Preface

These notes arose in the course of our studies of the systematic construction of higher-dimensional generalized manifolds given by Bryant, Ferry, Mio, and Weinberger [48]. The basis of their construction is the controlled surgery sequence. There were no doubts about its validity, yet complete proofs of the controlled surgery sequence appeared only later. This is the reason why we treat the $4k$-dimensional construction separately, by using the already established controlled surgery techniques, which can be given by appealing only to the final controlled sequence. Nevertheless, there are subtle choices of the ε's and δ's in the infinite approximation process leading to nonresolvable generalized manifolds.

Since surgery is the foundation of the theory, we review it, beginning with the "geometric" surgery [220, 223], the "bounded" surgery [125], and finally, the "controlled" surgery [217, 234]. We have omitted many details. It was our *Anliegen* to present the fundamentals, e.g., the "Chapter 9" interpretation of surgery [287], which immediately takes over, for instance to the "bounded" surgery, once the bounded Hurewicz–Whitehead theorem, the bounded π–π-theorem, etc. have been established.

We have included "bounded" surgery theory since among other benefits, it provides a proof of the canonical TOP-reduction of the Spivak fibration. The $\mathbb{L}$-spectra are of course, unavoidable, in particular the $\mathbb{L}$-(co)homology, and the $\mathbb{L}$-Poincaré duality [229]. One of the highlights of controlled surgery theory is the identification of the controlled Wall groups with $\mathbb{L}$-homology groups [122, 217, 218, 234]. For this purpose the controlled algebraic $\mathbb{L}$-theory is inevitable. This appears only partially in these notes, when we review material from [220, 223].

The Bryant–Ferry–Mio–Weinberger construction is in some sense fundamental since it has led to the treatment of generalized manifolds as "manifolds", namely in the sense that one can introduce transversality, embeddings, normal invariants, etc. However, a large part of this theory still remains to be discovered and developed. The greatest challenges are, in our opinion, to find local models and to prove (topological) homogeneity.

To make our notes easier to read, we begin with a brief historic survey of key previous results concerning generalized manifolds. To make our notes more useful and to give the interested reader an opportunity to learn more about this exciting subject, we have expanded the list of literature at the end with several important papers on the subject which we have not referenced directly in the text. We hope that our notes will be useful to anyone interested in learning about the key developments in this beautiful and exciting area of topology.

We would like to thank many experts with whom we have discussed this or related topics on various occasions in the past, in particular M. Bestvina, J.L. Bryant, J.W. Cannon, S.E. Cappell, A.V. Černavskii, R.J. Daverman, A.N. Dranišnikov, R.D. Edwards, S.C. Ferry, D.M. Halverson, W.C. Hsiang, R.C. Lacher, D.R. McMillan, W. Mio, W.J.R. Mitchell, E.K. Pedersen, F.S. Quinn, A.A. Ranicki, L.C. Siebenmann, E.G. Sklyarenko, M.A. Štan'ko, M. Ue, G.A. Venema, J.J. Walsh, S. Weinberger, and M. Yamasaki. We also thank all the referees who have provided several useful comments and suggestions.

Special acknowledgements are due to Mathematisches Forschungsinstitut Oberwolfach for enabling us to work on this project at the institute, within the *Research in Pairs* program, in 2002, 2004, and 2006, and for hosting a special meeting on exotic homology manifolds in Oberwolfach in 2003.

In the course of our work on this project we were supported by the GNSAGA of the CNR (National Research Council of Italy), the MIUR (Ministry for Scientific Research and Technology of Italy), within the project *Strutture Geometriche, Combinatoria e loro Applicazioni*, and the ARRS (Slovenian Research Agency), within the program P1-0292-0101, and projects J1-2057-0101, J1-4144-0101, J1-5345-0101, and J1-6721-0101. We thank K. Zupanc for her technical assistance with the preparation of the manuscript. We also thank A. Durham for her editorial assistance in all stages of the publication of the book.

A. Cavicchioli, F. Hegenbarth, and D. Repovš