

## Mauricio Rosenbaum (1921–2003): His main contributions to science and electrocardiography

1921: On August 25<sup>th</sup> Mauricio B. Rosenbaum was born in Carlos Casares (a province of Buenos Aires).

Before dealing with the formidable scientist that he was, it is important to highlight his qualities as a human being. Not only was his mind original and creative, but he managed to achieve great things in an area with difficult economic conditions, in a medium and conditions that were modest, and with limited resources. Nonetheless, his brilliant work was acknowledged throughout the world, and his influence on cardiology was crucial and is still felt today.

Those who knew him speak of his humbleness, his sensibility, his sense of humour, his sense of ethics, his determination, and the fact that he was a great educator. In short, an outstanding and lovable human being.

Now, to focus on his academic career, we should begin with his college education. He got his Medical Degree at the National University of Córdoba in 1946; after which he started training at the Pavilion of Cardiology Luis H. Inchauspe, at the Ramos Mejía Hospital, under the direction of Prof. Blas Moia.

His interest at first leant toward the investigation of Chagas disease, and his research became key in raising awareness of this endemic disease at a national level.

He later investigated the significance of Q wave in infarction in different locations, as well as in the left and right precordial leads, and different circumstances such as myocardial infection, as well as the analysis of the difficulties of anatomic-electrocardiographic correlation. His work was published in five successive articles in the Argentinean Medical Press [1–5].

His work reached beyond the borders of his country, and by 1954 he was chosen as a Research Associate at the University of Vermont. Twelve years later he became Chief of Cardiology at the Salaberry Hospital by winning a competition on the basis of his qualifications.



From 1967 to 1970 Rosenbaum and his school consolidated the concept of fascicular blocks, which they called hemiblocks [6]. He published, along with Drs. Marcelo Elizari and Julio Lazzari, the book “Hemiblocks”, a landmark both in his life and for the research of dromotropic disorders. The notorious treatise was translated into English and Italian. He went on to work further on this issue, and

made a classification of right bundle branch blocks, emphasizing their clinical significance.

Dr. Rosenbaum was later invited as a Guest Professor in Cardiology to the University of Kentucky, Lexington, by Boris Surawicz, who was quite captivated by Rosenbaum’s work.

Dr. Rosenbaum further produced a classification of ventricular extrasystoles this time, according to their morphology, characterizing the benign forms that originate in the right ventricle. Thus, they became known as “Rosenbaum Ventricular Extrasystoles” or extrasystoles in healthy subjects. These are distinguished by left bundle branch block morphology with SAQRS to the right. A subset is constituted by the so-called Wolffian ventricular extrasystoles, which originate at the base of the right ventricle.

He finally produced a classification of the different types of left bundle branch blocks, established their clinical significance, and described trifascicular blocks.

During the last years of his career he became Honorary Professor of Medicine at Buenos Aires University and acted as Chief of the Division of Cardiology at the Ramos Mejía Hospital in Buenos Aires until his retirement in 1986. On May 4<sup>th</sup> 2003 he passed away at the age of 81.

To fully understand the great input this outstanding man made to cardiology, we must mention his most notable contributions:

- he described the electrocardiographic characteristics of bilateral bundle branch block [7];

- he reported the effect of ventricular systole on atrial rhythm in atrioventricular block;
- he was intellectually responsible for the detailed knowledge of hemiblocks;
- he clarified the physiological bases of intermittent branch blocks [8–12];
- he came up with the concept of branch blocks masked by hemiblocks, which he called standard and precordial masked blocks [13];
- he established the concept of trifascicular blocks [14];
- his school is the mentor of tachycardia-dependent blocks, or in phase 3, and bradycardia-dependent blocks, or in phase 4 [15];
- he described the electrotonic memory of repolarization [16, 17];
- he described in detail the antiarrhythmic effects of amiodarone in different entities and in WPW [18–21];
- he described the characteristics and main causes of pseudoprimary T waves in humans and animals [22];
- he described the “pseudo” 2:1 atrioventricular block and T wave alternans as a manifestation of long QT interval [23];
- he identified the anti-beta receptor antibodies in idiopathic dilated and chagasic cardiomyopathy with agonist properties in the former [24];
- he described the characteristics and main causes of pseudoprimary T wave in humans and animals [25];
- he showed the causes that modify ECGs through supernormal conduction, highlighting their greater frequency regarding the data collected up to that date [26];
- he described the significance of phase 4 for clinical electrocardiography [27];
- he analyzed the mechanism of bidirectional tachycardia [28];
- he analyzed Wenckebach’s periods within the branches of the His bundle [29];
- he was mentor of the electrophysiological explanation of concealed conduction;
- he described the fatigue by His bundle branches.

Finally, it is worth mentioning that the passion Mauricio Rosenbaum displayed on the area of electrocardiology was shared on several eclectic areas, thus showing his broad mind and his many interests in life: classical music, chess, tango, and football.

Here’s to the memory of this great man and physician, Dr. Mauricio Rosenbaum!

## References

1. Rosenbaum MB. Semeiology of the Q wave. II. Physiologic Q wave of the left precordial derivations. *Prensa Med Argent*, 1953; 40: 1273–1277.
2. Rosenbaum MB. Semeiology of the Q wave. III. Modifications of the physiologic Q wave of the left precordial electrocardiogram in different circumstances of cardiac pathology. *Prensa Med Argent*, 1953; 40: 1474–1477.
3. Rosenbaum MB. Symptomologic value of Q wave; Q wave in myocardial infection. *Prensa Med Argent*, 1953; 40: 1930–1935.
4. Rosenbaum MB. Symptomologic value of Q wave; difficulties in anatomo-electrocardiographic correlation with special reference to Q wave in myocardial infraction. *Prensa Med Argent*, 1953; 40: 2001–2006.
5. Rosenbaum MB. Symptomologic value of Q wave; Q and QS waves in right precordial leads. *Prensa Med Argent*, 1953; 40: 2152–2158.
6. Rosenbaum MB, Elizari MV, Lazzari JO. *Los hemibloqueos*. Editorial Paidós S.A.I.C.F. Buenos Aires 1967.
7. Rosenbaum MB, Elizari MV, Lazzari JO, Halpern MS, Nau GJ. Bilateral bundle branch block: its recognition and significance. *Cardiovasc Clin*, 1971; 2: 151–179.
8. Rosenbaum MB, Elizari MV, Levi RJ et al. Five cases of intermittent left anterior hemiblock. *Am J Cardiol*, 1969; 24: 1–7.
9. Rosenbaum MB, Elizari MV. Mechanism of intermittent bundle-branch block and paroxysmal atrioventricular block. *Postgrad Med*, 1973; 53: 87–92.
10. Rosenbaum MB, Elizari MV, Lazzari JO, Halpern MS, Nau GJ, Levi RJ. The mechanism of intermittent bundle branch block: Relationship to prolonged recovery, hypopolarization and spontaneous diastolic depolarization. *Chest*, 1973; 63: 666–677.
11. Rosenbaum MB, Elizari MV, Lazzari JO et al. The physiological basis of intermittent bundle branch blocks. *Medicina (Buenos Aires)*, 1973; 33: 377–393.
12. Rosenbaum MB, Elizari MV, Levi RJ, Nau GJ. Paroxysmal atrio-ventricular block related to hypopolarization and spontaneous diastolic depolarization. *Chest*, 1973; 63: 678–688.
13. Rosenbaum MB, Yesuron J, Lazzari JO, Elizari MV. Left anterior hemiblock obscuring the diagnosis of right bundle branch block. *Circulation*, 1973; 48: 298–303.
14. Rosenbaum MB, Elizari MV, Lazzari JO, Nau GJ, Levi RJ, Halpern MS. Intraventricular trifascicular blocks. The syndrome of right bundle branch block with intermittent left anterior and posterior hemiblock. *Am Heart J*, 1969; 78: 306–317.
15. Elizari MV, Lazzari JO, Rosenbaum MB. Phase-3 and phase-4 intermittent left anterior hemiblock. Report of first case in the literature. *Chest*, 1972; 62: 673–677.
16. Rosenbaum MB, Blanco HH, Elizari MV et al. Electrotonic modulation of the T wave and cardiac memory. *Am J Cardiol*, 1982; 50: 213–222.
17. Rosenbaum MB, Blanco HH, Elizari MV et al. Electrotonic modulation of ventricular repolarization and cardiac memory. In: Rosenbaum MB, Elizari MV eds. *Frontiers of cardiac electrophysiology*. Mass: Martinus Nijhoff Publishing, Boston 1983: 67–99.
18. Rosenbaum MB, Chiale PA, Ryba D, Elizari MV. Control of tachyarrhythmias associated with Wolff-Parkinson-White syndrome by amiodarone hydrochloride. *Am J Cardiol*, 1974; 34: 215–223.

19. Rosenbaum MB, Chiale PA, Kaski JC, Elizari MV. Is amiodarone an ideal antiarrhythmic drug? *Pacing Clin Electrophysiol*, 1984; 7: 272–275.
20. Rosenbaum MB, Chiale PA, Halpern MS et al. Clinical efficacy of amiodarone as an antiarrhythmic agent. *Am J Cardiol*, 1976; 38: 934–944.
21. Rosenbaum MB, Chiale PA, Haedo A, Lazzari JO, Elizari MV. Ten years of experience with amiodarone. *Am Heart J*, 1983; 106: 957–964.
22. Rosenbaum MB, Blanco HH, Elizari MV. Electrocardiographic characteristics and main causes of pseudoprimary T wave changes. Significance of concordant and discordant T waves in the human and other animal species. *Ann NY Acad Sci*, 1990; 601: 36–50.
23. Rosenbaum MB, Acunzo RS. Pseudo 2:1 atrioventricular block and T wave alternans in the long QT syndromes. *J Am Coll Cardiol*, 1991; 18: 1363–1366.
24. Rosenbaum MB, Chiale PA, Schejtman D, Levin M, Elizari MV. Antibodies to beta-adrenergic receptors disclosing agonist-like properties in idiopathic dilated cardiomyopathy and Chagas' heart disease. *J Cardiovasc Electrophysiol*, 1994; 5: 367–375.
25. Rosenbaum MB, Blanco HH, Elizari MV. Electrocardiographic characteristics and main causes of pseudoprimary T wave changes. Significance of concordant and discordant T waves in the human and other animal species. *Ann NY Acad Sci*, 1990; 601: 36–50.
26. Rosenbaum MB, Levi RJ, Elizari MV, Vetulli HM, Sanchez RA. Supernormal excitability and conduction. *Cardiol Clin*, 1983; 1: 75–92.
27. Rosenbaum MB. The significance of phase 4 depolarization for clinical electrocardiography. *Eur J Cardiol*, 1975; 3: 253–255.
28. Rosenbaum MB, Elizari MV, Lazzari JO. The mechanism of bidirectional tachycardia. *Am Heart J*, 1969; 78: 4–12.
29. Rosenbaum MB, Nau GJ, Levi RJ, Halpern MS, Elizari MV, Lazzari JO. Wenckebach periods in the bundle branches. *Circulation*, 1969; 40: 79–86.

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