High-Performance Membrane Dialyzers
Contributions to Nephrology

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High-Performance Membrane Dialyzers

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Contributions to Nephrology
(Founded 1975 by Geoffrey M. Berlyne)

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Contents

VIII Preface
Saito, A. (Isehara)

X Foreword
Kawanishi, H. (Hiroshima)

Definitions of High-Performance Membranes (HPM)

1 Definition of High-Performance Membranes – From the Clinical Point of View
Saito, A. (Isehara/Yokohama)

11 Solute Removal Efficiency and Biocompatibility of the High-Performance Membrane – From Engineering Points of View
Sakai, K.; Matsuda, M. (Tokyo)

Clinical Benefits of High-Performance Membrane Dialyzers

23 Biocompatible Characteristics of High-Performance Membranes
Uda, S. (Kawasaki); Mizobuchi, M.; Akizawa, T. (Yokohama)

30 Selection Guidelines for High-Performance Membrane
Sanaka, T.; Koremoto, M. (Tokyo)

36 Preferred Performance of the High-Performance Membrane in the Case of Online Hemodiafiltration
Kawanishi, H. (Hiroshima)

44 Preferred Dialysis Fluid for the High-Performance Membrane
Tomo, T. (Hasama-machi)

53 Required Water Quality for the Use of High-Performance Membranes
Aoike, I. (Niigata)

58 Clinical Outcomes of the High-Performance Membrane Dialyzer
Koda, Y. (Tsubame)
<table>
<thead>
<tr>
<th>Page</th>
<th>Title</th>
<th>Authors</th>
</tr>
</thead>
<tbody>
<tr>
<td>70</td>
<td>Endotoxin and Bacterial Level of Dialysate Fluid Quality</td>
<td>Isakozawa, Y.; Takesawa, S.; David, V. (Nobeoka)</td>
</tr>
<tr>
<td>76</td>
<td>Albumin Loss Under the Use of the High-Performance Membrane</td>
<td>Tsuchida, K.; Minakuchi, J. (Tokushima City)</td>
</tr>
<tr>
<td>84</td>
<td>Choice of Modality with the Use of High-Performance Membrane and Evaluation for Clinical Effects</td>
<td>Masakane, I. (Yamagata)</td>
</tr>
</tbody>
</table>

**Mass Transfer Mechanisms and Characteristics of High-Performance Membranes**

<table>
<thead>
<tr>
<th>Page</th>
<th>Title</th>
<th>Authors</th>
</tr>
</thead>
<tbody>
<tr>
<td>95</td>
<td>Mass Transfer Mechanisms in High-Performance Membrane Dialyzers</td>
<td>Yamashita, A.C. (Fujisawa)</td>
</tr>
<tr>
<td>103</td>
<td>Fluid and Solute Transfer Characteristics in a Dialyzer with a High-Performance Membrane</td>
<td>Mineshima, M. (Tokyo)</td>
</tr>
<tr>
<td>110</td>
<td>Contribution of Polysulfone Membranes to the Success of Convective Dialysis Therapies</td>
<td>Bowry, S.K.; Gatti, E.; Vienken, J. (Bad Homburg)</td>
</tr>
<tr>
<td>119</td>
<td>AN69: Evolution of the World’s First High Permeability Membrane</td>
<td>Thomas, M. (Meyzieu); Moriyama, K. (Tokyo); Ledebo, I. (Lund)</td>
</tr>
<tr>
<td>130</td>
<td>Polymethylmethacrylate Membrane with a Series of Serendipity</td>
<td>Sakai, Y. (Urayasu)</td>
</tr>
<tr>
<td>137</td>
<td>Polyester Polymer Alloy as a High-Performance Membrane</td>
<td>Igoshi, T.; Tomisawa, N.; Hori, Y.; Jinbo, Y. (Tokyo)</td>
</tr>
<tr>
<td>156</td>
<td>Cellulose Triacetate as a High-Performance Membrane</td>
<td>Sunohara, T.; Masuda, T. (Osaka)</td>
</tr>
<tr>
<td>164</td>
<td>Ethylene Vinyl Alcohol Co-Polymer as a High-Performance Membrane: An EVOH Membrane with Excellent Biocompatibility</td>
<td>Nakano, A. (Nobeoka)</td>
</tr>
</tbody>
</table>

**High-Performance Membrane Dialyzers in Critical Care**

<table>
<thead>
<tr>
<th>Page</th>
<th>Title</th>
<th>Authors</th>
</tr>
</thead>
</table>
Comparison of Efficacy between Continuous Hemodiafiltration with a PMMA High-Performance Membrane Dialyzer and a PAN Membrane Hemofilter in the Treatment of Septic Shock Patients with Acute Renal Failure

Commercially Available High-Performance Membrane Dialyzers and Several Special Kinds on the Japanese Market (as of April 30, 2011)
Yamashita, A.C. (Fujisawa)

Author Index
Subject Index
Regenerated cellulose had been exclusively used as a dialysis membrane until the beginning of the 1980s since 1944, when Kolff et al. developed the drum-type dialysis system and used a cellophane membrane tube as a dialysis membrane. In the 1970s, synthetic membranes were used as hemofilters. In the 1970s, however, these membranes were not used as dialyzers because without a controller, an excess volume of water was removed from the body due to the characteristics of high-flux membranes. Therefore, a filtration volume controller was used instead in the 1980s, by which the ultrafiltration rate could be preset, thereby maintaining a stable ultrafiltration rate.

Middle molecular substances of 300–3,000 daltons were targeted for removal by hemodialysis and hemofiltration in the 1970s; this middle molecule removal was hypothesized by Babb et al. Despite testing the authenticity of the hypothesis for 10 years, researchers worldwide were unable to prove it. During and after this period, different directions in removal targets of uremic molecules were retrieved worldwide. Researchers in the USA focused on the kinetics of small molecular substances such as urea, and at the time the Kt/V value for urea was only used as a dialysis dose, whereas the researchers in Japan aimed at removing substances, ranging from small molecular substances to low molecular weight proteins, including small amounts of albumin, in order to approximate dialytic solute removal to glomerular filtration. Therefore, it is only in Japan that the specific name ‘high-performance dialysis membrane (HPM)’ is used for highly-permeable dialysis membranes with biocompatibility since the Japanese Society for HPM was established in 1985, and the First Annual Meeting for HPMs was held in Tokyo in 1986. HPM is different from ‘highly permeable dialysis membranes’ in that one of the solute removal characteristics of HPM is that it can remove a certain amount of albumin, which is also removed by glomerular filtration in the kidneys. Globally, except in Japan, small and middle molecular weight uremic toxins except albumin are the removal targets of hemodialysis. In 1997, HPMs were approved as type II dialyzers by the Japanese Government and were priced slightly higher than the conventional (type I) dialyzers. At that
point, type II dialyzers were adjusted such that a clearance of $\beta_2$-microglobulin of more than 10 ml/min was obtained, whereas the type I dialyzers were adjusted such that the clearance of $\beta_2$-microglobulin was below the detectable level. Recently, the classification of dialyzers was revised from two types, i.e. I and II, to 5 types from I to V.

In this volume of *Contributions to Nephrology*, we have submitted 23 papers on HPM, which include the definition, kinetics of solutes, performances, clinical effects, and each characteristic of the HPMs. We are thankful for the opportunity to publish our papers titled ‘High-Performance Dialysis Membranes’ and receive opinions from researchers and physicians working on dialysis membranes worldwide.

We would like to thank the authors and all the contributors for the enormous effort and the quality of their scientific chapters. We would also like to thank all those who made this publication possible, in particular Karger Publishers.
Foreword
by Hideki Kawanishi

Dialyzers today are being developed towards high permeability and biocompatibility with an absolute need for solid evidence with regard to their abilities. High-flux dialyzers are recommended for the progress of good outcomes for dialysis populations. However, the definition of such high-flux dialyzers remains controversial. In Japan, the classification of dialyzers refers to five types, from I to V, that is they are classified for the clearance of β2-microglobulin of less than 10, 30, 50, 70 and more than 70 ml/min at a blood flow rate of 200 ml/min and a dialyzer flow rate of 500 ml/min (see Appendix table). Especially types IV and V, the so-called ‘super high-flux dialyzers,’ share over 90% of the market in Japan. The classification based on permeability is the simplest way of evaluating dialyzers. However, in order to clinically evaluate dialyzers, not only permeability but also biocompatibility should be taken into consideration. In Japan, the term ‘high-performance membrane dialyzer (HPM dialyzer)’ has in general been called so since 1985, and refers to both higher solute removal and good biocompatibility. The category of this type of HPM dialyzer, which has been developed by several manufacturers, is now appearing on the world market and is expected to improve the overall outcome of dialysis patients.

With the cooperation of the Japanese Society for HPM (JSHPM) and the Japanese Society for Hemodiafiltration (JSHDF), this issue of Contributions to Nephrology was planned in order to call attention to HPM dialyzers on a wider scale. We firmly believe that this book, the first of its kind specifically on the subject of HPM dialyzers, will be widely recommended for international guidelines in the future.

All authors and contributors are thanked for the enormous effort and high quality of their scientific papers. We also thank those who made this publication possible, in particular Karger Publishers.