CONTENTS

1. INTRODUCTORY REMARKS AND AIMS 5

2. HISTORY 6
2.1 MONOPHASIC ACTION POTENTIAL (MAP) RECORDING TECHNIQUE 7
2.2 MECHANOELECTRIC FEEDBACK 9
2.2.1 Theoretical aspects and modelling 9
2.2.2 Mechanism, membrane and cellular aspects 9
2.2.3 Experimental studies in multicellular preparations including the intact heart 10
2.2.4 Relevance to the clinical situation 10
2.2.5 Perspectives 10
2.2.6 Excitation-contraction coupling and mechanoelectric transduction 10
2.2.7 Pharmacologic blockers of stretch-activated arrhythmias 10
2.2.8 Limitations of the classical interpretation of Starling's law of the heart 12
2.2.8.1 End-systolic pressure-volume relation 12
2.2.8.2 Action potential changes 12
2.2.8.3 Stretch-activated ion channels 12
2.2.9 Mechano-electric feedback in the human heart 14
2.2.10 Mechano-electric feedback: potential arrhythmogenic influence in patients with congestive heart failure 14
2.2.11 Mechanosensitive connective tissue: potential influence on the heart rhythm 14
2.2.12 Stretch-induced voltage changes in the isolated beating heart 15
2.2.13 Stretch-induced increase of Ca^{2+}_i in isolated guinea-pig ventricular myocytes 18

3. MAP AND LOCAL ELECTRICAL CHANGES IN HEART REPOLARIZATION 19

4. USE OF THE SUCTION ELECTRODE FOR MAP MEASUREMENT 19
4.1 DESCRIPTION OF THE SUCTION ELECRODE 19
4.2 CHANGES IN MEMBRANE RESISTANCE 21
4.3 ENDOCARDIAL MAP 21
4.4 NEGATIVE PRESSURE AND EXTENT OF DAMAGE 21
4.5 EXPERIMENTAL ISCHEMIA 21
4.6 INFLUENCE OF IONS 22
4.7 INFLUENCE OF AGE 23
4.8 DRUGS INFLUENCING Na^+, K^+ AND Ca^{2+} CHANNEL, STRETCH ACTIVATED CHANNEL AND THE pH EFFECT 23
4.9 COMPUTER MODELS AND ANALYSIS OF MAP 24
4.9.1 THE "FORWARD" PROBLEM OF ELECTROCARDIOGRAPHY 25

5. CHANGES IN TRANSMEMBRANE ACTION AND POTENTIALS ION ACTIVITIES UNDER A SUCTION ELECTRODE 26

6. THE POSSIBLE RELATIONS BETWEEN MAP AND PARAMETERS HEMODYNAMICS OF HEART MUSCLE IN CONTROLS AND PATHOLOGICAL SITUATIONS 34

7. INJURY CURRENT RECORDED BY A SUCTION ELECTRODE 38
7.1 TECHNICAL ASPECTS 38
7.1.1 Safety and line frequency interference 38

7.1.2 High frequencies 38
7.1.3 Low frequencies 38
7.2 SOURCES OF ERROR 38
7.3 UTILITY OF MAP PARAMETERS 40
7.4 THE ONGOING PROBLEM OF THE MAP 41

8. CLINICAL USE OF SUCTION ELECTRODE 42
8.1 MAP IN LONG Q-T SYNDROME 42
8.2 ISCHEMIA 44

9. MAP-CONTEMPORARY STATUS AND RELATION TO THE PRESENT RESULTS 47

10. CONCLUDING REMARKS 49

11. ACKNOWLEDGEMENTS 50

12. REFERENCES 51

LIST OF ABBREVIATIONS 62