

Predicting Vitiligo
Antigens Utilizing
Machine Learning

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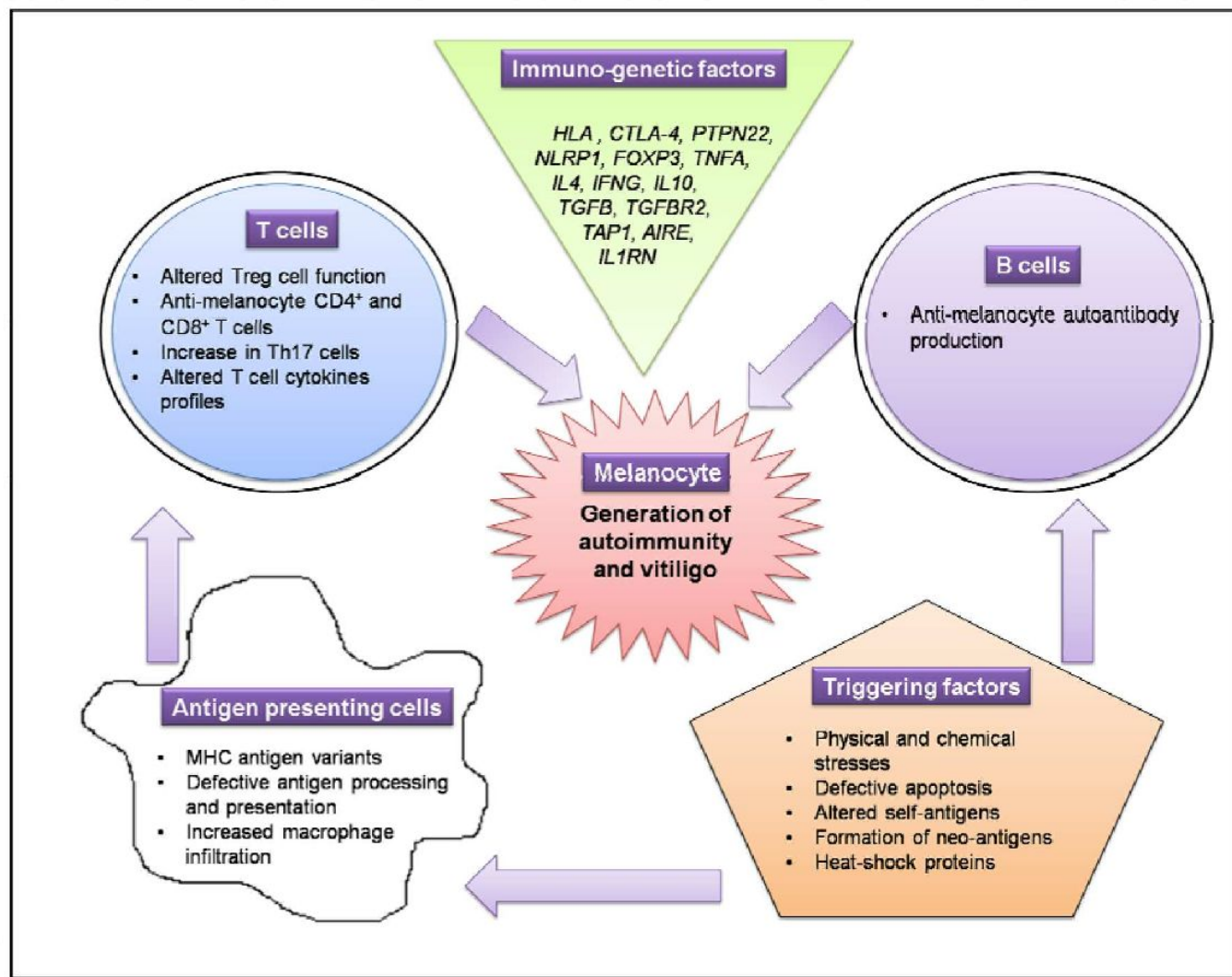


Fig. 2: This figure showcases the factors and symptoms that cause the expression of vitiligo (Dwivedi et al., 2015).

Engineering Problem:

Vitiligo is an autoimmune skin condition characterized by the loss of melanocytes, which is triggered by immune CD8+ T-cell recognition of neoantigens. Identifying these neoantigens is critical for developing therapies and more personalized treatments. Traditional experimental approaches are resource-intensive and often have severe side effects.

Engineering Goal:

The goal of this project is to identify protein sequences to predict the neoantigen-blocking peptide or agent for initial immune recognition in vitiligo through a machine learning algorithm.

Fig. 1: This figure displays the risk factors and reactions involved with antigens and T cells in the pathogenesis of vitiligo (Bergqvist & Ezzedine, 2020).

Executive Summary

Vitiligo is an autoimmune skin condition characterized by the loss of melanocytes, which is triggered by immune CD8+ T-cell recognition of neoantigens. Identifying these neoantigens is critical for developing therapies and more personalized treatments. Traditional experimental approaches are resource-intensive and often have severe side effects. In this study, machine learning was harnessed to predict the potential trigger antigen that sets off the depigmentation reaction in vitiligo. A previously found dataset from another study was utilized to train and assess the accuracy of a machine learning model made in Python.

This study highlights the potential of machine learning for the identification of neoantigens. Our findings provide a foundation for future validation studies and personalized therapeutic strategies in autoimmune diseases such as vitiligo.

Background

Today, over 70 million people worldwide are affected by vitiligo. This happens because the body's immune system, specifically CD8+ T cells, attacks melanocytes.

Although no definitive cure exists, scientists have identified various risk factors and genes related to this immune response. Vitiligo in itself is not life threatening, but it affects the quality of life for individuals who have it by weakening the immune system and increasing the susceptibility of sunburn in patients.

Methodology

I plan on using programming languages like Python and IEDB Analysis Resource. I will practice with different datasets from the internet, then begin prediction and preparation of the neoantigen based on online datasets as well as peptide libraries.

Application

This research will help reduce extensive side effects of current treatment and improve quality of life for diagnosed individuals.

Expected Results

What I expect to find is the weights of how much each antigen affects expression in vitiligo patients, as well as the “trigger” antigen. This research will help reduce extensive side effects of current treatment and improve quality of life for diagnosed individuals.

Future Research

This knowledge will be used for the development of more personalized treatment with less side effects than gene knockout therapy in the future.

References

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- Faraj, S., Kemp, E. H., & Gawkrödger, D. J. (2021). Patho-immunological mechanisms of vitiligo: the role of the innate and adaptive immunities and environmental stress factors. *Clinical and Experimental Immunology*, 207(1), 27–43. <https://doi.org/10.1093/cei/uxab002>