CHIEF SCIENTIST OFFICE

CODE: TCS/19/12

RESEARCH PROJECT BRIEFING

Developing a Cell Therapy Approach to Treat Rheumatoid Arthritis

AIMS

Rheumatoid arthritis affects approximately 1% of the UK population — around 450,000 people — making it a significant public health concern.

Building on our previously validated cell therapy approaches, this project aimed to progress our promising results from the laboratory towards clinical application for the treatment of Rheumatoid Arthritis (RA).

1.Identify Optimal Cell Populations: Select the most effective regulatory T cell (Treg) – a type of immune cell capable of switching off harmful immune responses – subpopulations to create an RA-targeted therapeutic product using a specialised receptor..
2.Understand Functional Issues: Investigate why some Treg subpopulations from RA patients are less functionally active than those from healthy donors.

In parallel, we initiated development of a new panel of chimeric antigen receptor (CAR) T cells to enhance the ability of therapeutic Tregs to home to and act within RA-affected tissues, improving precision and therapeutic potential.

KEY FINDINGS

Development of Therapeutic Cells: We successfully generated therapeutic cell products using immune cells taken from the blood of patients with rheumatoid arthritis.
Therapeutic Potential Confirmed: These cells demonstrated the potential to suppress harmful immune responses in lab tests, with effects comparable to healthy donor cells — but only when selecting specific sub-populations.
Understanding Disease-specific Cell Populations: We analysed cell types from RA patients using gene expression profiling to understand why some may be less effective in therapy
Designing Targeted Receptors: We created specialised receptors that recognise molecular features unique to RA inflammation sites, helping guide therapeutic cells to affected tissues.
Expression of Targeting Receptors: These receptors were successfully expressed on our therapeutic cells. Further validation is ongoing to confirm their targeting function.

WHAT DID THE STUDY INVOLVE?

We isolated immune cells, both from both healthy individuals and RA patients, that are known to switch off harmful immune responses. Using cell purification techniques and established gene-editing methods, we generated therapeutic cells from various subpopulations and tested their ability to suppress inflammation in the lab.

We also analysed gene expression profiles of these subpopulations to identify factors contributing to reduced effectiveness in some therapeutic cells.

Separately, we engineered specialised chimeric antigen receptors (CARs) to target RA-specific inflammation sites in the joints. These receptors, adapted from molecules typically involved in the disease process, were modified to 'switch off' inappropriate immune responses. Although successfully expressed on our therapeutic cells, further testing is underway to assess their ability to guide cell activity.

WHAT WERE THE RESULTS AND WHAT DO THEY MEAN?

Our study showed that therapeutic cells derived from both healthy individuals and RA patients were able to reduce immune activity in laboratory tests, supporting their potential as a future therapy for RA. However, some RA patient cells were less responsive, indicating underlying dysfunctions, which we began to map through genetic profiling. This work may help guide the design of more effective therapies and offer insight into disease mechanisms.

We created custom receptors to guide therapeutic cells specifically to RA-affected joints. These receptors were successfully incorporated into the therapeutic cells, but further experiments are needed to assess their precision and functional activity.

Together, our findings support the feasibility of this cell therapy approach and offer a clearer understanding of disease-specific challenges that can be addressed in future work.

WHAT IMPACT COULD THE FINDINGS HAVE?

Our research could help move us closer to long-term remission, or potentially a cure, for RA by:

Selecting the Most Effective Cells for Therapy: Identifying immune cells highly effective at suppressing harmful responses, guiding better therapy design.
Understanding Dysfunction: Investigating why some RA patient-derived cells are less responsive, enabling us to begin addressing these weaknesses.
Targeting RA Disease Processes: Designing RA-specific receptors to help therapeutic cells home in on and dampen disease activity at affected sites.

Together, these advances may support the development of targeted, long-lasting therapies that address the root causes of RA.

HOW WILL THE OUTCOMES BE DISSEMINATED?

We will publish our findings in open-access scientific journals and present them at key national and international conferences. Early-access versions will also be shared via the Edinburgh Napier University Research Repository.

Patient engagement remains a priority. We will share results through our collaborators at the University of Glasgow, including via the Rheumatoid Arthritis Centre for Excellence (RACE) and patient events hosted by the Rheumatosphere platform in the West of Scotland.

CONCLUSION

This study has made significant progress towards developing targeted cell therapies for rheumatoid arthritis, showing encouraging results in preclinical models. By identifying the most suitable cell populations and addressing disease-specific dysfunctions, we have built a strong foundation for advancing this therapy toward clinical use.

Our next steps will focus on validating the targeting receptors, ensuring the safety and stability of the cell products, and confirming their therapeutic potential. If these goals are met, we aim to progress toward clinical trials, bringing this promising therapy closer to becoming a viable treatment option for patients.

RESEARCH TEAM & CONTACT

Dr Graham Wright

Edinburgh Napier University,

Sighthill Campus, Edinburgh.

g.wright2@napier.ac.uk