Vaccine Substances

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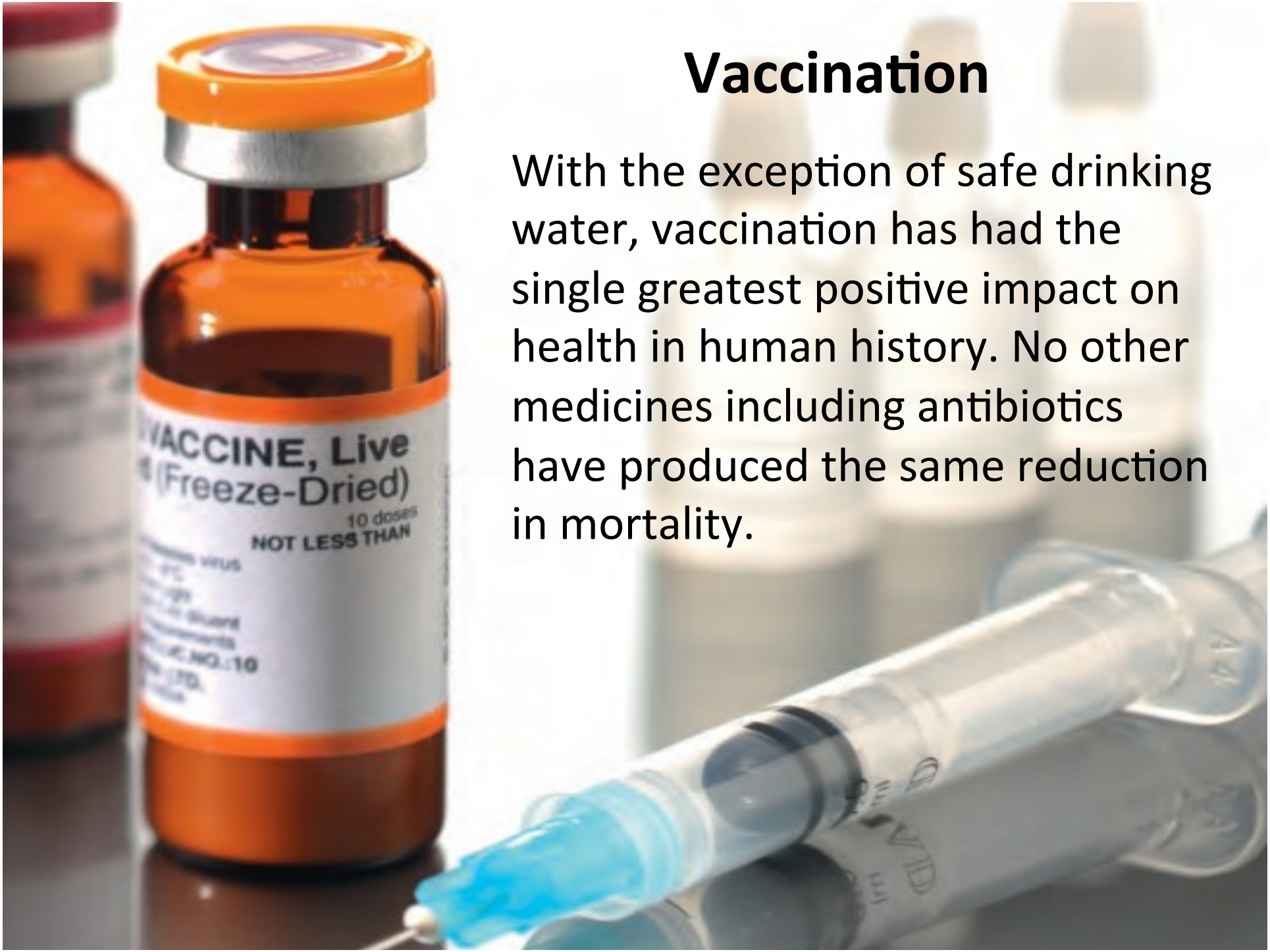


Vaccination

With the exception of safe drinking water, vaccination has had the single greatest positive impact on health in human history. No other medicines including antibiotics have produced the same reduction in mortality.

What is a Vaccine?

- A biological preparation that provides active acquired immunity to a particular disease
- Presents itself to the immune system as a disease-causing microorganism
- Often made from weakened or killed forms of the microorganism or a specific cellular component (usually on the organism's surface)

What is a Vaccine?

It stimulates the body's immune system to:

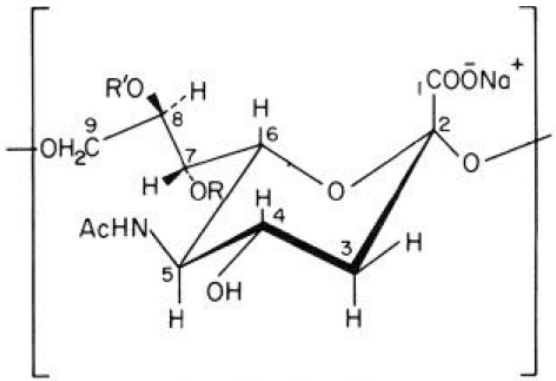
- Recognize the agent as a threat
- Destroy it
- Keep a record of it so that the immune system can more easily recognize and destroy any of these microorganisms that it later encounters

Vaccine Cell Components

- Lysates
- Envelope Glycoprotein Mixtures
- Pure Cellular Proteins (Protein)
- Capsule Polysaccharides (Polymer)

Polysaccharide Types B & C

β-methylglycosides) and on supportive chemical evidence. The data indicate that the serogroup B polysaccharide is a 2→8-α-linked homopolymer of sialic acid, identical in structure with colominic acid from *Escherichia coli*, whereas the de-*O*-acetylated serogroup C polysaccharide is a 2→9-α-linked homopolymer. The native serogroup C polysaccharide is *O*-acetylated (1.16 mol of *O*-acetyl per sialic acid residue), all the *O*-acetyl substituents being located only at C-7 and C-8 of the sialic acid residues, and in addition contains unacetylated residues (24%). The polysaccharide contains di-*O*-acetylated residues (*O*-acetyl on C-7 and C-8), and at least one of the possible monoacetylated residues at C-7 or C-8.

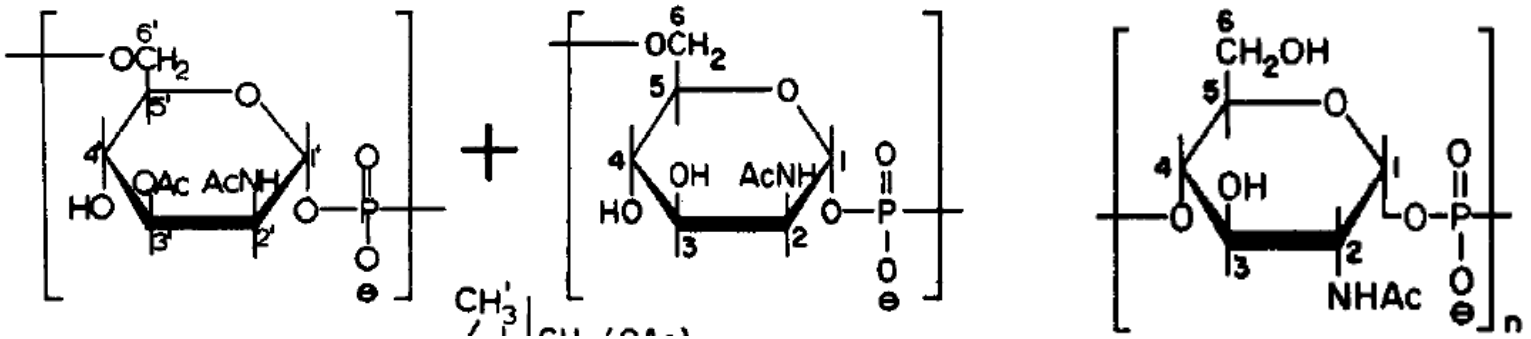


1 R = R′ = H
2 R = R′ = $COCH_3$
3 R = H, = R′ = $COCH_3$
4 R = $COCH_3$, R′ = H

FIG. 3. The four different *N*-acetylneuraminic acid residues possible in the serogroup C polysaccharide.

THE JOURNAL OF BIOLOGICAL CHEMISTRY
Vol. 250, No. 5, Issue of March 10, pp. 1926–1932, 1975

Polysaccharide Types A and X



phorylated polysaccharides. The serogroup A polysaccharide has been shown to be essentially a 1→6-linked homopolymer of partially *O*-acetylated 2-acetamido-2-deoxymannosyl phosphate (8) and that of serogroup X to be a homopolymer of 2-acetamido-2-deoxyglucosyl phosphate linked either 1→3 or 1→4 (9). Due

THE JOURNAL OF BIOLOGICAL CHEMISTRY
Vol. 249, No. 7, Issue of April 10, pp. 2275–2281, 1974

Polysaccharide Type 11A

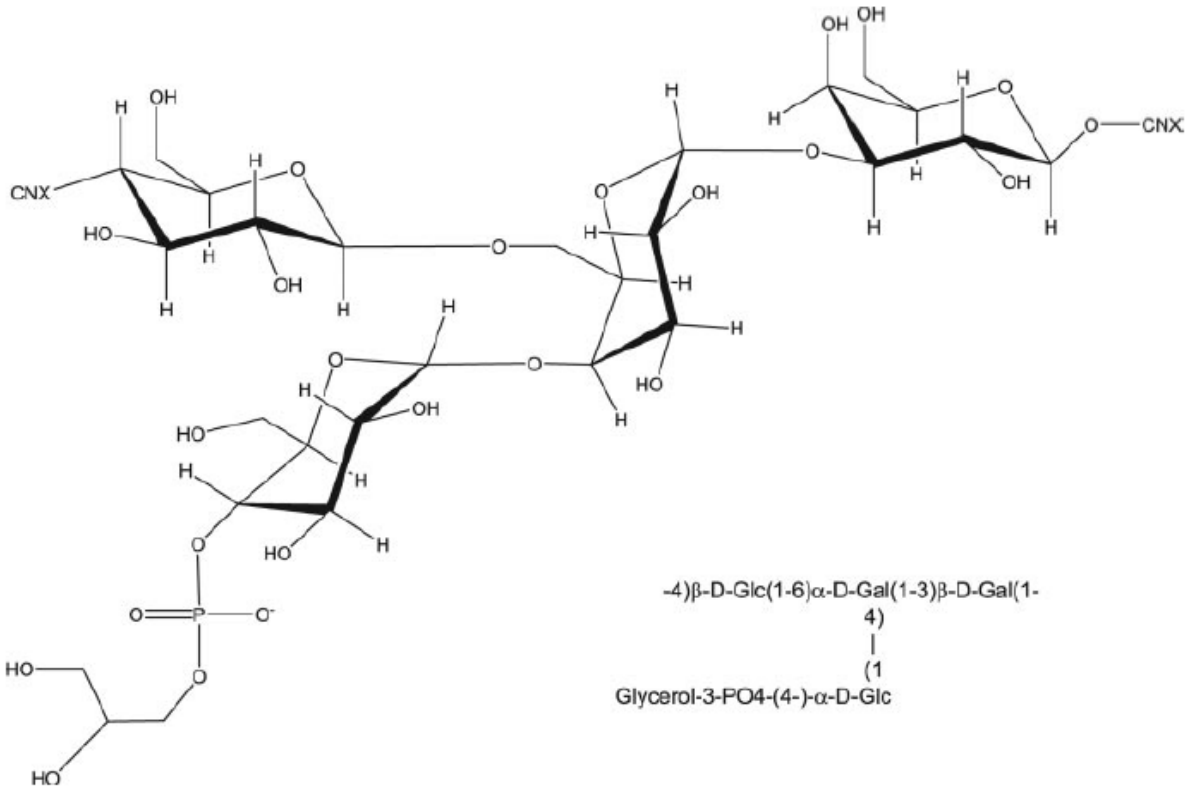


FIGURE 4. **Revised structure of de-*O*-acetylated *S. pneumoniae* 11A PS.**

THE JOURNAL OF BIOLOGICAL CHEMISTRY VOL. 284, NO. 11, pp. 7318–7329, March 13, 2009

Antigen Immunogenicity Modification

- Attenuated Strains
- Inactivation
- Conjugation

Live Attenuated Strains

- Produced by modifying a disease-producing ("wild") virus or bacterium
- Resulting vaccine organism retains the ability to replicate and produce immunity but usually does not cause illness

Vaccine Microorganism Taxonomy

- Bacteria
  - ITIS/NCBI
  - Antigens usually described at Serotype/group level
  - Attenuated strains
- Viruses
  - ICTV (In Catalogue of Life)/NCBI
  - Antigens described at Strain level

Inactivated Antigens

- Agent/Physical modifications of (protein or structurally-diverse protein mixtures) antigens
- Crosslinking agents
  - Formaldehyde
  - Glutaraldehyde
  - Propiolactone
  - Ultraviolet light
  - Heat

Conjugated Antigens

- Used if the cellular component is not sufficiently antigenic
- Conjugate is typically a toxoid protein
  - Inactivated toxin (inactivation agent)
  - Mutated toxin (CRM197)
- May or may not be able to describe the details of how the conjugating toxoid is bonded to the antigen

Subunits 2

Subunit 1

```
SLTDLGGELC IKIKNEDLTF IAEKNSFSEE PFQDEIVSYN TKNKPLNFNY SLDKIIVDYN
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DVSTIVPYIG PALNIVKQGY EGNFIGALET TGVVLLLEYI PEITLPVIAA LSIAESSTQK
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LEFDTQSKNI LMQYIKANSK FIGITELKKL ESKINKVFST PIPFSYSKNL DCWVDNEEDI
DVILKKSTIL NLDINNDIIS DISGFNSSVI TYPDAQLVPG INGKAIHLVN NESSEVIVHK
AMDIEYNDMF NNFTVSFWLR VPKVSASHLE QYGTNEYSII SSMKKHSLSI GSGWSVSLKG
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ITGLGAIRED NNITLKLDRC NNNNQYVSID KFRIFCKALN PKEIEKLYTS YLSITFLRDF
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KRYTPNNEID SFVKSGDFIK LYVSYNNNEH IVGYPKDGNA FNNLDRILRV GYNAPGIPLY
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Subunit 2

```
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Vaccine Products

- Most are polyvalent - multiple antigens
  - Antigens focused on different serotypes of the same organism
  - Antigens to vaccinate against different diseases
  - All are distinct active ingredients
- Many contain also adjuvating agents that increase antigen immunigenicity

ACTIVE INGREDIENT/ACTIVE MOIETY		
Ingredient Name	**Basis of Strength**	**Strength**
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INFLUENZA A VIRUS A/TEXAS/50/2012 X-223A (H3N2) ANTIGEN (FORMALDEHYDE INACTIVATED) (UNII: 4127F11825) (INFLUENZA A VIRUS A/TEXAS/50/2012 X-223A (H3N2) HEMAGGLUTININ ANTIGEN (FORMALDEHYDE INACTIVATED) - UNII:S477VIE5TZ)	INFLUENZA A VIRUS A/TEXAS/50/2012 X-223A (H3N2) ANTIGEN (FORMALDEHYDE INACTIVATED)	15 ug in 0.5 mL
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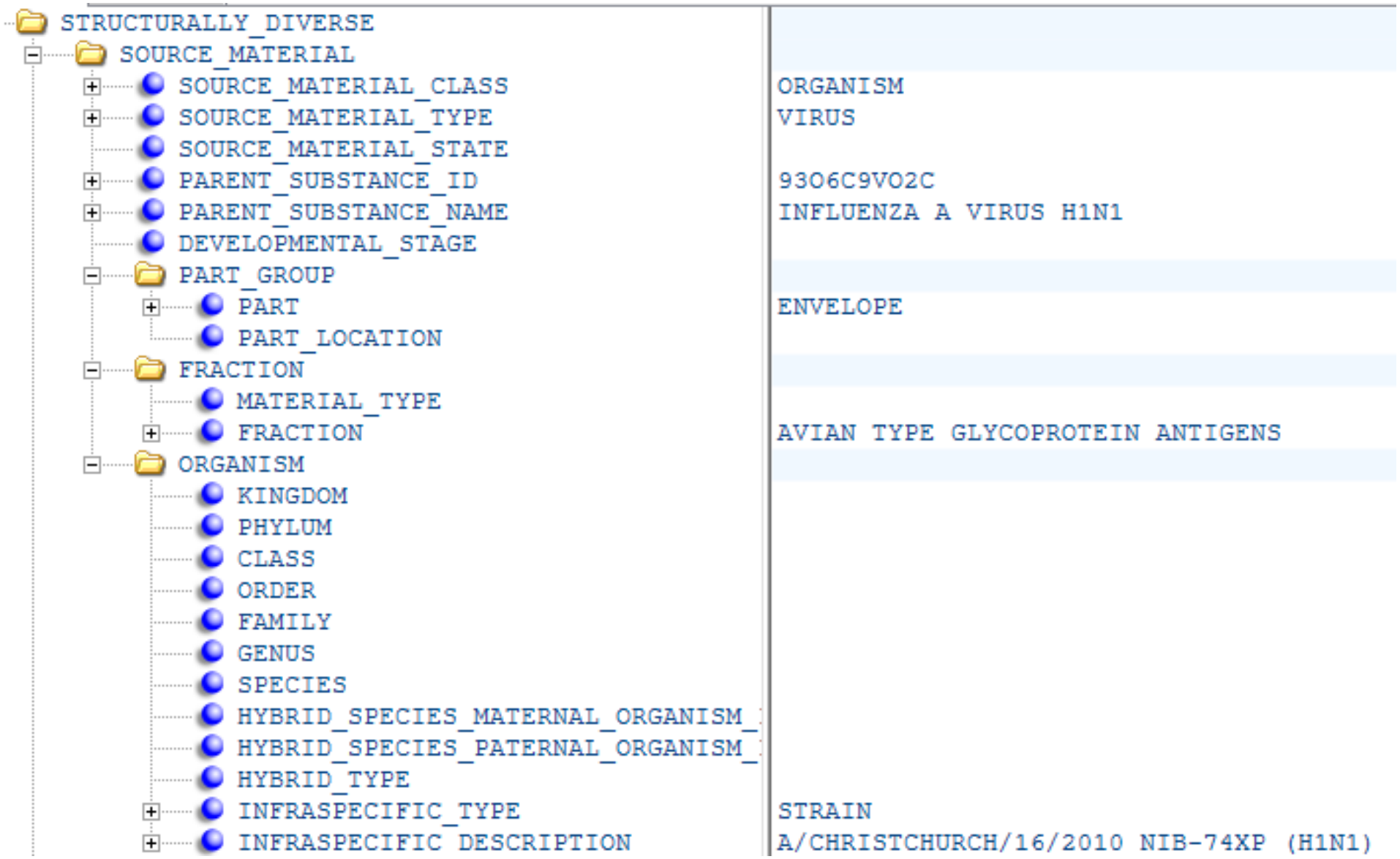
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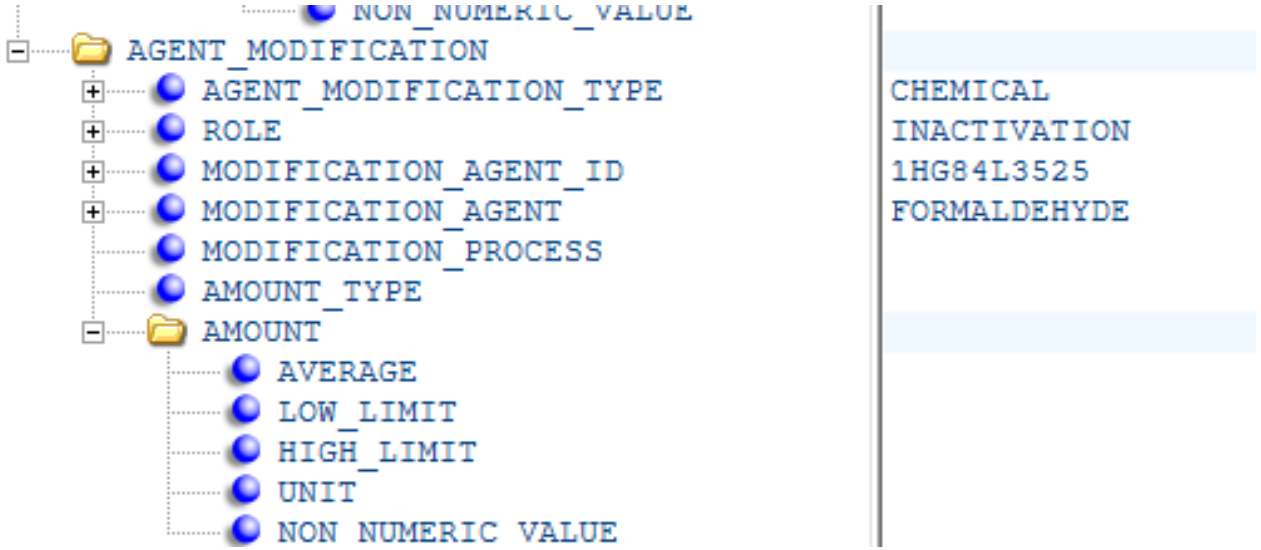
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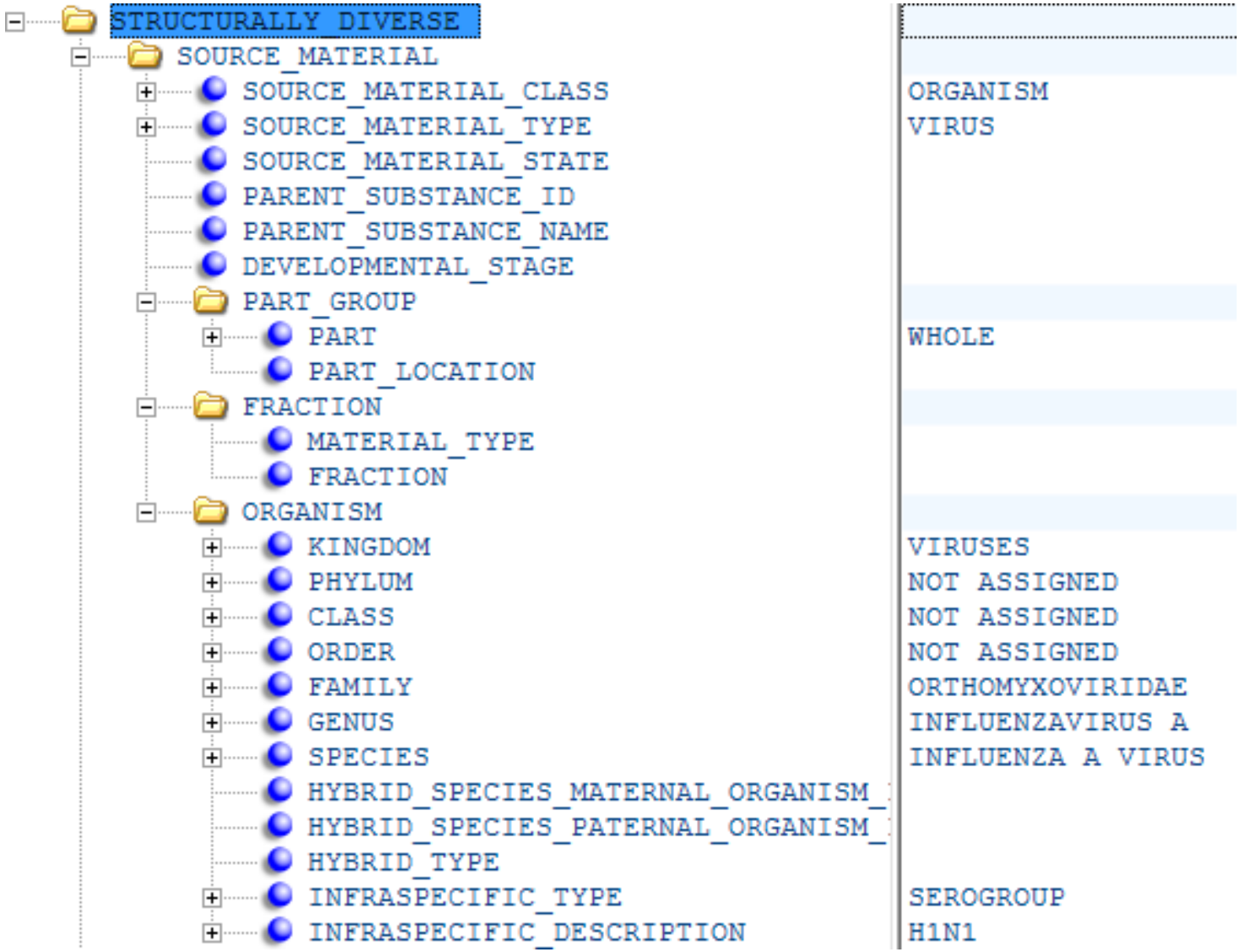
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Species details : *Influenzavirus a: Influenza A virus* ICTV

Accepted scientific name:	*Influenzavirus a: Influenza A virus* ICTV (accepted name)			
Synonyms:	-			
Common names:	-			
Classification:	Kingdom	Viruses	ICTV_MSL	LSID
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	Order	Not assigned	ICTV_MSL	LSID
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	Genus	*Influenzavirus a:*	ICTV_MSL	LSID
Distribution:	-			
Lifezones:	-			
Additional data:	-			
Source database:	ICTV_MSL, 1, Mar 2014	100% ★★★★★		
Latest taxonomic scrutiny:	A.M.Q.King, M.J.Adams, E.B. Carstens & E.J. Lefkowitz (Eds), Mar-2014			
Online resource:	http://ictvonline.org/virusTaxonomy.asp?version=2013			