

Genetic Engineering in Skin Carcinoma

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Key points

- What is genetic engineering?
- Types of skin carcinoma
- Technology used in genetic engineering for skin carcinoma.
- Mechanism
- Developments in genetic engineering regarding skin cancer
- Demographics

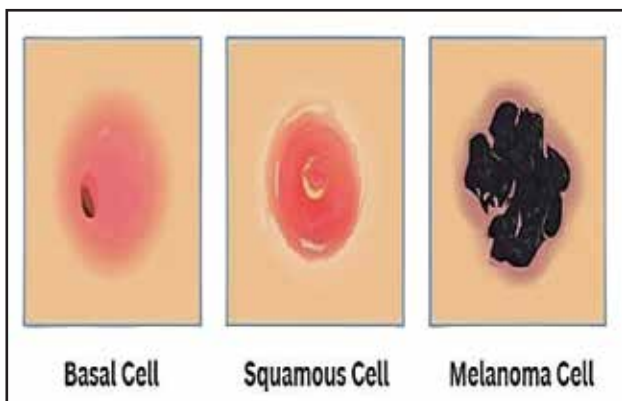
What is genetic engineering?

Genetic engineering involves the use of laboratory techniques and materials which help in altering DNA of organisms. The process includes switching base pairs, adding new segments or changing sequences of genes to make the new gene have favourable qualities.¹ Genetic engineering in terms of skin cancer has evolved immensely over the past years. In fact, skin cancer was the first cancer which showed successful gene therapy results.

Types of skin cancer

There are three main types of skin cancer:

1. Basal Cell Carcinoma
2. Squamous Cell Carcinoma
3. Malignant Melanoma.²



1. Basal cell carcinoma:

Basal cells produce new skin cells and are the bottom most layer of the epidermis. The DNA in these cells help in forming new skin cells. However, if these cells multiply an abnormal amount, they can form malignant lesions on the skin. The mutations to the basal cells may occur due to exposure to ultraviolet light which could come from tanning beds or just plain exposure to sun.

2. Squamous cell carcinoma:

This cancer is normally not life threatening and affects the squamous cells that make up the middle layer of the skin. If left untreated, the cancer spreads to other parts of the body, mainly lungs and liver. This is also mainly caused by ultraviolet radiation and can be inherited.

3. Malignant Melanoma:

This tumor is produced by the metastasis of melanocytes. Melanomas are derived from the neural crests and normally arise in the skin but spread to the gastrointestinal tract. Although the chances of this cancer are slim, too much exposure to sunlight or a family history of malignant melanoma can lead to children having this cancer.

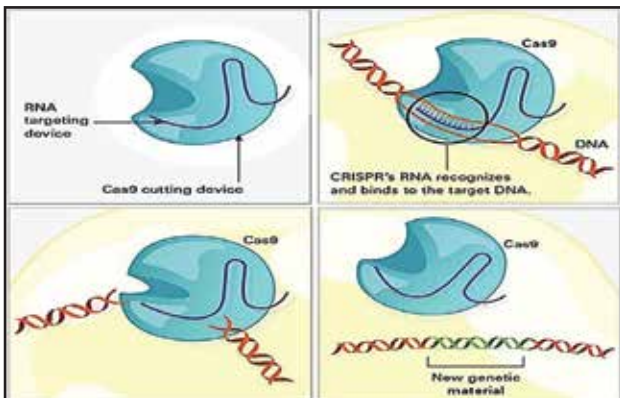
Technology used in genetic engineering for skin carcinoma. Although UV radiation is a big factor which causes skin cancer, the inheritable factor increases the risk of the child having cancer immensely. The most common type of technology for gene therapy in cancer patients is CRISPR (Clustered Regularly Interspaced Short Palindromic Repeats).³

CRISPR virtually edits parts of DNA which are out of the norm. These tests were first carried out on microbes then on humans. Other than CRISPR chemotherapy can also be used to treat skin cancer of all types. Electrodessication and cryotherapy are more of the successful therapies used for treatment of skin cancer.

Mechanism:

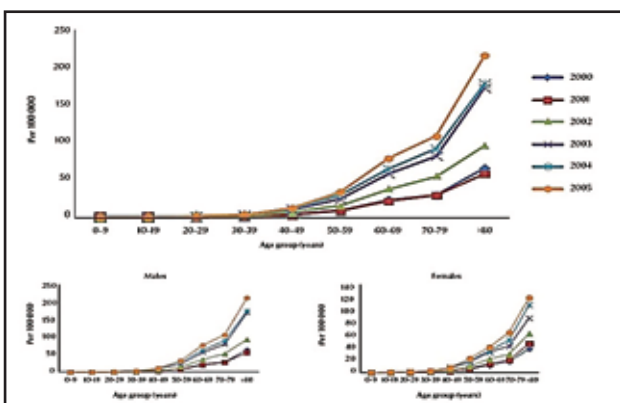
CRISPR consists of a guide RNA which basically acts a template which is on a Cas enzyme to help in the cutting process. Cas 9 is used the most in the laboratory. Once a DNA strand passes through Cas 9 and partners with the guide RNA, the RNA picks up on the target gene and once it is linked with it, Cas 9 cuts the DNA on that specific part and

that segment can now be replaced with a new pattern of DNA.



Developments in genetic engineering regarding skin cancer.

Nanotechnology which is technology which alters designs, helps in producing and using structures all with the help of manipulation of atoms and molecules. This is a new and upcoming way to treat skin cancer of all types.



Nanoparticles can act as anticancer agents and can target tumors and while also overcoming chemoresistance.

Although this is a new way to overcome skin cancer, it comes with its many flaws as scientists still haven't been able to perfect it. It is also very expensive.

Demographics

Skin cancer is one of the deadliest cancers and is quite common in places like Pakistan where there is immense heat intensity from the sun.

Annual trend in age standardized incidence of skin cancer per 100,000 population in Pakistan by age group and sex:3

This graph is a representation of how skin cancer has spread over Pakistan and the gender it has affected over the years. According to this graph, skin cancer occurs more in people from ages 50 and above. The graph clearly shows the incidence rate for cancer in females is higher than in males.

Average age standardized incidence of skin cancer per 100,000 population in 6 geographical regions in Pakistan:

Conclusion

Research on the cure for skin cancer is still ongoing but, there are many prevention methods and as recent reports have proven, the best way to find a more stable and permanent cure is through genetic engineering. If scientists manage to perfect CRISPR, many genetically transmitted diseases can be cured by a slight fix in DNA sequencing.4

References

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