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BOOK REVIEW

From barriers to channels

Review of: The Paracellular Channel: Biology, Physiology, and Disease by Jianghui Hou

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Early anatomic and physiologic studies of the epithelial tight junction focused on the ability of this structure to act as a seal between adjacent cells, thus its naming as the "zonula occludens" in the seminal 1963 paper by Farquhar and Palade.[1] However, interspersed with early physiologic analyses of the very "tight" tight junctions of frog skin were studies in gall bladder and intestine that documented the larger permeability of the paracellular "shunt" pathway in these leakier tissues (reviewed in[2]). These latter studies demonstrated that tight junctions were not always so tight; however, overall, paracellular barrier function remains the most widely studied tight junction characteristic.

As is implied by its title, in the impressive and important new book, "The Paracellular Channel: Biology, Physiology, and Disease,[3] author Jianghui Hou turns the focus from barrier function to concentrate instead on how ions and solutes navigate through tight junctions. This is highly appropriate, since the most exciting new information about tight junctions relates to the structure of the claudin-forming paracellular pores, how these proteins interact and are regulated and how the cytoskeletal proteins to which claudins bind can influence the magnitude of transport through the paracellular pathway.

"The Paracellular Channel" includes a useful overview of the many aspects of the modern tight junction field, but it is not intended as a comprehensive review of tight junction proteins or their behavior unrelated to their roles in paracellular permeability. This is not the book for readers interested in coming up to speed on the tight junction's role in cell polarity, signal transduction, gene transcription or the many non-barrier functions ascribed to the tight junction. There is also little discussion of the roles claudins might play in non-genetic diseases or in cancer.

However, "The Paracellular Channel" is both important and appropriate reading for those trying to understand the most recent information on the molecular basis of ion and water permeation through the junction. An early chapter covers theoretical and practical issues of paracellular channel recording, including the use of the classic Ussing chambers, the more novel technique of conductance scanning and the recently described patch clamping of the tight junction. This discussion is followed by separate chapters on paracellular anion, cation and water transport across the paracellular junctions. Woven into these chapters are explanations of how new physiologic techniques, new claudin structural information and mutational analyses and recognition of the roles of other tight junction proteins inform interpretation of the physiologic behavior of paracellular channels.

Hou builds on this information in subsequent chapters, putting the channel information into the contexts of organ systems, diseases and as drug targets. In all cases, Hou not only

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summarizes much of the relevant recent literature, but also includes many examples of primary data to illustrate particular points. The large number of colorful illustrations and images are welcome and useful additions.

Because this is a single author volume, it is unusually easy to read. In addition, recent results are presented in their historical context, so that interested readers can easily trace the genesis of new ideas. The last chapter, titled "Perspective" is a (too) short but very thoughtful and thought-provoking consideration of some of the most interesting unsolved issues in understanding in how paracellular channels are organized. Overall, "The Paracellular Channel" is essential reading for anyone in the tight junction field.

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