

## **UN RICORDO DI BACCIO BACCETTI A 10 ANNI DALLA SUA SCOMPARSA**

On 18-12-2010 died Baccio Baccetti, professor of General Biology and Zoology at the Siena University

On December 2011, the 1<sup>st</sup> anniversary, colleagues and friends met in the Accademia dei Fisiocritici in Siena, to recall and to commemorate the man, the life and work. Now, in the 10<sup>th</sup> anniversary, the proceedings of the meeting are published.

### **BACCIO BACCETTI - 2 DECEMBER 2011**

**Sara Ferri**

Accademico Fisiocritico

I met Baccio at the Academy. It was probably 1964 and I was part of the examination body in Biology for Medicine chaired by Prof. Omodeo.

Baccio, with his wife and son of about 2-3 years who was crying despairingly, had come to introduce himself to Omodeo, who was about to leave Siena, having been called to the University of Padua. At that time the Faculty of M. P. and N. Sciences was in the process of being established in Siena, and it would have had the need for many new professors to cover the teaching roles not present in Siena. And in fact Baccio was called to the new Faculty in 1965 as a temporary in General Biology and Zoology.

The Academy was very different then to how it is today: there was no glass door and the wooden main door was always closed. When you entered there was the closed door of what today is the Soldani room with a stuffed dog on a mat in front of it. The portico of the cloister was bricked up with some small windows; the lighting in the corridors was provided by weak light bulbs. Almost all of the first floor was occupied by the Institute of Biology directed by Omodeo who held his lesson in a small classroom on the ground floor, no longer in existence today.

The registers of the Academy show that after the annual assembly of 1959 chaired by President Francesco Spirito, who died in 1962, the next one is dated 1963 with the election of Prof. Ruggero Bertelli as president. The few meetings of the Council which followed, often cancelled due to lack of participants, took place at the hospital of Santa Maria della Scala because there was no heating in the Academy.

The constitution of the new Faculty of Sciences, brought a group of young teachers in naturalistic disciplines to Siena (Baccio Baccetti, Renato Pellizzer and others) who, together with several young teachers from the medical-biological sciences (including Carlo Ricci, Leonetto Comparini, Mauro Barni, Virgilio Lazzeroni), considering the academy with its museum and its library a structure worth reassessing, suggested returning the *Fisiocritici* to its ancient splendour. In 1965, to meet University's need to find new places and new areas for the Faculty of Sciences which was being formed, the Academy gave up part of the rooms and land it owned to build the Botany, Zoology and Mineralogy institutes. As payment for the divestitures which took place, the University undertook the restoration of a good part of the Academy's rooms. The cloister was reopened by

eliminating the brickwork from the arches and putting in appropriate windows; a large part of the unsafe roof was rebuilt and all premises were equipped with heating.

A great undertaking was the reorganization of the museums. The collections that had not been lost during the time it had been neglected, were reorganized, new shelves were built and all the palaeontological and geological collections were reunited on the ground floor (most had been on the first floor) and the zoological ones (which were on the ground floor) went to the first floor. In the new set up, the exhibits were arranged with scientific criteria so that they were didactically efficient. And everything on display was accompanied by a specific tag.

Creator of the reorganization of the Zoological Museum was Baccio, who had become a professor on 18 March 1968, elected as Superintendent of the Zoological Museum on 6 March 1969, an office which he filled up to (31 May) 2010, thus for 41 years, and the *Fisiocritici*, grateful, nominated him Honorary Professor at their meeting in April 2010. The reorganization of the Museums was a massive task carried out in a very short time.

On the occasion of the inauguration of the Museums on 13 January 1972 with the new arrangement in the restored rooms, commemorated with placement of a plaque in Aula Magna, President Carlo Ricci addressed a warm thanks not only to Superintendents Baccetti and Pellizzer, but also to the teaching and non-teaching staff of the Institutes of zoology and mineralogy that "with youthful ardour has materially contributed to the set up".

With the new course of the Academy, a new Statute and new agreement was drawn up with the University and frequent scientific meetings on various topics were held in the Aula Magna of the *Fisiocritici*, calling upon personalities from other universities, which were largely organised by Baccio. Not only that: Baccio planned seminars for teachers of upper and lower secondary schools and competitions for pupils from elementary schools were held for the preparations of naturalistic collections; the winners were given a microscope. During the week there were frequent visits by schools under the guidance of university teachers and graduates, while the museums were open to the public on Sunday mornings.

Baccio had the good fortune to meet a little boy, a young Fabrizio Cancelli who, after adequate preparation and under his guidance, began to enrich the Zoological Museum with many new artefacts, something made possible by the re-establishment, which Baccio had strongly desired, of the zoological laboratory that had been lacking at the Academy for almost a century.

With the collaboration of Fabrizio Cancelli, who in the meantime had become an excellent taxidermist, the Zoological Museum was enriched, by means of an agreement with the National Park of Abruzzo, with various specimens: among which the Marsican bear, the wild cat and bone findings of the chamois; the cassowary and echidna, study animals which were dead by now. also arrived at the Museum. Through his friendships with directors of zoological museums and aquariums, Baccio brought many animals there, including a bottlenose dolphin of over three meters from Milan and a shark from Livorno.

We cannot fail to mention the adventurous recovery of a young specimen of a 15-meter common fin whale which had beached on the nearby coast at Piombino in 1974. Baccio did not let the opportunity escape him and, with his collaborators, organized the burial of the mammal with a digger and crane from the Steelworks. Eight years later the skeleton was recovered, reconstructed and mounted in the courtyard of the Academy, where still today it is a fine show and has become the symbol of the Museum. That was the beginning of the Zoological Museum's specialization in cetaceans with participation at the Centro Studi Cetacai, today the Tuscan Cetaceans Observatory.

Much more should be said of the commitment and love that Baccio showed for "his" Zoological Museum. I would just like to recall a preparation carried out with his own hands: an entomological box with a sectioned locust accompanied by all the explanatory cards, a great example of teaching.

The zoological section still today maintains the set up created by Baccio and the various tags with explanations are his. I believe that a visit to this collection which he reorganized and wanted is the best way to pay tribute to him.

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## BACCIO OR THE FASCINATION OF RESEARCH

**Mauro Barni**

Accademico Fisiocritico

To speak about Baccio Baccetti, when his loss still has not been accepted in our mind, demands a proper, loving recollection but it is also, for me at least, cause for a subtle anxiety, quivering self-doubt, knowing as I do that he cannot contradict my words, as so often happened during our many conversations, in the eccentric alternations of our smug recitatives about transcendency and the futilities of our time. Perhaps though (I do enjoy fantasizing about it) my Friend is listening to me from some unlikely corner of His Universe, neither Infinite nor Eternal. That is how he thought about it, indifferent as he was to every fideism and, perhaps, to every hope if not those which could be attacked and dominated by science. What survives, in addition to the outcomes, often original, of an unfinished research, and at least in our archive of memories and dreams, is a glimmer of intelligence, a glow of energy, the sense of an amicable irony.

At the end of this brief foray of mine, perhaps foolish, into the labyrinth of a singular personality, but only at the end of it, I will answer for my extravagant hypothesis, but I will do so with his words, drawn from my memories and his lesser known writings, from his most beautiful letters, those that Nicola Baccetti, our dear, clever Nicola, generously made known to me. Thus, in recomposing an unexpected and possibly senseless mosaic as best I can, I will be able to grasp, together with those who are listening to me, some part of a profile, fascinating, disturbing, lovable, a deliberately stinging but intensely pervasive physiognomy, leaving to others, far more authorised, the summary of an undoubtedly brilliant scientific industriousness.

The first *flash-back* that springs to mind is like a single fluid snapshot in the long corridor on the first floor of the "anatomical rooms" of the Laterano. It is a late spring morning of 1965 and the poignant perfume of the linden trees in flower penetrates in a most intrusive way. With his gangly gait Baccio approaches a group of young colleagues: Leonetto Comparini, Carlo Ricci and myself and, I think, Bonetti, and introduces himself, candidate to the chair of Biology of the faculty of Medicine, as if for an informal meeting, almost as if he were there by chance. And it was immediate friendship, as if we were four friends at the bar, and he captivated us, smiling and bouncing around in a conversation which ran rampant, devoid of any scholarly ways, suited in any case to the new times that were impinging upon the university, for better or for worse.

And yet this new spirit did not enthuse the not so young of the Faculty, starting with the supreme Principal Alberto Bencini who, good ophthalmologist that he was, said to him "Look out, boy!" And even his most beloved teacher and predecessor, Emanuele Padoa, in the institutes so cruelly cramped, loaned by the Physiocritics, wrote to him from Florence (undated letter in the spring of 1965): Be careful, because *an assumption is taking root in the workplace that you are a little arrogant, such as, for example when they were looking for the area* (that is the research headquarters) *you could have gone to see it with the Administration people ...And also: Have you ever been to see the Rector (who is also a Physiologist in the Faculty of Science). Have you ever visited Giacomino Sarfatti (the Botanist)? Have you ever made contact with the geologist? (that good fellow Quattrini), with whom you will have to share the place? Personal advice: as soon you*

*are one of the three ... as soon as they have given you the "neighborhood" dedicate yourself entirely to Siena, organize the Institute, be seen by the others. As far as I'm concerned you are perfectly free to spend all your time in Siena ...*

The answer, very Garibaldian, was "*I obey*"!

And Baccio settled down here, Professor in Medicine and then in Mathematic, Physical and Natural Sciences, and then again to Medicine (toward the end of his academic career), restless but persistent, from his beautiful work place in the extensive buildings of the Orto Botanico, wanted and actually built by Renato Pellizzer, that hosted Mineralogy, Biology, Botany, where Sara Ferri prepared her academic itinerary, in this same atmospheric corner of the Contrada of the Tartuca.

The meetings multiplied as a friendly habit which then became institutional. Baccio was eager to investigate and to grow and become as Director of his own Institute and then (1975-1981) as Dean of Sciences and an authoritative member of the Academic Senate, a forum in which he strongly believed, while at the same time remaining spontaneous, direct, rebellious to any formal and bureaucratic provocations. As Rector at that time, I always admired his ability to demand and also, even, to *annoy*, but exemplarily investing the maximum commitment for the University, always - and rightly so - in the framework of a reciprocity which had to be rewarding, especially for his impassioned scientific mission, initiated and conducted along exploratory paths, obviously fruitful only if pursued with the most sophisticated and expensive equipment (almost unthinkable in Siena), up to enrolling himself in a relational network that helped him, also physically, to reach the cornerstones of biology applied mainly to medicine and supported by biotechnologies. And he was pushed by a tenacity that was often close to bulimia! The exciting sequelae were soon noticed and soon became totally and rightly part of a mighty period at the University of Siena: a period enlightened by the lively coexistence of young personalities of the economic sciences such as Lucio Izzo and Franco Romani, of humanistic speculation, such as Giovanni Previtali and Gianbiagio Conte. Out of this, an informal multidisciplinary sodality was born in which Baccio participated almost like a sorcerer's apprentice, with his congenial lack of discipline and of cultural osmosis pursued with reciprocal meddling in art and science. The constant growth of the scholar and his School thus went far beyond the limits of a commendable dedication: national bodies (and *in primis* the CNR and the Accademia dei Lincei) and the international assizes dedicated to biological sciences, the most qualified and impacted scientific journals, welcomed and then demanded the gifts of a highly original and modern experimental and cultural organization. In that regard I limit myself to recalling the extraordinary research and convincing incursions into the theme of *biology of reproduction* conducted through careful and documented observation on male gametes taken in the most varied conditions and subject to the most daring stimulations, with careful far-sighted and uninhibited attention to the clinical, genetic and reproductive prospects, in the knowledge, which I shared, of the generous reflections on a bioethical vision which was already sectorialized by opposing social and moral bulwarks. We talked long about it ... seriously ... even though the abrasive involvement of Mino Maccari was later genially amusing, easy-going and somewhat rebellious, and gave birth to an impertinent but overwhelming interpretation and satirical illustration typical of an irreverent and nonconformist artist.

The preoccupations that Baccio suffered in his consciousness, even if recalcitrant as far the ethical limits of experimentation were concerned, was debunked in the vitalistic consequences and

in the polite allusion to an inadvertent hypothesis of cellular harvesting for assisted reproduction, free as far as possible from the restriction of a dogmatism which had no other purpose.

Whatever we might say, his scientific life was not completely disorderly nor disillusioned, but it was indeed dominated and guided by the requirement for disclosure, not just with academic teaching but also and above all informative for everyone, aimed at informing the wider audience, preferably the young, of scientific progress, which is always necessary for social progress towards a better quality of being and "*knowing*". And in Baccio grew the ever more convinced belief in the force of the concise and appealing, stimulating and attractive, didactic and evocative, stimulating and attractiveness even of the museal exhibition, but especially media literacy in the adventures of science. The Accademia dei Fisiocritici also became a forge and an exemplary training ground for him, anticipatory to those public socio-cultural purposes articulated by scientific events to which Sara devotes herself today with her collaborators.

Science, just as in the most exciting season of Humanism, pursued the prudent sublimation of the Art in Baccio's fertile mind. And so Siena revealed itself as an ideal and exemplary temple of this synthesis attested by a time of freedom, of ancient democratic aggregations (art and politics), of traditional expressiveness of which he felt the suggestion without however completely understanding the sense of the Contrada and the less playful and fanatic sense of the Celebration. The pagan Sibyls engraved in the floor of the Christian Cathedral supported his curious aspiration to an ecumenism celebrated by Art, just as Paolo Mascagni's tables and his example of life strengthened the fervour in Science intended as the engine of freedom.

He wanted in some way to synthesize all this in an incredible collection of essays on "Cultura e Università a Siena " (1993) demanding from friends their testimonies and studies on those times, the topics, the protagonists of a city laden with glorious centuries, a city still today essential to European culture. But in the words that conclude his work he returns sceptically to the real impact of the University, *made up of large numbers and therefore highly politicized, with the local spontaneous and traditional civilization*. Hence the very dubious question of whether it is the case to impose "*a change perhaps already taking place; that might be positive or negative (?) on current affairs* - he asks himself - *in regard to the city and its culture?*" On the other hand - he concludes - *the problem is less obvious and expected than it may seem: studying it now seems a little premature ... and for this reason it will be appropriate to pay great attention to it, sooner or later return to it* ...

Pessimism and non-commitment: I do not really believe it. Perhaps just an urgency to return immediately and always to his research.

But here is another Baccio and, to illustrate this, I like to tell of the feast of St Joseph. With my Master, the Rector Giuseppe Bianchini, we celebrated the festival of spring with our families in a beautiful country residence immersed in the tender green of the Umbrian countryside. We departed in the morning not too early from Campino di San Prospero forming a long caravan of cars. Baccio wanted to take a dozen children with him, in a capacious old wreck, to talk to them during the three hours of the slow journey, of fairy tales, dreams, true stories and science, fascinating and amusing them enormously. During the year the afternoon teas at Montalbuccio were a similar appointment which both adults and children longed for.

His favorite form of relaxation were groups of people, vacations with friends and being with his little university court, of which he was at the same time the King, the Host, the animator. And then

there were the mythical winter holidays in the snow, in the vivaciously corporative context of the University Employees Sporting Group (*Gruppo Sportivo Dipendenti Unversitari - GSDU*), which existed mainly for festive encounters, exceptionally serious polisportive competitions, singing and choral performances, gastronomic events. And to think that he was quite a poor tennis player, that he sang out of key, and was a moderate gourmet. But he enjoyed it, as he infected and impassioned teachers, students, technicians, customers, gatecrashers and hangers-on of all kinds emphasizing an aspect – as he said in a famous speech in the Seventies – of University life as a promoter of friendship "*between people belonging to all categories that have helped to save the joint*". Some utilitarian (!?), inspiration – it would make one think – moved him, or not!? But it was however - it must be recognized - "*a beautiful story rich with characters and wonderful adventures ... and so it seems to us that we are still those of once upon a time (our childhood, our early years). Many multi-coloured images, many sounds: a custom which deeply penetrated all of us, a continuity of old and new endeavours which were celebrated and were more especially sung ... the profound song rises in the night to the starry sky and everyone listens again with an always new joy and surprise ... A lump in the throat overwhelms me. Tears escape from behind my spectacles and fall onto the glass of wine ...*".

As President of the Rotary Club in 1995, he promoted a new compendium of writings about Siena (*Sena pandit*) because he wanted to contribute to "*save the important monument*" which has survived in the *complications of generally burlesque, anecdotal oral tradition using the pattern of two great literary works which appeared in Tuscany in equally calamitous times: the "Decameron" and the "Novelle della Nonna"*. Apart from Giuliano Catoni's overwhelming narration, all that came out of it, however, was a pleasant *cahier* of stereotypical views of a Siena uselessly and naively regretted.

Baccio adored the personality of Einstein and like the supreme scientist he believed in a world of simplicity and harmony, happily guided by principles of experience and of conscience (rationality, responsibility) and he longed for the same stamp of levity, *humor*, of dedication of the science and he could not accept the thought that "the universe, the world can be understood only in the domain of Reason".

In a personal way of being, Baccio is still, however, without intimate contradictions, a wonderful boy, yearning for the oneiric privilege to reside in Kensington Gardens, living in the playful and poetic climates of childhood and of eternally free friendship, an adventurous happiness (which is also at the heart of scientific research) of which, on the other hand, he deceives himself that he will return to in his more weary and disappointing years.

A little bit Einstein, a little bit Peter Pan: and Siena was his *never-never-land*.

It was the Christmas of 1995 and Baccio was presenting his good wishes to his Club stressing, among the ways of understanding Christmas: the first one *idealistic* "that evokes the sweetness of childhood, the warmth of the family, in other words the *Log* even before *Christmas*, the second, universally religious, supportive, consoling, the third that he calls *vitalistic scientific*, "*and cannot help but look towards the universe*", a vast universe of stars and suns just as Galileo saw it, but not infinite, nor eternal ... a universe that has precise boundaries and consists of calculable energy and has an identifiable principle and an end which the Scientist can calculate "*whose soul and whose thought remain – very much - in time and in the memory of posterity, if in life it has been well-deserved*".

Our great Archbishop Mario Ishmael Castellano was struck by these words and he asked Baccio: "*How can you say that there is no need for this God, in a world that very slowly is able to explain everything about itself?*" And the Prelate, perhaps without realizing it, moved closer to Karl Popper than to Albert Einstein!

When Emanuele Padoa who had been an active part of the *happy company* of the Municipal Council of Siena, (but *why on earth, Baccio, this uncalled for witticism?*), the already mentioned prodigious Teacher, very old now, having read a beautiful page by Baccetti commemorating another illustrious biologist (Salfi), was aggrieved because of the fact that he would not be able to "hear" what Baccio would have said of him, after his own removal, as he did not believe in another life: "*It means to say that when I worsen you will compose (your epigraph) and then come to read it to me at my bedside. That's what I want!*". It did not happen, of course! So in the wondrous panegyric held in Florence - perhaps his most beautiful writing - the student Baccio addressed the Maestro reassuring him that "*you will continue to live on in your pupils, because your memory will be an example for future generations*" and to tell you that "*all that is left for me to do is take refuge in what you and I have never believed, that cultivating the irrational hope that there is, outside of the universe, a nook in which sooner or later I can find you again*".

I hope what I am saying here can be recorded in the continuity of his message, and of his memory!

Baccio loved the melodies of *swing*, and, in particular, a heart- rending song: *Unforgettable... Unforgettable!*

Mauro Barni

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# BACCIO BACCETTI AND RECONSTRUCTION OF THE PATHWAY OF TUSCAN ENTOMOLOGY

**Federico Roversi**

Accademico Fisiocritico

Distinguished Academicians, Ladies and Gentlemen

We are gathered here today to remember and pay homage to a man who has marked different fields of scientific knowledge for more than fifty years, always setting himself at the edge of what was known or assumed to be, with a gaze and desire to go beyond, whether it concerned human sterility, biogeography of animal populations, taxonomy or functional morphology and physiology made no difference.



Fig. 1 - Baccio Baccetti in 2003 in the *Tribuna di Galileo* in Florence on the occasion of the presentation of the volume published for the centenary of Redia.

From the 1400s up to recent times, entomological research and more in general zoological research has found its driving force in Tuscany in the push deriving from agricultural and forestry problems. From that initial and distant period of time, the fascinating history of the formation of a School of

Entomology has unravelled, a basic history of an agrarian-forestry type, which boasted various persons among the most glorious names of scientists who have worked for over six centuries of studies, research and experiences.

Among the men whose stories depict the initial and intermediate sections of the pathway of Tuscan Entomology, Baccio Baccetti was the constant, erudite and attentive archaeologist, able to speak and let speak anyone whose passion had led them to become entomologists, even in preference to doctors, pharmacists, mathematicians, literary men and men of the Church.

In this moment of commemoration of Baccio Baccetti, I have the impression, as he himself wrote in memory of a friend, "...of finding myself before one of the most difficult jobs that has ever come my way". Perhaps it would have been easy to focus on his brilliant and imposing scientific production, even with just the reference to invertebrates, but by doing so I am sure I would not have been able to define this personage in full. Nor would I have been able, either, probably because of my limitations, to delineate the figure of a scholar, both curious and ingenious, one which we are rarely likely to meet. For this reason too, in opening this reading of mine, I would like to describe Baccetti with the words that he himself used in 1980 in remembering Emmanuele Padoa, Livornese by birth, who gave biological science work of the highest level exactly in Siena. That scientist about whom Baccetti says several times and to me also, the following words "*And this is the true value of the sciences, and their first objective: to teach to reason, to teach an ever increasing number of men (and women) to behave like rational beings, freeing them from ancient terrors and the ancient myths, while keeping alive in them .... the sense of values, meaning moral judgment, and the desire for greater knowledge, which then becomes the need for greater freedom*".

Of that which the thought and the pen of B. Baccetti have left behind, I would like to emphasize his patient work, incredibly torn - I don't know how - from which snippets of his time as a researcher - in reconstructing the path of Tuscan entomology, giving life once again to men who put our country at the vertices of global scientific prestige, challenging inquisitors and anxieties of life and of which very few had any recollection or any kind of memory.

In 1957 Baccio Baccetti began to publish a first work on a text by Pietro Rossi printed in 1788 entitled "Osservazioni insettologiche del sig. Pietro Rossi, Regio Professore nell'Università di Pisa, indirizzate al Sig. Conte Hochenwart, Professore d'Istoria Politica per le AA. RR. Gli Arciduchi Principi di Toscana" (Insectological observations of Mr Pietro Rossi, Regius Professor at the University of Pisa, addressed to Mr Conte Hochenwart, Professor of Political History for the AA. RR. The Archdukes Princes of Tuscany), for which, with great surprise, Baccetti drew attention to the absence of citations from the main taxonomies.

So to do justice to the substance of the man, even before the scientist whom we are remembering today, I think it is right to repeat the words that he himself used in the header of the work in which he gathered together and expounded everything that he had been able to reconstruct on Pietro Rossi. Baccetti wrote in the frontispiece "*This work, which I began writing in April 1962 in a Florentine clinic during the last days of life of my wife Luciana, is dedicated to His memory. For both of us it helped to distract our attention for many hours from the memory of a happy past, from the certainty of a dire present, from the unlikelihood of a future.*"

As a student at the Specola from the age of 8 years (1939) Baccetti later related in his memoirs of how, as he thumbed through the only book that spoke of Tuscan Entomology, Etruscan Fauna, adorned with beautiful colour plates, the desire was born in him to understand who this man was, a man he went on to consider an imaginary friend. During his years at high school and university he carried on trying to find Rossi's date of birth, manuscripts, works and diplomas buried in the Boboli *limonaie* and in 1962 he published the work "Pietro Rossi naturalista toscano del '700" (Pietro Rossi Tuscan Naturalist of the '700s) in which he emphasized the extreme importance of what, born "...as a simple catalogue of his own entomological collection" became a strongly innovative work for 3 main aspects that Baccetti highlighted with great acumen: 1) in the "...descriptions Rossi uses an expedient which nobody had adopted before. For the species already described he shows all the diagnoses, or a summary thereof, owed to the original descriptor and other authors consulted. Then he prints his own description comparing it with the previous"; 2) "...while the most well-known works of systematics seem to deliberately ignore any phytogeographic and ethological investigation ... ..Rossi provides details of dates and characteristics of the location where it was gathered"; 3) "...as already stated, he accompanies this with unpublished particulars on the ethology of the species". In the next reading on Pietro Rossi, held in Pisa with R. Poggi in 2001, during the celebration of the second centenary of the first chair of entomology in the world, Baccetti wrote as follows of the Tuscan entomologist "...Our man showed the acumen of a specialized ethologist".

After the publication of the first two works on P. Rossi, as time passed B. Baccetti showed a growing interest not only in the history of entomology but more especially in the entomologists and their vicissitudes, and described them as follows in the celebrations of the 250th anniversary of the Accademia dei Georgofili, "Kooky characters, moved by an unbridled passion for these multiform and multi-coloured little beasts, which often have the stubborn habit of devouring those foodstuffs that man has always tried to cultivate and preserve".

In 1965 Baccetti recovered and saved the first true text of an entomological topic written in the vernacular, the unpublished fifteenth-century manuscript "*Trattatello di apicoltura del porre i mori e del porre i bigatti*", ("Small treatise of apiculture of placing the mulberries and placing the larvae"), datable in the last quarter of the XV century and preserved among palatine codes in the National Library of Florence flooded in 1966, but only one year beforehand interpreted, photographed and published by B. Baccetti in the Memoirs of the Italian National Accademy of Entomology. In his presentation of the anonymous "Trattatello" Baccetti, with a thorough historical-scientific discussion, elaborated starting from Aristotle's "History of Animals", he pointed out how this work was filling a gap of almost two centuries of silence concerning Zoology and represented the "...first embryo of specialized entomological work" in which results and personal experiences were used. Perhaps this is the starting point of the "**long pathway of Tuscan entomology**".

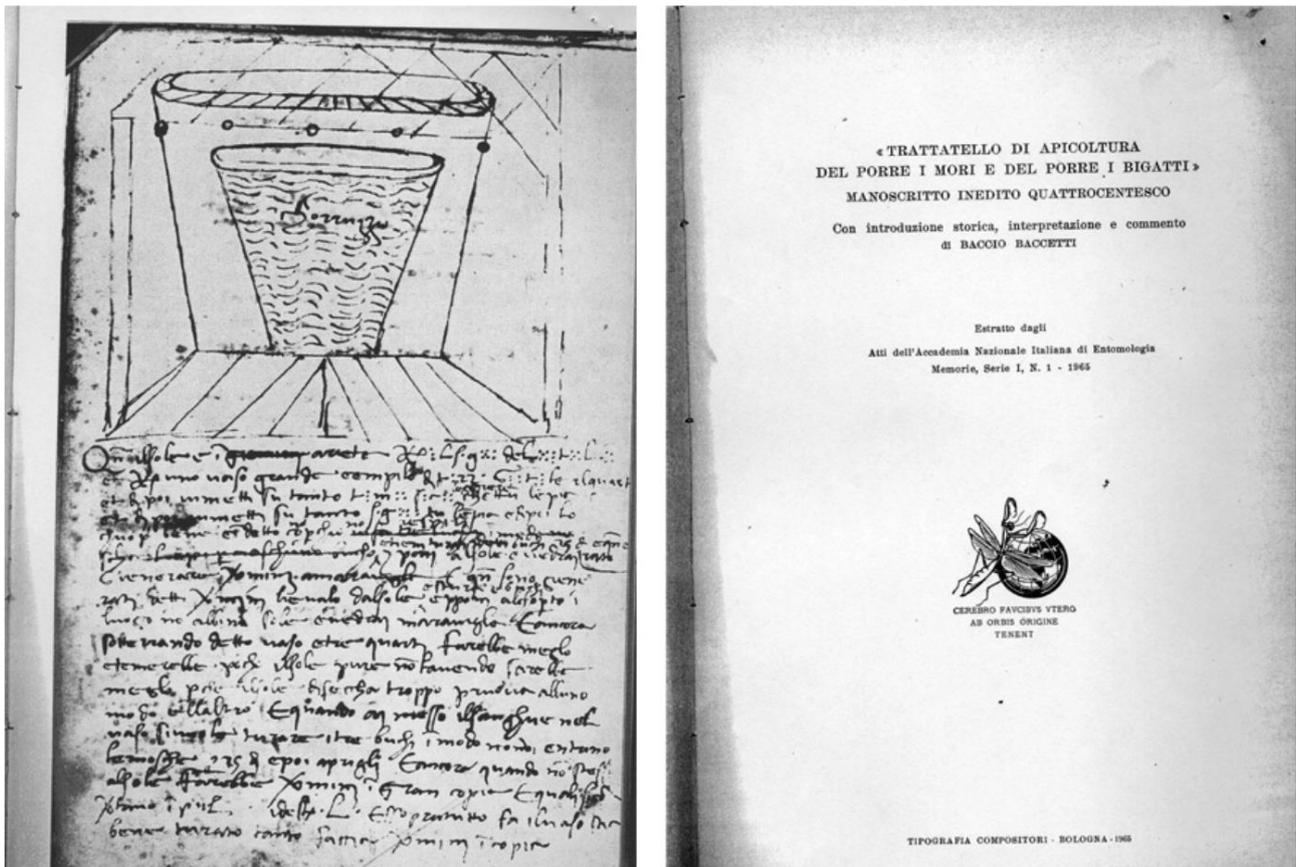


Fig. 2 - Original page of the "Trattatello di apicoltura del porre i mori e del porre i bigatti" and the front page of B. Baccetti's publication of 1965.

In his publication on "Entomology applied to agriculture in the framework of the academic movement in Tuscany", Baccetti later emphasized how "the Trattatello" had not followed great research work in the '500s and how the various Accademias devoted themselves essentially to the human sciences. As reported by Baccetti, the most well-known Tuscan who at that time dealt with animal things was also a humanist: Monsignor Giovanni Rucellai, born in Florence in 1475, and the author of the little poem "Le Api" (The Bees), forerunner of microscopy that enlarged images of these Hymenoptera using systems of mirrors.

Apart from other brief references, such as those for the text "La Coltivazione" (Cultivation) by Luigi Alamanni published in 1546 in Florence, Baccetti emphasized in his writings how a real turning point can be identified only after the passage to the next century, and began with Cosimo III who in 1610 enticed Galileo Galilei to Florence. The year before, the scholar Pisano had built an apparatus to enlarge things and very small animals, calling it "Occhialino", giving one of them to the Accademia dei Lincei where, thanks to this instrument, as Baccetti writes in a contribution which was printed in 1992 in the Essays of the Italian Society of Entomology, Francesco Stelluti becomes the first scholar "...to put an animal under the microscope and describe it, forty years before Robert Hooke noticed the first cellular contours in a plant."

Baccetti later emphasized the merit of the youngest son of Cosimo II, Leopoldo de' Medici, of having founded in 1657, pervaded by the Galilean Spirit, the Accademia del Cimento that for 10 years will become the centre of experimental research and discussion "...continuing the spirit and tradition of the Lincei, after the closure of their Academy which took place in 1630". In 2004 Baccetti wrote "...the best figment of the Accademia del Cimento... is the doctor, scholar and naturalist Francesco Redi (1626-1698), chief physician of Cosimo III, probably one of the greatest figures to carry out his activity as a scientist in the field of animal biology". In his writings Baccetti strongly emphasizes how F. Redi, defined as a "most high encyclopedic genius" should be considered in his own right the founder of Applied Entomology and Parasitology.

Redi destroyed the superstitions of "spontaneous generation", publishing in 1668 his "Esperienze intorno alla generazione degli Insetti" (Experiences around the generation of insects) and in 1684 the text "Animali viventi che si trovano negli animali viventi" (Living animals that are found in living animals). Thus Redi, squashing the Jesuitic school under the weight of his experimental logic, launched the investigations on the reproduction of noxious insects in the medical and agrarian field, which was to open the road to investigations for the control of mosquitoes and flies that have seen the convergence of the energies of many excellent entomologists with those of the latter centuries of the past millennium. To Baccetti goes the merit of having also reminded us that Redi's pupils were Pietro Paolo da Sangallo, Antonio Vallisnieri and Giuseppe Del Papa, leaving us their precious reconstructions and testimonies.

Redi had described how flies, gnats, mosquitos, grasshoppers, butterflies, mites, scorpions and other animals laid their eggs in environments with well-defined characteristics and how "*little vermiform animals*" emerged from them which, with successive transformations ended up producing adults identical to those who had laid the eggs. As reported by Baccetti and Nannelli in 2007, P.P. da Sangallo devoted himself scrupulously to the study of the development of mosquitos, raising them in tightly closed glass containers so as to be able to describe the most important moments of the metamorphosis with the aid of drawings made with particular care. Da Sangallo's results, collected in a report in the form of a letter dedicated to the illustrious Francesco Redi, printed in 1679, were taken up and published in full by Baccetti and Nannelli in the publications of the National Italian Academy of Entomology. It is worthwhile recalling here what Baccetti and Nannelli stressed of how da Sangallo derided many of the known remedies to defend ourselves from mosquitos, "...bathe with wine containing oil of wormwood, ..... plaster your face with ... saliva after...dirtying yourself all over with juniper coals, or fill yourself with oil, vinegar and crushed sage". In their volume Baccetti and Nannelli also quoted da Sangallo's conclusion, written in the perfect Redi spirit, "All these... are totally unnecessary and annoying, more so than the mosquitoes themselves, against which good protection seems to me to be the only and unmatched one that was found in ancient times by the fishermen of Egypt, i.e. a good mosquito net that surrounds the bed perfectly, and in our times is made of very nice voile from Bologna...".

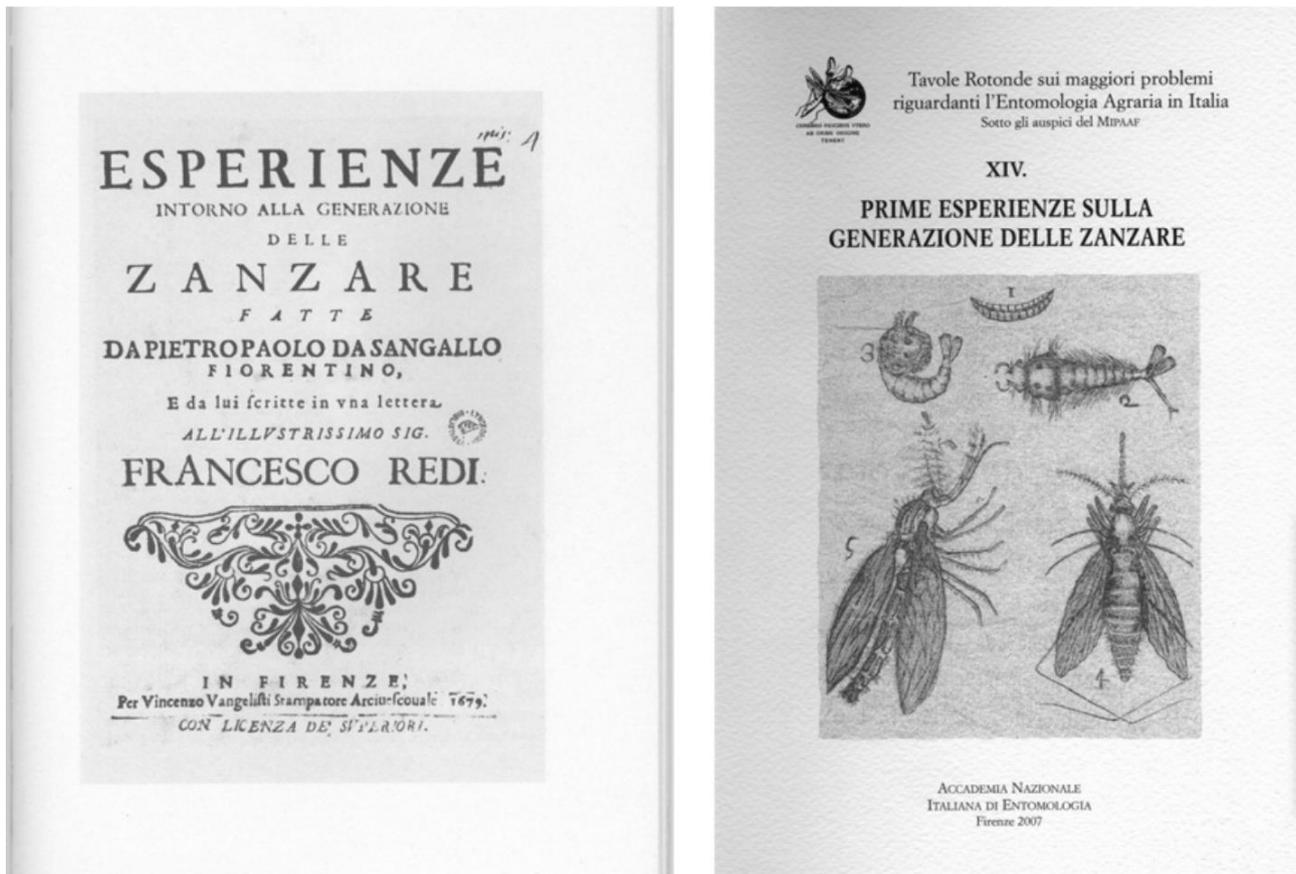


Fig. 3 - Original text of Pietro Paolo da Sangallo " Esperienze intorno alla generazione delle zanzare" and the frontispiece of B. Baccetti and R. Nannelli 's publication dated 2007.

Antonio Vallisnieri, from Lucca, was among Redi's disciples and he devoted himself to the study of various insects, accurately connecting, as Baccetti pointed out, the microscopic morphology of various insects with their habits. In 2005 Baccetti, with Nannelli and Schettini Piazza, dedicated a further valuable work to the third of Francesco Redi's pupils, Monsignor Giuseppe Del Papa, entitled " La lotta alle cavallette iniziò ai tempi Medici" (The fight against locusts began in Medicean times). The word "Locusts" had always evoked biblical scourges and in their volume Baccetti and collaborators put emphasis on the sensitivity shown by Cosimo III de' Medici in giving his chief physician and family tutor, Del Papa, the mandate to take care of the phenomenon of the hordes of grasshoppers by studying their reproductive biology with the ultimate aim of identifying possible defence strategies. Del Papa's text was printed in Florence in 1716 without the name of the author, with the title 'Relazione delle diligenze usate con felice successo nell'anno MDCCXVI per distruggere le cavallette le quali avevano stranamente ingombrato gran parte delle Maremme di Pisa, di Siena, di Volterra e tutte le campagne di Piombino, Scarlino e Suvvereto"' (Report on the deligence used with success in the year MDCCXVI to destroy the locusts which had strangely taken up residence in a large part of the Maremma of Pisa, Siena, Volterra and all the countryside of Piombino, Scarlino and Suvvereto). The paternity of the work was attributed to Del Papa thanks only to the eulogy made by a Roman friend of his, Monsignor Giovanni Bottari. As Baccetti wrote in a letter of 2005, Del Papa, a very educated prelate, professor of medicine at the University of Pisa, turned out to be a fine agrarian entomologist with taxonomic research of a

morphologic-comparative type and with ethologic studies that helped the study of Orthopterans make the first true leap forward since the times of the comments of Scholars such as Alberto Magno and the little that was written after the end of the XVI century by Aldrovandi.



Fig- 4 - Original text by Giuseppe Del Papa "Relazione delle diligenze usate con felice successo nell'anno MDCCXVI per distruggere le cavallette" and frontispiece of the publication of B. Baccetti , R. Nannelli and E. Schettini Piazza dated 2005.

In the volume on Del Papa, Baccetti further emphasized how the scholar had with great realism drawn attention to the influence of environmental factors such as drought on the development of the infestations of grasshoppers, based also on experiments he led in first person by transferring the eggs of these voracious insects from the open field to a hothouse of the Giardino dei Semplici in Pisa. Del Papa, recalls Baccetti, with his experience and his dissections finds and expounds with rigorous scientific explanations on the reproduction modes of "locusts" as he too, also one of Redi's pupils, challenges the idea of "spontaneous generation".

After Del Papa, Pietro Rossi appears, mentioned at the beginning of this reading, to whom Baccetti dedicated enormous energy and from whom he gained the initial motivation for his investigations into the men in this story.

What happened next, as Baccetti shows in various publications of a general nature on the studies of Zoology in Tuscany, winds through figures such as Giorgio Santi who in 1810 also published a

good text on the fight against locusts in Val d'Orcia and Carlo Passerini who in 1829 wrote on the Olive Fly and other insect pests, until they intersected with the commitment in the Zoological sector by Bettino Ricasoli who, after the fall of the Lorena family in 1859, as a passionate naturalist brought about the constitution of the Institute of Higher Studies of Florence, with a section for Natural Sciences and the establishment of a chair in Zoology. In his work of 1989 Baccetti recalls how "*...with the establishment of the chair, someone had to cover it, and things were, as usual, done in-house. But the practice, for once, produced a good result.* Adolfo Targioni Tozzetti (1823 - 1902), was in fact appointed: a botanist, physicist, chemist, of whom Baccetti wrote "*...he founded a zoological school destined to become, with various ramifications, one of the most important in the world*".

In his writings dedicated to that period, Baccetti described the great fervour of the successive years culminating in the foundation of the Italian Entomological Society, wherein Targioni Tozzetti, always more involved by the then Ministry of Agriculture, was joined by Ferdinando Piccioli and Peter Stefanelli as well as various others such as Enrico Hillyer Giglioli and Enrico Benvenuti. The words used by Baccetti were the following "*These are wonderful years for Zoology*". Further enthusiastic declaration followed and was inserted in his report to the Georgofili of 2003 on "Evolution of the means of phytosanitary defence", in which Baccetti recalled how Targioni had launched the study of cochineals in Italy and in the world, protected the vineyards of Europe by leading the anti- phylloxera movement, inaugurating the study of biocenosis as such and no longer organisms as isolated entities, impersonating the figure of the applied modern entomologist with foundations of systematics and ethology to embody in the processing capacity of new strategies for the protection of crops.

Another event of this period which greatly impressed Baccio Baccetti was the foundation of the Agrarian Entomology Station in Florence in 1875 by Del Targioni, the first institution of its kind in Europe and probably in the world, into which was later called the scholar who will become, in the opinion of many, the greatest entomologist and acarologist, Antonio Berlese to continue the work.

Baccetti always nourished a great and unconditional admiration for Berlese, titanic figure in our scientific landscape and sublime designer, which was noticeable in his notes dedicated to the great entomologist, Paduan by birth but to all effects Tuscan by adoption, in the most fruitful period for his immense scientific production, culminating in the basic studies with the investigations on the metamorphoses and in the realization of the most important and successful interventions of biological battle in terms of applied sciences.

Baccio Baccetti later wrote many other things, with his natural elegance of style, but it is at this point that my meager discussion today concludes, because I believe that Baccetti has given the best of himself precisely toward the "ancients", reconstructing history by bringing the "stories" together.

At the conclusion of this, let me thank all of you for the invitation to participate in this commemoration, giving me the opportunity to send an affectionate greeting to my last Master and ..... Friend.....

Goodbye Baccio.

Siena 2 December 2011

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# REMEMBERING BACCIO BACCETTI – SPERMATOLOGIST

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Accademico Fisiocritico

In Baccio Baccetti's scientific works the words: spermatozoa, spermatogenesis and fertility are found for the first time in two works published in 1958<sup>1</sup> and in 1961<sup>2</sup>; they describe the research into the use of ionizing radiation for the sterilization of insect pests in agriculture; insects to introduce into the field with the aim of creating disharmony in the reproductive processes of natural populations and hence limit the number of successive generations. Once again on the same topic we find a 1982 work on combating the pine processionary.<sup>3</sup> Other contributions to the development of this methodology are described in the same year in a reading<sup>4</sup> at the Economic-Agrarian Academy of the Georgofili.

From the early sixties Baccetti had started to use the then innovative electronic microscopy techniques and in 1963 a work on the ultrastructure of the testis of some Diptera was presented to the 4th Italian Congress of Electronic Microscopy<sup>5</sup>; then in 1964 and 1965, two works followed regarding the ultrastructure of spermatozoa of *Dacus oleae* and *Drosophila melanogaster*<sup>6,7</sup>. These publications mark the true beginning of what will become the research activity of Baccetti "the spermatologist"; extensive and unique notes begin to appear in the drafts of the following works: extreme accuracy in the description of the ultrastructure and comparative analysis of the morphological data for a phyletic interpretation of the spermatozoa of different species studied. Another feature present in many of Baccetti's works is the use of stylish designs in India ink taken from microphotographs; these drawings, as well as their intrinsic beauty, illustrate in great detail the ultrastructure of the sub cell components of the spermatozoa studied and their mutual relationship.

Toward the end of the sixties in a reading at the VII<sup>o</sup> Italian National Congress of Entomology, Baccetti outlines what may be the potential for development of spermatology in troubleshooting phyletic problems. In the conclusions of the work it reads:

*... at this point I wouldn't know how to evaluate the practical importance of spermatology. As things stand today it seems to me that it is certainly the most fruitful field of morphological investigation which can be tackled at the moment, and it seems to me that zoological conclusions valid at every level can emerge from it. It appears difficult today to think that the descriptions of sperms can enter the analytical realm, while it seems more logical to call the structure into question*

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<sup>1</sup> Baccio Baccetti L'energia nucleare contro gli insetti dannosi, L'ITALIA AGRICOLA n° 11 Nov. 1958

<sup>2</sup> B. Baccetti, M. Cappellini: Ricerche sulla sterilizzazione di insetti nocivi con radiazioni ionizzanti. Nuntius Radiologicus N° 7; July 1961: Soc. Universo Ed. Roma

<sup>3</sup> Baccio Baccetti, Rodolfo Zocchi. Prove di lotta contro la processionaria del pino mediante l'uso di radiazioni ionizzanti. Redia, Vol. XLVII, (1962) pp. 161-168

<sup>4</sup> Baccio Baccetti. L'energia atomica nella lotta contro gli insetti. Accademia Economico-Agraria dei Georgofili; Reading of 16, December 1962 Vol. IX - Serie Settima- Vol. 138° from the beginning.

<sup>5</sup> Baccio Baccetti. Osservazioni preliminari sull'ultrastruttura dei testicoli in alcuni Insetti. Atti IV Congresso Italiano di Microscopia Elettronica, Padua 25-26 November (1963)

<sup>6</sup> Baccio Baccetti, A. Bairati Jr. Indagini comparative sulla ultrastruttura delle cellule germinali maschili in *Dacus oleae* Gmel e *Drosophila melanogaster* Meig (Ins Diptera) REDIA, Vol. XLIX, (1964) pp. 1.29. 18 Tavv.

<sup>7</sup> A. Bairati Jr., Baccio Baccetti Indagini comparative sulla ultrastruttura delle cellule germinali maschili in *Dacus oleae* Gmel e *Drosophila melanogaster* Meig (Ins Diptera) Il Nuovi reperti ultrastrutturali sul filamento assile degli spermatozoi. REDIA, Vol. XLIX, (1965) pp. 81-85, 1 Fig., 2 tav.

to settle more general phylogenetic problems. You can never say. The same destiny seemed reserved for chromosomal formulas, which now for many groups (such as the planaria for example) are the easiest and safest diagnostic element. And deep down this is the great fascination of systematics, the most ancient of naturalistic disciplines, but also the most constrained, in its synthetic function, in taking all the conquests of science into account, cultivating in each one of us the hope of a great discovery, tomorrow. There will be, in any case, an advantage: the collections of spermatozoa occupy very little space.

In this work the term "spermatology" appears for the first time.<sup>8</sup>

These ideas, this hope, these insights, suitably reworked, will accompany all Baccetti's scientific activity; traces of it are also found in those predominantly bio-medical edited publications.

It is in this period that the research on the ultrastructure of the spermatozoon of Arthropods had a substantial development involving various groups: Aphaniptera, Ephemeroptera, Plecoptera, Trichoptera, Orthopterans, Phasmatodea and others. The works that derived from it began to be collected in the series "The spermatozoon of Arthropoda" and at the end of the series, a few decades later, they will amount to more than forty.

As data on the ultrastructural morphology of the spermatozoa were accumulating, they were read and interpreted by Baccetti with ever greater precision from a phylogenetic point of view. The ultrastructure of the spermatozoon and the respective sub-cellular organelles was detected, described with extreme precision and analysed comparatively the result which sprang from this showed how the spermatozoa had undergone an evolution of their own and that they could be organized in phyletic lines in agreement with those derived from the usual classification of animal Phyla.

Particular attention was also directed to the transformations that take place at the expense of cellular organelles during the whole process of spermatogenesis, thus allowing the definition of the origin of those sub-cellular components which determine the structure of the mature spermatozoon: a few years later, this knowledge will enable a statistical-mathematical system to be devised for the evaluation of the spermatozoa in humans and other mammals,

The electronic microscopy techniques SEM, TEM and freeze-fracture used for ultrastructural morphological research were soon combined with biochemical Immunohistochemistry and rapid micro cinematography techniques; this integration of various methodologies allowed the clarification of the composition and the function of the protein-enzymatic components of organelles that are the basis of the movement and the fertilizing capacity of the spermatozoon.

As an example of this method of doing research we recall the study on the sperm of the stick insect: the Phasmatodea *Bacillus rossius* *Bacillus rossius*<sup>9</sup>. This work represents the sum of the research on the spermatozoa that was conducted in the seventies in the Zoology Institute of the University of Siena. The spermatozoon was studied with different techniques: those of electronic microscopy associated with freeze-fracture for the ultrastructure, immunocytochemistry for submicroscopic localization of some enzymatic activities, biochemical ones for the definition of the metabolic model and those of rapid cinematography for the description of the movement. There is

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<sup>8</sup> Baccio Baccetti. Spermatologia comparata degli artropodi. Atti del VII Congresso Nazionale Italiano di Entomologia. Verona, Settembre 1967.

<sup>9</sup> B. Baccetti, A.G. Burrini, R. Dallai, V. Pallini, P. Periti, F. Piantelli, F. Rosati and G. Selmi. The spermatozoon of Arthropoda XIX. Structure and Function in the Spermatozoon of *Bacillus rossius*. J of Ultrastructure Research, Vol. 44, N° 12 pp 1-73 July (1973) (Suppl.12) .

further documentation on the transformations that take place in the cellular organelles during the process of spermatogenesis defining the origin of the various components of the architecture of the mature spermatozoon. The motion data were analysed with the computer that at those times was still working with punched cards of cardboard, but that yielded precious indications of the frequencies of oscillation of the oscillation of the axoneme found also in other biological systems.

In the seventies the amount of data obtained on the ultrastructure and protein composition of the spermatozoa allow Baccetti to write copious works on the physiology of the sperm cell; these are finely illustrated by photomicrographs and drawings.<sup>10</sup>

Also publications with a more educational approach see the light with the intent of making this particular cell type known outside the circle of insiders.<sup>11</sup>

Also in this period, having refined the new techniques for the study of the spermatozoa, Baccetti and collaborators widened their field of interest turning their attention to other groups of animals<sup>12,13</sup> and so it was that fish, reptiles, birds and mammals (including man) had to donate their sperm that were dissected, broken down into their organelles, studied and described for their ultrastructural morphology and their physiology.

The bull was taken as a model for the first studies on the spermatozoon of mammals. The cell was broken down into its organelles and the ancillary fibres were determined.<sup>14</sup> The localization of some enzyme activities were compared with those of other models of spermatozoa.<sup>15,16,17</sup>

The analysis of the morphological, biochemical and histo-cytochemical data on spermatogenesis of various Phyla animals allowed us to understand the role of the Golgi complex during the maturation of the spermatozoa deemed the most primitive and compare it to what happened in those considered more evolved.<sup>18</sup>

At the same time there were experiments in innovative techniques of fixing of the spermatozoa of Mammals for a better morphological and ultrastructural result and sophisticated techniques of TEM X-ray microanalysis are used for the study of the chemical composition of the subcellular components, allowing the localization of elements directly onto the image being studied.<sup>19</sup>

It is in the midst of these activities that the human sperm starts to become the main target of Baccetti and his collaborators' spermatologic research. This line of research is immediately oriented

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<sup>10</sup> Baccio Baccetti. *InsectSpermCells*. *Advanced InsectPhysiol.* 9, (1972)

<sup>11</sup> Baccio Baccetti. *Spermatozoi ed uova*. *Civiltà delle macchine*, n° 1-2- January- April 1972.

<sup>12</sup> Baccio Baccetti, Floriana Rosati and Gloria Selmi. *Electron microscopy of Tardigrades*, 4, *The spermatozoon*. *Monitore Zool. Ital.* (n.s.) 5 :231-240 (1971)

<sup>13</sup> Baccio Baccetti, Anna G. Burrini and Romano Dallai. *The spermatozoon of Brachiostomalanceolatum* L. J. *Morph.* Vol. 136, Vol. 2, 211-226 (1972)

<sup>14</sup> B. Baccetti, V. Pallini and A.G. Burrini. *The accessoryfibres of the sperm tail. 1 Structure and chemical composition of the bull "coarsefibres"* *J. Submicr. Cytol.*, 5, 237-256 (1973)

<sup>15</sup> B. Baccetti, V. Pallini, A.G. Burrini. *Localization and catalytic proprieties of lactate dehydrogenase in different sperm models*. *Experimental Cell Research* Vol. 90, 183-190 (1975)

<sup>16</sup> B. Baccetti, F. Bernini, E. Bigliardi, A.G. Burrini, R.Dallai, F. Giusti, M. Mazzini, V. Pallini, T. Renieri, F. Rosati, G. Selmi and M. Vegni. *Motility patterns in sperms with different tail structure*. Reprinted from: *The functional Anatomy of the spermatozoon* B. A. Afzelius Ed., Pergamon Press. Oxford and New York (1974)

<sup>17</sup> B. Baccetti. *Localization of enzymes in some flagellate spermatozoa*. *The Biology of Male Gamete* J.G. Duckett and P.A. Racey Ed. *Suppl. N° 1 to the Biological Journal of the Linnean Society*, Vol. 7, pp. 317-319 (1975)

<sup>18</sup> Baccio Baccetti. *The role of the Golgi complex during spermatogenesis*. Reprint from *Current Topics in Development Biology*, Vol. 10, (3) Academic Press Inc. New York, San Francisco, London (1975)

<sup>19</sup> B. Baccetti, V. Pallini, and A. G. Burrini. *The accessory fibers of the sperm tail. II their role in binding Zinc in Mammals and Cephalopods*. *Journal of Ultrastructure Research*. 54, 261-275 (1976)

toward the study of the causes that are at the origin of the various pathologies present in sperm that by reducing or eliminating the ability to fertilize have important implications both in the medical and social fields.

It was clear from the outset that the root causes of the various pathologies of the human sperm could be divided into two different types: those of genetic origin and those of environmental origin, this latter term being understood in the widest possible sense, such as food, drugs, hormonal balance, lifestyles, age, infections of the genitourinary tract etc.

The first work on human sperm is dated 1975 and describes a genetic malformation of the axoneme linked to the absence of dynein,<sup>20</sup> a protein involved in movement.

This first work is followed by a whole series that describe various pathologies of the human male germinal cell and in many cases it is highlighted as the cause.

As an example of sperm pathologies studied in humans we can mention:

The "Round Head" spermatozoa missing from the acrosome; in testicular biopsy of the patients the various stages of spermatogenesis that lead to this unusual shape of the core are described<sup>21</sup>, spermatozoa missing from the central microtubules of the axoneme<sup>22</sup> or with a complete absence of the axoneme.<sup>23</sup>

One study revealed spermatozoa with the same severe diseases of genetic origin found in the tail and head in two patients who were brothers.<sup>24,25</sup>

An abnormally high percentage of double spermatozoa which resulted after incomplete meiotic divisions was found in patients with high levels of prolactin in the blood.<sup>26,27</sup> Spermatozoa in patients with dysplasia of the fibrous sheath and with chromosomal translocations were recently described and studied.<sup>28,29,30,31</sup>

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<sup>20</sup>B. Baccetti, A. Burrini, V. Pallini, T. Renieri, F. Rosati and G. F. MenchiniFabris. The short-tailed human spermatozoa. Ultrastructural alterations and dynein absence. *J. Submicr. Cytol.*, 7, 349-359 (1975)

<sup>21</sup>B. Baccetti, T. Renieri, F. Rosati, M. G. Selmi, and S. Casanova. Further observations on the Morphogenesis of Round Headed Human Spermatozoa. *Andrologia* (3) : 255-264 (1977)

<sup>22</sup> B. Baccetti, A. G. Burrini, A. Maver, V. Pallini and T. Renieri. "0+0" Immotile Spermatozoa in an Infertile Man. *Andrologia* 11 (6): 437-443 (1979)

<sup>23</sup> B. Baccetti, A. G. Burrini and V. Pallini. Spermatozoa and Cilia Lacking Axoneme in an Infertile Man. *Andrologia* 12 (6): 525-532 (1980)

<sup>24</sup> B. Baccetti, A. G. Burrini, G. Collodel, A. R. Magnano, P. Piomboni, T. Renieri, and C. Sensini. Morphogenesis of the Decapitated and Decaudated Sperm Defect in Two Brothers. *Gamete Research* 23: 181-188 (1989)

<sup>25</sup> Baccio Baccetti, Anna G. Burrini, Giulia Collodel, Paola Piomboni, and Tommaso Renieri. A "Miniacrosome" Sperm Defect Causing Infertility in Two Brothers. *Journal of Andrology* Vol. 12, N° 2, (1991)

<sup>26</sup> B. Baccetti, F. Fraioli, D. Paolucci, G. Selmi, G. Spera, and T. Renieri. Double Spermatozoa in a Hyperprolactinemic Man. *J. Submicr. Cytol.*, 10 (2), 240-260 (1978)

<sup>27</sup> B. Baccetti, F. Fraioli, D. Paolucci, G. Selmi, G. Spera, and T. Renieri. High Prolactin Level and Double Spermatozoa. *Gamete Research* 2: 193-199 (1979)

<sup>28</sup> Baccio Baccetti, Giulia Collodel, Laura Gambera, Elena Moretti, Francesca Serafini, and Paola Piomboni. Fluorescence *in situ* and molecular studies in infertile man with dysplasia of the fibrous sheath. *Fertility and Sterility* Vol. 84, N° 1, (2005)

<sup>29</sup> B. Baccetti, G. Collodel, R. R. Marzella, E. Moretti, P. Piomboni, G. Scapigliati, and F. Serafini. Ultrastructural studies of spermatozoa from infertile males with Robertsonian translocation and 18 X,Y aneuploidies. *Human Reproduction* Vol. 20, N° 8, pp. 2295-2300, (2005)

<sup>30</sup> B. Baccetti, G. Collodel, M. Estenoz, D. Manca, E. Moretti, and P. Piomboni. Gene deletions in an infertile man with sperm fibrous sheath dysplasia. *Human Reproduction* Vol. 20, N° 10 pp. 2790-2794. (2005)

<sup>31</sup> Baccio M. Baccetti, Emanuele Bruni, Serena Capitani, Giulia Collodel, Stefano Mancini, Paola Piomboni and Elena Moretti. Studies on Varicocele III: Ultrastructural Sperm Evaluation and 18, X and Y Aneuploidies. *Journal of Andrology*, Vol. 27, N° 1 (2006)

Having these models of altered spermatozoa available, it was possible to link cytoskeletal components to the functionality of the cell and the pathologies it presented.<sup>32</sup> The localization of actin and other proteins in mature spermatozoa is correlated with the methods for the positioning of mitochondria along the axoneme during spermiogenesis.<sup>33,34,35</sup>

The research on human sperm brought Baccetti closer to Andrology and Assisted Reproduction Medicine; that was the start of research into the relations existing between the quality of the ejaculated spermatozoa and pathological conditions of the various areas of the reproductive system<sup>36,37</sup>, or with the hormone levels in the blood.

With the prospects of an increase in life expectancy, even men of an advanced age could be interested in knowing the status of their germinal cells; research was carried out therefore into the quality of germinal cells in men over 70 years of age.<sup>38</sup>

A particularly important field of research concerned the possibility that human sperm could be the vector of the HIV virus: data indicate that the galactosylceramide glycolipid present on the membrane of the spermatozoa may perform the function of alternate receptor for the HIV virus. Through studies of electronic microscopy and *in situ* hybridization, the virus was identified in the inside of the spermatozoa of infected men or in spermatozoa infected *in vitro*<sup>39,40</sup>. In addition it was also demonstrated *in vitro* the possibility of a passage of the virus from the sperm to the oocyte.

The knowledge acquired on the transformation and on reciprocal interrelationships of various cellular organelles during the process of spermatogenesis, together with those acquired during the studies on the ultrastructural morphology, and relative phylogenetic reading of ultrastructure of spermatozoa of all animal groups studied, spurred the creativity of Baccetti to hypothesize a system with which it was possible to "predict" the general quality of the population of spermatozoa in an ejaculate.

On the basis of the data of ultrastructural morphology of the various organelles of the mature spermatozoon it was possible to develop a statistical-mathematical formula that considering all the statistical possibilities for the ultrastructural defects identified in the spermatozoa present in a

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<sup>32</sup> B. Baccetti, A. G. Burrini, G. Collodel, A. R. Magnano, P. Piomboni, C. Sensini and T. Renieri. Human SpermCytoskeleton: Function and Pathology. Perspectives in Andrology, SeroSymposiaPublications from Raven Press Vol. 53: M. Serio Ed., New York. (1989)

<sup>33</sup> A. G. Burrini, B. Baccetti, C. Campanella, E. Ruger- Brandle and G. Gabbiani. Pericentriolaractin in spermatozoa. J. Submicr. Cytol., 12 (1), 161-164 (1980)

<sup>34</sup> B. Baccetti, E. Bigliardi, A. G. Burrini, and V. Pallini. Actin Filaments and Mitochondrial Movement in Vertebrate Spermiogenesis. Gamete Research 3: 203-209 (1980)

<sup>35</sup> B. Baccetti. Proteins in the structure and function on human spermatozoa. Reprinted from: Morphological Basis of Human Reproductive Function, G. Spera and D.M. De Kretser eds., Plenum Press, New-York and London . Acta Medica edizioni e congressi, Rome (1987)

<sup>36</sup> B. Baccetti, A. G. Burrini, S. Capitani, G. Collodel, G. Di Cairano, P. Piomboni, T. Renieri and C. Setacci. Studies on varicocele. 1. Submicroscopical and endocrinological features. J. Submicrosc. Cytol. Pathol., 23 (4), 659-665, (1991)

<sup>37</sup> B. Baccetti, E. Bigliardi, M. Vegni-Talluri, P. Soldani, T. Renieri, M. G. Selmi, A. De Martino, R. Bracci, and M. G. Vanni. The Fine Structure of Testis in the Cryptorchid Man. "Cryptorchidism" Proc. SeroSymposia, 25 J.R. Bierich and Giarola (Eds) Academic Press (1979)

<sup>38</sup> B. Baccetti, T. Renieri, M.G. Selmi, and P. Soldani. Sperm morphogenesis, structure and function in human over 70 years old. J. Submicrosc. Cytol., 16 (3), 585-600 (1984)

<sup>39</sup> B. Baccetti, A. Benedetto, A.G. Burrini, G. Collodel, G. Elia, P. Piombini, T. Renieri and M. Zaccarelli. Retrovirus- like particles detected in spermatozoa of patients with AIDS. Abstracts 1th International Symposium on AIDS and Reproduction. December 12-15, 1990 Fieracongressi, Genoa, Italy.

<sup>40</sup> B. Baccetti, A. Benedetto, A. G. Burrini, G. Collodel, G. Elia, P. Piomboni, T. Renieri, C. Sensini and M. Zaccarelli. Retrovirus- like particles detected in spermatozoa of patients with AIDS. J. Submicrosc. Cytol. Pathol., 23 (2) 399-345 (1991)

sample provides the total number of spermatozoa probably affected and consequently that of spermatozoa probably free of defects.<sup>41,42, 43</sup>

After a period of experimentation, in groups of selected patients, this mathematical-statistical system becomes ordinarily used in the analysis in electronic microscopy of the spermatozoa of patients with various problems of sterility<sup>44,45,46</sup> or as an aid in evaluating the quality of the spermatozoa in the practice of the assisted insemination<sup>47,48,49,50</sup> and also for the evaluation of the effectiveness of medical treatments to treat infertility.<sup>51,52</sup>

This system, after changing some parameters, can also be used for the evaluation of the sperm in all operations related to artificial insemination of farm animals, such as cattle and horses<sup>53</sup>. Antigen-antibody methodologies for the assessment of bovine semen were also developed in order to verify the presence and location of the protein components responsible for the normal physiology of the spermatozoon.<sup>54</sup>

Other systems for the evaluation of the quality of the spermatozoa were studied by Baccetti and collaborators, such as for example a system for the kinematic analysis of movement,<sup>55,56</sup> or

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<sup>41</sup>B. Baccetti and M. Mirolli. Notulaeseminologicae 3. Mathematical diagnosis from TEM seminal detection. *Andrologia* 26, 47-49 (1994)

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<sup>43</sup> B. Baccetti, A. G. Burrini, G. Collodel, M. Mirolli, E. Moretti and P. Piomboni. Seminological Investigations by Submicroscopical Methods. *Frontiers in Endocrinology: Perspectives on Assisted Reproduction*, T. Mohri, T. Tominaga, T. Aono, M. Hiroi (Eds) (1994)

<sup>44</sup> B. Baccetti, G. Bernieri, A. G. Burrini, S. Capitani, G. Collodel, M. Mirolli, E. Moretti, P. Piomboni and T. Renieri, *NotulaeSeminologicae*. 4. Mathematical Evaluation of submicroscopical alterations in spermatozoa of sterile men with varicocele. *Andrologia* 27, 13-17 (1995)

<sup>45</sup> B. Baccetti, G. Bernieri, A.G. Burrini, G. Collodel, N. Crisà, M. Mirolli, E. Moretti, and P. Piomboni. *NotulaeSeminologicae*. 5. Mathematical Evaluation of Interdependent Submicroscopic Sperm Alterations. *Journal of Andrology*, Vol.16, N° 4 (1995)

<sup>46</sup> B. Baccetti. Un nuovo metodo ultrastrutturale-matematico per la valutazione degli spermatozoi. *Clinica Ospedaliera, atti e memorie della Società Medica del Lazio*, 2, Vol. 6 (1995)

<sup>47</sup> E. Streher, S. Capitani, G. Collodel, M. De Santo, E. Moretti, P. Piomboni, S. Sterzik and B. Baccetti. *NotulaeSeminologicae*. 6. Submicroscopic mathematical evaluation of spermatozoa in assisted reproduction. I. Intracytoplasmic sperm injection. *J. Submicrosc. Cytol. Pathol.*, 27 (4), 573-586 (1995)

<sup>48</sup> Baccetti B., Sterzik K., Streher E., Capitani S., Collodel G., De Santo M., Moretti E., Piomboni P. The evaluation of spermatozoa in assisted reproduction. *Medically assisted procreation. From gametes to embryo implantation; basic and clinical aspects*. N. D'Antona and P. Inaudi (Eds), Siena (Italy), May 19-21 (1996)

<sup>49</sup> P. Piomboni, E. Streher, S. Capitani, G. Collodel, M. De Santo, L. Gambera, E. Moretti, B. Baccetti and S. Sterzik. *NotulaeSeminologicae*. 7. Submicroscopic mathematical evaluation of spermatozoa in assisted reproduction. *In Vitro Fertilization. Journal of Assisted Reproduction and Genetics*. Vol. 13, N° 8, 1996. (O.O. Vol. XII 1996-1998)

<sup>50</sup> E. Streher, K. Sterzik, M. De Santo, B. Baccetti, S. Capitani, G. Collodel, L. Gambera, E. Moretti, and P. Piomboni. Submicroscopic mathematical evaluation of spermatozoa in assisted reproduction. 3. Partial zona dissection (PZD) (*Notulaeseminologicae* 12) *J Submicrosc. Cytol. Pathol.*, 29, (3), 387-391 (1997)

<sup>51</sup> Jian Pei, Erwin Strehler, Ulrich Noss, Markus Abt, Paola Piomboni, Baccio Baccetti, and Karl Sterzik. Quantitative evaluation of spermatozoa ultrastructure after acupuncture treatment for idiopathic infertility. *Fertility and Sterility* Vol. 84, N° 1 (2005)

<sup>52</sup> Erwin Streher, Karl Sterzik, Mariela De Santo, Markus Abt, Rainer Wiedemann, Umberto Bellati, Giulia Collodel, Paola Piomboni and Baccio Baccetti. The Effect of Follicle-Stimulating Hormone Therapy on Sperm Quality: An Ultrastructural Mathematical Evaluation. *Journal of Andrology*, Vol. 18, N° 4 (1997)

<sup>53</sup> B. Baccetti, M. Bergamini, G. Bernieri, S. Capitani, M. Estenoz, A.R. Magnano, M. Mirolli, M. Moretti, and C. Sensini. Submicroscopic mathematical evaluation of spermatozoa in assisted reproduction. 4. The bovine fertilization (*Notulaeseminologicae* 10) *J. Submicrosc. Cytol. Pathol.*, 29 (4), 563-582 (1997)

<sup>54</sup> B. Baccetti, G. Braga, A. G. Burrini, G. Collodel, E. Costantino- Ceccarini, M. Estenoz, G. Gatti, R. Giordano, A.R. Magnano, P. Piomboni, T. Renieri and D. Solazzo. Molecular probes for testing bovine sperm quality. In *Embryonic development and manipulation in animal production: Trends in research and application* Lauria A. and Gandolfi F. (Eds) Portland Press Ltd. London, pp. 37-49 (1992)

<sup>55</sup> L. Azzarelli, M. Chimenti, S. Minutoli, O. Salvetti, B. Baccetti, T. Renieri. Un sistema per l'analisi della cinematica di cellule germinali. *Atti della Fondazione Giorgio Ronchi. Anno LIII, n° 5 Sett- Ott- 1998*

another for analysis in optical polarized light microscopy capable of assessing the single spermatozoon; this system has proved to be particularly useful for supporting the choice of the spermatozoa to be used in ICSI assisted fertilization<sup>57</sup>. The systems and techniques used for the study and evaluation of the integrity of the spermatozoa were compared between them to verify their sensitivity and reliability.<sup>58,59,60,61,62</sup>

The sperm cells of mammals were also studied as a function of a decrease or annulment of their fertilizing capability in the perspective of the development of molecular systems capable of preventing the fertilization. A work in 1975 describes the *in vitro* effects of a chemo-sterilant on testicular cells of the rat.<sup>63</sup> Other studies were conducted on the effect that some vegetable extracts have on the axoneme of spermatozoa of the bull<sup>64</sup> and the rat.<sup>65,66,67,68</sup>

As the different morphological and functional parameters at the basis of the physiological sperm production in mammals and humans in particular became known, the objectives of Baccetti's research focus on correlating the pathologies of the spermatozoon with the pathological status of the male reproductive system, such as cryptorchidism, varicocele, hormonal imbalances, the phlogistic conditions incurred by bacterial and viral infections in the testis, in the prostate and in the epididymal. These researches have favoured experimental medical interventions increasingly targeted at the diagnosis and treatment of many cases of infertility.

Overall, Baccetti's research activity as a spermatologist can be quantified as approximately 150 printed publications that have radically influenced the growth of spermatological science providing innovative cultural contributions and new working practices.

Although strongly committed to studying the spermatozoon, Baccetti never abandoned his other research interests: Biogeography, the Historiography of the naturalists of the past and the mechanisms of biological evolution that were constantly addressed and discussed, almost as if he

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<sup>56</sup> T. Renieri, B. Baccetti, C. Scala, O. Salvetti, and M. Chimenti. Detection of different Kinetic Parameters of Whole Sperm Cell Using a Novel CASA System. Proc. 9<sup>th</sup> Inter. Symp. On Spermatology, Cape Town /South Africa) Oct. 6-11, 2000: pp.253-256.

<sup>57</sup> B. Baccetti, Microscopical advances in assisted reproduction J. Submicrosc. Cytol, Pathol., 36 3-4 , 333-339 (2004)

<sup>58</sup> M. Muratori, P. Piomboni, E. Baldi, E. Filimberti, E. Moretti, L. Gambera, B. Baccetti, G. Forti, M. Maggi. La Frammentazione del DNA spermico: Citometria a flusso e microscopia elettronica a confronto. La medicina della Riproduzione. Cleup Editrice – Padova (2000)

<sup>59</sup> B. Baccetti, S. Capitani, G. Collodel, L. Gambera, E. Moretti and P. Piomboni. Electron Microscopy and Recent Advances in Human Sperm Pathology. Proc. 9<sup>th</sup> Inter. Symp. On Spermatology, Cape Town /South Africa) Oct. 6-11, 2000: pp.245-252.

<sup>60</sup> P. Piomboni, A. La Marca, S. Capitani, E. Bruni, L. Gambera, F. Serafini, G. Scapigliati, E. Moretti, V. De Leo, F. Petraglia and B. Baccetti. Ultrastructural Sperm Analysis in Men with Insulin-dependent Diabetes. Proc. 9<sup>th</sup> Inter. Symp. On Spermatology, Cape Town /South Africa) Oct. 6-11, 2000: pp.275-278.

<sup>61</sup> B. Baccetti, A. G. Burrini, G. Collodel, P. Piomboni, T. Renieri. Submicroscopical methods in human spermatology. In Tecniche di inseminazione artificiale eterologa, C.E.C.O.S. Italia (1992)

<sup>62</sup> B. Baccetti. Advances in submicroscopic evaluation of human sperm function. Proc. Foundation Congress European Society for Gynecologic and Obstetric Investigation: pp. 449-452, A.R. Genazzani, F. Petraglia and A.D. Gennazzani (Eds.) Madonna di Campiglio, Italy February 1993

<sup>63</sup> B. Baccetti, E. Bigliardi, and M. Vegni. Ultrastructural observations on the effect of TEPA chemiosterilant on male rat germinal tissue *in vitro*. Cell Differentiation, 4, 327-338 (1975)

<sup>64</sup> B. Baccetti, L. Bracci, A. G. Burrini, M. Contorni, C. Mencarelli, and V. Pallini. Gossypol and mammalian spermatogenesis. J Submicrosc. Cytol., 16 (1), 85-88 (1984)

<sup>65</sup> Baccio Baccetti, Elisa Bigliardi, Anna Giselda Burrini, Tommaso Renieri and Gloria Selmi. The Action of Gossypol on Rat Germinal Cells. Gamete Research 13: 1-17 (1986)

<sup>66</sup> B. Baccetti, E. Bigliardi, A. G. Burrini, T. Renieri, and M. G. Selmi. Action of Gossypol on Rat Germinal Cells. II Acrosome. Gamete Research 16: 11-21 (1987)

<sup>67</sup> B. Baccetti, A.G. Burrini, J. S. Chen, G. Collodel, D. Giachetti, F. Matteucci, M.G. Menesini-Chen, E. Moretti, P. Piomboni, and C. Sensini. Evaluation of the antifertility activity of the broom *Spatium Junceum* in the mammalian male. Zygote 1( February), pp 71-78 (1993)

<sup>68</sup> J. S. Chen, M. G. Menesini-Chen, D. Giachetti, F. Matteucci, M. Barbetti, C. Sensini, and B. Baccetti. Correlation between male fertility and acrosin-like protease activity in rats treated with *Spatium junceum*. Zygote 1 (November), pp 209-313 (1993)

were in search of new principles that facilitated a more appropriate correlation for all the numerous morpho-physiological data that had been produced in the course of research.

Baccetti was not only a laboratory man, but also a very valuable creator of projects and lines of research.

In the middle of the seventies Baccetti, together with other biologists, clinicians, gynecologists and endocrinologists launches within the CNR (National Research Centre) the "Biology of Reproduction" research project of which he will be the director for its entire duration from 1977 to 1983. This project turned out to be innovative because of its interdisciplinary nature aimed at the study of the mechanisms that regulate fertility in humans and animals and plants of economic interest. The project had a notable scientific production with positive repercussions of application.

A few years before, in 1969, Baccetti had conceived and organized the first "International Congress of Spermatology" for the Accademia dei Lincei. The work took place in Siena and Rome and saw the participation of all the researchers who then began to study this specific cell. The Acts of the Symposium came out in 1970, a year which is regarded as the date of commencement of spermatology.

In 1991, at a distance of 20 years, when Spermatology had by now become a science with its own well-characterized physiognomy and autonomy, Baccetti once again organizes the 6th *Symposium Spermatology Comparative: 20 Years After* in Siena and together with Afzelius traces the history of twenty years of fruitful spermatological research.<sup>69</sup>

These symposia continue today and are organized every four years.

Two unusual publications produced together with his friend the painter Mino Maccari in the magazine *L'Indiscreto* (The Indiscreet) reveal how Baccetti was attracted by the interrelations between Science and Art hoping perhaps to encourage the emergence of that atmosphere of Renaissance in which it was possible to design a future of research and experimentation freed from the contingent situations and ideologies.

In these pleasant booklets Baccetti talks about scientific knowledge on sperm<sup>70</sup> and egg<sup>71</sup> and has a dialog with Maccari who, with his scathing, ironic and poetic style illustrates the implications and the perception that these scientific data have on the imagination of man.

Upon careful reading, most of the ideas that Baccetti had on the relationship between scientific research, natural laws and human activities are encased in these two publications "*Research* (he insists), *especially biomedical research, has important implications and consequences on the thinking and acting of man, but it has its own objectives, its own temporal dynamics and can eventually provide data that may not meet man's expectations.*"

Several other scientific interests, other lines of research and many results and publications obtained by Baccetti could be recalled for a more complete definition as a researcher concerned and fascinated by the different aspects of knowledge.

His dream was to bring men of Science together in a "College" together with men of Letters, History, Philosophy, Economy and Art because they could compare the different assumptions that

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<sup>69</sup>B. A. Afzelius and B. Baccetti. *History of Spermatology. Comparative Spermatology 20 Years After*, Serono Symposia Publications From Raven Press Vol. 75, New York (1991)

<sup>70</sup> Baccio Baccetti e Mino Maccari. *Storia Naturale dello Spermatozoo.. Breve Storia dell'Evoluzione della Cellula Germinale Maschile ad uso dei Profani e dei Dilettanti. L'Indiscreto Periodico di Cultura ed Arte. Anno IX- N° 3 Firenze (1979)*

<sup>71</sup> Baccio Baccetti e Mino Maccari ( a cura di) *L' Indiscreto svela 'uovo e il suo segreto.. L'Indiscreto, AAnno XVI n.1, Galleria Pananti ed., Firenze maggio (1984)*

are at the base of each particular system of investigation of a single reality; only with this approach can those insights and those right ideas lead to deciphering the present, which is an essential prerequisite for a cultural evolution of Man that is not harmful.

In future times other biographers, not pressed by the contingency of a vivid memory, will outline a more accomplished historical profile of the man and of the polyhedral researcher, but certainly there is one aspect that they cannot fail to take into account: his continual, sometimes frantic, desire to undertake research which is now deposited in over 600 printed publications.

Ciao Baccio.