

PREFACE

The following eight papers are by mathematicians and physicists connected in some way to the three meetings held at the Woods Hole Oceanographic Institution (WHOI) during the past six years. This book is not a proceedings in the usual sense, but expositions of recent work contributed by those researchers interested in this form, and written with no pressure from editors. The topics of the meetings were suggested by the interests of the Sullivan Seminar at the City University of New York Graduate Center from diverse areas of mathematics and physics, but related certainly in concepts and techniques. One of the strands of this mix may have started in Woods Hole forty years ago (cf. the reminiscences of Raoul Bott in the Introduction to this book).

The first meeting (1998) at Woods Hole was on fluid flow: the perennial problems of the Euler and Navier-Stokes equations and turbulence. A main theme was alternatives to the continuum model as a way of overcoming issues of regularity, the combinatorial difficulty of completing the evolution model when shock waves develop, and the limits to any numerical computation. When the continuum equations are written in finite terms, a fundamental algebraic problem appears: the symmetry of the infinitesimal algebra is broken. From this point Sullivan took the first steps towards a combinatorial geometry in fluid flow, later echoed in his work on string topology.

The 1999 meeting celebrated the 35th anniversary of the Woods Hole (or Atiyah-Bott) theorem, the eponym reflecting the cooperative nature of the original proof (cf. Bott, *ibid*). The event was one of many marking the end of Bott's formal teaching career at Harvard. The central topic of the meeting was the integral and combinatorial invariants of three-manifolds.

The third meeting (2001), *Graph Theory: Confluences in Molecular Biology and the Physical Sciences*, studied the uses of diagram techniques in molecular biology, physics, and Teichmüller theory. Lenore Cowen gave an example of using both proteins to isolate a feature of secondary structure that may signal disease. Both Louis Kauffman and Bob Penner gave possible applications of their work to molecular biology (cf. their contributions in this volume).

Below is a list of the speakers from the last three meetings; the list might be compared with the list of participants in the 1964 meeting given by Bott in the Introduction:

S. Axelrod	C. Epstein	R. Kaufman	T. Tangerman
R. Bott	M. Farge	G. Kuperberg	D. Thurston
L. Chekhov	K. Helfrich	S. Martin	J. Weitsman
L. Cowen	L. Kauffman	R. Penner	

Our participants were of course a much larger group, whose names might be difficult to recover; there were nine days of meetings, not a month. But the summer of 1964 was a more leisurely time, and rambling houses on Quissett Harbor were still within the reach of academics.

The meetings at Woods Hole were possible only through the support of WHOI Senior Scientist Andrew M. Solow, the institution itself, and the National Science Foundation.

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