# Cell Size Limits

## Cytology

| Cell | Edge | Surf. Area | Volume | Ratio |
|---|---|---|---|---|
| A | 1 | 6 | 1 | 6:1 |
| B | 2 | 24 | 8 | 3:1 |
| C | 4 | 96 | 64 | 1.5:1 |
| D | 8 | 384 | 512 | 1:1.3 |

Based on the information above, it is apparent that as cells INCREASE in size, their surface area increases at a slower rate than their volume.

Therefore as cells increase in size , their surface area to volume ratio decreases.

This means there is less surface area per unit of volume

It is through the cell's surface (ie: the cell membrane) that the exchange of nutrients and waste necessary to keep the cell alive takes place.

Thus, in order to stay alive, a cell must have a fairly large amount of surface area fo
each unit of volume in order to bring in enough nutrients and remove enough waste

Therefore, in order for a cell to survive it must have a relatively large SA/V ratio.

Since larger cells would have a relatively small SA/V ratio, they cannot survive

Consequently, cells do not grow very big; once they reach a certain size they divide which increases their SA/V ratio once again

# Cancer (Oncology)

Cytology

# Characteristics of Cancer

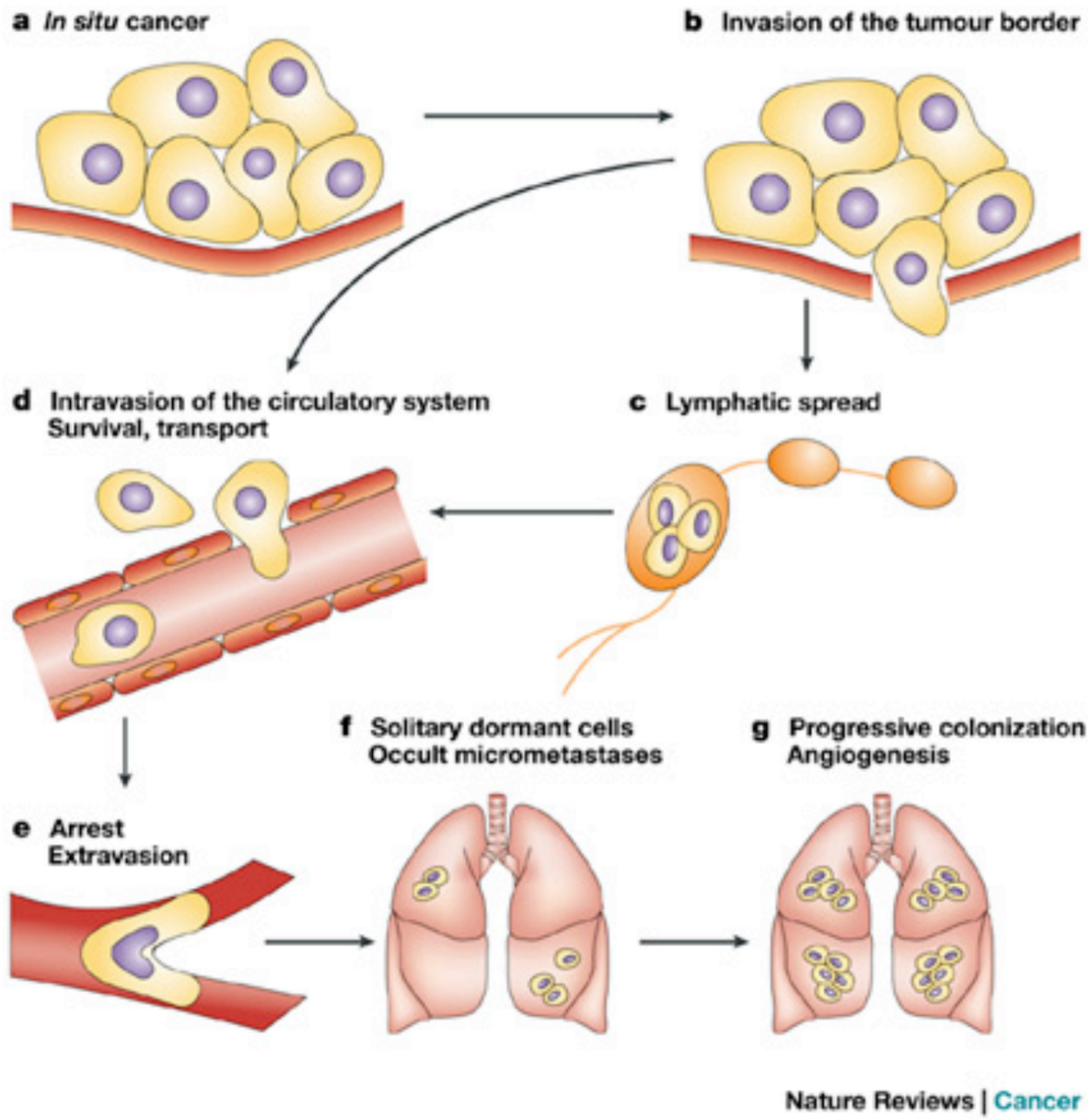
**Abnormal nuclei** Are usually large and have serrated nuclear membranes

**Disorganized, Uncontrolled growth**

The cancer cells divide to form a growth or tumor which invades and destroys neighboring tissue. The cells of this new growth (neoplasia) are non-differentiated and disorganized. Disorganized growth is termed anaplasia. The cells produced perform no function for the body.

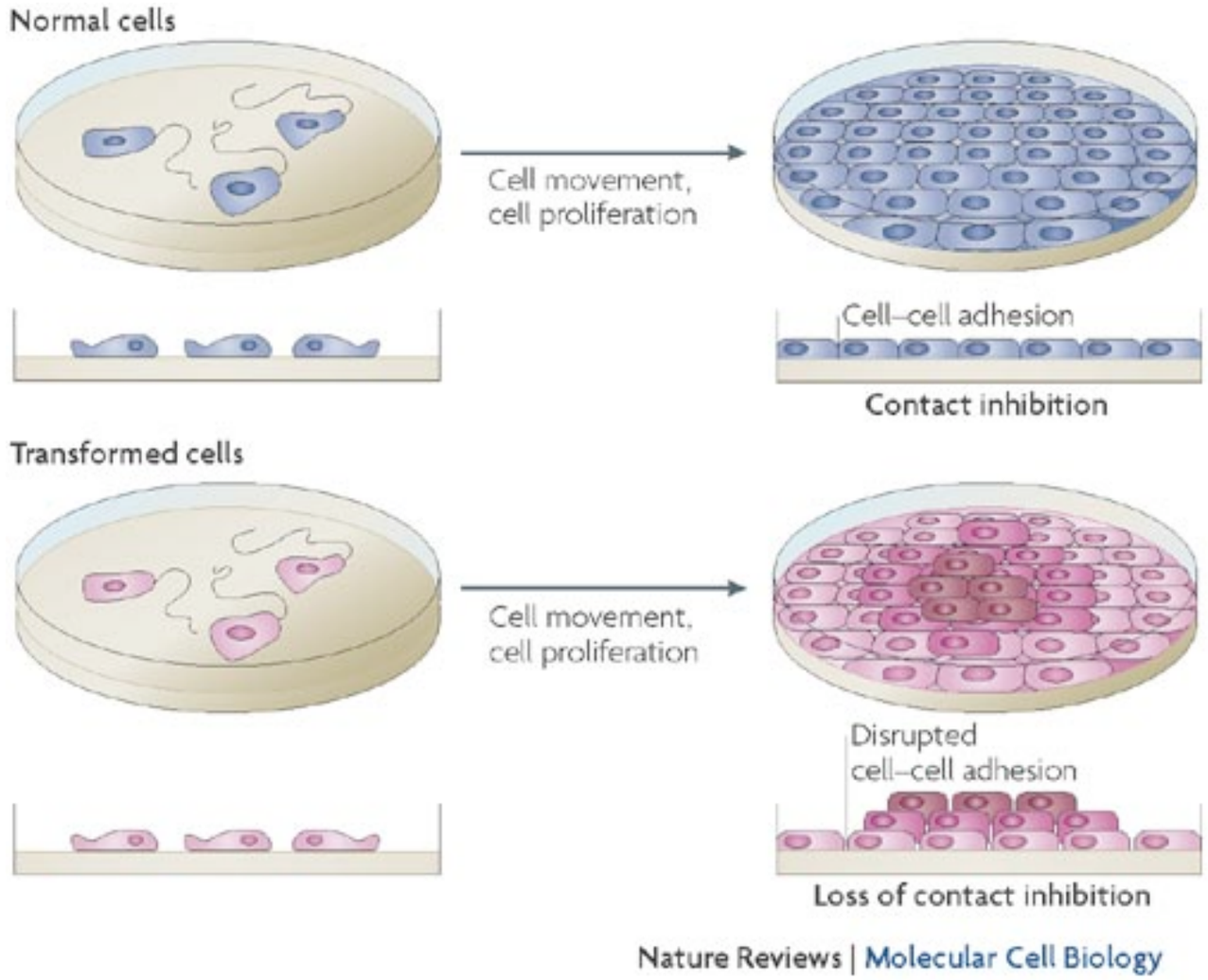
## Metastasis

Some of the cancer cells break loose and are transported by the blood and lymph to new sites in the body where a secondary tumor begins. The diagram below shows metastasis.



## Lack of contact inhibition

Normal animal cells in culture grow only in one layer because they adhere to the glass and stop growing once they make contact with their neighbors. Cancer cells have lost all restraint and grow in multiple layers because of changes in their cell surfaces.



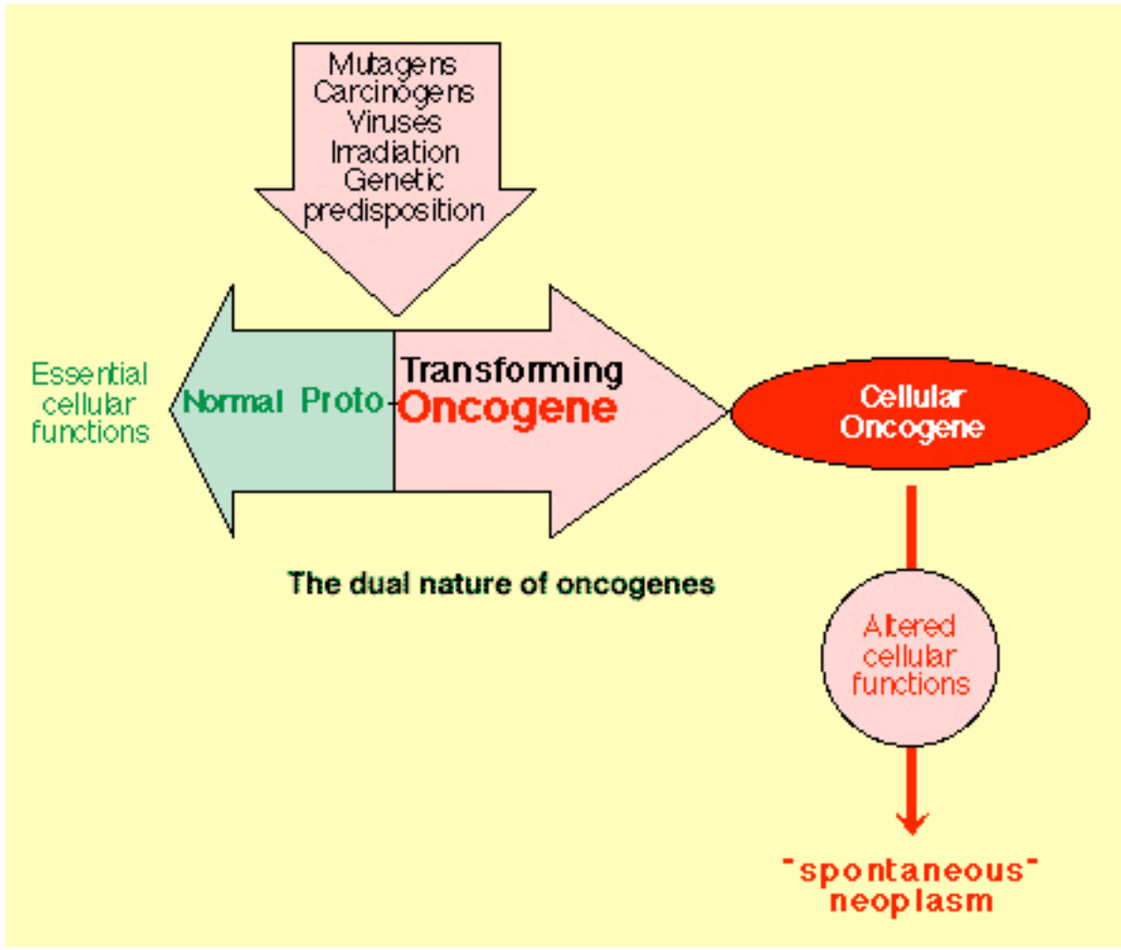
**Vascularization** - To support the growth of the tumor, the cells making up the tumor release a growth factor which causes neighboring blood vessels to branch into the cancerous tumor.

## Seven Danger signs of Cancer

1. **C**hange in bowel or bladder habits
2. **A** sore that does not heal
3. **U**nusual bleeding or discharge
4. **T**hickening lump in the breast or elsewhere in the body
5. **I**ndigestion or trouble swallowing
6. **O**bvious changes in a wart or mole
7. **N**agging cough or hoarseness

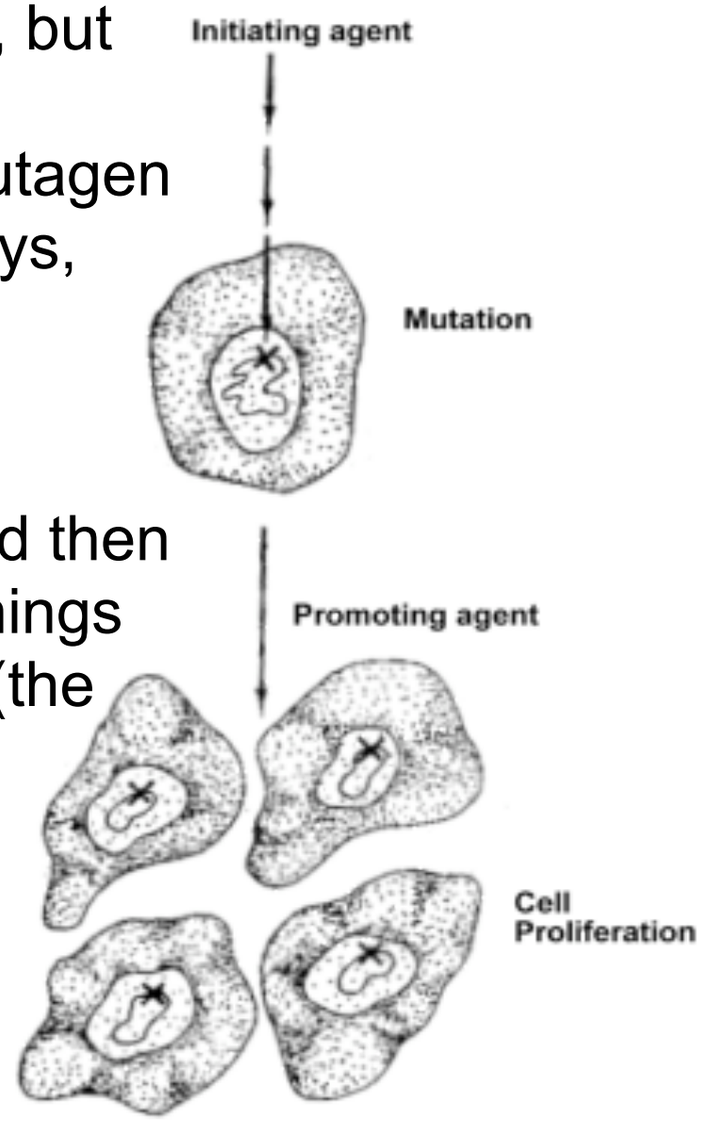
# Proto-oncogenes and Oncogenes

An Oncogene is a cancer causing gene. A proto-oncogene is an oncogene in its non-cancerous state, it is a normal gene. Proto-oncogenes can be transformed into oncogenes by initiators (mutagens)



The dual nature of oncogenes

Genetic inheritance may predispose some people to cancer, but there must be initiation and promotion.
An initiator is a substance that causes a mutation. (It is a mutagen that causes a mutation in the DNA. Some mutagens are xrays, ultraviolet rays etc)
A promoter speeds up the expression of the effects of the mutation.
The DNA-damaged cell has to multiply, become a tumor, and then become stimulated by the promotor. Asbestos from brake linings is the initator (mutagen), and people who smoke cigarettes (the smoke is the promoter) are more likely to get cancer.



# How Viruses can cause Cancer

A cancer causing virus may pick up an oncogene when it reproduced in a previous host. It may pass this on to its new host. Or if it lacks an oncogene, the virus may introduce a control element that causes the cell to become cancerous. These control elements are called enhancers and a cell can turn cancerous if a normally inactive gene is transcribed or when a gene becomes overactive.