PhD Project (e.g. P1)	Host institution	Start date (e.g. Month 6)	Duration (e.g. 48 months)	Supervisors (primary and co-supervisor)
P5	**FHCW**	**1**	**48**	**I. Swoboda/A. Otto Associate Expert S. Gruber**

Project Title: Immune responses to biomaterials

Hypotheses/Aims:
The use of polymers and polymer composites for biomedical applications can be hampered by strong adverse immune reactions, which might result in excessive inflammation or allergic reactions that lead to the dysfunction of medical devices. In contrast, it is also known that controlled immune responses are crucial for integration of foreign materials and for tissue repair. This PhD project has two major objectives: i) to compare immune responses induced by different biomaterials to gain a better understanding of harmful and beneficial cellular and molecular mechanisms involved in the interaction between novel biomaterials and the immune system, and ii) to characterize chitosan as an antimicrobial compound with known high biocompatibility for the coating of medical devices with the goal of increasing the tolerability of medical devices.

Short Description of the PhD project and Role of both Organizations (TUW & FHCW):
This project will mainly be carried out at the FHCW, biomaterials will be provided by the TUW.
The first part of the project will be divided into the following tasks:
Task 1: Evaluation of inflammatory responses by exposure of immune cells to biomaterials followed by measurement of proliferation and analysis of the expression of inflammatory cytokines (FHCW)
Task 2: Characterisation of biomaterial-induced immune responses by analysis of the differentiation of monocytes either into macrophages or into dendritic cells, since this differentiation has been shown to influence the acceptance of implanted biomaterials (FHCW)
Task 3: Analysis of adaptive immune response by studying T cell polarization into different subsets (Th1, Th2, Treg), as T cells are involved in resolution of inflammation and tissue repair (FHCW)
Task 4: Analysis of type I allergic responses by evaluation of IgE reactivity and basophil activation capacity of the biomaterials (FHCW)
The second part of the project will be divided into the following tasks:
Task 5: Analysis of biocidal activity of chitosans by testing different grades of chitosans in *in-vitro* assays regarding their biocidal efficacy against bacteria known as problematic on medical devices (FHCW)
Task 6: Characterisation of immune responses to chitosan by evaluating their anti-inflammatory activity in cellular assays (FHCW)
Task 7: Purification of chitosans and handing over to TUW for coating of biomaterials and exposure of chitosan-coated materials to laser processes that affect structures and surface topography of the coated materials (FHCW & TUW)
Task 8: Analysis of biocidal and anti-inflammatory activity of chitosan-coated materials (FHCW)

Expected Results:
- A better understanding of the induction of immune responses to different biomaterials
- Skewing of the immune response towards tolerance by coating of materials with chitosan

Participating Faculty: I. Swoboda (FHCW), A. Otto (TUW)
Associate Faculty Member S. Gruber (FHCW) will support the project with her expertise in biofilms and in the purification and preparation of chitosan

Planned lab rotations:
FHCW: 42 months: analysis of inflammatory and allergic responses, analysis of biocidal activity
TUW: 6 months (3 months in year 2, 3 months in year 4): production of surface coats