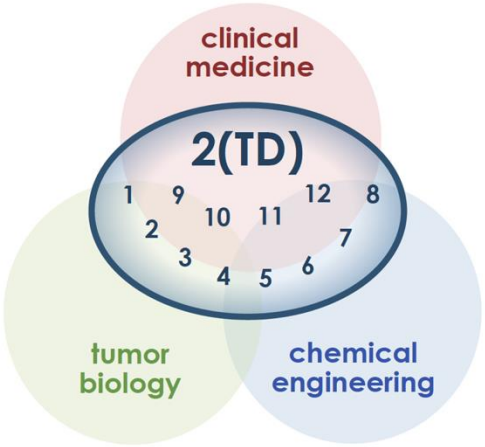
Summary

Drug delivery systems (DDS) aim to improve the performance of anticancer agents. They prevent their rapid degradation and elimination, prolong circulation times, increase target site accumulation and protect healthy organs. Many DDS have been developed over the years, including liposomes, polymers, micelles and antibodies, and several of them are approved for clinical use. However, the full potential of tumor-targeted DDS is yet to be unlocked and there is still significant room for improvement, in particular in terms of response rates and survival times. To this end, intimate and interdisciplinary collaboration is needed at the interface of clinical medicine, tumor biology and chemical engineering, together resulting in the identification of rational scenarios for clinical translation. The RTG “Tumor-Targeted Drug Delivery” (acronym 2(TD)) will generate knowledge at the interface of these three key contributing fields, exploiting the complementary experience and expertise of the involved PIs, and creating a local framework and international network for improving the performance, patient benefit and clinical impact of tumor-targeted DDS. 2(TD) will address the vascular and microenvironmental heterogeneity in tumors and metastases, and establish probes and protocols to preselect patients and personalize tumor-targeted treatments. Inter- and intra-individual differences in vascular and microenvironmental features will be correlated with the accumulation, penetration and efficacy of DDS. Pharmacological and physical co-treatments will be employed to modulate vascular permeability and tumor penetration. Chemical protocols will be refined, enabling tight control over DDS size, polydispersity, drug loading, release kinetics and degradation. Pharmaceutical production processes will be established to achieve efficient and reproducible upscaling. Drug repurposing, combination treatments and companion diagnostics will also be investigated. Education and training will benefit from the interdisciplinary experience and expertise available at RWTH Aachen University and from exchange programs with US partners. This will maximize the interaction between students and PIs from different disciplines. As such, 2(TD) will contribute to the development of better DDS and more efficient tumor-targeted treatments, and to a better and broader education of the next generation of scientists working in this interdisciplinary field.

Project structure and PhD thesis topics (main PI between brackets):



P1: Metastasis targeting (Lammers)
P2: Vascular priming (Lederle)
P3: Macrophage modulation (Tacke)
P4: Inflammation targeting (Trautwein)
P5: Theranostic nanogels (Moeller)
P6: Auger-emitting theranostics (Mottaghy)
P7: Multi-drug nanoparticles (Kuehne)
P8: Continuous-flow manufacturing (Metselaar)
P9: Sonoporation (Kiessling)
P10: Antibody-drug conjugates (Buyel)
P11: Iron oxide NP repurposing (Knuechel-Clarke)
P12: Liposomal dexamethasone (Bruemmendorf)