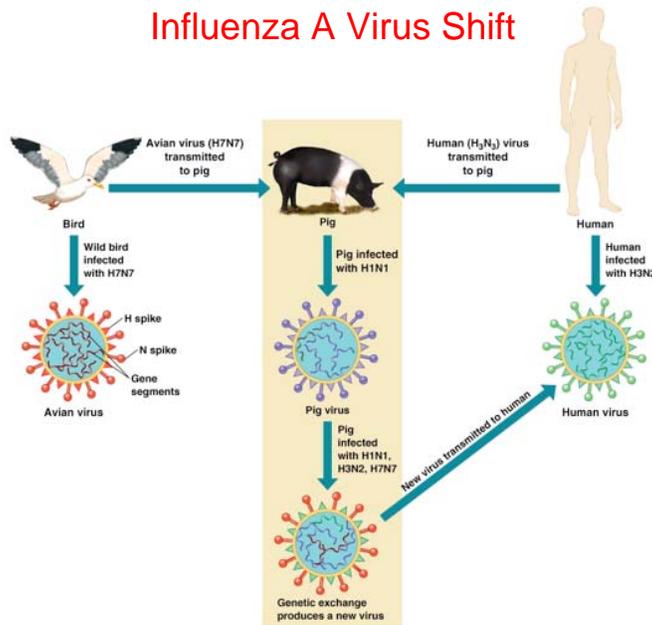


## Virus Influenza: Antigènes de surface

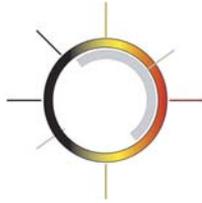


[http://www.brown.edu/Courses/Bio\\_160/Projects1999/flu/mechanism.html](http://www.brown.edu/Courses/Bio_160/Projects1999/flu/mechanism.html)

## Influenza A Virus Shift



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Commissariat  
interministériel Influenza

## La Grippe

### A distinguer :



Grippe saisonnière  
(Maladie humaine)

→ Attendue chaque hiver



Cas humains de  
grippe aviaire  
(Zoonose)

→ Situation récente en Asie



Pandémie de grippe  
(Zoonose évoluant en  
maladie humaine)

→ Situation actuelle (H<sub>1</sub>N<sub>1</sub>)

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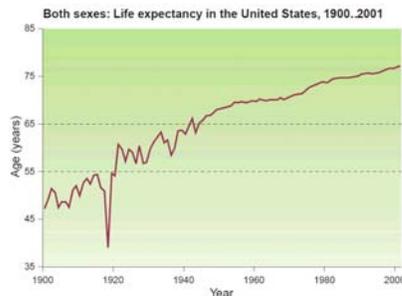
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## Histoire des pandémies ...

1889-90	A/H2N8	
1900-03	A/H3N8	
1918-19	A/H1N1	<i>Spanish Flu</i>
1957-58	A/H2N2	<i>Asian Flu</i>
1968-69	A/H3N2	<i>Hong Kong Flu</i>
(1977-78)	A/H1N1	<i>Russian Flu</i>
2009	A/H1N1	<i>Mexican Flu</i>



Australian Red Cross 1918



Life expectancy from 1900 to 2001 showing the impact of the 1918 influenza pandemic. Data are adapted from the National Vital Statistics Reports, Vol. 52, No. 14, February 18, 2004. ([http://www.cdc.gov/nchs/data/dvs/mvsr52\\_14112.pdf](http://www.cdc.gov/nchs/data/dvs/mvsr52_14112.pdf)).



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## Voies de transmission

1. aérosolisation



2. Voie aérienne



3. Objets contaminés

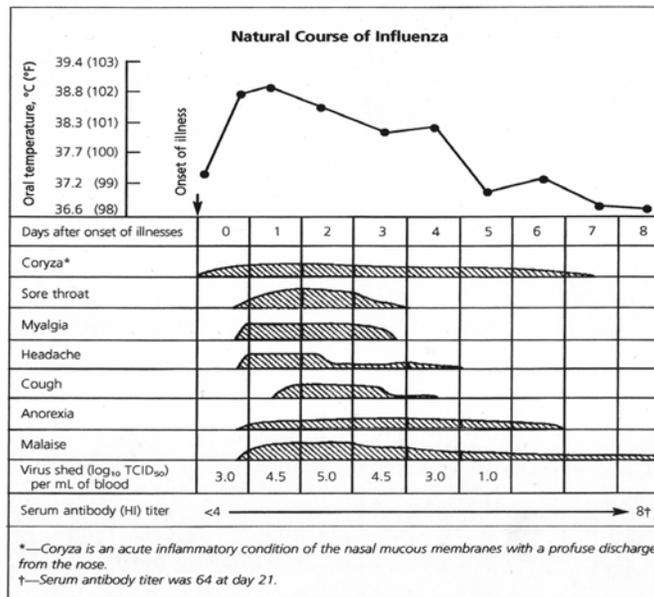


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## La grippe: signes cliniques

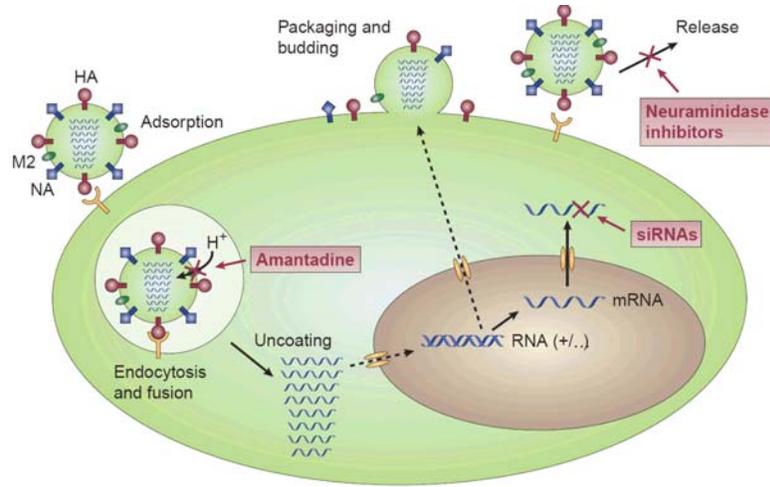


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## Cibles des antiviraux



*P. Palese Nature Medicine 10 : 2004*

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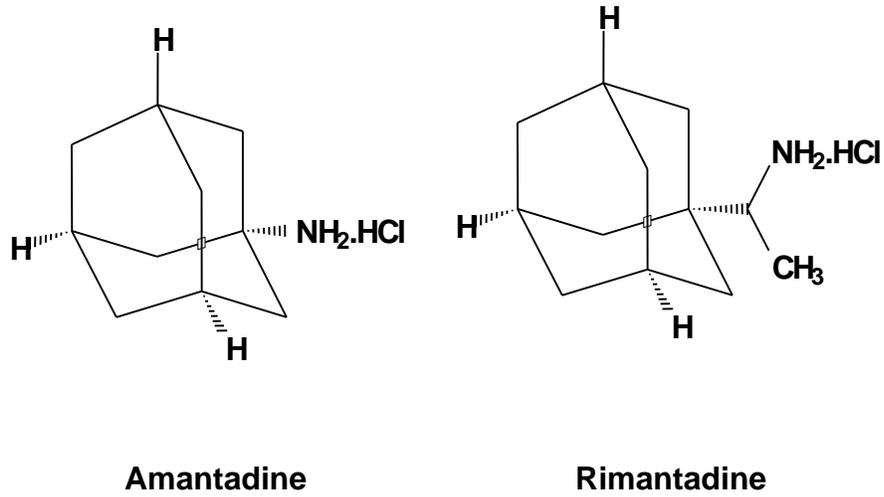
**ADAMANTANES**

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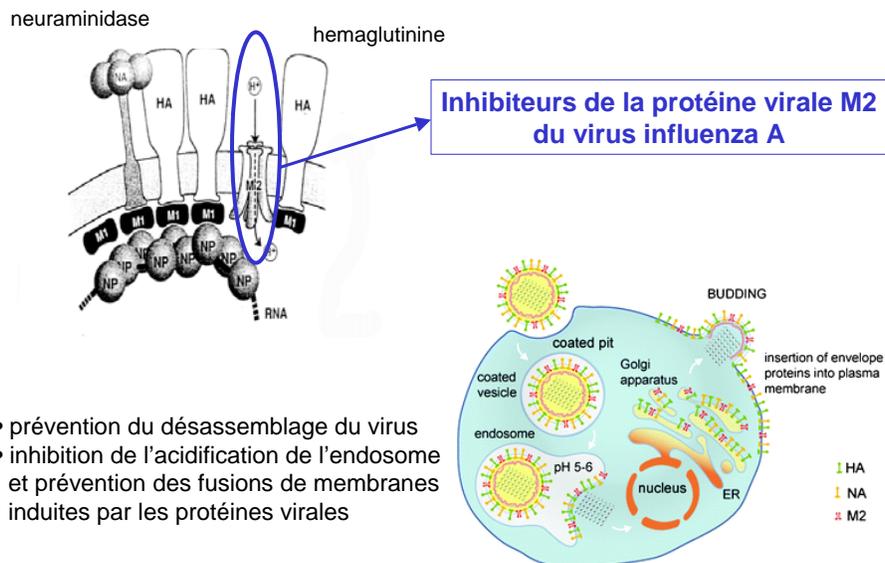
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## Adamantanes



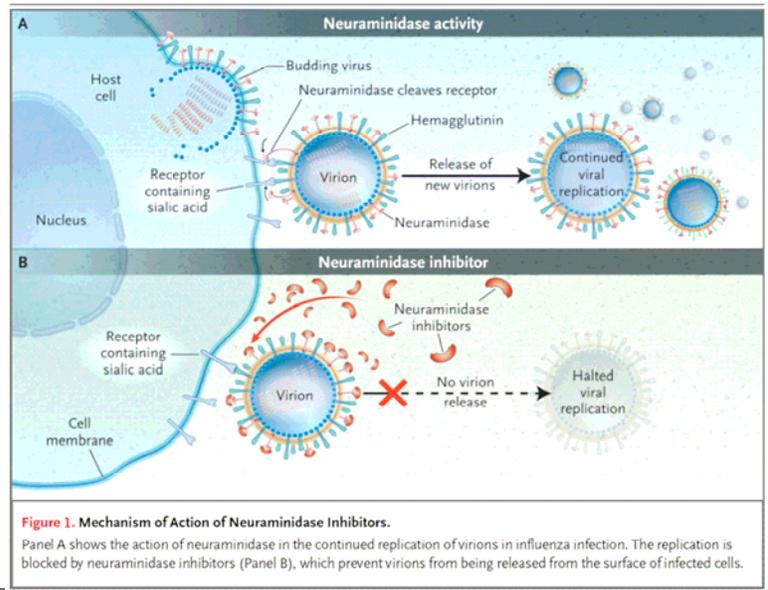
## Mode d'action



# INHIBITEURS DE NEURAMINIDASE

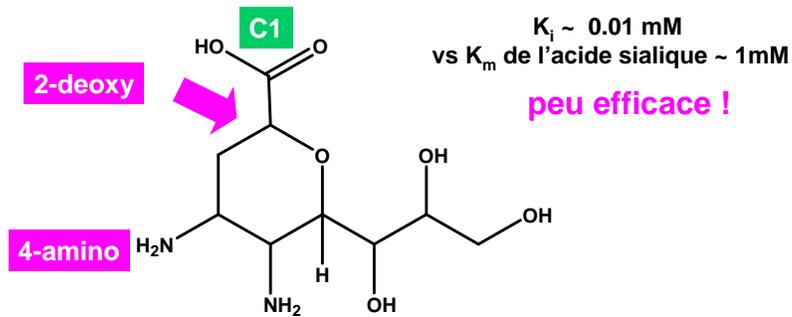
## La neuraminidase

*Moscona, NEJM (2005) 353:1363-1373*





## Découverte du premier inhibiteur ... 1969 !



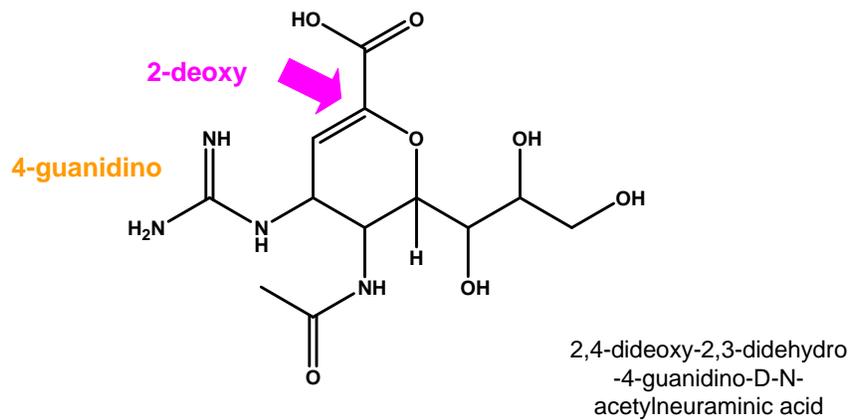
**2,4-dideoxy-2,3-didehydro-4-amino-D-N-acetylneuraminic acid**  
*Meindl et al., Hoppe-Seyler's Z. Physiol. Chem., 350:1088-1092, 1969*

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## Le zanamivir

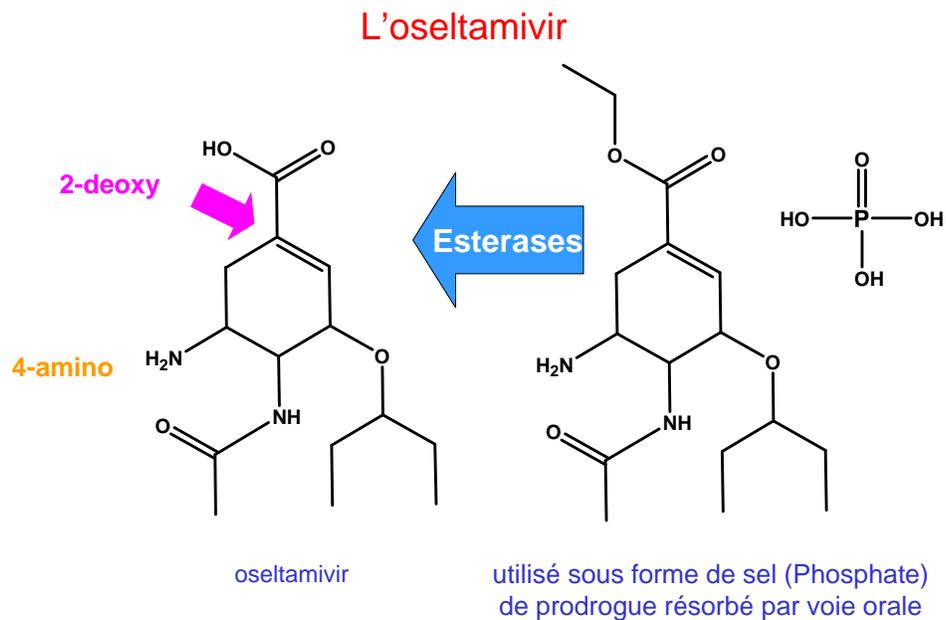


*von Itzstein et al., Nature (1993) 363: 418-423, 1993*

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## Résistance: mutation de la cible

### Neuraminidase

#### 119 Glu → Gly:

- Résistance au zanamivir  
(Glu 119 interagit avec guanidinium)

#### 292 Arg → Lys (R292K):

- Résistance à l'oseltamivir  
(Arg 292 interagit avec acide carboxylique mais conformation de la poche enzymatique adhoc pour le zanamivir)

#### 274 His → Tyr (H274Y) et 294 Asn → Ser (N294S)

- Résistance à l'oseltamivir

### Hemagglutinine

Certaines mutations ( 198 Thr → Ile) diminuent l'affinité pour le récepteur

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## Comparaison des inhibiteurs de neuraminidase

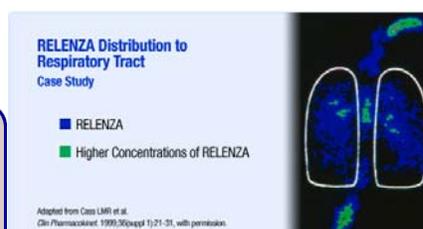
propriété	zanamivir	oseltamivir
spectre	Influenza A et B	
Voie d'administration	Inhalation 10 mg 2X/jour	Voie orale: 75-150 mg 2 X/jour
Traitement (5 jours)	↘ durée des symptômes – grippe saisonnière	
Prophylaxie	4 semaines: ↘ du nb de personnes malades	6 semaines: ↘ du nb de personnes malades
Activité sur H5N1	Peu efficace chez les patients contaminés	
tolérance	Bonne sauf path. respir.	bonne

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## Zanamivir: voie d'administration



<http://www.relenza.com/how-to-use-diskhaler.jsp?languages=French>

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## Zanamivir: comment l'administrer correctement ?



<http://www.relenza.com/how-to-use-diskhaler.jsp?languages=French>

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## Zanamivir: comment l'administrer correctement ?



**1 dose: = 2 cupules**

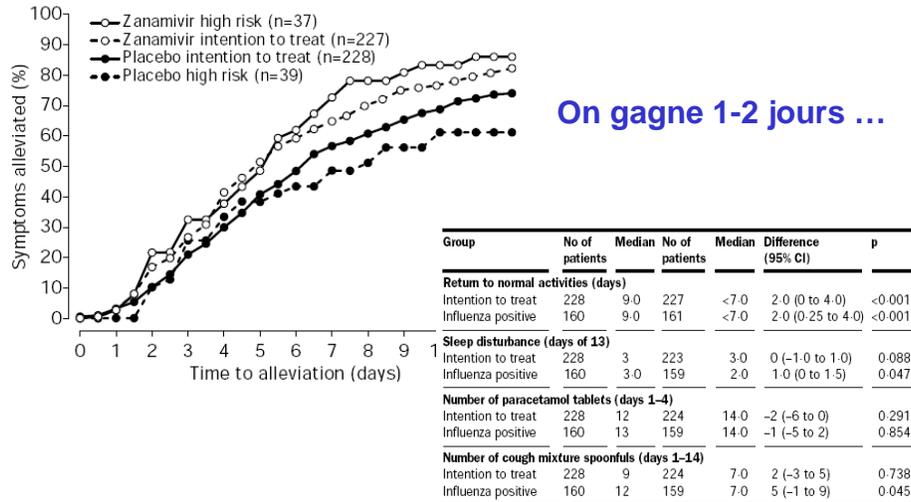
<http://www.relenza.com/how-to-use-diskhaler.jsp?languages=French>

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## Zanamivir: efficacité clinique



The Lancet (1998) 352: 1877-1881

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## Zanamivir: efficacité en prophylaxie

**Table 2.** Efficacy of Zanamivir in Prevention of Influenza Infection and Disease\*

Outcome	Frequencies in Study Groups, No. (%)		Odds Ratio (95% CI)	Estimated Risk Ratio (95% CI)	Efficacy, 1 - Risk Ratio (95% CI), %
	Placebo (n = 554)	Zanamivir (n = 553)			
Laboratory-confirmed clinical influenza	34 (6)	11 (2)	0.31 (0.14-0.64)†	0.33 (0.17-0.61)	67 (39-83)
Laboratory-confirmed influenza with fever	19 (3)	3 (<1)	0.15 (0.03-0.53)†	0.16 (0.06-0.45)	84 (55-94)
All febrile illnesses	58 (10)	33 (6)	0.54 (0.34-0.86)‡	0.57 (0.38-0.86)	43 (14-62)
Influenza infection with or without illness	77 (14)	53 (10)	0.66 (0.44-0.97)§	0.69 (0.50-0.96)	31 (4-50)

\*CI indicates confidence interval.

†P ≤ .001.

‡P = .009.

§P = .03.

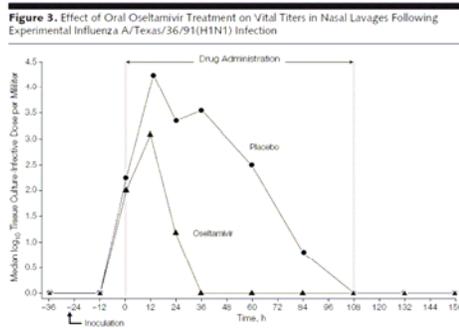
JAMA (1999) 282: 31-35

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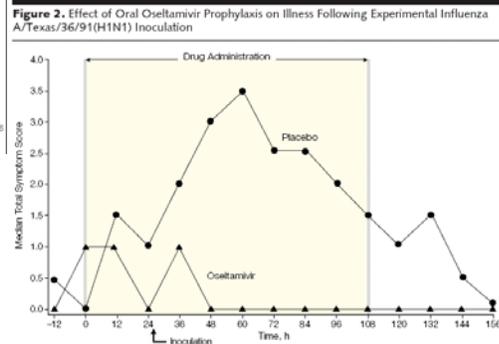
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## Et l'oseltamivir ?



**Traitement :  
On gagne 1-2 jours ...**

**Prophylaxie :  
efficace**



The total symptom score area under the curve value was lower in the combined oseltamivir groups (n=21) compared with placebo (n=12);  $P=.02$ . Fourteen symptoms related to influenza were included in the score.

JAMA (1999) 282:31-36

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## Zanamivir: effets secondaires et contre-indications

### Important Safety Information

**RELENZA IS NOT RECOMMENDED FOR TREATMENT OR PROPHYLAXIS OF INFLUENZA IN INDIVIDUALS WITH UNDERLYING AIRWAY DISEASE (SUCH AS ASTHMA OR CHRONIC OBSTRUCTIVE PULMONARY DISEASE).**

- ◆ Serious cases of bronchospasm, including fatalities, have been reported during treatment with RELENZA in patients with and without underlying airway disease. Many of these cases were reported during postmarketing, and causality was difficult to assess
- ◆ RELENZA SHOULD BE DISCONTINUED IN ANY PATIENT WHO DEVELOPS BRONCHOSPASM OR DECLINE IN RESPIRATORY FUNCTION; immediate treatment and hospitalization may be required
- ◆ RELENZA has not been proven effective for treatment of influenza in individuals with underlying airways disease.
- ◆ If treatment with RELENZA is considered for a patient with underlying airway disease, the potential risks and benefits should be carefully weighed. If a decision is made to prescribe RELENZA for such a patient, this should be done only under conditions of careful monitoring of respiratory function, close observation, and appropriate supportive care including availability of [fast-acting bronchodilators](#)
- ◆ Common adverse events in treatment and prophylaxis studies with RELENZA were nausea, diarrhea, sinusitis, viral respiratory infections, headaches, nasal signs and symptoms. The incidence of these adverse events was similar in both groups for RELENZA and placebo-treated groups

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## Bénéfice potentiel des inhibiteurs de neuraminidase

### Thérapeutique:

- ↘ durée des symptômes de 1-2 jours
- ↘ risque de transmission du virus
- ↘ risque de complications (sinusite, bronchite)
- ↘ usage d'antibiotiques

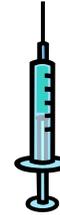
### Prophylaxie:

- Prévention saisonnière de l'infection

## Pharmacothérapie de la grippe

- **Traitement symptomatique**
  - antipyrétiques
    - éviter aspirine chez les enfants (syndrome de Reye)
  - selon les symptômes: décongestionnants, antitussifs
- **Traitement antiviral**
  - intérêt assez limité en traitement ...
  - commencer < 36 heures après le début des symptômes
  - prophylaxie de l'environnement familial ?
- **Suivre la survenue de complications (personnes à risque!)**
- **Vaccination !**

## Recommandations de vaccination (grippe saisonnière)

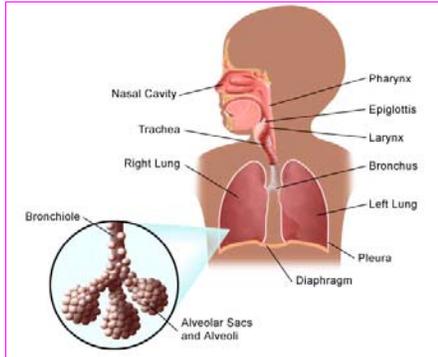


- Personnes à risque de complication:
  - > 65 ans
  - personnes vivant en institutions
  - co-morbidités
- Personnes susceptibles de transmettre la maladie à des personnes à risque (personnel médical, ...)



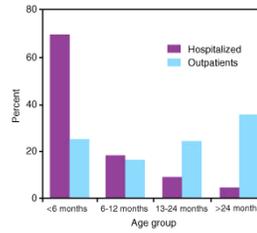
**ANTIVIRAUX ACTIFS SUR  
RESPIRATORY SYNCYTIAL VIRUS (RSV)**

## Infections respiratoires à RSV



Respiratory Illnesses Caused by Respiratory Syncytial Virus (RSV)

Syndrome	Percentage Caused by RSV
Bronchiolitis	43-90
Pneumonia	5-40
Tracheobronchitis	10-30
Croup	3-10
Asymptomatic	0.3



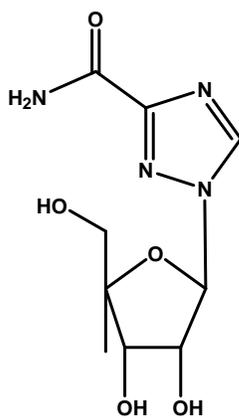
Difference in age distribution of inpatients and outpatients with respiratory syncytial virus infection in Rochester, NY. Of infants requiring hospitalization, 70% were younger than 6 months. In comparison, 25% of the children treated as outpatients were younger than 6 months and 38% were older than 2 years.

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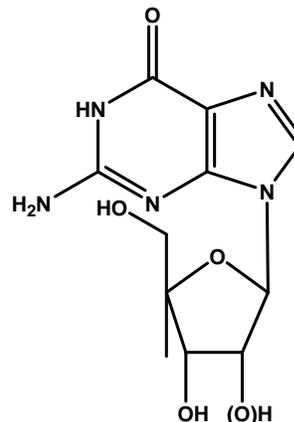
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## la ribavirine, un analogue de la guanosine



**RIBAVIRINE**



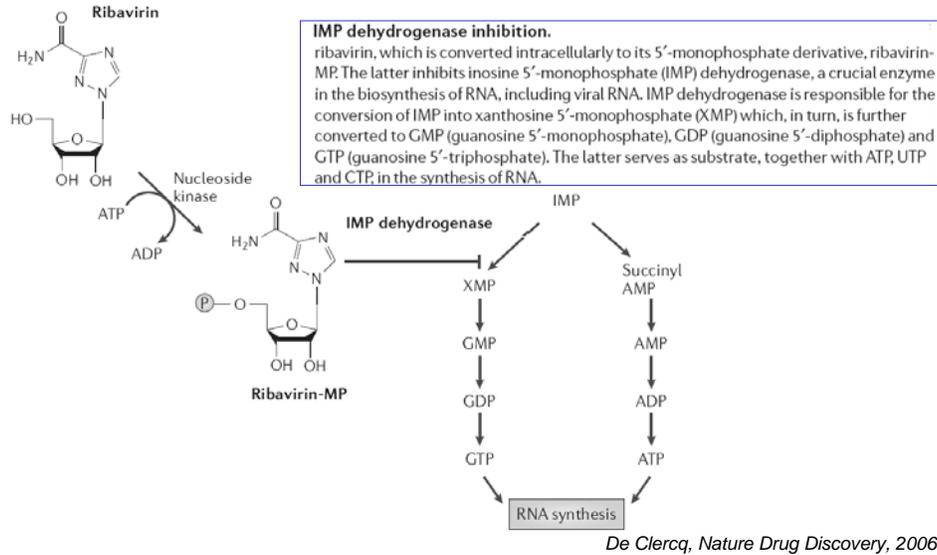
**(deoxy)GUANOSINE**

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## Mode d'action de la ribavirine



## Indications et propriétés pharmacologiques

**Aérosol :** traitement des infections à RSV  
mais peu utilisé ... affection bénigne

**Voie générale:** adjuvant dans le traitement de l'hépatite C

### Effets secondaires:

- Détérioration de la fonction respiratoire
- Anémie hémolytique + hypoplasie médullaire  
(Concentration dans les globules rouges)

## Traitement des infections à RSV

### Traitement symptomatique

- antipyrétique
- apport de fluides
- oxygène si nécessaire
  
- bronchodilatateurs
- cortocôïdes



### Traitement antiviral

(ribavirine)

