Remembering the past – studies on evolution done by the genetics group at Universidade Federal do Rio Grande do Sul (UFRGS)

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Abstract

After a brief introduction about the factors that are involved in science development, and world and Brazilian evolutionary genetics, the studies developed in Porto Alegre in this area were reviewed. Four periods in the development of this group were distinguished: (a) Origins and first expansion (1949-1961); (b) Second expansion (1962-1988); (c) Third expansion (1989-2001); and (d) The last 15 years (2002-present). The international Porto Alegre Biological Evolution Workshops (PABEWs), with five biannual events from 2007 to 2015, were also mentioned. The final message stressed the importance of the maintenance of this and other Brazilian groups of research through adequate finance and recognition.

Keywords: History, genetics research, evolutionary genetics, Porto Alegre, Brazil.

Factors involved in science development

What conditions the formation and maintenance of a research group? We could conveniently classify them in two components. The first is environmental. Important scientific investigation cannot thrive in a hostile environment, characterized by violence (wars, within-nations arrest due to power contests), poor economic development, or general ignorance about the importance of science. The second is mainly historical; it depends on the presence of the right person, in the right place. All societies have persons endowed with high intelligence and adequate drive to pursue a successful scientific career. However, they may never have the opportunity of adopting it due to the absence of adequate conditions. Another crucial factor is continuity. Initially favorable situations may be of short duration, and the entire enterprise may then fail to be maintained. In addition, the formation of a scientist is a slow process. It depends on an initial adequate interpersonal relationship in the educational process, which is of an artisan type. The assimilation of the abstract concepts involved requires time and may be subjected to distracting interests. Therefore, research groups lasting for many years are rarely numerous.

It is in this context that we should view the history of our group that, despite fluctuations in the economic conditions and governmental policies, maintained a pattern of excellence not common in Third World countries. This continuity can be documented through the years that elapsed since Doctoral titles were awarded to the main contributors of our research group (Table 1). The dates extend from 1954 to 2009, more than half a century, with a steady rhythm of growth during the 1970s to 1990s.

World and Brazilian evolutionary genetics

The beginning of evolutionary genetics can be conveniently dated to 1908, when the fundamental principle developed by G. H. Hardy (1877-1947) and W. Weinberg (1862-1937), established what would be the fate of genes in populations. What could be labeled as the period of classical genetics extends from 1900 to 1953 (Carlson, 2004), and the formation of the UFRGS genetics group occurred during the fusion of Darwinism and Mendelism, in the fertile two decades (1930-1950) of the development of the synthetic theory of evolution (Herrera et al., 2016).

The subsequent years were characterized by a phenomenal development in the area of genetics, starting in 1953 with the elegant DNA molecule model devised by James D. Watson (born in 1928) and Francis H. C. Crick (1916-2004), to which Rosalind E. Franklin (1921-1958) and Maurice H. F. Wilkins (1916-2004) significantly contributed.

The progress in the area of evolutionary genetics was in great part due to the development of laboratory and analytic methods for the study of population variability, that evolved from immunological to biochemical, to molecular determinations, that then were extensively analyzed by computer and bioinformatics programs.
Table 1 - List of the main researchers involved in evolutionary studies in Porto Alegre with the dates they obtained their Ph.D. degrees.

| Researcher                  | Main organisms studied | Date of Ph.D. award |
|-----------------------------|------------------------|---------------------|
| 1. Antonio R. Cordeiro     | Animal                 | 1954                |
| 2. Francisco M. Salzano     | *Homo sapiens*         | 1955                |
| 3. Edmundo K. Marques      | Animal                 | 1968                |
| 4. Fernando J. da Rocha    | *Homo sapiens*         | 1970                |
| 5. Maria Irene B. Moraes   | Plant                  | 1971                |
| 6. Casemiro V. Tondo       | *Homo sapiens*         | 1971                |
| 7. Helga Winge              | Plant                  | 1971                |
| 8. Maria José Melo e Freitas | *Homo sapiens*       | 1971                |
| 9. Aldo M. Araújo          | Animal                 | 1973                |
| 10. Margarete S. Mattevi   | Animal                 | 1974                |
| 11. Marly Napp             | Animal                 | 1975                |
| 12. Alice K. Oliveira      | Animal                 | 1979                |
| 13. Tania A. Weimer        | *Homo sapiens*         | 1980                |
| 14. Maria Helena L. P. Franco | *Homo sapiens*      | 1980                |
| 15. Mara H. Hutz           | *Homo sapiens*         | 1981                |
| 16. Vera L. S. Valente     | Animal                 | 1984                |
| 17. Suzana C. Molina       | Plant                  | 1984                |
| 18. Sídia M. Callegari-Jacques | *Homo sapiens*    | 1985                |
| 19. Thales R. O. Freitas   | *Homo sapiens*         | 1990                |
| 20. Márcia Margis-Pinheiro | Plant                  | 1993                |
| 21. Rogério Margis         | Plant                  | 1993                |
| 22. Maria Cátira Bortolini | *Homo sapiens*         | 1996                |
| 23. Tatiana T. Souza-Chies | Plant                  | 1996                |
| 24. Sandro L. Bonatto      | *Homo sapiens*         | 1997                |
| 25. Eligion L. S. Loreto   | Animal                 | 1997                |
| 26. Karen L. Haag          | Animal                 | 1997                |
| 27. Loreta B. Freitas      | Plant                  | 1997                |
| 28. Eliane K. Santos       | Plant                  | 1999                |
| 29. Fernanda Bered         | Plant                  | 1999                |
| 30. Eduardo Eizirik        | Animal                 | 2002                |
| 31. Nelson J. R. Fagundes  | *Homo sapiens*         | 2007                |
| 32. Andréia C. T. Zolet    | Plant                  | 2009                |

Flavio Lewgoy never obtained a formal Ph.D. degree.

What was happening in Brazil during these years? Well, no Brazilian received the Nobel Prize for his/her studies in evolutionary genetics. However, Brazilian researchers followed closely these tendencies, furnishing valuable data of worldwide importance. I have reviewed this information along the years (Salzano, 1979, 2011, 2012) and the reader is referred to these publications for more details.

Studies in Porto Alegre

Origins and first expansion (1949-1961)

It all started with a young man of 24 years of age, Antonio Rodrigues Cordeiro, student of the Natural History Course, School of Philosophy, University of Rio Grande do Sul (at the time it was not yet a Federal University). After a practical class on *Drosophila melanogaster* he decided to verify whether these flies occurred also in our environment. He then wrote to Croddovaldo Pavan, at the time an Assistant Professor at the University of São Paulo, who sent him a detailed letter on the way that these flies could be collected and raised in the laboratory.

One year later, Theodosius Dobzhansky, one of the scholars responsible for the development of the synthetic theory of evolution, arrived in São Paulo for a stay of one year, and Cordeiro, together with A. G. L. Cavalcanti (who worked in Rio de Janeiro) were selected for a one-year fellowship to form (with others) the team responsible for the research to be coordinated by Dobzhansky.

In September, 1949, A. R. Cordeiro returned from São Paulo. He was already an Assistant Professor at UFRGS, and with the decisive support of the then Director of the School of Philosophy, Bernardo Geisel (1901-1985), he organized a small laboratory in the basement of the Law School. The first expansion of genetics research in Porto Alegre occurred in 1953, when we moved to a new building with much more space, which was the seat of a newly created Institute, the Institute of Natural Sciences. During the period that elapsed until the new move, in 1961, significant research was performed, which is summarized in Cordeiro and Salzano (1961).

My relationship with the group started as a voluntary student, before my graduation, in 1950. In the next year I received a fellowship from the University of São Paulo, and during one year worked there under the guidance of Antonio Brito da Cunha, Croddovaldo Pavan, and Hampton L. Carson, from the Washington University, Missouri, USA. After returning to Porto Alegre in 1952 I was invited to work as an Instructor at UFRGS, the institution where I remained until now. Four years later (1956) I obtained a one-year post-doctoral fellowship to work at the University of Michigan, Ann Arbor, under the supervision of James V. Neel, and after my return started to work on human population genetics, that continues up to the present.

Selected aspects of the research in evolutionary genetics performed at the time will now be briefly summarized. Key persons involved besides Cordeiro and myself were, in alphabetical order of the first name, Casemiro V. Tondo, Edmundo K. Marques, Flavio Lewgoy, Helga Winge, and Marly Napp.

Recessive alleles concealed due to dominance in *Drosophila* could be detected due to a skillful method of crossings. These were performed by the group using *Drosophila willistoni*, and the main results were reported in Burla et al. (1949), Pavan et al. (1951), Cordeiro (1952), and Cordeiro and Dobzhansky (1954).

In 1956 the laboratories of biophysics and genetics merged, and Casemiro V. Tondo became a full member of the group. Cordeiro was aware of the need to develop new
methods of genetic analysis, and together with Tondo and Flavio Lewgoy, a biochemist, produced a series of four articles all entitled Biophysical Genetics (Tondo and Cordeiro, 1956; Lewgoy and Cordeiro, 1958; Tondo et al., 1959; Cordeiro et al., 1960a). They applied chromatography, paper electrophoresis, and spectrophotometric methods to characterize homo and heterozygous strains, as well as interzarial hybrids of Drosophila willistoni.

Concomitantly, inversion polymorphisms and the peculiarities of the bocainensis cryptic group of species were investigated by Da Cunha et al. (1953) and Salzano (1956). The fate of chromosome inversions experimentally released in populations where they had been previously absent was examined by Cordeiro et al. (1960b).

In another area, the first studies in plants were performed by Winge (1959), on the cytotaxonomy and polymorphism of the genus Allophila (Iridaceae).

Studies in human evolutionary genetics had started in 1958, and a series of papers reporting the investigations performed among the Kaingang Amerindians of Rio Grande do Sul were published (Salzano, 1961a-d).

Second expansion (1962-1988)

The transfer of the Department’s seat from the UFRGS Central Campus to a new and much expanded space, located in three floors of a commercial building situated in the center of the city, opened considerable new opportunities for expansion, both in terms of personnel and research.

Considering first studies in animals, the investigations with Drosophila continued with vigor; examples are as follows: 1. The finding of hybrids between D. willistoni and D. paulistorum (Winge and Cordeiro, 1963), first denied by some researchers, but afterwards firmly confirmed; 2. the question of the adaptation of D. willistoni to an environment with high background radiation (Cordeiro et al., 1973); 3. biochemical variability (esterases, alcohol dehydrogenases) in natural populations (Napp and Cordeiro, 1978; Albuquerque and Napp, 1981; Oliveira and Cordeiro, 1985; Uriarte and Napp, 1988); 4. ecology in D. incompta (Hofmann and Napp, 1984); and 5. chromosomal polymorphism in D. willistoni (Valente and Araújo, 1986).

Studies on the butterfly genus Heliconius were performed by Lima and Araújo (1982), and Menna-Barreto and Araújo (1985). Going from insects to mammals, investigations were done on Scaepetromys (Freitas et al., 1984), Nectomys (Maia et al., 1984), and Deltamys (Sbalqueiro et al., 1984). Also, a long-term relationship between the Genetics Departments of the Federal Universities of Rio Grande do Sul and Pará resulted in four articles about the genetic variability of Amazonian bufaloes and non-human primates (Cebus, Alouatta). Details can be obtained with Horacio and Maria Paula Cruz Schneider, in Belém.

Plant evolutionary genetics involved: 1. Chromosome relationships in the genera Paspalum and Axonopus (Gramineae), (Moraes-Fernandes et al., 1968, 1973, 1974; Hickenbick et al., 1975); 2. Altitude and cyanogenesis in the white clover Trifolium repens (Araújo, 1976); and 3. Biochemical variability in the rubiaceae Relbunium (Porto et al., 1977; Cavalli-Molina and Winge, 1988).

Extensive work during this period was done on human populations, and the corresponding list of publications is too extensive to be given in full. Key persons at this time were (again by alphabetical listing of the first name) Case-miro V. Tondo, Fernando J. da Rocha, Mara H. Hutz, Maria Helena L. P. Franco, Maria José de Melo e Freitas, Sídia M. Callegari-Jacques, and Tania A. Weimer. I published studies resulting from field work on Amerindians, including the Kaingang, Xavante, Kayapo, Krahó, Macushi, Wapishana, Yanomama, Ticuna, Pacaás Novos, Sateré-Mawé, and Içana River populations. These studies, together with others done by our group and by additional researchers, were considered in a global way by Salzano and Callegari-Jacques (1988). Non-Amerindian populations were also investigated, including communities from Porto Alegre, Natal, Aracajú, and several Amazonian locations. Special mention should be made of the discovery of Hemoglobin Porto Alegre (Tondo et al., 1963) due to its peculiarity (in vitro polymerization into octamers and dodecamers), as well as its intermediate frequency, not being very rare nor much frequent. These results, together with those presented in the context of the next historical period, were reviewed in Salzano and Bortolini (2002).

Third expansion (1989-2001)

With the increase in the number of persons and studies that occurred in this and the following period, references would have to be even more selective than those of the previous sections. Starting with animal evolutionary genetics, 12 articles reporting Drosophila results have been published; including D. nebulosa, D. maculifrons, D. willistoni, D. paulistorum, D. simulans, D. polymorpha, D. tripunctata, and many other species. A general review about the transposable elements in Neotropical Drosophila was published by Loreto et al. (1998). Work on other insects were much less numerous, including aphids, Chauleognathus (Coleoptera), and Dryas iulia (Lepidoptera; Haag et al., 1993). Studies in rodents were numerous, involving work on Deltamys, Ctenomys, Oryzomys, Oligoryzomys, Akodon, Rhipidomys, Delomys, Nectomys, and Dendomys genera, as well as two species of bats and Neotropical cats (Eizirik et al., 1998). The association between the Federal Universities of Pará and Rio Grande do Sul (see the previous section) resulted in nine articles published between 1989 and 1995 on biochemical protein polymorphisms, and seven on chromosome markers, all in New World primates. Details about this latter data set can be obtained from Julio Cesar Pieczarka and/or Cleusa Y. Nagamachi in Belém.
In plants, additional studies in *Relbunium*, *Ilex*, and *Leucaena* (Leguminosae; Cardoso et al., 2000) were published.

As far as humans are concerned, as mentioned previously, the results obtained on non-Amerindian populations were extensively reviewed in Salzano and Bortolini (2002). Special mention can be made of a series of articles that resulted from a joint program of our group with the Biological Anthropology Department, School of Humanities and Education Sciences, Universidad de la República, Montevideo, as for the study by Sans et al. (1997). This period was especially fruitful with regard to the genetic investigations on Amerindian populations, performed in association with a network of colleagues from Latin America, North America, Europe and Asia. No less than 47 different groups (Table 2) were investigated on various aspects related to protein and DNA markers. Details can be provided on request. Two especially important, widely cited papers were those of Bonatto and Salzano (1997a, b) who, through a sophisticated analysis of Amerindian mitochondrial DNA sequences, arrived at the conclusion that the prehistoric peopling of the Americas occurred due to a single and early migration.

The last 15 years (2002-present)

The amount of publications presented in this period is very large, and a comprehensive list is impossible within the limits of this review. Therefore, only general information is provided in Tables 3-6, with indications of the years in which they were published and the colleagues who could give more details about them.

Table 3 presents some selected examples of studies of general nature and of those involving microorganisms. Recently, Cazé et al. (2016) considered the question of factors affecting the genetic variability of the Atlantic Forest, with special reference to the refuge theory and river barriers.

Selected studies on plants are listed in Table 4. A large number of proteins of different types were surveyed in many species, searching for factors involved in their evolution. Specific studies in nine taxonomic families were indicated in the table, and specific mention can be made of a phylogenetic study with ecological niche modeling in the Myrtaceae (Turchetto-Zolet et al., 2016), relating them with climate changes in the southern and northern Atlantic Forest.

Animal research, in species ranging all the way from Platyhelminthes to primates, is mentioned in Table 5. The Paired box (PAX) family of transcription regulators and developmental genes plays a key role in numerous stages of embryonic development, and its variability from Porifera to Vertebrates was investigated by Paixão-Côrtes et al. (2015). At another level, an analysis of the Drosophilid fauna was performed to address the question of the conservation units in the Caatinga biome (Oliveira et al., 2016).

Selected examples of human evolutionary studies are given in Table 6. The whole genomes of *Homo sapiens*, *Homo neanderthalensis*, and Denisovans were searched by

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Table 2 - List of the Amerindian populations for which genetic data have been reported by members of the Porto Alegre group in collaboration with many colleagues from Latin America, North America, Europe, and Asia, in the period between 1989 and 2001.

| Amerindian populations          |                  |
|---------------------------------|------------------|
| 1. Ache                         | 25. Mapuche      |
| 2. Apalai-Wayana                | 26. Mataco (Wichi) |
| 3. Arara                        | 27. Mundurucu    |
| 4. Araweté                      | 28. Mura         |
| 5. Asurini-Koatinemo            | 29. Mvskoke      |
| 6. Asurini-Trocara              | 30. Pacaás Novos |
| 7. Ayoreco                      | 31. Palikour     |
| 8. Carrier-Sekani               | 32. Parakanã     |
| 9. Choroti                      | 33. Pilagá       |
| 10. Cinta Larga                 | 34. Pukany       |
| 11. Galibi                      | 35. Sateré-Mawé  |
| 12. Gavião                      | 36. Suruí        |
| 13. Guarani                     | 37. Tehuelche    |
| 14. Íçana River                 | 38. Tenharim     |
| 15. Jamamadi                    | 39. Ticuna       |
| 16. Kaingang                    | 40. Tiriýó       |
| 17. Kararahô                    | 41. Toba         |
| 18. Karitiana                   | 42. Urubu-Kaapor |
| 19. Kayapo                      | 43. Wai Wai      |
| 20. Krahó                       | 44. Waïapi       |
| 21. Kubenkokre                  | 45. Wayana       |
| 22. Lengua                      | 46. Xavante      |
| 23. Macushi                     | 47. Zoró         |
| 24. Makiritare                  |                  |

Table 3 - Selected examples of evolutionary studies of a general nature and on microorganisms performed by members of the Porto Alegre group (2002-present).

| Year    | Nature of the study                          | Contact                  |
|---------|----------------------------------------------|--------------------------|
| 2007    | Phylogenomics of mycoplasmas                 | S.L. Bonatto             |
| 2007, 2010 | Phylogeny, Ciliophora, Peritrichia          | E. Eizirik               |
| 2008    | Molecular markers, populations, and geography | S.L. Bonatto, E. Eizirik, T.R.O. Freitas |
| 2011    | Rates of evolution, porcine parvovirus       | S.L. Bonatto             |
| 2013/14 | Population expansion and genome reduction in microsporidia | K.L. Haag |
| 2015    | Retrovirus, felids, identification and characterisation | E. Eizirik |
| 2016    | Hepatitis B virus distribution in an ecological context | N.J.R. Fagundes, F.M. Salzano |
|         | Refuge theory, geographical barriers, and biome variability in the Atlantic Forest | L.B. Freitas, S.L. Bonatto |
Table 4 - Selected examples of plant evolutionary studies performed by members of the Porto Alegre group (2002-present).

| Year       | Nature of the study and organisms                                                                 | Contact                                                                 |
|------------|--------------------------------------------------------------------------------------------------|------------------------------------------------------------------------|
| 2003-present | Extensive number of different types of proteins, their taxonomic distribution, phylogeny and phylogeography | M. Margis-Pinheiro, R. Margis, L.B. Freitas, A.C. Turchetto-Zolet          |
| 2009       | Aquifoliaceae, *Ilex* phylogeny                                                                  | T.T. Souza-Chies                                                       |
| 2016       | Asteraceae, *Gerbera*, phylogeny and biogeography                                                 | T.T. Souza-Chies                                                       |
| 2007-2016  | Bromeliaceae, *Vriesea, Bromelia, Aechmea* molecular variability                                  | F. Bered                                                               |
| 2011, 2015 | Iridaceae, *Sisyrinchium*, cytogenetic distribution, phylogeny                                   | E.K. Santos, T.T. Souza-Chies                                          |
| 2012       | Lamiaceae, *Canilla*, phylogeny                                                                 | T.T. Souza-Chies                                                       |
| 2016       | Myrtaceae, phylogography                                                                         | R. Margis                                                              |
| 2005-present | Passifloraceae, extensive studies on large number of species, and aspects of their evolution, phylogeny, and phylogeography | L.B. Freitas                                                           |
| 2006, 2008, 2015, 2016 | Poaceae, *Briza, Paspalum, Eryochrysis, Saccharum*, phylogeny, hybridization | T.T. Souza-Chies                                                      |
| 2006-present | Solanaceae, *Petunia*, large number of studies on their phylogeny and phylogeography            | L.B. Freitas                                                           |

Table 5 - Selected examples of animal evolutionary studies performed by members of the Porto Alegre group (2002-present).

| Year, 2013, 2015 | Nature of the study and organism                                                                 | Contact                                                                 |
|------------------|--------------------------------------------------------------------------------------------------|------------------------------------------------------------------------|
| 2006, 2008, 2016 | General, Paired box (PAX) gene family, origins, evolvability, phylogeny                          | M.C. Bortolini, F.M. Salzano                                          |
| 2010             | Platyhelminthes, Cestoda, *Echinococcus*, variability, phylogeography                            | K.L. Haag                                                              |
| 2004             | Arthropoda, Coleoptera, *Chauliognathus*, phylogeny                                              | S.L. Bonatto                                                           |
| 2011             | Arthropoda, Lepidoptera, *Heliconius*, kin recognition, evolutionary implications                | A.M. Araújo                                                           |
| 2002-2016        | Arthropoda, Diptera, *Drosophilidae, Drosophila, Culicidae, Anopheles*, extensive investigation on all aspects of evolutionary diversification in many species, phylogeny, transposon identification and coevolutionary relationship | V.L.S. Valente, E.L.S. Loreto                                        |
| 2011             | Vertebrates, Siluriformes, Neoplecostominatae, Hypoptopomatinae, phylogeny                       | S.L. Bonatto                                                           |
| 2006, 2012       | Reptilia, *Bothrops, Corallus*, Dipsadidae, phylogeny                                          | S.L. Bonatto                                                           |
| 2009, 2016       | Aves, *Scytalopus, Eleosscytalopus*, Ramphastidae, toucans, phylogeny, phylogography, cryptic diversification | S.L. Bonatto, T.R.O. Freitas, N.J.R. Fagundes                           |
| 2016             | Mammalia, placental, oxytocin and arginine vaspressin receptor evolution                        | M.C. Bortolini, F.M. Salzano                                          |
| 2004             | Mammalia, Insectivora, origin                                                                    | E. Eizirik                                                            |
| 2002-present     | Mammalia, Rodentia, *Ctenomys, Calomys*, *Zigodontomys*, extensive study involving many species, chromosome evolution, hybrids, phylogeny, phylogeography | T.R.O. Freitas                                                        |
| 2002-present     | Carnivora, Felidae, Mustelidae, Canidae, extensive study, many species, phylogeny, hybridization, phylogeography, implications for conservation. | E. Eizirik, T.R.O. Freitas                                            |
| 2015, 2017       | Primates, oxytocin (OXT) and its receptor (OXTR), coevolution, paternal care in New World primates | M.C. Bortolini, F.M. Salzano                                          |

Paixão-Côrtes et al. (2013) to investigate the question of possible differences in cognitive ability between extinct and extant hominins. Results from 51 genes that affect this ability indicated similarity, with all the derived alleles being present in the three entities; while alternative models of human evolution were tested by Fagundes et al. (2007).

Latin American populations were extensively investigated during the period considered, and the question of interethnic admixture dynamics was addressed by Salzano and Sans (2014).

As for Amerindians, the prehistoric peopling of the Americas was examined in detail, using craniofacial morphology and uniparental genetic markers (González-José et al., 2008). The French Guiana Amerindians were investigated using protein and DNA (autosome, mtDNA, Y-chromosomal) markers, and the fundamental question of the relationship between gene and culture was addressed in several publications, especially for the Xavante (Hüne-meyer et al., 2012). These Amerindians were the subject of a whole book published by Coimbra Jr et al. (2002).

The Porto Alegre Biological Evolution Workshops (PABEWs)

In 2006 our group, together with some other colleagues, considered it appropriate to start a cycle of international workshops in which key aspects of the evolutionary...
process could be discussed, where working hypotheses could be formulated and research projects delineated to answer questions. The invited persons, both Brazilian and foreigners, needed to have a wide vision of the evolutionary processes, which should be considered from a historical-philosophical point of view using empirical data from plant, animals, and humans. The first Workshop occurred in November, 2007, followed by four others in 2009, 2011, 2013, and 2015, always in November. Their format was also always the same: one-hour conferences, all by worldwide renown scholars, would be followed by 10 minutes of comments given by two specialists, followed by participation from the audience. The discussion period was always equal to that of the conference. The number of participants could not be more than 120, and attendance was subjected to previous selection, to assure that only persons already involved in evolutionary studies would attend.

The Fifth PABEW was held from November 9 to 11, 2015, in the Auditorium of our Department. It included 13 non-Brazilian speakers from Argentina, French Guiana, USA (3), UK (2), Norway, Switzerland (2), France, Spain, and Australia. Among the Brazilian commenting researchers 11 were from universities other than UFRGS. The meeting, as the previous ones, was a success for interchange of ideas and results, which in some instances led to the formation of joint research projects.

**Final message**

As was emphasized at the beginning of this article, the process of formation of research groups is a slow one, and their maintenance is always in danger due to internal or external factors. These difficulties are especially notable in Third World countries, making the maintenance of our group for almost seven decades a remarkable event. It was, therefore, appropriate to review these accomplishments now, especially since Brazil is in a new period of economic difficulties, and there are generalized misunderstandings among our government officials about the importance of science. I finish this paper by expressing my hopes that this situation will be transitory, and that we and colleagues from other institutions will continue to contribute in a significant way to world knowledge.

**Table 6** - Selected examples of human evolutionary studies performed by members of the Porto Alegre group (2002-present).

| Year          | Nature of the study                                                                 | Contact                                                                                     |
|---------------|--------------------------------------------------------------------------------------|--------------------------------------------------------------------------------------------|
| 2005, 2007, 2012, 2013 | 1. Non-Amerindian populations  
1.1. Extinct and extant, worldwide, comparison of *H. sapiens* with neandertals and denisovans, alternative models of human evolution, and variability in the low density lipoprotein receptor (LDLR) gene | N.J.R. Fagundes, S.L. Bonatto, M.C. Bortolini, F.M. Salzano                               |
| 2003-2005, 2007, 2015   | 1.2. Latin America, studies in populations from Rio Grande do Sul, Porto Velho (Amazon), Uruguay, Argentina, Colombia, and Venezuela | M.C. Bortolini, F.M. Salzano, M.H. Hutz, S.M. Callegari-Jacques                           |
| 2003-2005, 2007-2009, 2014 | 1.3. Interethnic admixture, Latin America, genetic and genomic approaches, many populations | M.C. Bortolini, F.M. Salzano, S.M. Callegari-Jacques                                    |
| 2002, 2006            | 2. Amerindians  
2.1. General reviews | F.M. Salzano, S.M. Callegari-Jacques                                                          |
| 2007, 2008, 2011, 2012, 2015 | 2.2. Prehistoric peopling of the Americas, general review, genetic and genomic approaches | M.C. Bortolini, F.M. Salzano, N.J.R. Fagundes, S.L. Bonatto                           |
| 2002, 2008, 2010, 2012, 2013, 2015 | 2.3. Gene-culture coevolution, ecology, genetic/genomic relations with languages, other aspects of culture | M.C. Bortolini, F.M. Salzano, S.L. Bonatto, N.J.R. Fagundes                           |
| 2006-2009, 2011       | 2.4. French Guiana, extensive investigation of its Amerindians, in close collaboration with colleagues from Toulouse, France | F.M. Salzano, S.M. Callegari-Jacques, M.H. Hutz, M.C. Bortolini, S.L. Bonatto          |
| 2002, 2007, 2008      | 2.5. Specific population approaches, extensive studies in Kaingang, Guarani, Xavante and Ache populations | F.M. Salzano, S.M. Callegari-Jacques, M.C. Bortolini, M.H. Hutz |
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