

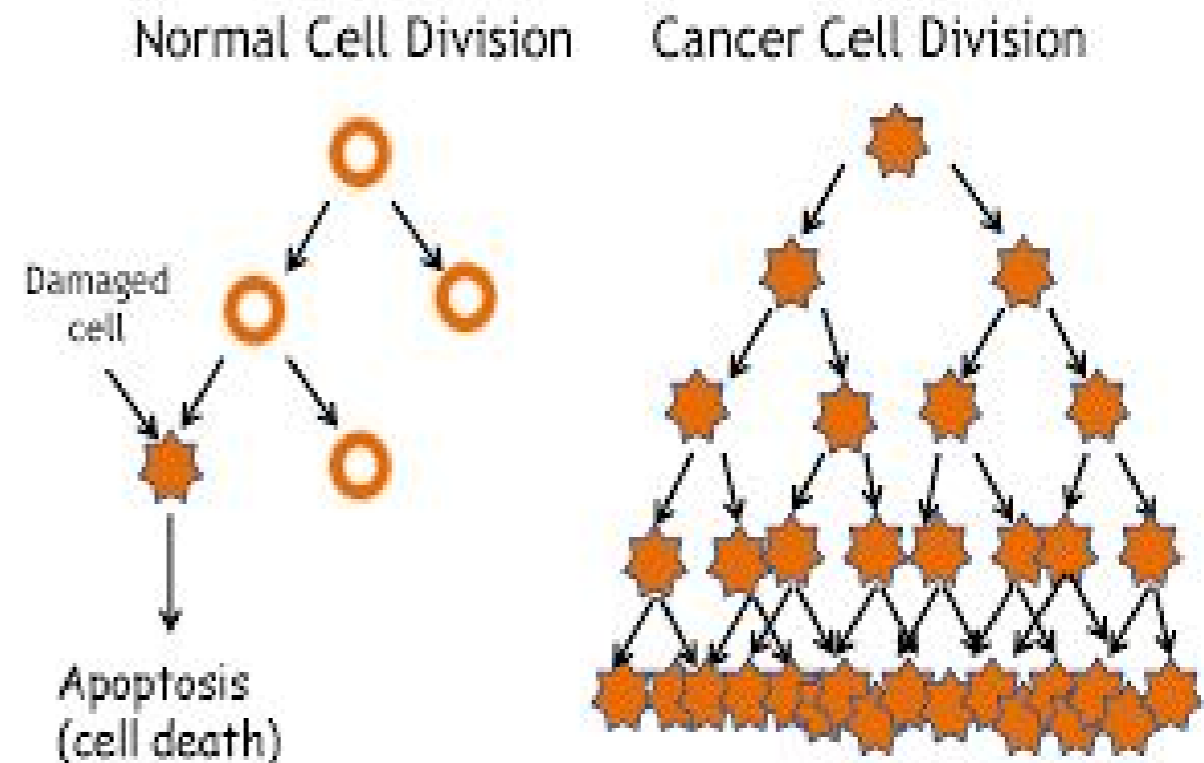


GENOMIC DATA-GUIDED MATHEMATICAL MODELING OF CANCER

By : Roxanne Casio

THE BIOLOGICAL BASIS : WHAT IS CANCER ?

- Cancer is one of the most common causes of death in the US.
- There are over 100 different types of cancer.
- Normal Cells :
 - Reproduce as old or damaged cells die.
 - Receive chemical signals from other cells that tell them when to stop reproducing.
- Cancer cells :
 - Reproduce at an uncontrollable rate even if the cells are damaged or have mutated.
 - Fail to receive anti-growth signals.
- Tumors : An abnormal mass of tissue. A tumor may be malignant or benign.



THE GOAL OF THIS RESEARCH

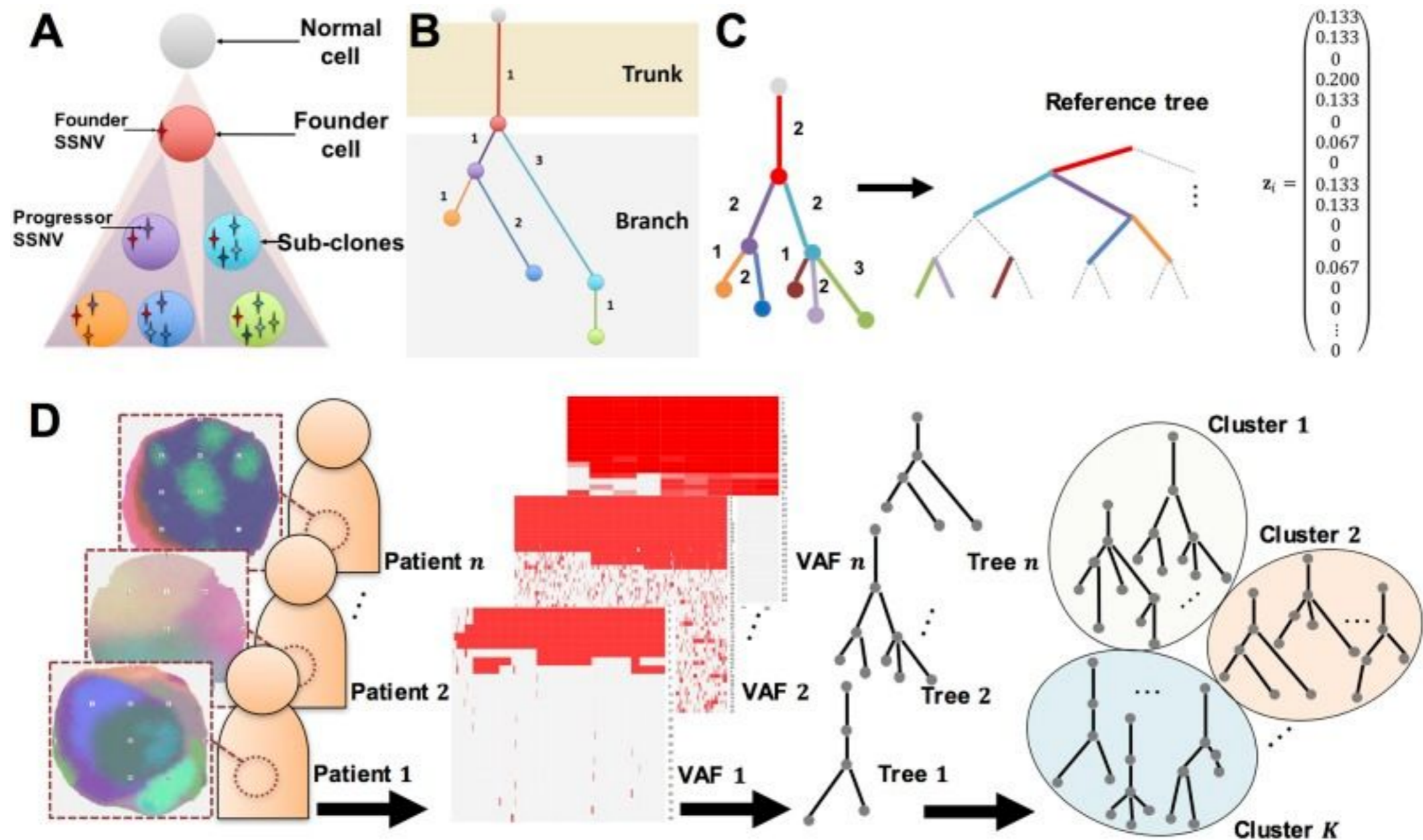
Why isn't there a cure to cancer ?

- The very nature of cancer is unpredictable.
 - It is hard to predict the growth of cancer.
 - Cancer may or may not be localized.

By this research, we hope to create and relate mathematical models that can shed light on:

1. How and at what rate the tumor has grown/will grow.
2. Insight to a tumor's ancestry and predictions of its future states - clonal evolution
3. Cancerous cell's spatial relationships

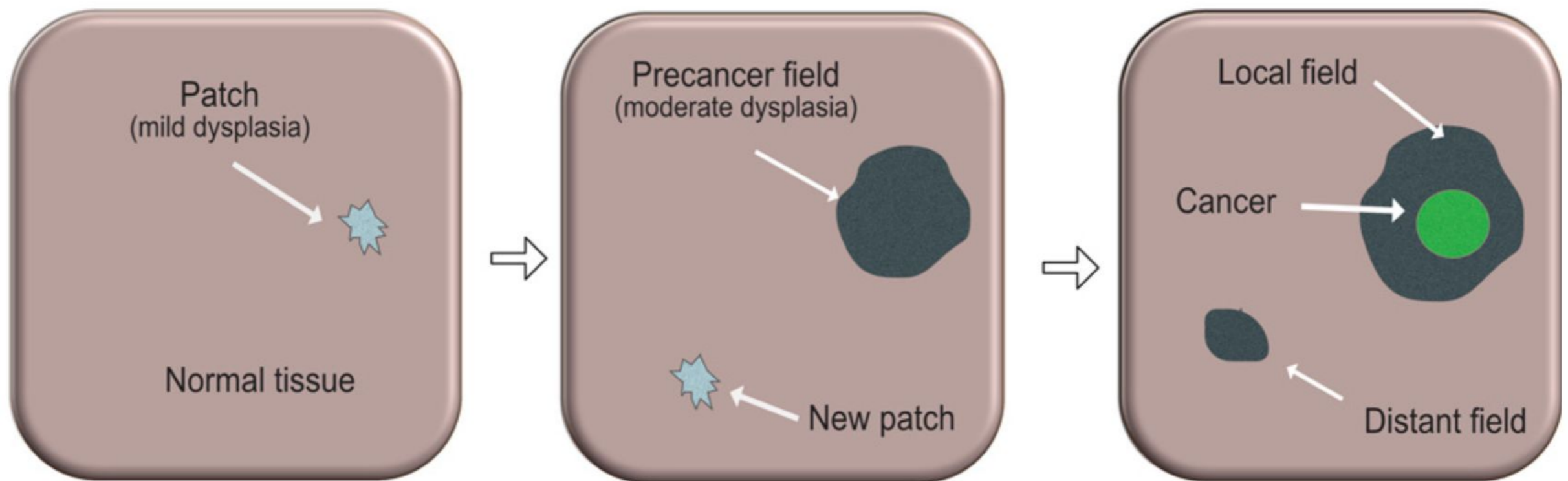
CANCER'S EVOLUTION :



Cancer follows evolutionary process. As cancerous cells reproduce, they have the chance to acquire advantageous mutations. Examples of the types of mutations cancerous cells may acquire : Increased reproduction rate, Decreased death rate

CANCER'S EFFECT ON SURROUNDING TISSUES :

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As seen through these slides, the effect of cancer is not solely dependent on the tumor. If the cancer were to affect a local field surrounding the cancer, then how long and to what extent might this local field become cancerous ?

CANCER WITH RELATION TO TIME AND TREATMENT :

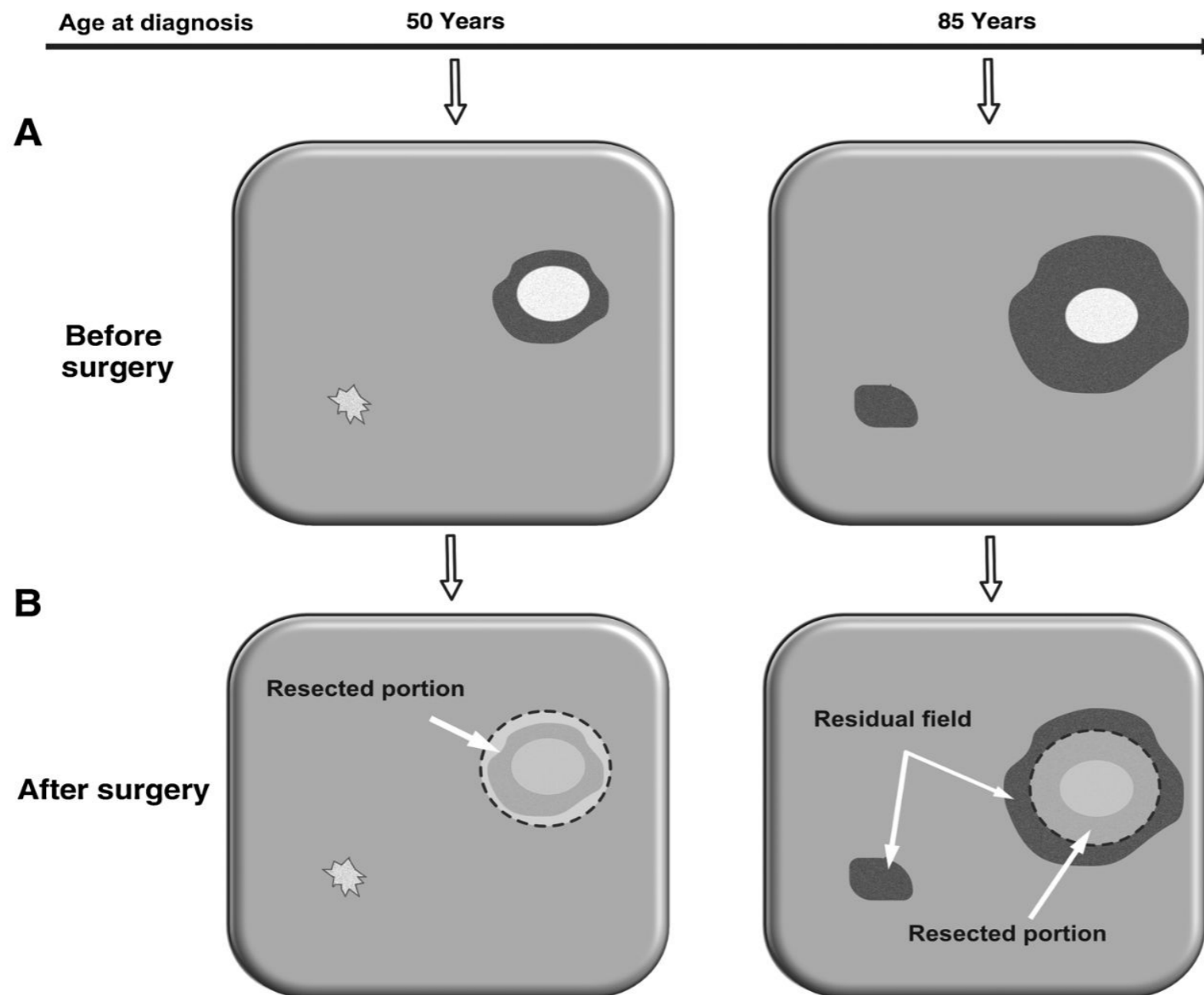


Figure 4.

Surgical margins and residual field. **A**, Illustration of age-related differences in local field size and number of unrelated fields. Before surgery, only one local field may be present in a younger patient (left), whereas a larger local field and additional distant fields may be present in an older patient (right). **B**, During surgery, the local field is removed in the younger patient (left) but only partially resected in the older patient (right), where the residual field portions elevate the risk of recurrence.

With respect to time, how will the cancerous cells affect the “normal” tissues surrounding it? Is treatment an accurate “cure” ?

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