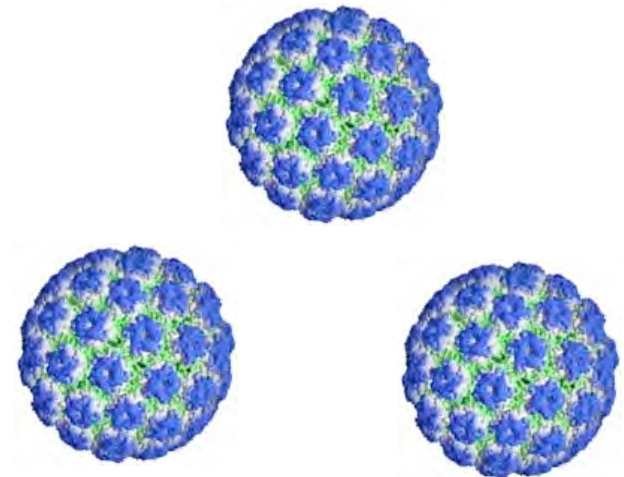
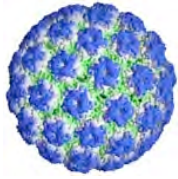


# A Vaccine for Cancer?

Michelle A. Ozbun, Ph.D. and Rebecca Hartley, Ph.D.

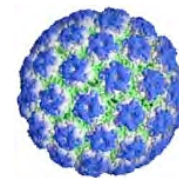
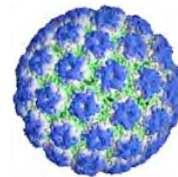
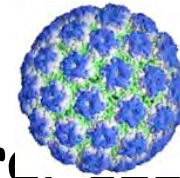
The University of New Mexico Cancer Center



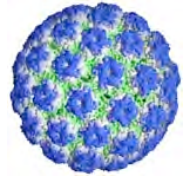


## Some questions

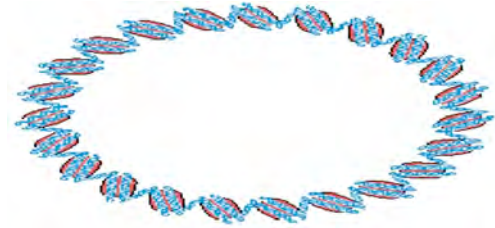
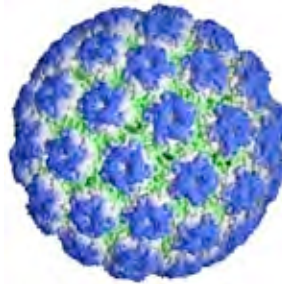
1. What is a virus?
2. What is cancer?
3. How are cancer cells different from normal cells?
3. How do viruses cause cancer?
4. How can a vaccine protect against virus-caused cancers?



# What is a Virus?



- A virus is
  - a set of genes (or "chromosomes"), either DNA or RNA,
  - packaged in a protein coat



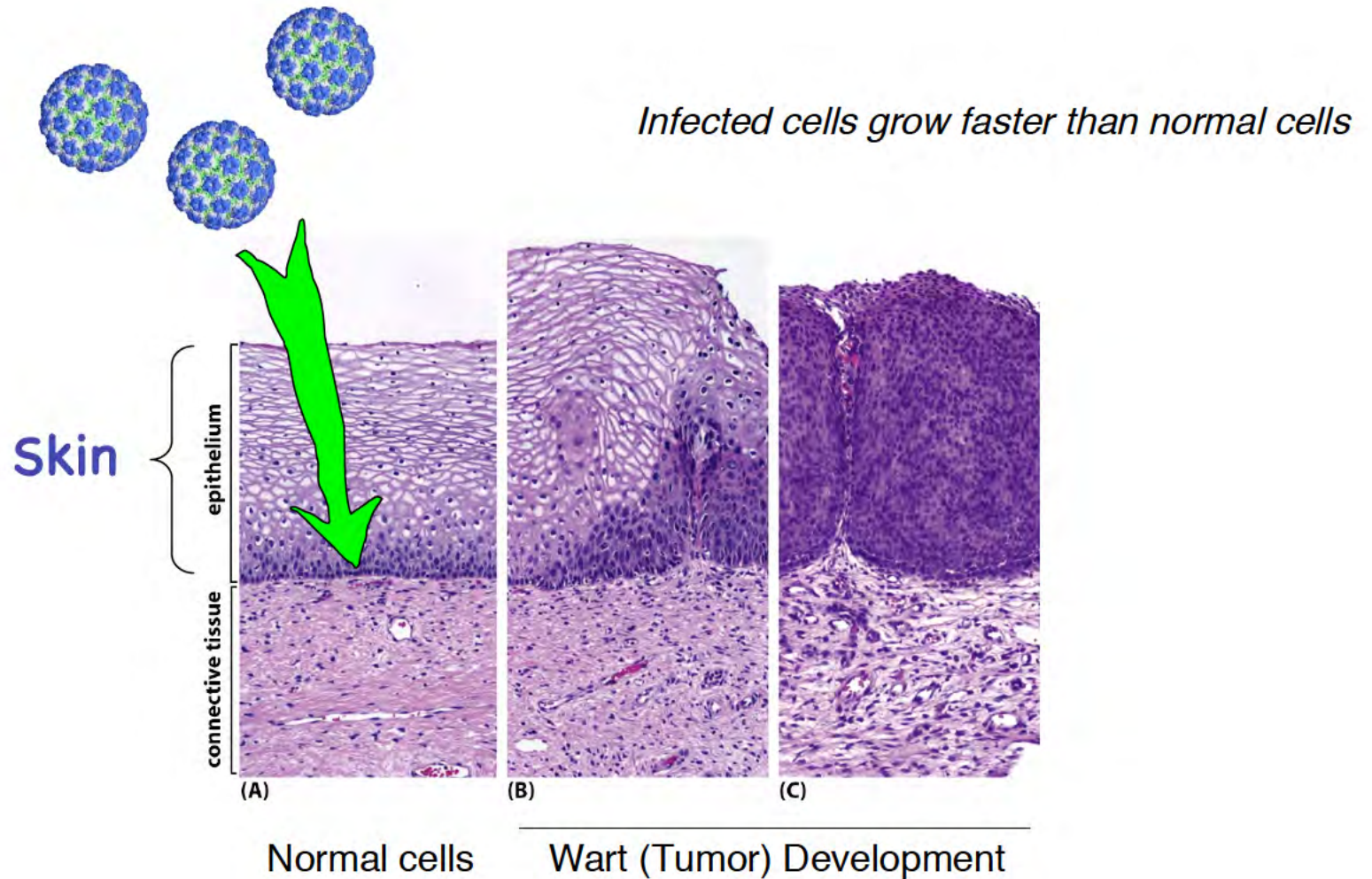
- It is an infectious agent and it relies totally on the cell it infects for the ability to reproduce (replicate) and make new viruses.

# Human Papilloma Virus (HPV)

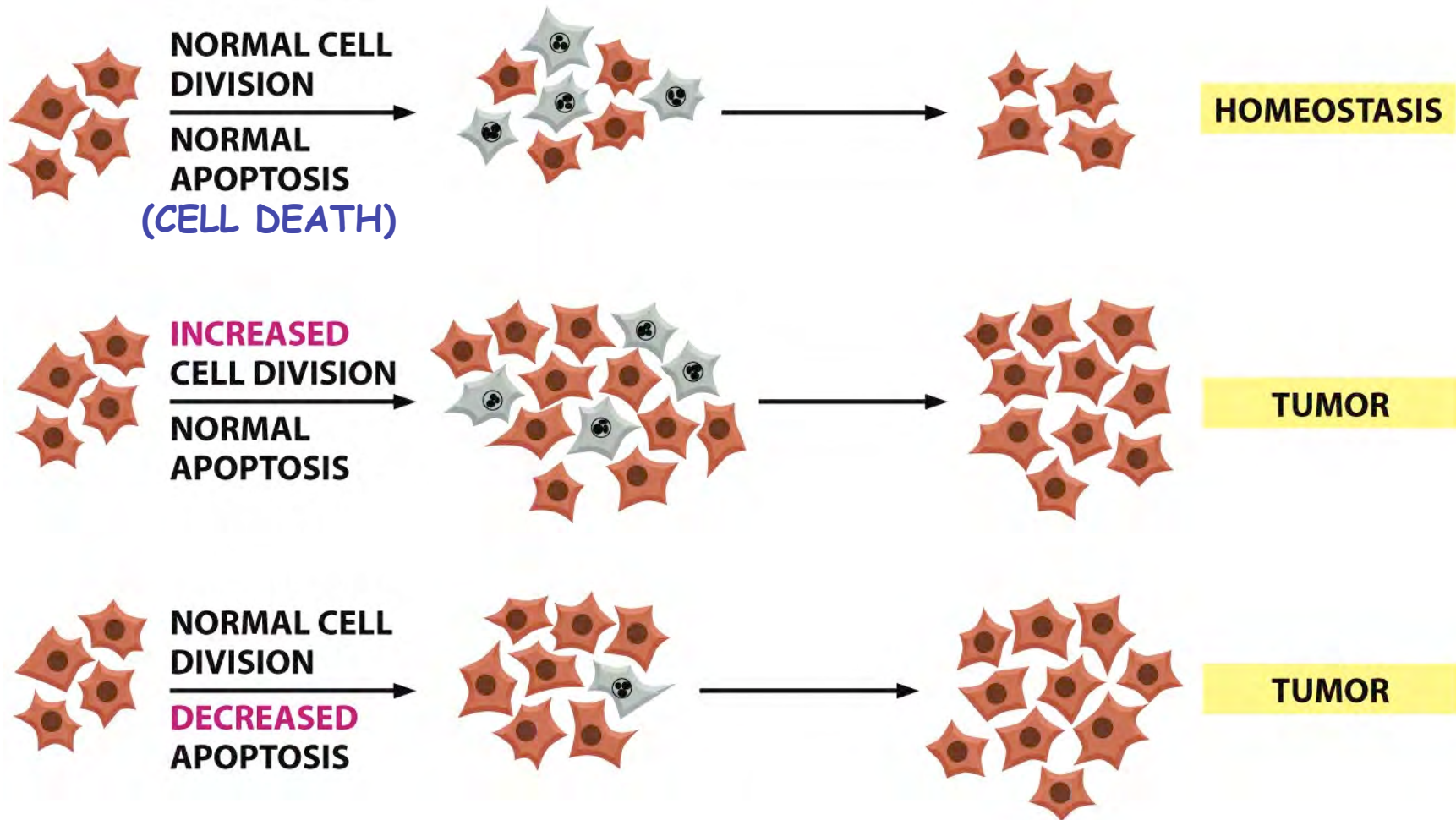
- Human papilloma viruses cause skin warts (papilloma = wart = abnormal growth = tumor)
- Our bodies are covered by epithelium (skin), outside, and in many cavities - oral, genital
- Different HPV "types" cause warts on the skin of different areas of our bodies; HPVs are transmitted by breaks in the skin
- Some of the warts (tumors) can become cancerous



# How do HPVs cause warts (tumors)?

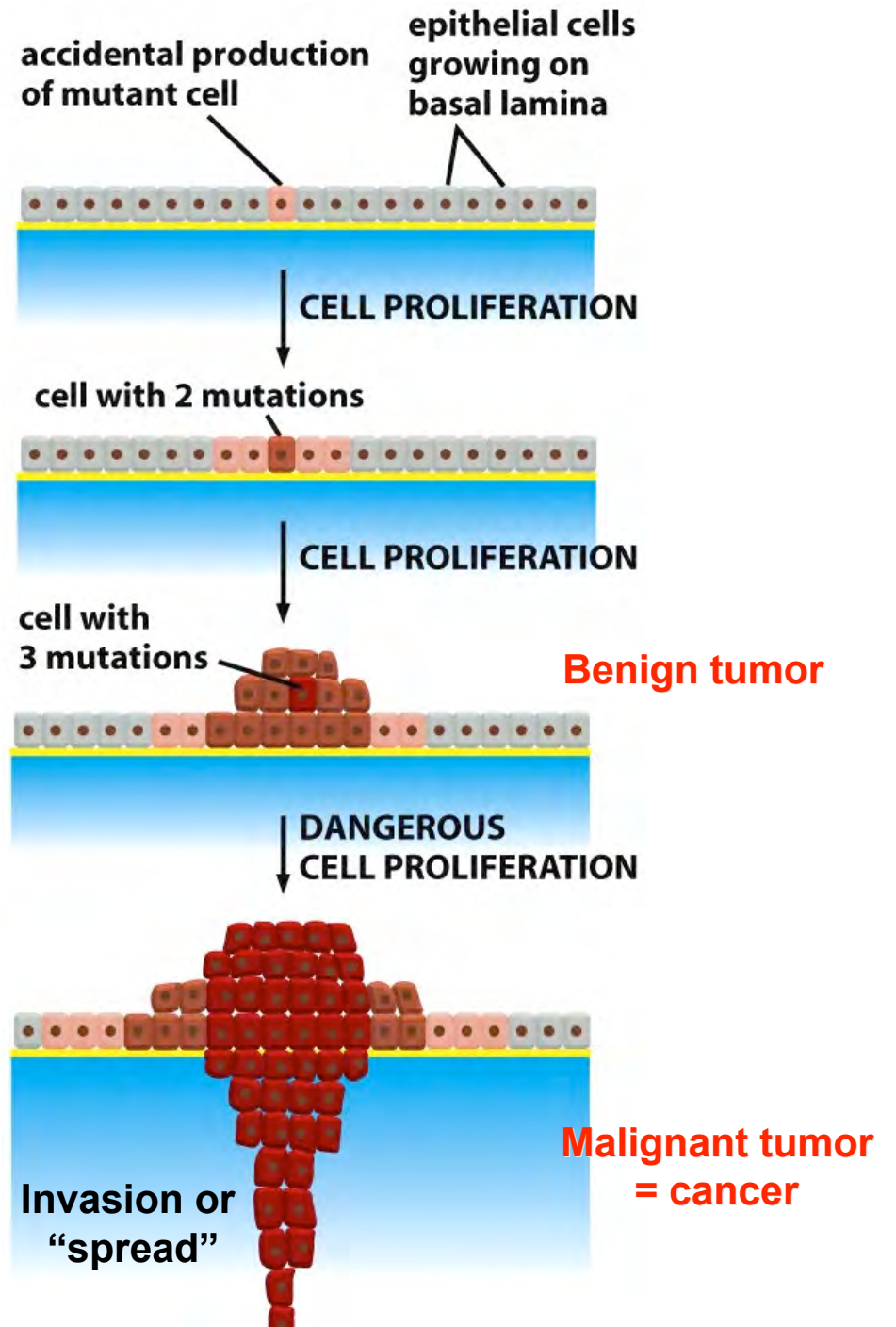
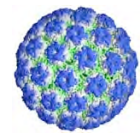


# How are TUMOR cells different from "normal" cells?

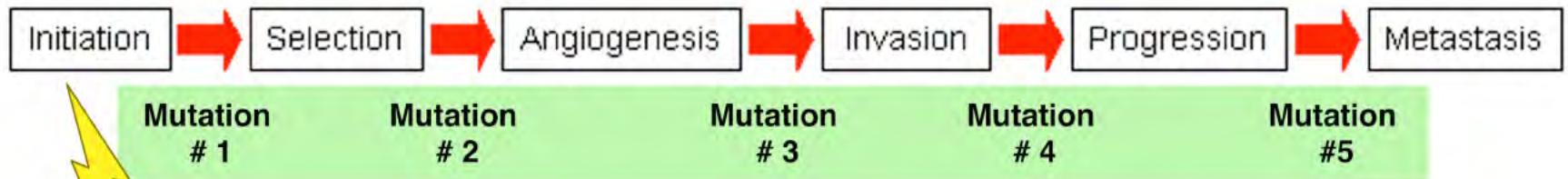
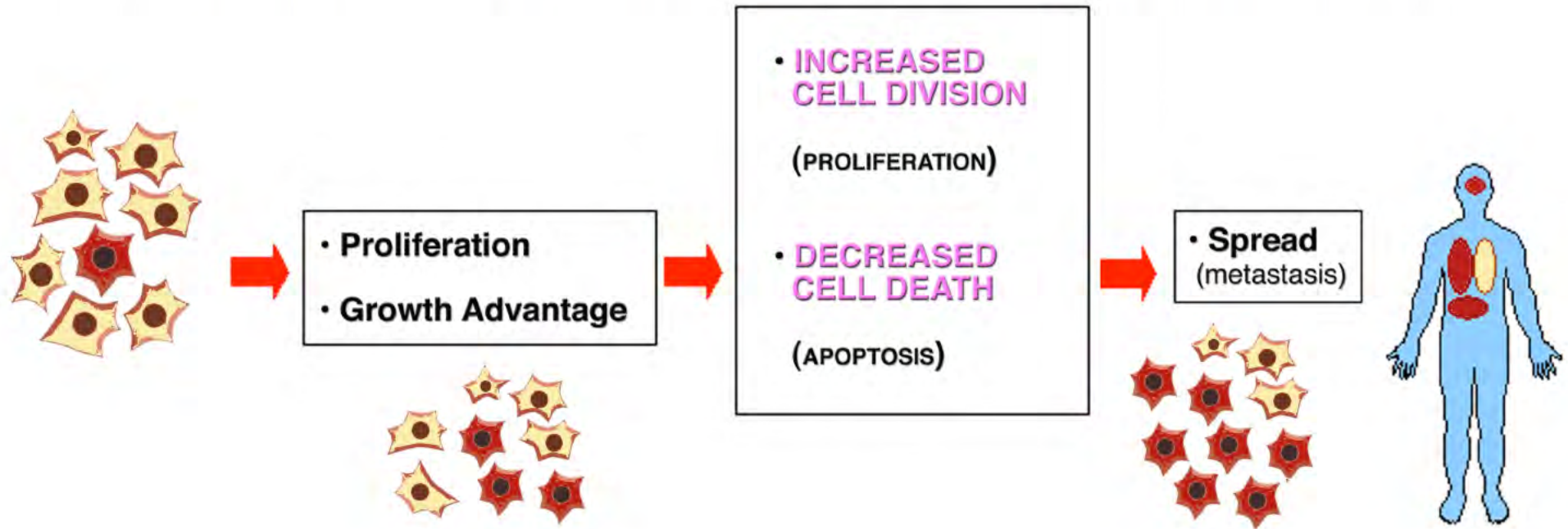


Cancer development requires multiple rounds of mutation and proliferation

≈5 DNA mutations



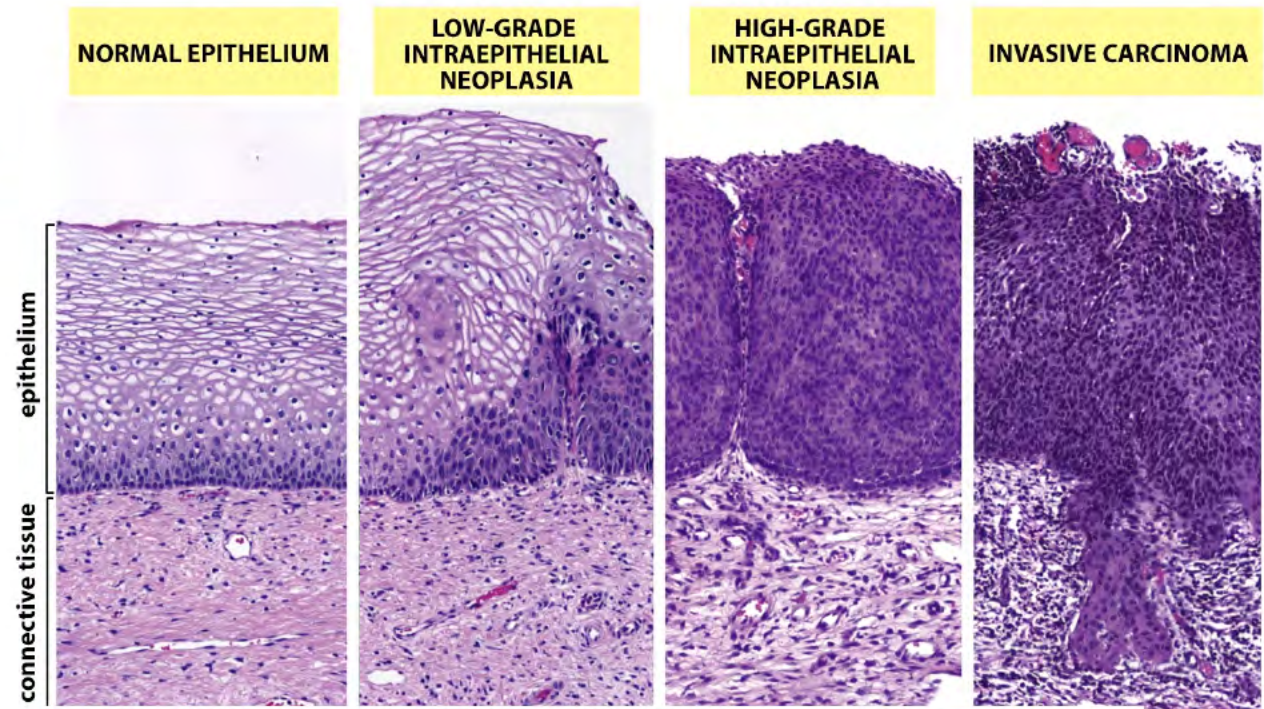
# Cancer is a Multi-Step Process



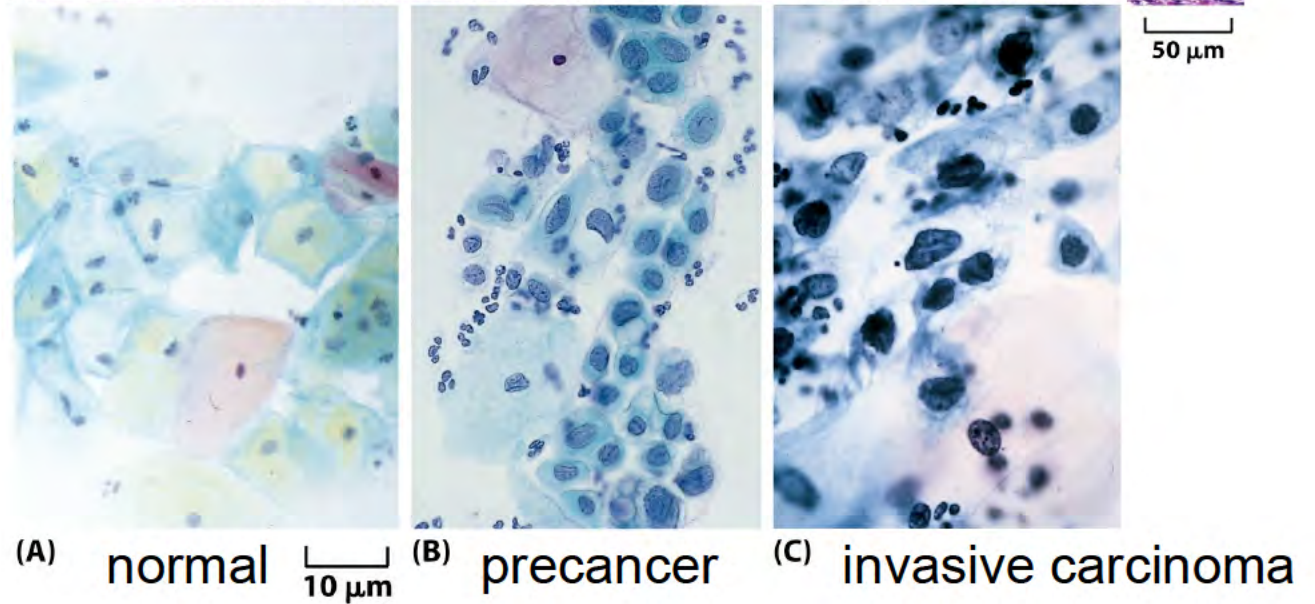
Often a viral or bacterial infection is the "initiating event"



# Cervical cancer progression



# Pap smear

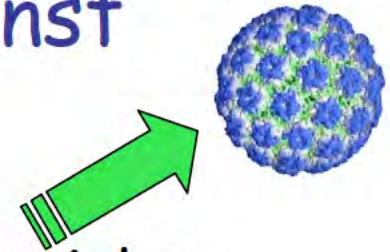




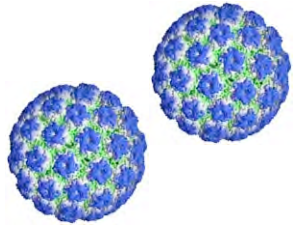
## Why was the HPV vaccine developed?

- More than 80% of Americans (women & men) will contract HPV by age 50; most common STD in US
- HPV infections cause (initiate) virtually all cervical cancers, also many penile, anal, head-&-neck cancers
- In the US: 11,900 new cervical cancer cases/year & 3,850 deaths/year; **screening costs \$4-5 BILLION/yr**
- 80% of cervical cancer deaths occur in poor countries
- Widespread vaccination could reduce screening costs (*eventually*) and two-thirds of cervical cancer deaths around the world

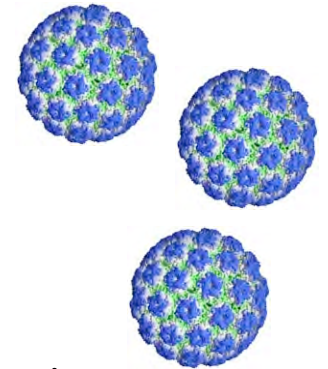
# How can a vaccine protect against viral-caused cancers?



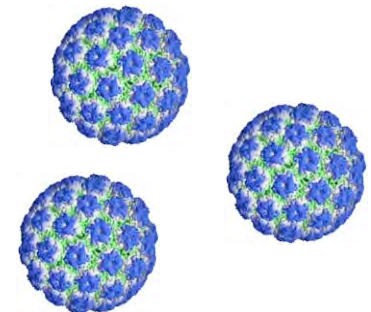
- HPV vaccines are based on hollow virus-like particles; they are not infectious.
- Targets HPV types that cause **about 70% of all cervical cancers**; the current vaccine *Gardasil*® also targets HPV types that cause about 90% of genital warts.
- They elicit virus-neutralizing antibody responses that prevent initial infection with the HPV types represented in the vaccine.
- The vaccine offers  $\approx 100\%$  protection against infections, cervical precancers, and genital warts.



# Important Issues

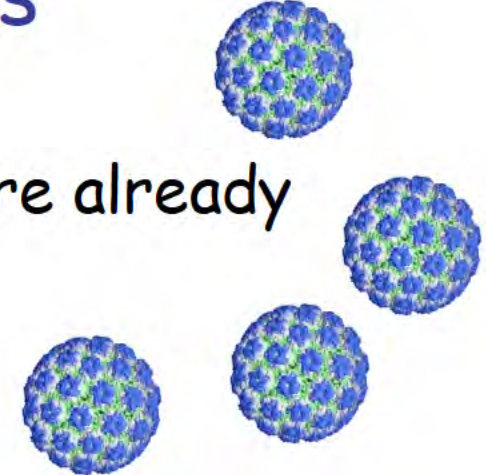


1. Three doses of the vaccine are required.
2. Recommended routinely for girls 11-12 y.o.; and 13-26 y.o. unvaccinated females.
3. Must continue Pap screening to ensure effectiveness (other HPV types can cause cancer).
4. Unclear how long immunity will last (could require booster shots).
5. Most expensive routine vaccine in history.





# Discussion Questions

1. Will the vaccine protect people who are already infected with HPV?
    - Why?
    - Why not?
  2. Should the vaccine be required?
  3. What are the roadblocks associated with vaccination implementation in the US?
  4. What are the roadblocks associated with global vaccination implementation?
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