The Symposium on Frontiers in Analytical Electrochemistry of the 54th ISE and the Division of Electrochemistry and Electroanalysis of the Brazilian Chemical Society present:

A Tribute to Professor Eduardo Neves for Outstanding Contributions to the Development of Electroanalytical Chemistry in Brazil

On the occasion of the 54th Annual Meeting of the International Society of Electrochemistry, September 2003, São Pedro, Brazil, in the Symposium on Frontiers in Analytical Electrochemistry, a tribute is given to Professor Eduardo F. A. Neves – on the year of the celebration of his 70th birthday – for outstanding contributions to the development of Electroanalytical Chemistry in Brazil. In the next pages, an account is presented of the scientific career and accomplishments of Prof. Neves, highlighting his decisive actions to widespread the knowledge and practice of Electroanalysis, as well as to establish a prolific science school that, to a large extent, merges Analytical Chemistry with Electrochemistry in its research activities.

A Tribute to Professor Eduardo Neves for Outstanding Contributions to the Development of Electroanalytical Chemistry in Brazil

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These lines are hardly enough to fully portray a scholar and a master of the stature of Professor Eduardo Neves. The passionate inclination for intellectual creative activity, soundly rooted on experimental practice – preferably supported by techniques like the electroanalytical ones, easily available and with costs compatible with the economical standard of Brazil – the resolute search of originality and excellence in thesis and publications, hard work, cooperation and friendship are some of the principles of his school, which is just a natural evolution of that of his scientific ancestors, Profs. Paschoal Senise and Heinrich Rheinboldt. These same values, assimilated by over 50 disciples of his, have become important resources in the hands of those who afterwards returned to, or newly entered, establishments with deficient laboratories or with no research tradition, but also for all the others that were appointed in consolidated institutions.

Born in Pedra Azul, MG, on November 7 1933, Eduardo Fausto de Almeida Neves became acquainted with chemistry at an early stage: in the small laboratory of his father's dentist surgery, during science classes at the secondary school (given by an enthusiastic engineer) and in his own photographic laboratory. In 1950, young Eduardo headed to Belo Horizonte to attend a scientific course at the Instituto Padre Machado, directed by a brilliant academic, Prof. Otto Lara Rezende.

Determined to study Chemistry, he proceeded to São Paulo in 1953 and entered the Chemistry Course at the Department of Philosophy, Sciences and Literature (Faculdade de Filosofia, Ciências e Letras, FFCL) of USP in 1954. In this extremely tough course, run since 1934 under Germanic standards by Prof. Heinrich Rheinboldt and his then-assistant Heinrich Hauptmann, Eduardo studied and learned immensely with those pioneers and their first Brazilian graduates, among whom Simão Mathias, Paschoal Senise, Ernesto Giesbrecht, Blanka Wladislaw and Geraldo Vicentini, as well as with other teachers. He stood out as a student, being legendary the fact that he never failed a qualitative analysis. He used to devote his vacations to laboratory stages. Of a group of 30 admitted in 1954,

only Eduardo, Franco Levi, Divo Sanioto, José Roberto Giglio and Karola Zimber graduated in 1957. He obtained a BSc with technological and pedagogical attributes. The same year, he started lecturing in the evening course at the Oswaldo Cruz Technical School.

In 1958, he started his graduate work under Paschoal Senise's supervision – the first disciple of Rheinboldt to embrace Analytical Chemistry. By this time, Senise had already come back to Brazil after post-doctorate experiences with Profs. P. W. West and Paul Delahay, the latter being the inventor of chronopotenciometry and multiple-scan voltammetry and the author of "New Instrumental Methods in Electrochemistry". In his studies, Neves systematically investigated the interactions of pseudo-halides, such as azide, with a large number of elements of the period table. He aimed to stabilize less usual oxidation states and examine coordination equilibria, objectives pursued by broadly employing polarography and potentiometry, but also spectrophotometry.

The exceptional talent shown towards research by PhD student Eduardo, resulted in his appointment at the FFCL-USP, initially as a part-time Instructor, in 1959, then as a full-time Instructor from 1961, thus combining both teaching and research functions at the Chemistry Department. He followed up the integration of all chemistry and most biochemistry lecturers, with their research and disciplines spread all around the different units of the University, an effort coordinated by Prof. Senise (at present, Professor Emeritus of USP). Prof. Eduardo's PhD thesis was the first one defended in the newly established IQ in São Paulo, in 1966. His work, entitled "Studies on the reaction between azide ions and metallic cations", gave rise to 7 publications.

Soon, as an Assistant Professor and with the incentive of Prof. Pawel Krumholtz, Neves started off as supervisor in 1968, when he also formulated and institutionalized the first post-graduation discipline of the IQ-USP, "Some aspects of electroanalytical chemistry". This theoretical and experimental discipline has been taught – with gradual updates in its content – for more than three decades at the IQ-USP, initially by Neves alone, subsequently together with his followers and then, from the 90's, entirely by them. Attended by hundreds of postgraduates, it helped to disseminate electroanalytical chemistry all around the country.

With the main aim of quantifying the electrochemical adsorption of the complexes that he had been studying, in 1971 Neves proceeded to the California Institute of Technology where renowned Prof. Fred Anson and his coworkers had invented chronocoulometry a few years earlier. During his 2-year post-doctorate activity, among other issues approached, he observed new and interesting phenomena on white-metals labile complexes induced adsorption. These were interpreted using analogies with solvent extraction in his professorship dissertation "Role of anions in the adsorption of 2-2'-bipyridile on the mercury electrode", brilliantly defended in 1973, which guaranteed him the position of Associate Professor. The interaction with Caltech was further extended during a CNPq/NAS joint program, which led to the visit of Prof. Anson to Brazil and a new mission of Prof. Eduardo with the author of this text to Caltech. In that occasion, further accelerated investigations on metal complexes adsorption were carried out combining Anson's on-line instrumentation for chronocoulometry with a new and precise automatic mercury electrode developed at IQ-USP.

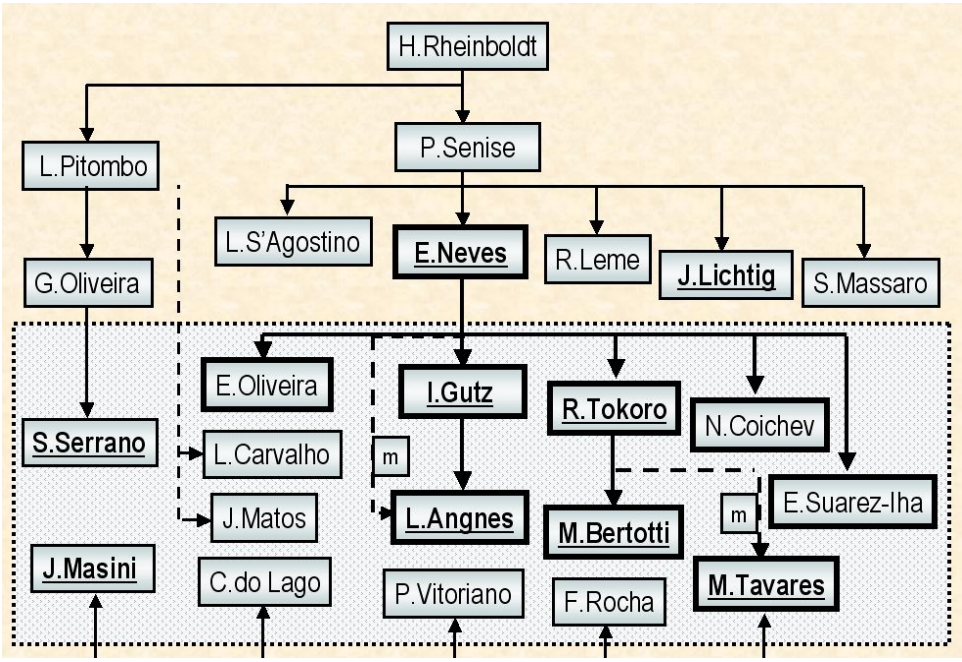
In order to relieve the lack of highly qualified teachers in analytical chemistry and in consonance with USP policy, Neves collaborated for many semesters with public universities within São Paulo State, lecturing at the Chemistry Department of the USP campus in Ribeirão Preto, then at the Chemistry Department of FFCL-Araraquara (currently IQ-UNESP) and later at the Department of Chemistry at the Federal University in São Carlos (UFSCar-USP). He also lectured Analytical Chemistry or Electroanalysis in intensive and summer courses at several Universities, from Natal (in northeast of the country) to Santa Maria (in very south of Brazil).

But, certainly, the alumni prepared in the "school of Eduardo Neves" have amplified the beneficial

influence of the "master" on the Brazilian (electro)analytical chemistry. Since 1972, he supervised the following PhDs: at IQ-USP, Douglas W. Franco, (1972), Elizabeth de Oliveira (1974), Roberto Tokoro (1977), Ivano G. R. Gutz (1978), Gilberto Chierice (1978), Morena P. Peters (1980), Zacheu L. Santos (1980), Ruth G. Tavares (1981), Jose F. Andrade (1982), Maria E. V. Suarez (1983), Wagner Polito (1983), Thais V. Silva (1984), Nina Coichev (1984), Luis H. Mazo (1985), Orlando Fatibello Fo. (1985), Luiz H. Mazo (1985), Luis A. Azevedo (1986), Milton Capelato (1988), Tânia Tavares (1990, co-supervisor, Dieter Klockow), Dilson Zanette (1992), Maura V. Rossi (1992), Arnaldo Bona (1994), Márcia Guekezian (1996); at UFSCar, José A. Santos (1995), Neila M. Cassiano (1998), Rosa L. G. N. P. Silva (1999), Edemar Benedetti Fo. (2000). Additionally, Neves co-supervised the thesis of Silvia L. Agostinho (1975, superv.: Ivo Jordan), Joachim Gebert (1988, superv.: Dieter Klockow), Horácio D. Moya (1998, superv.: Nina Coichev).

The list of Masters prepared by Neves embraces: at IQ-USP, Roberto Tokoro (1974), Luis A. Azevedo (1976), Nelson C. Milcken (1977), Luis H. Mazo (1978), Vera L. Leitão (1980), João O. Tognolli (1980), Lúcio Angnes (1981), Márcio Augelli (1981), Celia de Oliveira (1982), Maura V. Rossi (1986), Josely K. Oliveira (1986), Evaldo de Oliveira (1986), Jose J. Pecchioni (1988), Márcia Guekezian (1992), Horácio D. Moya (1993), Hilda M. S. Leite (1998); at UFSCar, Joseane Bülow (1994), Luciana M. Saran (1997), E. Benedetti Filho (1997), Maria C. T. Diniz (1998), Débora C. Souza (2000). Neves has also co-supervised the dissertations of Maria F. N. Campos (1991, superv.: Milton Capelato), Cláudia M. M. Inga (1997, superv.: Ivano Gutz), Antonio R Fiorucci (1999, superv.: Eder Cavalheiro), Cláudia Bernal (1999, superv.: Eder Cavalheiro), Elisângela C. Lima (2000, superv.: Antônio Mozeto).

As expected, the "school of Eduardo Neves" is most strongly established at IQ-USP itself, where Neves is the scientific ancestor of half of the current staff of Analytical Chemists, identified in the following diagram.



Neves' academic genealogy (bold) in the section of Analytical Chemistry at the IQ-USP, São Paulo. The dotted frame highlights effective (i.e. non-retired) staff members in 2002. Dotted arrows identify MSc supervisions. Upward arrows point to PhDs that did obtain their degree outside the IQ-USP. Researchers mainly involved with electroanalytical techniques or chemistry are underlined. (Note: to improve clarity, some names have been omitted from the upper half of the diagram).

However, an even higher number of PhDs mentored by Neves conquered positions and has developed productive careers in four public Universities, all with chemistry courses and located nearby, in the middle of the State of São Paulo: D. Franco, G. O. Chierice, L. H. Mazo and W. L. Polito at the Institute of Chemistry of USP in São Carlos (IQSC-USP), O. Fatibello-Filho and M. D. Capelato at the Chemistry Department of the Federal University of São Carlos (UFSCar), J. O. Tognolli at the Chemistry Institute of the State University of São Paulo (IQ-UNESP), and J. F. de Andrade at the Chemistry Department of the USP campus in Ribeirão Preto (DQ-FFCLRP-USP).

Most other disciples have spread out in federal universities around the country, but some have established in private institutions in São Paulo; all of them succeeded in improving teaching of analytical chemistry as a science and many were able to introduce or improve research activities in analytical chemistry, regardless of local limitations. It is not surprising, thus, that and incomplete account of the second generation of descendants of the "school of Neves" is reaching three hundred graduates! And the third and fourth generations have been already triggered…

But going back to the seventies, soon after taking up the Associate Professor position in 1977, Prof. Neves and Prof. Tibor Rabóczkay created the Brazilian Symposium of Electrochemistry and Electroanalysis (SIBEE) in a joint effort. The first event took place in October 1978. Established with biannual periodicity, the 2nd, 5th and 6th happenings were also organized at the IQ-USP. The circumstances, the remarkably successful course of this Symposium and its significance in the dissemination and intensification of researches in this field were recently appraised in an article by Profs. L.A. Avaca and R. Tokoro in Química Nova (2002, **25** (Supl.1), 25-30), available at quimicanova.sbq.org.br/qnol/2002/vol25_esp1/04.pdf

In the 80's, Prof. Eduardo established a scientific interchange with Prof. D. Beterrige at Swansea University (UK) based on the use of microcomputers in analytical instrumentation. Later on, he began a long-lasting cooperation with Prof. D. Klockow, from Dortmund University and ISAS (Germany) on environmental analytical chemistry topics. Some of his research ideas have also thrived in other overseas groups, e.g. Rudi van Eldik's (Univ. Witten/Herdecke, Germany). In Brazil, Prof. Eduardo maintained collaborations with many of his disciples and has taken part in several projects; he has personally fundraised to install their own laboratories. Wherever he steps, from thesis defense examining boards to informal conversations, Neves is always discussing research matters and contributing with ideas.

Neves obtained his first title of Full Professor in a public examination at the IQ-USP in 1983. The documentary account of his scientific accomplishments that he presented in that occasion included, alongside with the presentation of his exemplary curriculum and an appraisal of his rich research areas, 32 extra pages in which the candidate introduced himself by means of facts, ideas and points of view. This format, highly praised by the examining board, has been frequently used by others afterwards. In this text, the erudite master summarizes some lessons of life that he has metabolized and attempts to convey to the disciples of his school. As an example, I wish to quote some of his remarks on the creative activity in science:

"No doubt ideas generate ideas. But be careful! Although paradoxical this may seem, excess of study inhibits creative imagination. Ideas often arise during scientific debates and this makes seminars and scientific congresses – where attentive listeners can unexpectedly find solutions to their research dilemmas – so important. The informal every-day scientific debate is even better. I do enjoy walking a mile just to have lunch with my post-graduation students outside the campus. Many research problems were discussed in these circumstances, climbing the Pico do Jaraguá hill or around a table in a pub during quiet celebrations … Whoever deals with science cannot utterly separate work from leisure. This is not obsession for work but love to the Art, while waiting for the creativity. Our unconscious self, that generates ideas and is a source of inspiration, does not choose the instant for releasing its fine products. The subconscious needs to be stimulated

and fed … A discreet alert state suffices to seize ideas, which crop up in sudden daydreams, and not to let them flee forever – as it sometimes happens. "

Institutionally, Neves resolutely acted within working groups and committees, as in the Post-Graduation board, where he catalyzed the enlargement of the body of supervisors and post-graduates in analytical chemistry, as well as the assembly of the laboratories, always keeping the Analytical Chemistry course at top ranking in the CAPES assessments. Outside the IQ-USP, he operated within the Chemistry Committees of CNPq and CAPES, among others. From 1987 to 1989, in a skillful and discreet fashion Neves occupied the position of Head of the Department of Fundamental Chemistry of the IQ-USP, which at that time comprised nearly 80 lecturers. Beside fulfilling his institutional duties, he reduced tensions by reallocating researchers who were not well integrated in certain groups; induced some who were no longer motivated, to retire; solved possible conflicts between students and teachers before acquiring consistency and producing repercussions, etc. At the end of his administration, he requested his retirement but, in order to alleviate the huge void created in the Institute, he completed the supervision of his post-graduates and reduced collaborations very gradually, especially with his younger disciples, until they acquired independence.

Nonetheless, instead of than reducing his professional activity, he accepted the invitation from the Chemistry Department of the UFSCar to join his staff and in 1991 he became Full Professor at that University. Hence, he resumed a cycle of intense work, which goes on ever since and includes lecturing, supervising, research and institutional activities. Soon after his integration in the UFSCar, he structured the post-graduation course in analytical chemistry. This course, very well evaluated by CAPES, has prepared dozens of post-graduates and has proved the effectiveness of his determination of starting off both MSc and PhD programs at the same time, against resistance from other sectors of the Department believing that PhD programs had to be postponed. Between 1993 and 1995 he was Head of the Chemistry Department at UFSCar. With the beginning of the new millennium, approaching the age of compulsory retirement, he carries on with such dynamism that he has already been invited (before somebody else does it!) to continue his activity at the UFSCar.

The scientific production of Prof. Eduardo consists of nearly a hundred papers, mainly published in top-line international journals, as can be acquainted in the ISI Web of Science and other data banks. Another four dozens contributions were published in their full form in the Proceedings of the first seven SIBEEs. His curriculum is worth being considered in the CNPq site, Lattes platform (http://lattes.cnpq.br/curriculo/), for its quality as well as for the amazing range of diverse research areas. These include: several fundamental studies on metal complex equilibria, some of them involving mixed and polynuclear species; studies on complex-induced adsorption processes; proposals for analytical instrumentation and computer programs; development of a wide variety of electroanalytical and spectrophotometric methods, sometimes catalytic or, possibly, flow techniques; development of soluble lead-salts batteries; organic electrosynthesis; didactical publications; new applications of classic titrations; solvent extraction studies; kinetic studies, with mechanism proposals; environmental studies on species such as SO_2, nitrogen oxides, humic acids, SF_6 and its degradation products; revisions and important reviews on the situation of analytical chemistry in the country. His research on azide ions received outstanding international attention and brought the American Chemical Society to invite him to present five of his works on the pseudo-halide at the 124th Annual ACS Congress in 1982.

But the relentless research activity of Prof. Eduardo over the decades has not been confined to the academic context. In order to illustrate the wide variety of his accomplishments in applied or technological fields, the following examples will suffice: a) development of an important project on the exploration of residual waters after sea salt extraction, mainly with a research group from the Federal University of Natal, RN; b) coordination of a broad joint project, multidisciplinary

and pluriannual, with Telebrás' *R&D* Division, aiming at upgrading stationary batteries for telephone stations – one of the many outcomes was a prototype absorbed in commercial production; c) consultancies for COPEL (Paraná State Energy Company) on issues of corrosion in hydraulic electricity generators, water pollutants and gas dielectrics, effecting savings of some millions of R$s over the years.

Full Member of the Brazilian Academy of Sciences, Prof. Eduardo is one of those rare analytical chemists in Brazil who has displayed, for decades, top performance within the Productivity Sponsorship system of CNPq. In order to make public his merits, the Brazilian Chemical Association (ABQ) organized and dedicated to him an Analytical Chemistry Symposium during the XXIX Brazilian Congress of Chemistry in 1989. The Brazilian Chemical Society (SBQ) awarded him with the "Simão Mathias" Medal during the Annual Meeting in 2001. In a tribute given in the recent XIII SIBEE (December 2002) he was honored as “Patron of Electroanalytical Chemistry in Brazil” (Editorial, J. Braz. Chem. Soc, 2003, **14**(4) and full text on the CD of the XIII SIBEE).

The present article records the 54th ISE´s tribute to Prof. Eduardo Neves.

I conclude in the belief of having illustrated the academic prominence of Prof. Eduardo Neves and depicted his unparalleled enrolment in the development of electroanalytical chemistry in Brazil, his scientific fertility and his mastering of chemistry as a whole. Still, in these few pages, I could not possibly discuss on personal aspects like his elevated character and integrity, his love to his wife and children, his precise political positions, his sober style of life, detached from material possessions and superfluous comforts, his bonds with his homeland, where he restores energies at least once a year, nor the spirit of companionship almost parental with his students and coworkers.

In short: the stature of Prof. Eduardo Neves magnifies alongside with the extension of the privilege of sharing his friendship.