The origin of Audiology and the contribution of Italian Audiology: the Bari school

Ettore Cassandro interviews Antonio Quaranta

Antonio Quaranta was born in Bari (Italy) on 02.01.1943. After completing his classical studies, he enrolled in the Degree Course in Law and after a year in the Degree Course in Medicine and Surgery. In 1967 he enrolled in the Specialization School in Gynecology and Obstetrics and in 1968 at the Specialization School in Otolaryngology. Full Professor of Audiology and of Otolaryngology, he was director of the Center of Audiology and Otology of the University of Bari (1986-1990), of the Otolaryngology Clinic of the University of Bari (1990-1998; 2001-2011), of the Otolaryngology Clinic, Otology and Otoneurology Microsurgery of the University of Parma (1998-2000), of the Residency Schools of Audiology and Phoniatrics (1987-1993) and in Otolaryngology (2005-2006), coordinator of the PhD Program in " Audiology Science "and of projects of research of the Ministry of the University and of the CNR (" Cochlear implants"," Aging "," Pathophysiology of the auditory efferent system ", " Effects from the senescence on neuro-otological degenerative pathologies ", " Effects of the neurotrophic factors on functional performance of the ears with cochlear implant "). He was Dean of the Faculty of Medicine and Surgery of the University of Bari (2006-2011), director of the Pilot Center of Audiology and Otology for the Countries of the Mediterranean Area (1985-1998), founder and president of the Mediterranean Society of Otology and Audiology - MSOA (1987-2000), president of the Italian Society of Audiology (1989-1991, 1995-1997), president of the International Society of Audiology (2000-2002), president of the XXIII Congress of the International Society of Audiology (Bari, 1996). He is a member of the Collegium Oto–Rhino-Laryngologicum Amcitiae Sacrum- CORLAS since 1992.

How was the love for audiology born?

On March 27, 1970 professor Giuseppe Cervellera, director of the Institute of Otorhinolaryngology of the University of Bari, in a letter addressed to the Rector of the University writes "Dr. Antonio Quaranta has been attending this Institute since 1968. During these years he has shown that possess a strong aptitude for research and a natural intuition and analysis of scientific problems. Gifted with lively intelligence and a firm will to achieve, he devoted himself to the study of the problems inherent in auditory masking and the physiopathology of the ear. He has planned a series of researches that should be noted for the originality of the approach and the accuracy of the experimental method ". In reality, falling in love with Audiology occurred since the first moment I started to attend the Residency Program of Otolaryngology directed by professor Gualtiero Lugli (1898-1991) (Figure 1), one of the first Italian researchers to dedicate himself after the 1940 to the study of psychoacoustics ("Quantitative relationships between stimuli and auditory

sensations" 1942, "Phenomenon of beats in relation to the theories of hearing" 1942, "Fatigue effect of cochlear receptors as a function of the frequency and intensity of sounds" 1942, "Effects of auditory fatigue on the level of sensation" 1942, "Electrical phenomena of the function of the inner ear" 1943, "Fatigue effect of acoustic receptors" 1945, "Physiological effect of Recruitment" 1953, "Absence of fatigue of masked receptors for the action of fatiguing sound" 1956, and more).

Figure 1 Gualtiero Lugli

Certainly it was not difficult for me to fall in love with audiology after the frequent meetings during which professor Lugli was pleased to talk about the research he did in the immediate post-war period at the CNR Institute of Electroacoustics and to remember the development of Audiology in Italy since the "Audiology course" held in january 1951 at the Otorhinolaryngology Clinic of the University of Milan in wich he had a conference on " The effects of auditory fatigue and their application to the study of cochlear receptors ". Gualtiero Lugli had the same age and was a good friend of Luigi Pietrantoni who started to direct the ENT Clinic of the University of Milan in 1947 and was from 1955 to 1958 the first of the three italian presidents of the International Society of Audiology (1972-74 E. Bocca, 2000-02 A. Quaranta). Lugli directed the ENT Clinic of the University of Bari from 1936 to 1968 when Cervellera started to direct the Clinic and in 1969 the Italian Society of Audiology and Phoniatrics entrusted him with the Official Report " Physiopathological and Clinical Problems of Tonal Masking", which was to be held in Bari from 30 April to May 1, 1971. (Figure 2)

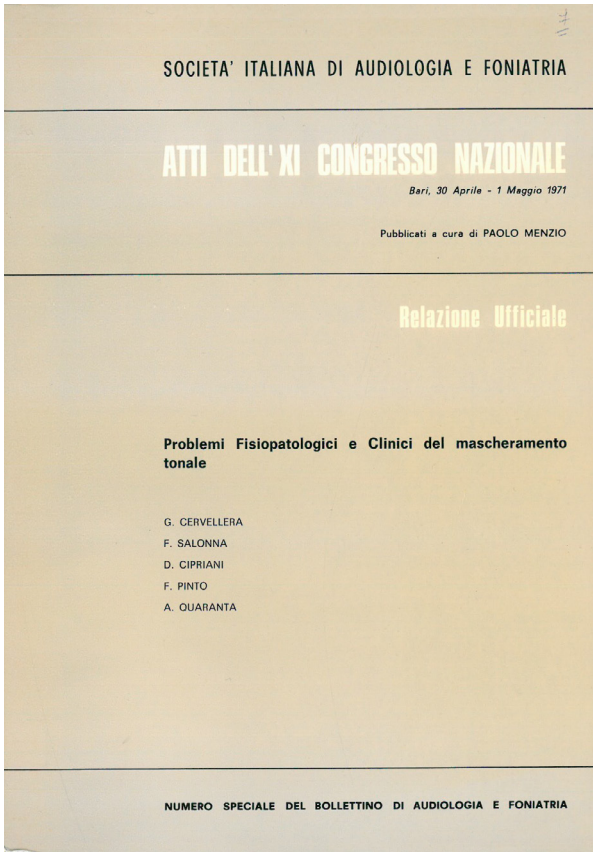

Figure 2 "Problemi Fisiopatologici e Clinici del mascheramento tonale", official report at the XI Congresso Nazionale della Società Italiana di Audiologia e Foniatria (Bari April 30 - May 1, 1971)

Right from the start I was involved and immersed in the difficult bibliographic research of what had been published over the years, in accredited scientific books and journals, on the pathophysiology of the inner ear and central auditory pathways and on auditory masking; this allowed me to familiarize myself with the studies of A.M. Valsalva (1666-1732), D. Cotugno (1736-1822), A. Volta (1745-1827), H. von Helmhotz (1821-1894), R. Barany (1876

-1936, Nobel Prize for medicine in 1914), G. von Békésy (1899-1972, Nobel Prize for medicine in 1961), J. Zwislocki, J. Jerger and many other scientists and researchers over the years had ennobled the study of the auditory system and its functions. At that time, the Bari Clinic was equipped with two traditional clinical audiometers, a Bekesy audiometer, and some old equipment used by Lugli for his research. With the collaboration of a friend, assistant of the Institute of Electronics of the University of Bari, we developed systems that allowed us to study, in normal hearing subjects and in ears with Ménière's disease or sensorineural hearing impairments, the intensity discrimination, frequency selectivity, auditory adaptation in the absence and in the presence of tonal masking; the effects of central masking; remote masking (RM); temporal masking; binaural masking and in particular the difference of masking level changing the interaural phase relationships (masking level difference - MLD).

What are the results of your main audiological researches?

Over the years numerous studies have concerned the auditory performance of children, adults and the elderly, of subjects chronically exposed to noise and / or with acute or chronic pathologies, of ears with cochlear implants utilizing advanced tests that assess primarily cochlear function (remote masking-RM, Brief Tone Audiometry -BTA, Critical Ratio-CR, Psichoacustical Touning Curves- PTCs, Evoked Otoacoustic Emissions-EOEs), neural auditory function (tone decay), central auditory function (ipsilateral vs contralateral acoustic reflex, tonal Masking Level Difference-MLD), and / or Auditory Braistem Responses-ABRs.

Concerning the tests assessing primary cochlear functions, RM has been attributed to mechanical non linear distortion of vibrating structure within the inner ear and has been proposed as a test of cochlear partition elasticity; BTA is based on the quantitative determination of temporal integration of acoustic energy at threshold depending on the integrity of the outer hair cells (OHCs); CR and PTCs measure frequency selectivity that is the ability of the auditory system to detect one signal in presence of another, an ability attributed to the filter process of the basilar membrane and of the organ of Corti , particularly the OHCs; EOAEs reflect an active mechanism in the cochlea due to OHCs.

We found that cochlear and central auditory functions are almost the same in three-ears-old as they are in adults, if not better; with the age, there is a decrease in incidence of EOAEs, a reduction of the temporal integration of acoustic energy, a deterioration of the efficiency of the signal detection mechanism or frequency selectivity, an increase of stiffness in the hydrodynamic system of acoustic energy transmission, an alteration of the binaural analytic process of phase, an increase of synaptic resistence in the cochlear-facial pathways and rarely a pathological tone decay. In elderly subjects has also been found that cochlear and central hearing functions can be impaired without a significant hearing loss; moreover we have demonstrated that elderly and ears with multichannel cochlear implants who had the poorest speech recognition scores also had worst frequency selectivity.

Searches in Chinchillas on the functional consequences of aging have shown a rate of loss more similar to that of humans and supported the notion that aging, independent of hearing loss, can influence suprathreshold auditory function; nowadays chinchillas are recognized as a reliable model for understanding the etiology of human presbycusis.

From a clinical point of view our research support the usefulness of testing primary cochlear functions to monitor inner ear disorders in subjects with suspected immunomediated , diabetic or thyroid pathogenesis, and of tonal MLD and / or ABRs in normally hearing subjects suspected to have central hearing pathways lesions and / or multiple sclerosis.

Finally our studies found that: in normal-hearing chinchillas a noise exposure that produces Temporal Threshold Shifts (TTSs) also produces rapid and significant changes in RM; in chinchillas with permanent threshold shift (PTSs) RM value is significantly lower than in normal hearing chinchillas; during auditory medial efferent stimulation in humans, frequency resolution is improved at low frequencies but impaired at high frequencies; in young normally hearing subjects with a

normal auditory efferent system exposed to an ipsilateral low-intensity and low frequency narrow-band noise, a course of alpha-lipoic acid or "supra-physiological" vitamin B12 administration could reduce the risk of hearing dysfunction from noise exposure.

What role did Bari play in the socio-cultural, health, and educational integration in the audiological field between the countries of the Euro-Mediterranean area?

In the second half of the 80s of the twentieth century, the countries of the Southern Mediterranean (Algeria, Egypt, Syria, Morocco, Tunisia, Lebanon, etc.) were classified by international organizations as "developing countries" because of the poor standard of living , inadequate income, widespread poverty, limited industrial activity, low human development index. In these countries, the reports of the World Health Organization (WHO) highlighted a significantly higher mortality than that of the "industrialized countries" mostly due to nutritional deficits, unprotected sexual activities, unsafe water, lack of adequate sanitation, environmental pollution. The same WHO reports certified ear diseases and deafness in fourth place among chronic and disabling diseases, after rheumatic, cardiovascular and mental diseases. It also emerged that in these developing countries, although a higher number of people in need of ear surgery and/or hearing aids, there was a small number of specialist doctors and technicians useful for prevention, early diagnosis and the treatment of ear diseases, and the rehabilitation of childhood and adult deafness. Already from many years, I was actively involved of the International Society of Audiology (ISA), and these data led me in 1987 to organize in Puglia (Rosa Marina, Brindisi) from 7 to 13 June the " Ist International Meeting for the Mediterranean Countries" (Figure 3) with the purpose of << making an analysis of the most recent notions on practical, clinical and advanced research in Audiology and, above all, to compare the experience of all those engaged in Audiology in industrialized countries with the experience of those living in developing countries >> (Clinical Audiology '87, A. Quaranta) (Figure 4).

Figure 3 Opening ceremony of the Ist International Meeting for the Mediterranean Countries "Clinical Audiology '87" (Rosa Marina 7-13 June,1987)

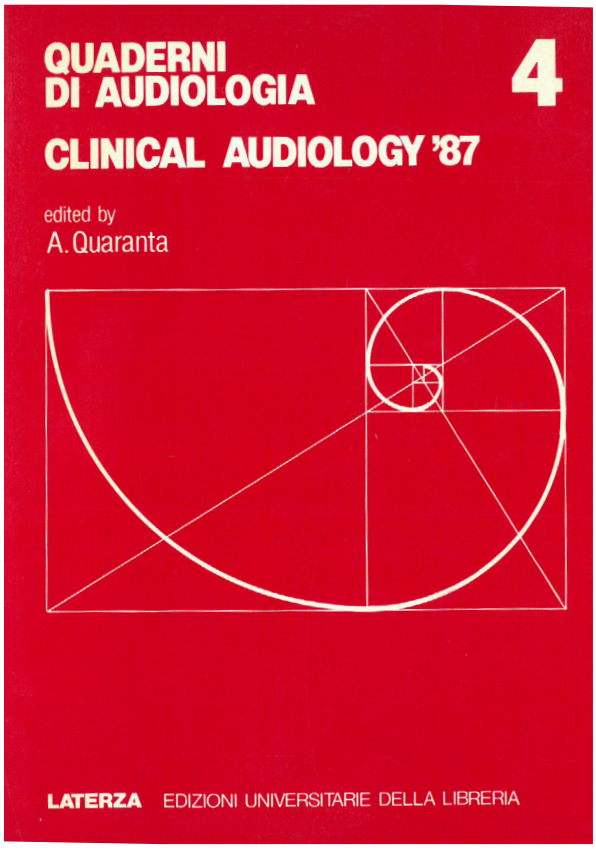

Figure 4 Clinical Audiology '87, edited by Antonio Quaranta (Laterza,Bari)

The meeting was attended by 170 speakers and over 400 clinicians, researchers, and young doctors of different socio-cultural traditions, languages, and religions, coming not only from the Mediterranean countries but also from Central and Northern Europe, USA,

Canada, Argentina, Mexico, Australia, Japan, China . The idea of this meeting was born from the desire to initiate and promote socio-cultural, health, and training integration in the audio-otology field between the industrialized and the developing countries of the Euro-Mediterranean area. During the Rosa Marina meeting, I seat at the same table J. Sadè (Israel), L. Manolidis (Greece), A. Belal (Egypt), M. Bergman (Israel), H. Soliman (Egypt) and J. Barajas (Spain), and, at my proposal, in full agreement we founded the Mediterranean Society of Otology and Audiology (MSOA). This initiative had a multiple perspective value: on the diplomatic side, at mitigating possible socio-political inconveniences resulting from the sometimes tense relations between the countries of the Southern Mediterranean area, and on the other hand, interpersonal and scientific to foster friendship between researchers from the countries of the Euro-Mediterranean area and to promote a real cooperation between industrialized and developing countries in the context of projects and clinical activities, research, training, and development of socio-health pathways in the audio-otology field.

In 1988 the International Federation of ORL Societes (IFOS) and the Committee for Worldwide Prevention of Hearing Impairment (WOPHIC), in agreement with the WHO, promoted cooperation between indusrialized and developing countries aimed at activating, in different areas of the world, Pilot Centers to promote and develop socio-health pathways in developing countries for prevention, early diagnosis and medical-surgical and/or rehabilitative treatment of audio-otology pathologies, and for the training and specialization of the necessary medical, technical and rehabilitative personnel. Seven Centers have been planned: Bangkok for the Far East, Mexico City for Latin America, Kuwait for the Near East, Budapest for Eastern Europe, one for French-speaking Africa, Cairo and Bari for the Mediterranean area. The Bari Mediterranean Center (BMC) had its headquarters at the Center of Audiology and Otology of the University of Bari, was directed and coordinated by me, and had the adhesion of 27 university and/or medical institutions of the Mediterranean countries (Italy, Spain , Egypt, France, Turkey, Israel, Lebanon, Malta, Yugoslavia, Greece, Albania). Between 1991 and 1994, the BMC financed 6 scholarships of three million lire each, plus travel expenses, for young ENT doctors and/or audio-verbal rehabilitation technicians from Mediterranean developing countries who wanted to attend the Center for three months. The scholarships were awarded to doctors and/or technicians from Albania, Syria, Egypt, Lebanon, Turkey, who attended the BMC as planned. In those years the BMC, with its Director, was present in working groups at the WHO in Geneva (WHO Informal Working Group on Prevention of Deafness and Hearing Impairment, 1991; WHO Informal Consultation of Hearing Impairment by Ototoxic Drugs, 1994) and hosted the Ear Care Workshop in Bari (June 1994), a meeting aimed at harmonizing WHO programs in the audio-otology field between industrialized and developing countries of the Euro- Mediterranean area, in which panelists were T.Lundborg (Sweden, President of Hearing International- HI) , B. Thylefors (Switzerland, WHO delegate), R. Filipo (Italy, President of the Italian Society of Audiology-SIA), N. Kotby (Egypt, Cairo Mediterranean Center), F.E. Offieciers (Belgium, ENT European Academy), P.W. Alberti (Canada, Secretary General of the International Federation of Otorhinolaryngological Societes -IFOS), E. Arslan (Italy, delegate of the Collegium Oto -Rhino- Laryngologicum Amicitiae Sacrum- CORLAS), P. Berruecos (Mexico, President of the International Society of Audiology-ISA). (Figure 5)

Figure 5 Ear Care Workshop held in Bari in June 1994 ; from bottom to top recognizable P. Alberti, E. Arslan, E. Cassandro, A. Quaranta, T. Lundborg, R. Filipo, N. Kotby, B. Thylefors, and others

In 1996, from 16 to 20 June, I was President in Bari of the XXIII Congress of the International Society of Audiology (Figure 6); the participants were more than 500 representing Mediterranean countries, Central and Northen Europe, USA, Japan, China, Argentina, Brazil, Mexico, Thailand, and others, and scientific communications more than 300 (Figures A,B,C,D,E).

Figure 6A XXIII International Congress of Audiology held in Bari in 1996. President A. Quaranta officially opens the Congress

Figure 6B Opening ceremony, among others in the first row Donald Henderson and Richard Salvi

Figure 6C Antonio Quaranta, Edoardo Arslan, Richard Salvi and others follow the scientific works

Figure 6D Richard Salvi, Nicola Quaranta and others during the Congress

Figure 6E James Jerger and Antonio Quaranta chair a scientific session

The MSOA, of which I remained President until 2004, has continued over the years its original mission of friendship and dissemination, updating and training by organizing conferences and scientific meetings in various Mediterranean countries (Greece, Egypt, France, Spain, Turkey, Tunisia, Croatia, Italy, Israel, Slovenia) and since 2005 publishes an

international scientific journal initially until 2008 as the "Mediterranean Journal of Otology" and since 2009 as "The Journal of International Advanced Otology". O.Nuri Ozgirgin of Ankara, President of the MSOA, recently written << The Mediterranean Region has its own friendly, affectionate behavior which is unique in the World. Indeed it was a very good idea gathering the people having different religion and races but inspiring the same atmosphere even if there are still some conflicts creating sorrow and pain in some parts >>. Reading what the Turkish friend wrote more than 30 years after the founding of the MSOA, is a silent award for those who have always believed and believe that example, dialogue, culture and science are the real driving force for peace and friendship between men and peoples.

What future of clinical audiology?

The future of the clinical audiology is in its history. The word audiology is a Latin and Greek combination: the Latin "audire" meaning "to hear" and Greek "logos" in the sense of discourse or reason. It is, therefore, the study of hearing in all its aspects: physical, physiological, psychological, clinical, medical, surgical, etc. Before World War II the roots of audiology stemmed largely from speech pathology and remains oriented more toward rehabilitation than diagnosis. In the second half of 40s of the twentieth century in Europe and America changed from its emphasis to a speciality which is primarily diagnostic. Clinical audiology is today concerned with assessment and remediation of communication handicaps and therefore audiology and otology - which studies normal and pathological anatomy and physiology of the ears well as their diseases, diagnosis, and medical and surgical treatment – are jojntly responsible for the diagnosis and the management of the ear and auditory system lesions. It is therefore useful that clinical audiologists know many of the same things as clinical otologists and vice versa, but it must be borne in mind that from an ethical and professional point of view audiologists are not otologists , nor should they be, and otologists are not audiologists, nor should they be. In 2022 clinical audiologists can provide hearing health care from birth to end of-life; they diagnose and treat those with hearing loss, proactively prevent related damage, and can also specialize in the rehabilitation of tinnitus, hyperacusis, auditory processing disorders, cochlear implant use, and /or hearing aid use.

Your life in one line

«*To my father I owe my life,*
to my Master a life worth living»

(Alexander the Great, 356 BC - 323 BC)

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