Epidemiology and Prevention of Vaccine-Preventable Diseases

12th EDITION
SECOND PRINTING
Revised May 2012

This book was produced by the Education, Information and Partnership Branch, National Center for Immunization and Respiratory Diseases, Centers for Disease Control and Prevention, who is solely responsible for its content. It was printed and distributed by the Public Health Foundation. For additional copies, contact the Public Health Foundation at 877–252–1200 or website http://bookstore.phf.org/.

Slide sets to accompany this book are available on the CDC Vaccines and Immunization website at http://www.cdc.gov/vaccines/pubs/pinkbook/default.htm.

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DEPARTMENT OF HEALTH AND HUMAN SERVICES
CENTERS FOR DISEASE CONTROL AND PREVENTION
On the cover

Four scientists who made major contributions to vaccine research and development (clockwise from top left): **Emil von Behring** (1854-1917) – developed the first effective diphtheria antitoxin. For this work he received the first Nobel Prize for Medicine or Physiology in 1901; **Gaston Ramon** (1886-1963) – French veterinarian who in the 1920s developed methods for inactivating diphtheria and tetanus toxins, a critical discovery for the development of diphtheria and tetanus toxoids; **Maurice Hilleman** (1919-2005) – researcher who developed numerous vaccines at Merck including hepatitis B, mumps, and MMR vaccines; **John Enders** (1897-1985) – developed a method to grow poliovirus using tissue culture media which led to the development of the first successful polio vaccines. He and his coworkers received the Nobel Prize in Medicine in 1954 for this discovery. Dr. Enders was also the first to isolate measles virus in 1954, which led to the first measles vaccine.

Images of these scientists appear in the animated “gallery” shown at the beginning of all NCIRD broadcasts and video productions.

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*Lie is a series of hellos and goodbyes*
*I’m afraid it’s time for goodbye again…*


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**Milestones in the History of Vaccination**

<table>
<thead>
<tr>
<th>Year</th>
<th>Event</th>
</tr>
</thead>
<tbody>
<tr>
<td>400 BCE</td>
<td>Hippocrates describes diphtheria, epidemic jaundice, and other conditions</td>
</tr>
<tr>
<td>1100s</td>
<td>Variolation for smallpox first reported in China</td>
</tr>
<tr>
<td>1721</td>
<td>Variolation introduced into Great Britain</td>
</tr>
<tr>
<td>1796</td>
<td>Edward Jenner inoculates James Phipps with cowpox, and calls the procedure vaccination (“vacca” is Latin for cow)</td>
</tr>
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</table>
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<th>Event</th>
</tr>
</thead>
<tbody>
<tr>
<td>1870</td>
<td>Louis Pasteur creates the first live attenuated bacterial vaccine</td>
</tr>
<tr>
<td></td>
<td>(chicken cholera)</td>
</tr>
<tr>
<td>1884</td>
<td>Pasteur creates the first live attenuated viral vaccine (rabies)</td>
</tr>
<tr>
<td>1885</td>
<td>Pasteur first uses rabies vaccine in a human</td>
</tr>
<tr>
<td>1887</td>
<td>Institut Pasteur established</td>
</tr>
<tr>
<td>1900</td>
<td>Paul Ehrlich formulates receptor theory of immunity</td>
</tr>
</tbody>
</table>
Milestones in the History of Vaccination

1901  First Nobel Prize in Medicine to von Behring for diphtheria antitoxin
1909  Theobald Smith discovers a method for inactivating diphtheria toxin
1919  Calmette and Guerin create BCG, the first live attenuated bacterial vaccine for humans
1923  First whole-cell pertussis vaccine tested
1926  Ramon and Christian Zoeller develop tetanus toxoid
### Milestones in the History of Vaccination

<table>
<thead>
<tr>
<th>Year</th>
<th>Event</th>
</tr>
</thead>
<tbody>
<tr>
<td>1955</td>
<td>Inactivated polio vaccine licensed</td>
</tr>
<tr>
<td>1961</td>
<td>Human diploid cell line developed</td>
</tr>
<tr>
<td>1963</td>
<td>Measles vaccine licensed Trivalent oral polio vaccine licensed</td>
</tr>
<tr>
<td>1965</td>
<td>Bifurcated needle for smallpox vaccine licensed</td>
</tr>
<tr>
<td>1966</td>
<td>World Health Assembly calls for global smallpox eradication</td>
</tr>
</tbody>
</table>

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<td>1966</td>
<td>World Health Assembly calls for global smallpox eradication</td>
</tr>
<tr>
<td>1967</td>
<td>Maurice Hilleman develops Jeryl Lynn strain of mumps virus</td>
</tr>
<tr>
<td>1969</td>
<td>Stanley Plotkin develops RA27/3 strain of rubella vaccine virus</td>
</tr>
<tr>
<td>1971</td>
<td>MMR vaccine licensed</td>
</tr>
<tr>
<td>1977</td>
<td>Last indigenous case of smallpox (Somalia)</td>
</tr>
<tr>
<td>1979</td>
<td>Last wild poliovirus transmission in the U.S.</td>
</tr>
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Milestones in the History of Vaccination

1981
First hepatitis B vaccine licensed

1983
Smallpox vaccine withdrawn from civilian market

1986
First recombinant vaccine licensed (hepatitis B)
National Childhood Vaccine Injury Act

1989
Two-dose measles vaccine recommendation

1990
First polysaccharide conjugate vaccine licensed
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Milestones in the History of Vaccination

1994
Polio elimination certified in the Americas
Vaccines for Children program begins

1995
Varicella vaccine licensed
Hepatitis A vaccine licensed
First harmonized childhood immunization schedule published

1996
Acellular pertussis vaccine licensed for infants

1997
Sequential polio vaccination recommended

1998
First rotavirus vaccine licensed
### Milestones in the History of Vaccination

<table>
<thead>
<tr>
<th>Year</th>
<th>Event</th>
</tr>
</thead>
<tbody>
<tr>
<td>1999</td>
<td>Exclusive use of inactivated polio vaccine recommended. Rotavirus vaccine withdrawn.</td>
</tr>
<tr>
<td>2000</td>
<td>Pneumococcal conjugate vaccine licensed for infants.</td>
</tr>
<tr>
<td>2003</td>
<td>Live attenuated influenza vaccine licensed.</td>
</tr>
<tr>
<td>2004</td>
<td>Inactivated influenza vaccine recommended for all children 6–23 months of age. Indigenous transmission of rubella virus interrupted.</td>
</tr>
</tbody>
</table>
### Milestones in the History of Vaccination

<table>
<thead>
<tr>
<th>Year</th>
<th>Event</th>
</tr>
</thead>
<tbody>
<tr>
<td>2005</td>
<td>Acellular pertussis vaccines licensed for adolescents and adults</td>
</tr>
<tr>
<td>2005</td>
<td>MMR-varicella (MMRV) licensed</td>
</tr>
<tr>
<td>2006</td>
<td>Second generation rotavirus vaccine licensed</td>
</tr>
<tr>
<td>2006</td>
<td>First human papillomavirus vaccine licensed</td>
</tr>
<tr>
<td>2006</td>
<td>First herpes zoster vaccine licensed</td>
</tr>
<tr>
<td>Vaccine/Biologic</td>
<td>Brand Name</td>
</tr>
<tr>
<td>--------------------------------------</td>
<td>------------------</td>
</tr>
<tr>
<td>Anthrax, adsorbed</td>
<td>BacTrax®</td>
</tr>
<tr>
<td>Botulism immune globulin (BIG-IV)</td>
<td>BabyBIG®</td>
</tr>
<tr>
<td>Diphtheria, tetanus, acellular Pertussis</td>
<td>Infanrix®</td>
</tr>
<tr>
<td>Diphtheria, tetanus, acellular Pertussis</td>
<td>Tdap®</td>
</tr>
<tr>
<td>Diphtheria, tetanus, acellular Pertussis</td>
<td>Pediarix®</td>
</tr>
<tr>
<td>Diphtheria, tetanus, acellular Pertussis</td>
<td>Pentacel®</td>
</tr>
<tr>
<td>Diphtheria, tetanus, acellular Pertussis</td>
<td>Kenrix®</td>
</tr>
<tr>
<td>Diphtheria, tetanus, acellular Pertussis</td>
<td>sanofi pasteur</td>
</tr>
<tr>
<td>Tetanus, Diphtheria, adsorbed (TD ≥7 y)</td>
<td>Decavac®</td>
</tr>
<tr>
<td>Tetanus, Diphtheria, adsorbed (TD ≥7 y)</td>
<td>Tenvac®</td>
</tr>
<tr>
<td>Tetanus, Diphtheria, adsorbed (TD ≥7 y)</td>
<td>Sanofi pasteur</td>
</tr>
<tr>
<td>Tetanus toxoid, adsorbed (TT ≥7 y)</td>
<td>Adacel®</td>
</tr>
<tr>
<td>Tetanus toxoid, adsorbed (TT, adult booster use only)</td>
<td>sanofi pasteur</td>
</tr>
<tr>
<td>Tetanus immune globulin (TIG)</td>
<td>Hyper TET®</td>
</tr>
<tr>
<td>Haemophilus influenzae type b (PRP-T)</td>
<td>ActHIB®</td>
</tr>
<tr>
<td>Haemophilus influenzae type b (PRP-OMP)</td>
<td>PedsavHIB®</td>
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<tr>
<td>Haemophilus influenzae type b (PRP-T)</td>
<td>Hibex®</td>
</tr>
<tr>
<td>Haemophilus influenzae type b (PRP-OMP)</td>
<td>Convax®</td>
</tr>
<tr>
<td>Hepatitis A, ped/ado &amp; adult formulations</td>
<td>Havrix®</td>
</tr>
<tr>
<td>Hepatitis A, ped/ado &amp; adult formulations</td>
<td>sanofi pasteur</td>
</tr>
<tr>
<td>Hepatitis B, ped/ado &amp; adult formulations</td>
<td>Engerix®</td>
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<td>Hepatitis B, ped/ado &amp; adult formulations</td>
<td>sanofi pasteur</td>
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<tr>
<td>Hepatitis B dialysis formulation</td>
<td>Recombivax-HB®</td>
</tr>
<tr>
<td>Hepatitis B immune globulin (HBIG)</td>
<td>HyperHEP B®</td>
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<td>Hepatitis B immune globulin (HBIG) ped formulation</td>
<td>HyperHEP B®</td>
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<tr>
<td>Hepatitis B immune globulin (HBIG)</td>
<td>Nabi-HB®</td>
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<tr>
<td>Hepatitis A &amp; B adult formulations</td>
<td>Twinrix®</td>
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<tr>
<td>Human papillomavirus, quadrivalent (HPV4)</td>
<td>Gardasil®</td>
</tr>
<tr>
<td>Human papillomavirus, bivalent (HPV2)</td>
<td>Cervarix®</td>
</tr>
<tr>
<td>Influenza, bivalent inactivated (TV) (normal)</td>
<td>multiple</td>
</tr>
<tr>
<td>Influenza, bivalent inactivated (TV) (High-Dose ≥65 yrs)</td>
<td>FluZone High Dose®</td>
</tr>
<tr>
<td>Influenza, bivalent inactivated (TV) (Intradermal)</td>
<td>FluZone Intradermal®</td>
</tr>
<tr>
<td>Influenza, live attenuated (LAIV)</td>
<td>FluMist®</td>
</tr>
<tr>
<td>Japanese encephalitis</td>
<td>Ixaro®</td>
</tr>
<tr>
<td>Measles, Mumps, Rubella (MRM)</td>
<td>M-M-R III®</td>
</tr>
<tr>
<td>Measles, Mumps, Rubella, Varicella (MMRV)</td>
<td>ProQuad®</td>
</tr>
<tr>
<td>Meningococcal conjugate, quadrivalent</td>
<td>Meningoccal conjugate, quadrivalent</td>
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<td>Meningococcal conjugate, quadrivalent</td>
<td>Menomune®</td>
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<tr>
<td>Meningococcal polysaccharide, quadrivalent</td>
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<td>Poliovirus inactivated (IPV)</td>
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<td>Rabies</td>
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<td>Rabies immune globulin (RIG)</td>
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<td>Rabies immune globulin (RIG)</td>
<td>Imogam Rabies-HT®</td>
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<td>Rotavirus, pentavalent (RV5)</td>
<td>RotaTeq®</td>
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<td>Rotavirus, monovalent (RV1)</td>
<td>Rotarix®</td>
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<tr>
<td>Typhoid, Vi polysaccharide</td>
<td>Typhim Vi®</td>
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<tr>
<td>Typhoid, live oral Ty21a</td>
<td>VivoTif®</td>
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<tr>
<td>Varicella</td>
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<tr>
<td>Varicella Zoster immune globulin (VZIG) (IND)</td>
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<td>Yellow fever</td>
<td>YF-Vax®</td>
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<td>Zoster</td>
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