Creating a “Transcampus” in Diabetes Research Between King’s College London and the Technische Universität Dresden: Update on Islet Biology and Transplantation

Currently, we are witnessing a pandemic increase of diabetes on a global level and the disease and its complications constitute a major burden for our modern health care systems. While type 1 diabetes has an autoimmune aetiology, a common denominator of type 2 diabetes and the associated metabolic syndrome is insulin resistance. Type 2 diabetes and the metabolic syndrome are also closely linked to environmental triggers and modern stressors, to the dominance of the western lifestyle with excessive nutrition, to migration and mobility, to the effect of globalisation, as well as socioeconomic factors. Besides these factors, alterations in immune/inflammatory pathways have emerged as major players in the development of obesity-related insulin resistance and type 2 diabetes [1–3]. Given the magnitude and the multidisciplinarity of the health burden posed by diabetes with a large number of unresolved questions and a major scientific workload ahead of us, research in diabetes requires combined efforts and large scale investments. A major aspect is that experts from complementary disciplines need to join forces in diabetes research. It is therefore becoming obvious that this ambitious mission will not be accomplished by single institutions. Breaking new grounds of research and health management in this area requires the cooperative and synergistic bundling of specific competencies and resources based on the development of new structures for the interaction between leading basic research institutions and academic health science centres.

Based on this background, we embarked on creating a “Transcampus” for diabetes research and management combining 2 of Europe’s academic institutions, King’s College London in the United Kingdom and Technische Universität Dresden in Germany. This endeavour could create the critical mass for advancing understanding and treatment of diabetes. The unique advantage of creating such a Transcampus lies in the formation of a “Star Alliance” of 2 centres with a strong focus and tradition of excellence in diabetes research in 2 of the biggest European countries (Fig. 1). Both, King’s College and the Technische Universität Dresden represent academic science health centres in their respective country and have a particular strength and emphasis in diabetes and metabolic disease. This Transcampus creates synergistic value not only by joined funding and joined research grants but also by the exchange of students and expert staff. It creates a new business model of complimentary portfolios and infrastructures. Joined appointments and affiliations in combination with appropriate recruitment packages for leading scientists and clinicians could foster attractive collaborations to the Transcampus. It will facilitate large-scale industry-academia partnership and help to catalyse more efficiently the transfer of innovative research into society [4].

The Diabetes Transcampus Programme will focus on several facets of diabetes research. In this issue of Hormone and Metabolic Research we present the current research and clinical programmes of the Transcampus pertinent to central aspects of diabetes research, in particular, islet biology and islet transplantation. A specific advantage of this Transcampus with regard to islet replacement therapies is the added value generated by combining the only active human islet replacement therapies is the added value generated by combining the only active human islet transplantation programme in Germany with one of the UK-located programmes. While the Dresden diabetes centre comprises a more homogenous Caucasian population of patients with a strong rural component, the patient population at King’s Health Partners and in particular King’s College Hospital represents a modern urban multiracial society with a strong migratory and non-European background. This provides the advantage to perform joined clinical trials and create diabetes management programmes com-
paring and integrating the diverse needs of these populations in different social settings. Even more important, the 2 programmes can learn from each other’s experience. Moreover, the complex and diverse ethical and regulatory requirements in the 2 different countries will allow more flexibility and efficiency in the translational process of research results from bench to bedside.

Ludwig and co-authors [5, 6] summarize their data on the islet transplantation programme from Dresden, whereas Byrne et al. [7] report on the outcomes of adult patients with type-1-diabetes suffering from severe hypoglycaemia or that were referred for islet transplantation to King’s College. However, islet transplantation appears not to be widely available on a global scale. While centers offer the opportunity to perform islet isolation and transplantation locally, remote center transplantation, where islet transplantation may occur at a site distinct from the islet isolation unit may help to overcome infrastructural limitations of the procedure. Therefore, Marathe and co-authors from the Royal Adelaide Hospital report their experience from the South Australian remote center transplantation programme [8]. Since immunosuppression is a major problem of allogeneic islet transplantation, novel implantable islet cell containing devices offering an immune barrier between graft and host and, thus, an optimized islet survival environment, may help to circumvent these problems [9, 10]. However, since islets require sufficient oxygenation, novel technological developments like the islet chamber described by Evron et al. [11], providing the oxygen supply by photosynthesis, represents a cutting-edge bio-engineering approach in the field of diabetes technology. Since allotransplantation is limited by the rarity of donor organs, xenotransplantation of islets from other species like pigs may be a potential therapeutic option to treat type 1 diabetes in the future. Reichart and co-authors [12] summarize the latest developments in this field. One of the major limitations of xenogeneic transplantation approaches is immunological graft rejection, which is initiated by interactions between host leukocytes and the graft endothelium. In this respect, Kourtzelis and co-authors [13] describe complement-targeting approaches to potentially attenuate the immune response. Animal models provide excellent tools to advance our knowledge on type 1 diabetes as well as in transplantation medicine and Rahmig et al. [14] provide us an overview on humanized mouse models for type 1 diabetes.

The T-cell based destruction of islet beta cells is the major pathophysiological event in the development of type 1 diabetes and T regulatory cells may be considered for autologous cell therapy in order to prevent the immune mediated destruction of beta cells. Theil and co-authors [15] summarize their results on cord blood as a source for autologous T regulatory cells. The purity of these T-cells allows for higher expansion and therefore improved effectiveness making them excellent candidates for fighting immune mediated beta-cell destruction.

In addition to transplantation, regenerative approaches for the treatment of type 1 diabetes also appear to be promising. In this context, the knowledge about the details of endocrine pancreas development during early postnatal life is scarce. Somatostatin has been suggested to play a significant role in the aforementioned process [16]. In this issue, Richardson et al. [17] will introduce the results of a highly relevant study based on somatostatin-deficient mice indicating an important function of somatostatin in beta-cell apoptosis, proliferation and expansion. Also of high interest in embryonic development of the endocrine pancreas is the well-established perinatal maternal increase of the beta-cell mass. Drynda et al. [18] explore the different aspects of this observation, studying the placental vs. non-placental stimulating signals in animal models suggesting that both are playing a significant role in this adaptation process of the islets.

Endothelial cells are of major interest in the process of islet revascularisation and survival after transplantation and 2 articles lay their focus on that. While Zhao and co-authors [19] shed light on the potential impact of the islet preparation method on endothelial preservation, King et al. [20] investigate the impact of pharmacological inhibition of the ALK5-signalling pathway, which is critically involved in endothelial cell survival and proliferation, on islet graft revascularization and function.

Finally, during the last decade, novel and effective drugs for the treatment of type 2 diabetes have been developed on the basis of the so-called incretin concept [21]. Since incretins are involved in the regulation of physiological islet function, novel aspects in this setting are summarized in a mini-review by Kamvissi et al. [22]. Taken together, this issue provides a comprehensive summary on current research activities on islet biology and transplantation performed in a novel Transcampus concept of 2 leading
European academic institutions in this field – King’s College London (United Kingdom) and Technische Universität Dresden (Germany).

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