Vaccine Preventable Diseases (VPDs) & Outbreak Management in Schools

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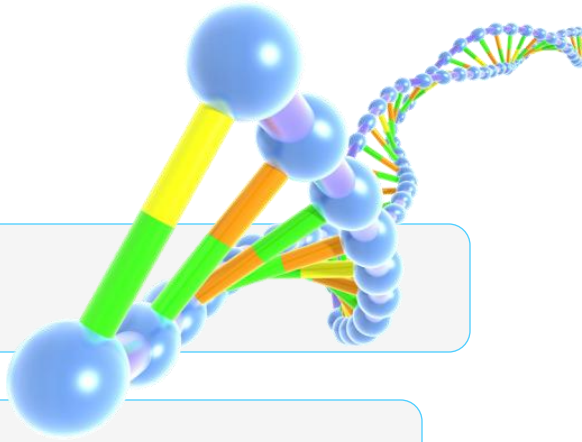
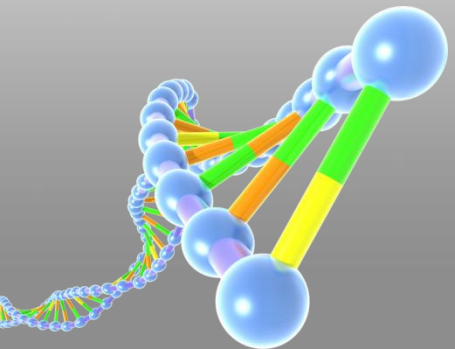
2012

•Agenda

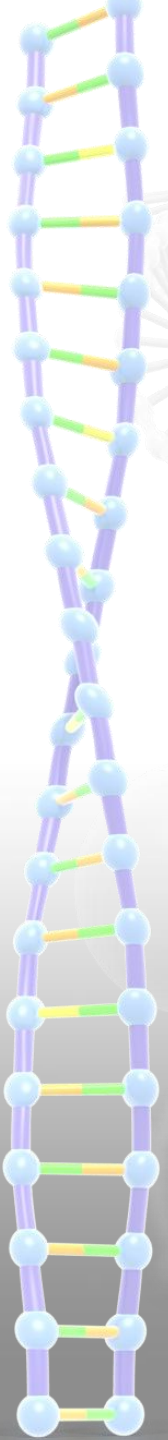


Item 1	Immunity 101
Item 2	Vaccinology 101
Item 3	Surveillance (Reportables) & Outbreak
Item 4	Specific VPDs
Item 5	Conclusion / Questions



Disclaimer; Neither I nor my immediate family have or have had in the last twelve months, a relevant financial, professional, or personal relationship with a commercial interest producing health care goods/services related to this educational activity.
FDA off label use of the Tdap vaccine will be presented and identified during my presentation.

•Immunity 101
Innate vs. Adaptive



INNATE IMMUNITY

- First line of defense
  - Physical
    - Skin
    - Nasal hair
  - Chemical
    - Enzymes in perspiration a & saliva
    - Acids in the stomach
    - Inflammatory response

ADAPTIVE IMMUNITY

- When a pathogen gets past the first line of defense, specific defense mechanisms are alerted (memory of antigen that the immune system has)
- 2 parts
  - Cell-Mediated (T-Cell)
    - Protects against antigens that have invaded cells (CA)
    - Activate B-cells to produce antibodies
    - Activate macrophages
    - Kill our own cells that are infected
  - Humoral or Antibody-Mediated(B-cells)
    - Protects fluids of the body

•Immunity 101

Antibodies

- Programmed to recognize and bind to an antigen posing a threat
- Proteins that are produced by B-lymphocytes to neutralize the antigen and prepare it for destruction
- Y-shaped molecules
  - Constant region is specific to antigen
  - Variable region allows different antigens to be identified
- Can activate proteins called complements that assist in the killing of pathogens or infected cells

•Immunity 101

Immunological Memory

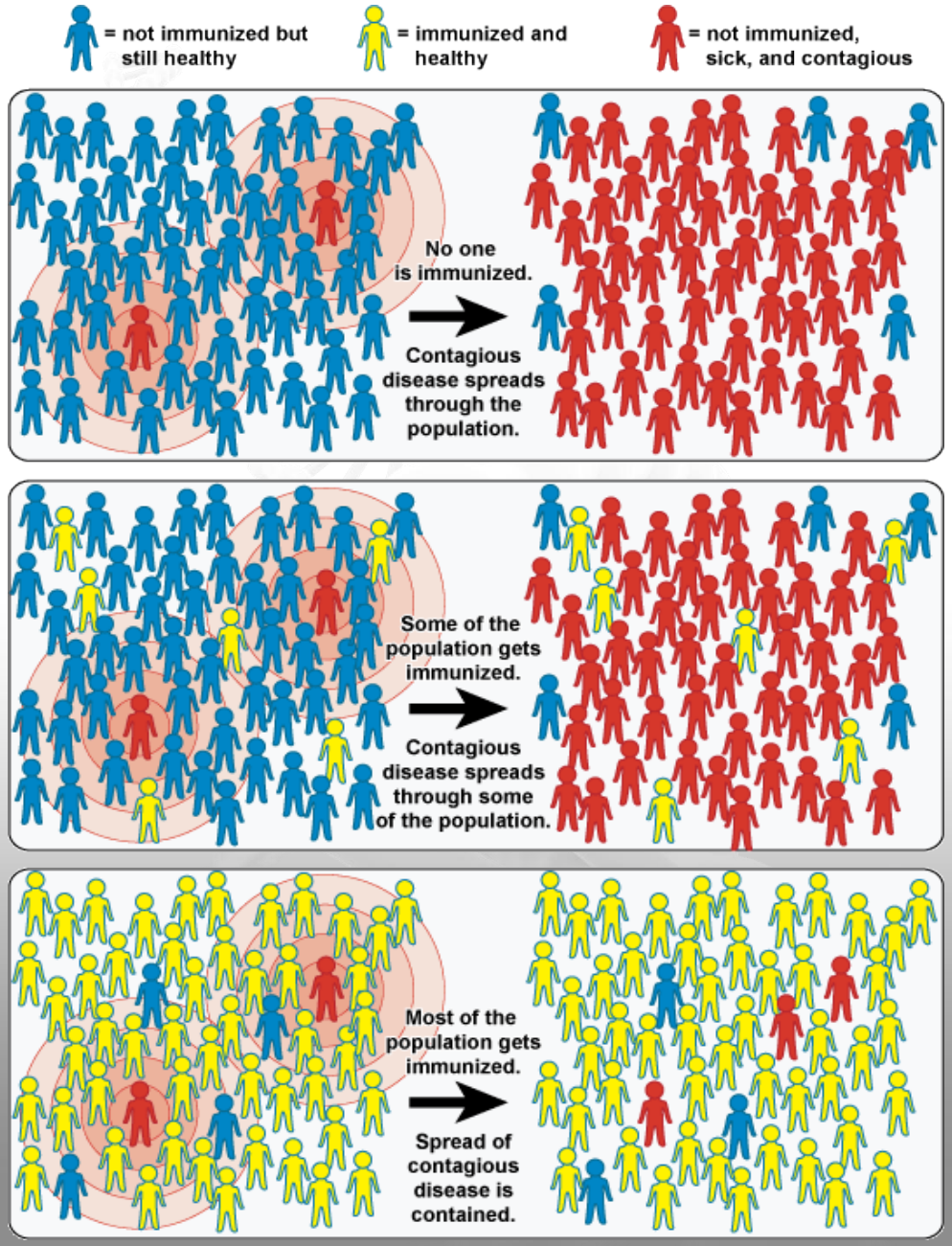
- "Memory Cells" circulate, constantly patrolling for specific antigens
  - Recognize and rapidly respond to antigens on subsequent exposures
- **Vaccination** is the deliberate initiation of adaptive immunity so that the immune system develops immunological memory
  - The individual does not have to experience the disease to develop immunity

•Herd or Community Immunity

Vaccine Goal in Community

- When a sufficient proportion of a population is immune to an infectious disease it makes the spread of the infectious disease from person to person unlikely.

- Individuals not vaccinated (such as newborns and those with chronic illnesses) are offered some protection because the disease has little opportunity to spread within the community.



•Vaccinology 101

• Understanding the Cause of Disease

Bacterial Diseases → **Bacteria produces toxins (poisons) which result in disease** → **Treatment = Antibiotics**

Viral Diseases → **Viruses enter a living cell and replicates itself resulting in disease** → **Treatment = Time**

•Vaccinology 101

•Types of Vaccines

Live Attenuated

- MMR, Varicella, Rotavirus, Intranasal Influenza
- Results in less than 20x replication therefore, does not result in disease
- Advantage;
  - 1-2 doses needed to produce life-long immunity
- Disadvantage;
  - Contraindicated in immunosuppressed

Inactivated

- IPV, HAV, Influenza, Rabies
- Virus is killed chemically but is still recognized and activates immune response
- Advantage;
  - Can be given to immunosuppressed
- Disadvantage;
  - Requires several doses to achieve immuno-reponse

Acellular

- Viral (HBV, HPV)
  - Surface PRO from virus is used to trigger immuno-response
- Bacterial (DTaP, Tdap, Hib, PCV, MCV)
  - Toxin produced by bacteria inactivated resulting in toxoid
- Advantage;
  - Can be given to immunosuppressed
- Disadvantage;
  - Requires several doses to achieve immuno-reponse

•Surveillance

ILLINOIS DEPARTMENT OF PUBLIC HEALTH

ILLINOIS REPORTABLE DISEASES

Mandated reporters, such as health care providers, hospitals and laboratories must report any suspected or confirmed human cases of these diseases to the McHenry County Department of Health within the designated time frame. (*HIV/AIDS is reportable directly to IDPH)

Mandated Reporters such as; HCPs, Hospitals, Schools, and Laboratories

School Syndromic Surveillance

MCDH Communicable Disease Program

Illinois Department of PUBLIC HEALTH Illinois - National Electronic Disease Surveillance System I-NEDSS

CDC National Electronic Disease Surveillance System

•Surveillance

How is Surveillance Data Used

•Surveillance data collected through case investigations are used;

- •To assess burden of disease and monitor changes in epidemiology over time
- •To guide policy and development of control strategies

•Local and State Health Departments use surveillance data to identify clusters or related cases that might indicate an outbreak.

•CDC uses surveillance data to monitor national trends in disease and identify populations at risk

•Surveillance

Diagnosis vs. Case Definition

DIAGNOSIS	CASE DEFINITION
• The opinion derived from the evaluation of identifying or determining the nature and cause of a disease or injury through evaluation of patient history, examination, and review of laboratory data. • Medical Art & Science	• A set of standard criteria for identifying a particular disease or health-related condition, by specifying clinical criteria and limitations on time, place, and person • Statistical Science/Epidemiology

•Outbreak

CDC, State, Local, and Hollywood

The CDC defines an outbreak as;

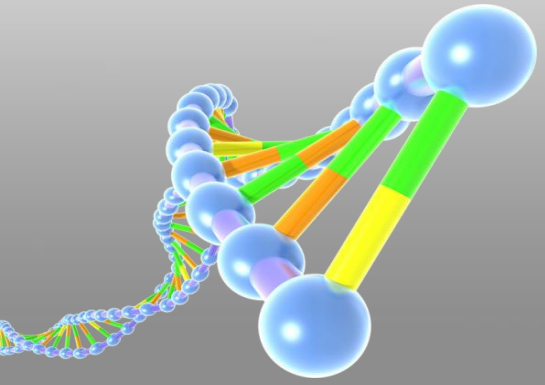
"*The occurrence of more cases of disease than normally expected within a specific place or group of people over a given period of time*".

State & Local Health Departments (IDPH & MCDH)identify outbreaks as;

"*The occurrence of 2 or more cases of disease than normally expected within a specific place or group of people over a given period of time*".

•VPDs in Schools/Daycares

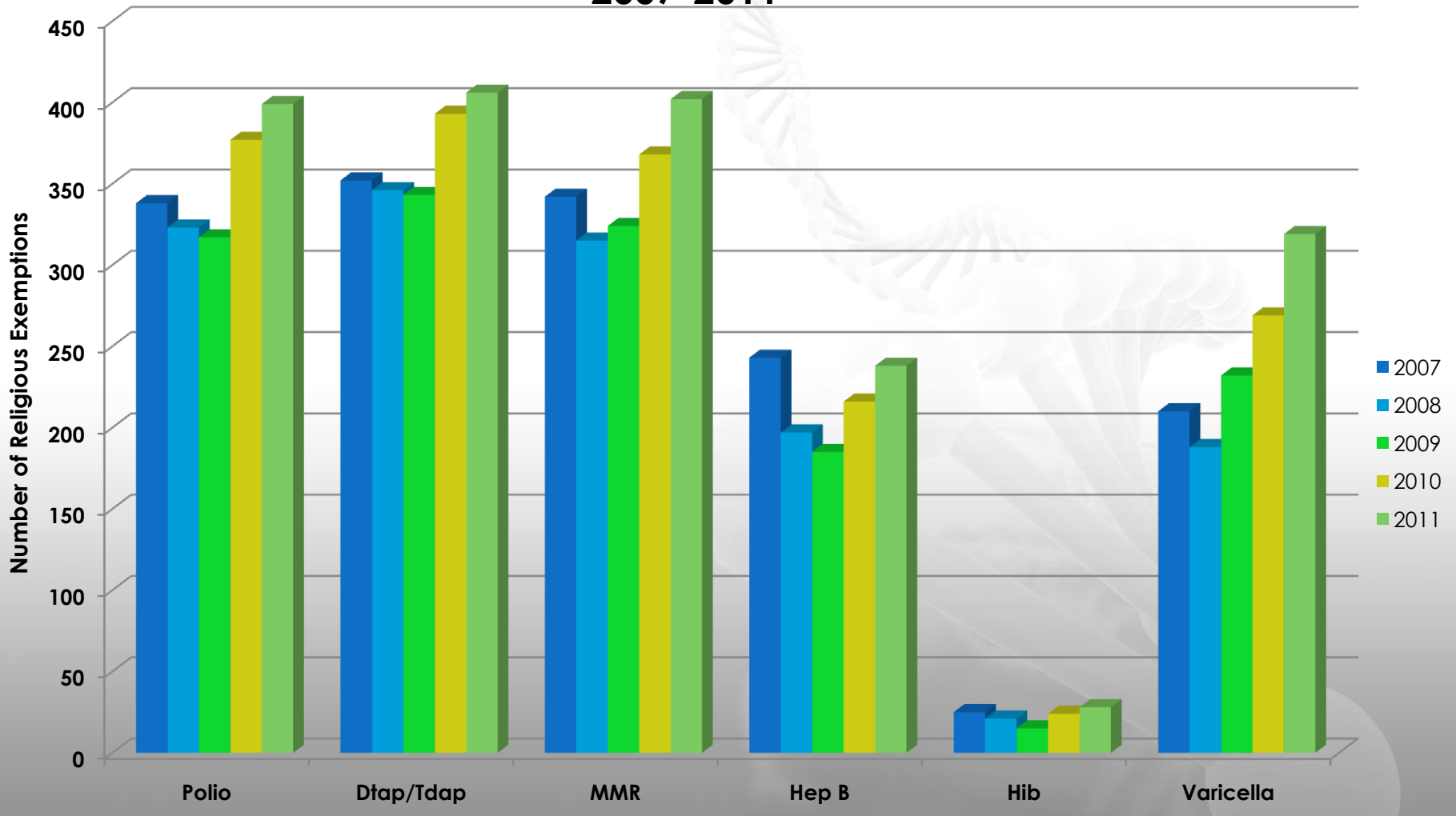
- Varicella *(Chickenpox)*
- Measles
- Mumps
- Meningitis
  - *Pneumococcal*
  - *Haemophilus*
  - *Neisseria meningitidis*
- Pertussis *(Whooping Cough)*



Disease	Pre-Vaccine Era Estimated Annual Morbidity*	Most Recent Reports† or Estimates‡ of U.S. Cases	Percent Decrease
Diphtheria	21,053	0†	100%
H. influenzae (invasive, <5 years of age)	20,000	243†§	99%
Hepatitis A	117,333	11,049‡	91%
Hepatitis B (acute)	66,232	11,269‡	83%
Measles	530,217	61†	>99%
Mumps	162,344	982†	99%
Pertussis	200,752	13,506†	93%
Pneumococcal disease (invasive, <5 years of age)	16,069	4,167‡	74%
Polio (paralytic)	16,316	0†	100%
Rubella	47,745	4†	>99%
Congenital Rubella Syndrome	152	1†	99%
Smallpox	29,005	0†	100%
Tetanus	580	14†	98%
Varicella	4,085,120	449,363‡	89%

*CDC. JAMA, November 14, 2007; 298(18):2155–63
†CDC. MMWR, January 8, 2010; 58(51,52):1458–68
‡2008 estimates, *S. pneumoniae* estimates from Active Bacterial Core Surveillance
§25 type b and 218 unknown

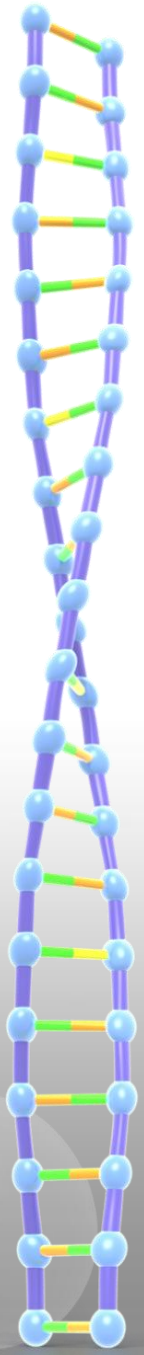
Religious Exemptions to Vaccines in McHenry County Schools 2007-2011*



** 2012 Data Analysis & Progress Reporting/Illinois State Board of Education*

•Varicella (Chickenpox)

- Prior to widespread use of vaccine the disease affected 4 million children with as many as 100 deaths and 11,000 hospitalizations annually
- Vaccine / Varivax introduced in 1995
  - Currently fewer than 10 deaths annually with most occurring in unimmunized individuals
- Pathophysiology
  - Transmitted through respiratory secretions and lesion fluids
  - Varicella-Zoster Virus (VZV) enters through respiratory system & colonizes in the upper respiratory tract mucosa
  - Viral replication takes place in regional lymph nodes & viremia spreads the virus throughout body
    - Respiratory system resulting in contagion prior to skin lesions
    - Typical skin lesion
    - Can infect CNS (encephalitis), liver (hepatitis), respiratory (pneumonia)

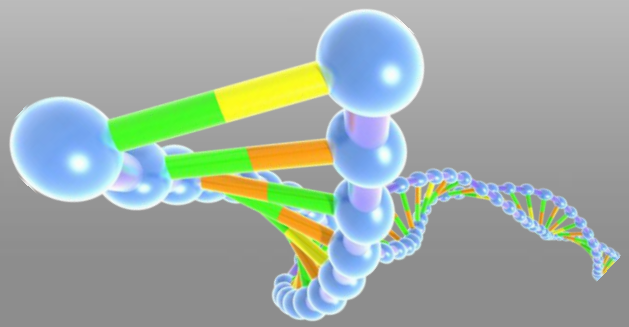


•Varicella (Chickenpox)

- Incubation; 10-21 days
- Contagious; 1-2 days before skin lesions until crusted over (usually 5-6 days)

•Management of Varicella

- Exclude until lesions crusted over.
- Notify MCDH using report form
- Notify parents of susceptable children (unimmunized, immunosuppressed)
- Notify exposed pregnant staff to inform their Obstetrician of exposure
- Notification of contacts of signs and symptoms and to follow up with primary care physician (PCP)as needed



•What's Shingles?

- After primary VZV infection the virus remains dormant in sensory nerve roots for life
- Reactivation of the virus can occur when immune mechanisms are compromised
  - Medications, illness, malnutrition, and natural decline of immune system with age
- Upon reactivation;
  - Virus migrates along sensory nerves and produces sensory loss, pain, and other neurological complications
- Vaccine / Zostervax
- Rate of occurrence is 5/1000 of population
  - May decrease with immunzed children becoming adults

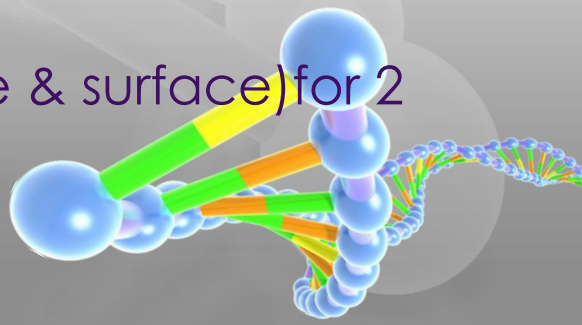
- **Individual with shingles can infect individual who has not had primary VZV infection**
- **Individual with primary VZV infection cannot cause shingles in a contact**

•Measles (Rubeola)

- Most contagious infectious disease
  - 90% rate of infection
  - Unvaccinated has 60-fold increase in risk of disease
- Vaccine introduced in 1963
  - Currently live attenuated combination (MMR)
- Epidemiology
  - In the U.S. the incidence decreased by 99% when vaccine was implemented in schools to control outbreaks
  - 1989-1991 resurgence of disease seen in preschools resulted in 55,000 cases and 130 deaths
    - 2nd dose recommended, led to effective elimination in the U.S. of endemic transmission
  - Unsubstantiated claims that MMR vaccine causes autism has damaged immunization rates, especially in Europe

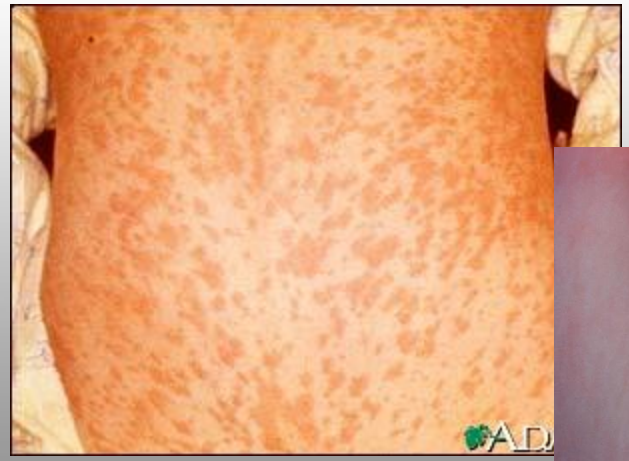
•Measles (Rubeola)

- Developing international countries;
  - 30 million children infected with 1 million deaths, and 15,000-60,000 cases of blindness occur annually
- In the U.S. from Jan 1 to May 20, 2011 118 cases were reported to the CDC
  - 105 were associated with importation, remaining 13 could not be ascertained
    - All 105 were unvaccinated
    - 24 of the 105 were children 12 mos-19 years whose parents claimed personal or religious exemption
- Pathophysiology
  - Peak infection in late winter and spring
  - Transmitted via respiratory droplets
    - Droplets can remain contagious (airborne & surface)for 2 hours
  - Incubation, 7-14 days



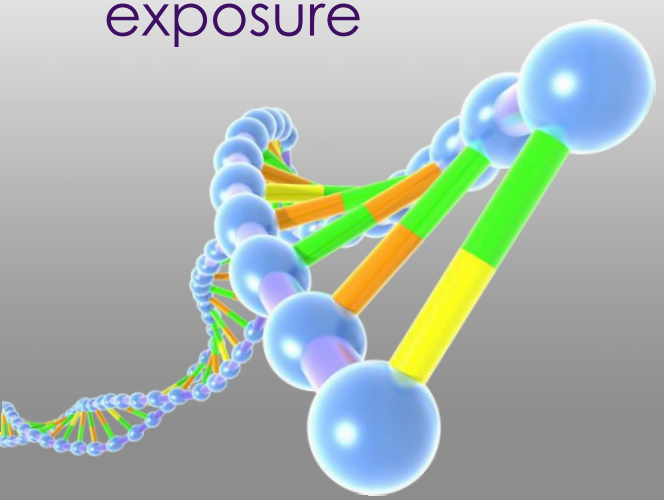
•Measles (Rubeola)

- Signs & Symptoms
  - Prodromal fever, cough, coryza (stuffy nose), conjunctivitis (lasts 2-4 days),
  - Koplik spots, and erythematous maculopapular rash appear (lasts 4-7 days)
- Contagious 1-2 days prior to prodromal symptoms to 4 days after rash onset



•Management of Measles

- **STOP!!!**
  - Notify MCDH immediately of any suspect or reported case
- Exclude until 4 days after rash onset
- Notify and exclude close contacts who are unimmunized & immunosuppressed for 21 days after diagnosis of last case
  - If contact becomes ill may return after 4th day of rash onset
- Notify immunized contacts with signs and symptoms and to encourage to seek medical attention as needed related to exposure

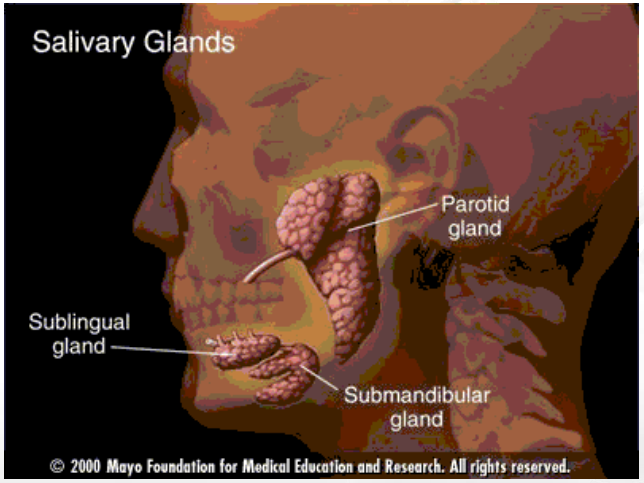


•Mumps

- Epidemiology;
  - 152,209 cases reported in 1968
  - Mumps vaccine licensed in 1967 with subsequent immunization laws for schools
    - Rapid decline in cases reported with 231 cases reported in 2003
    - Gradual increase in cases (982 in 2010) from decrease in immunization rates internationally and nationally
- Pathophysiology;
  - Transmission is by respiratory droplets and saliva
  - Incubation 16-18 days
  - Prodromal symptoms
    - Low grade fever, malaise, myalgias, HA, and anorexia
    - Last 3-5 days
  - 48 hours following prodromal swelling of one of the salivary organs occurs, primarily parotid
    - More severs cases testes, pancreas, eyes, ovaries, CNS, joints, and kidneys can become infected

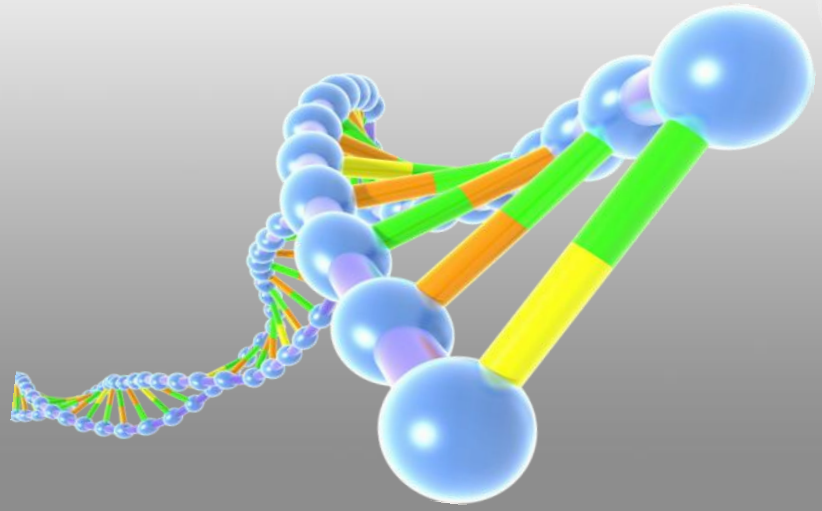
•Mumps

- Contagious;
  - 6 days prior to prodromal symptoms and 9 days after onset of swelling



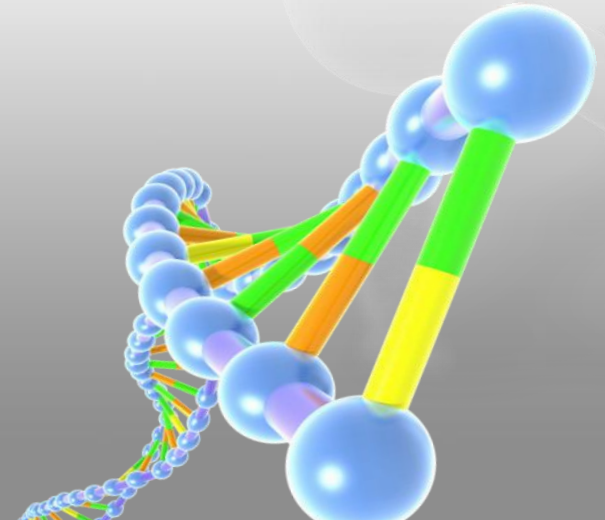
•Management of Mumps

- **STOP!!!**
  - Notify MCDH immediately of any suspect or reported case
- Exclude until 9 days following onset of swelling
- Susceptible contact (unimmunized and immunosuppressed) should be excluded up to 25 days from last exposure to diagnosed case
- Notify all other contacts of signs and symptoms and to seek medical attention as needed.



•Meningitis

- **Invasive Pneumococcal Disease (IPD)**
  - Most common bacterial infection in children
    - OM, sinusitis, bacteremia, pneumonia, and meningitis
  - Epidemiology;
    - Most common cause of bacterial meningitis in children (< 5)
    - Vaccine / Pneumoccal Conjugate Vaccine – 13 (PCV-13)
      - Ninety serotypes, 13 most invasive in vaccine
      - 74% decrease in rate of infection
  - Pathophysiology;
    - *Streptococcoccus pneumoniae* colonizes URT of healthy individuals
    - Resistant to PCN

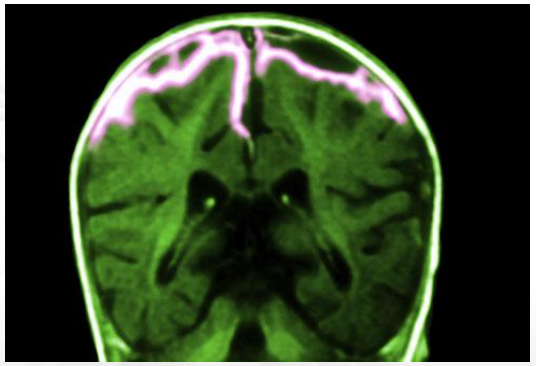


•Meningitis

- **Neisseria meningitidis**
  - Epidemiology;
    - Peaks in late winter and early spring
    - At least 13 serotypes;
      - Serogroups B & C are most common in the U.S.
      - An increase in Y since 1990
    - Morbidity and Mortality high
      - 500,000 cases reported with 50,000 deaths annually
      - Prognosis poor, fatality rates at 40%, if antibiotic treatment started promptly fatality rate remains at 5-10%
      - For those that survive 20% experience some sequelae
        - Limb loss, hearing loss, arthritis, etc.
    - Vaccine / Menactra or Menveo
  - Pathophysiology;
    - Human mucosal membranes is reservoir

•Meningitis

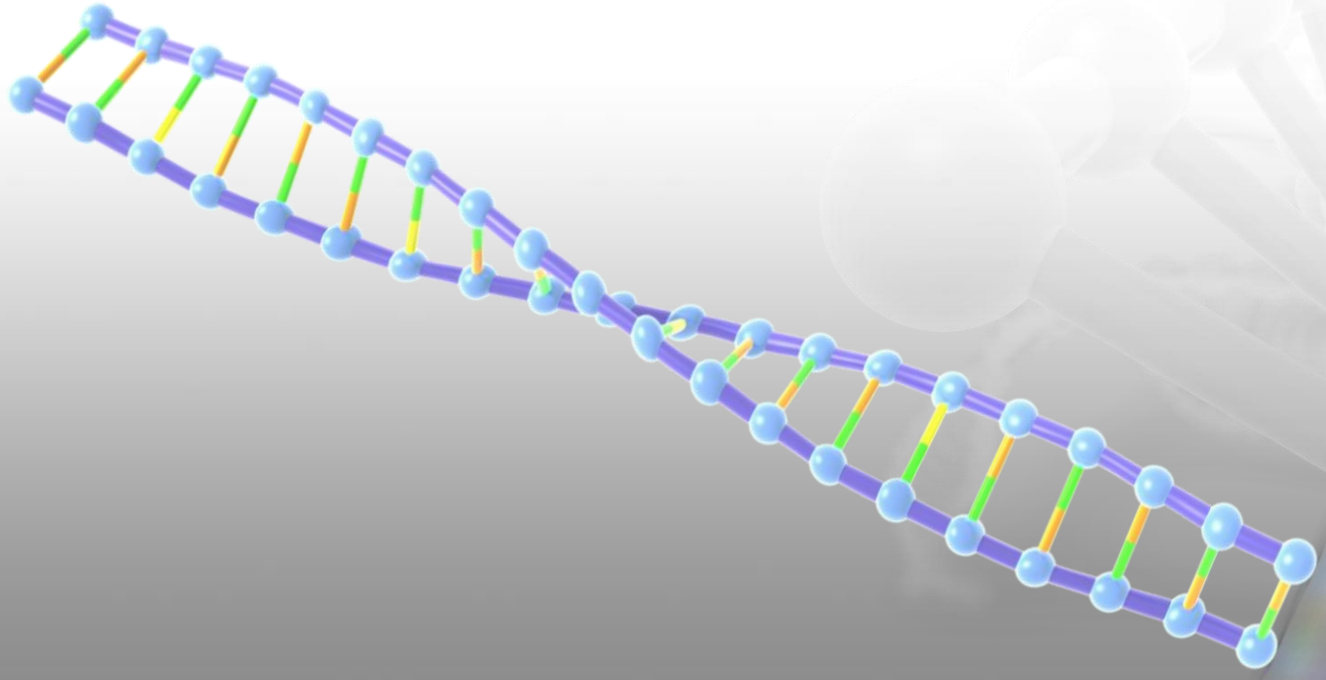
- **Neisseria meningitidis**
  - 5-10% adults are asymptomatic nasopharyngeal carriers
  - Increases to 60-80% in closed populations (military recruits, dormatories)
- Transmission by direct contact of secretions or respiratory droplets
- Incubation; 2-10 days
- Contagious; 2-10 days



- Signs & Symptoms;
  - Sudden onset of fever, headache, stiff neck (except in infants), nausea, often vomiting, a purplish-red rash in some cases, confusion or difficulty awakening from sleep are common

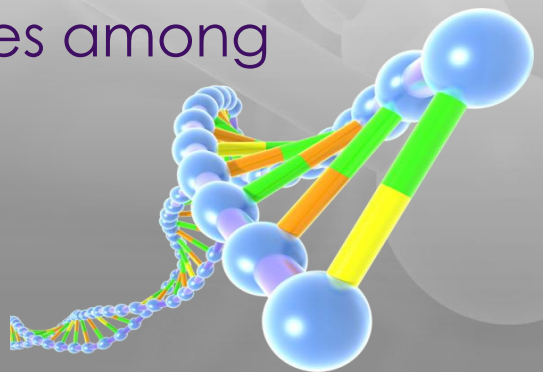
•Management of Meningitis

- **STOP!!!**
  - Contact MCDH immediately with any suspect or reported case
  - Recommendations will be made on individual situation, dependent on causative organism

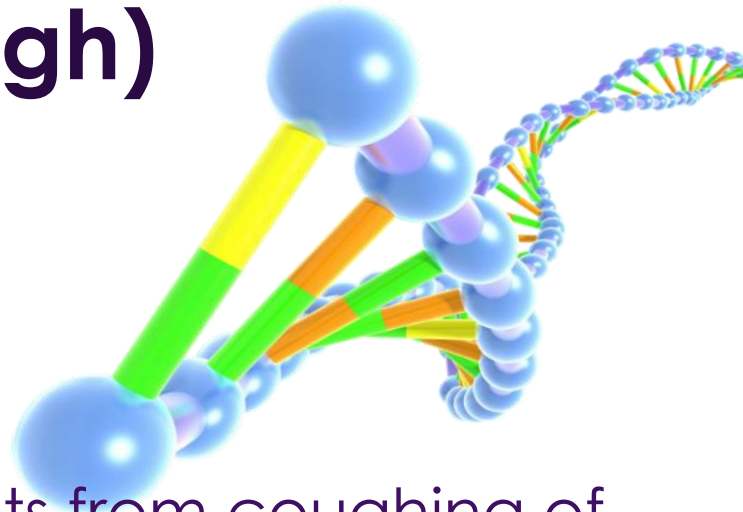


•Pertussis (Whooping Cough)

- Identified in the 16th century
- In 1906 Jules Bordet isolated *Bordetella pertussis*
- *Bordetella pertussis, Bordetella parapertussis, and Bordetella holmseii* have all been identified to cause "whooping cough"
- Epidemiology;
  - Since 1980s cyclical increases (3-5 years)
  - Most occur in June and September
  - Infection and/or vaccine does not provide lifelong immunity
  - Major cause of morbidity and mortality among infants and children before vaccination introduced in 1940s (99% decrease in cases)
  - 1980-2005 dramatic increase of cases among adolescents and adults
    - 2005 Tdap introduced



•Pertussis (Whooping Cough)



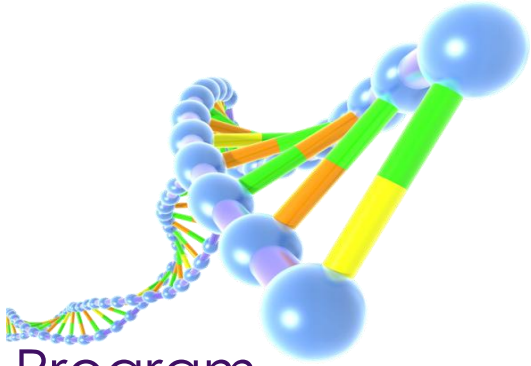
- Vaccine
  - Accelular (DTaP, Tdap)
- Pathophysiology;
  - Humans are sole reservoir
  - Spreads via aerosolized droplets from coughing of infected individuals
  - Bacillus attaches to and damages ciliated respiratory epithelium
    - Results in persistant cough even after antibiotic treatment completed
    - Signs & Symptoms
      - Prodromal; Mild fever, cough, runny nose
      - Cough progressively becomes worse; proxsysmal and posttussive emesis.
      - Adolescents and adults typically have mild or atypical symptoms

•Pertussis (Whooping Cough)

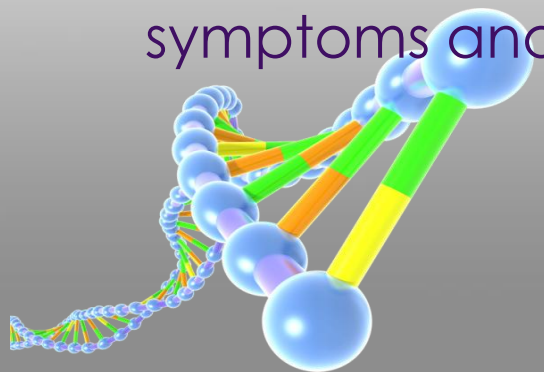
- Incubation; 7-21 days
- Contagious;
  - At first sign of respiratory symptom to 3 weeks after onset of cough
  - Treated- At first sign of respiratory symptom to the **completion** of antibiotic treatment
- Complications;
  - Infants ≤ 6 months and immunosuppressed;
    - Seizures and encephalopathy as a result of severe paroxysmal-induced cerebral hypoxia
  - Syncope, sleep disturbance, incontinence, rib fractures, and pneumonia

- http://www.youtube.com/watch?v=31tnXPlhA7w
- http://www.youtube.com/watch?v=fAkDrcZoWwQ

•Managing Pertussis



- **Stop!!!**
  - Contact MCDH Communicable Disease Program
  - Exclude for 5 days (completion of antibiotic treatment)
  - Per recommendations of MCDH prophylaxis of close contacts may be necessary
  - Notify unvaccinated and immunosuppressed
    - should be excluded from school, day care, and public gatherings for 14 days after last exposure or until the cases and contacts have received at least five days of a course of an appropriate antimicrobial agent
  - Letter home to parents and staff regarding signs and symptoms and to seek medical attention as needed.



Questions