

Pedro R. García Barreno
Professional activity

Principles. Half a dozen references, accumulated over time, have accompanied all my professional activity. *Wisconsin Idea*: «Never be content until the beneficent influence of the university reaches every family in the state. It is not an abstract concept; it is the idealistic and the humane concern that knowledge could and should have practical impact on the needs, problems and aspirations of people». With this commitment in mind, the statement from Karl R. Popper: «*We are not students of some subject matter but students of problems. And problems may cut right across the borders of any subjectmatter or discipline. We are scholars of problems, not disciplines*». The conclusions of David Weatherall: «The increasingly important role of science in the provision of health care, and the difficult social and ethical issue that will stem from our newfound ability to determine our futures, makes it essential transversal cooperation or knowledge convergence». Joseph L. Goldstein y Michael S. Brown referred to the clinical investigator as a: «bewitched, bothered, and bewildered – but still beloved». In recent years, the concept «creative destruction», popularized by the economist Joseph A. Schumpeter, has been recovered in the area of health in view of its invasion by ICTs. And the recommendation of Johann W. von Goethe: «Knowing is not enough; we must apply. Willing is not enough; we must do». All this gave rise to three principles: reinvigorate the intellectual foundation of academic medicine by convergence of the different areas of knowledge, assimilating the mighty avalanche of technologies, promote and facilitate partnerships and encourage innovation and transfer results.

Pathophysiological basis of diseases. The Thesis focused on shock situations; a serious clinical condition that in its inflammatory variant still causes a mortality rate over 50%. The papers published during the second half of the 1970' and the first half of the 1980' provided data that helped to define and understand the clinical syndrome as two distinct nosologic entities (hypovolemic shock and inflammatory/septic shock) and they opened new therapeutic strategies: drug administration of corticosteroid to high-risk patients. Although the amount of the dose has been revised, administration of corticosteroids in inflammatory shock syndrome is current and fully supported (*Critical Care*, 2017) («Disease-Oriented Research – DOR», J.L. Goldstein & M.S. Brown). These Works –*bench-to-bed*– were recognized by the Foundations Asociación Española Contra el Cáncer and Barrié de la Maza-Condesa de Fenosa.

Mechanical circulatory assist devices. It was approached from a surgical perspective, and various experiments on isolated organs were performed as background which later were returned. It started in 1982 as a support to the Hospital's cardiac surgery department: the incorporation to the clinic of some circulatory assist devices. The initial objective was to design and develop a commercial artificial ventricle control console prototype. The favorable results achieved and the difficulty to Access to such technology in our midst, expanded the line of research into the design and development of our own artificial cardiac ventricle and its electronic and mechanical drive control system. After the Alliance with a company (*Biomed S.A.* ®) and extramural collaboration in the field of mechanics of fluid and biomedical materials, we approached the development of a complete electromechanical circulatory assistance system. The «Project BCM (Biomed-Comunidad de Madrid)» incorporated an innovative concept –false atrium–, never used before in devices of this kind and that basically consists in the incorporation of a compliance camera in the cannula to the ventricle; this facilitates the filling up to the ventricle and reduces hemolysis, the main limiting factor of artificial circulation. After overcoming the requirements –the BCM assumed the U.S. Food & Drug Administration /FDA) standards since there is no Spanish or European regulations approved– in computer models, testing bench, and more than a hundred experiences with sheep, acute and chronic, there was requested authorization to the Ministry of Health for the clinical trial. Such a trial consisted of ten implants in humans. The first intervention in a human patient took place on July 1st, 1989, and ending the test in December 1991 with favorable results. Since then and after the clinical trial, the company involved in the Project from the beginning (Biomed®) was in charge of the industrial manufacturing process and marketing of the device and control console. The artificial ventricle single or double aims to ensure cardiac function during periods between hours and a maximum of two months, waiting for access to a heart transplant. The multifunction console control is used in hemodialysis and peritoneal dialysis («Patient-Oriented Research – POR», J.L. Goldstein & M.S. Brown, partnership and knowledge transfer).

Medical image. On the basis of the first surgical clinical research —portal vein angiography through repermeabilization of umbilical vein and external omphalos-spahenous bypass, 1970— a third subject focuses on the research on techniques of medical imaging, both the development of new technologies and methods of processing and its practical application. This reserach was organizad in 1994 and had a strong interdisciplinary and multicenter carácter, and facilitates a strong connection with the clinical reality which allows you to guide the choice of job topics on the basis of actual needs derived from the assistance to patients («patient-oriented reseach»). Some contracts were signed with Philips®–IBM®: *Computer Vision in Radiology / COVIRA (Commission of the European Communities –Philips Medizin Systeme – IBM United Kingdom Laboratories Ltd – Universita di Genova – Universität Hamburg – Hospital General Gregorio Marañón)*. Later on some partnership were stablished with con Suinsa® (Madrid). The areas of interest of this alliances were: **a)** Magnetic resonance imaging (MRI). Image reconstruction: algorithms and analysis (Philips ®) **b)** Integration of multimodality imaging data. **c)** Quantification of functional cardiac imaging through tissue Doppler imaging (DTI); eco potentiation intravascular contrasts administration were also used. Algorithms and other computer tolos were developed and transferred to Acuson ® USA. **d)** Telemedicine: Active participation in European Union-funded telemedicine projects. Implementation of a teleradiology system station, *Telra*, transferred to Suinsa ® by a technology ttransfer contract, in 2002. **e)** Ultra-high-resolution imaging of samall labratory animals: PET molecular image and high-resolution computed tomography systems transfered to industry (*Suinsa ®-General Electric ®*). All this work unprecedented en sus inicios in the field of medical imaging y el trabajo inicial con circulatory assistance devices has been recognized with the Award for Innovation 2004 of the Union of Businessmen of the Chamber of Commerce and Industry.

Epidemiological research. In 1982, as Chairman of the Scientific Committee for the Toxic oil síndrome, new techniques were developed to try to determine tha causative xenobiotic. In 1985 as Head of of the National Plan for prevention of Subnormality demanded technical for massive microanalytical screening, that culminated with the coverage of 100% of the newborns in Spain and allowed to expand form 2 to 19 the controlled diseases. In 1989, on the grounds of the V Centenary of the Discovery of America, an ambitious plan was developed for analysis of genetic polymorphism (HLA) in Spanish-American and indigenous populations (Colombia, Mexico, Venezuela), and to elaborate a quantitative susceptibility mapping. Systematic introduction in 1993 laparoscopic techniques.

Convergence: Life sciences, Physical sciences, Engineering. In 2000, as Chairman of the Botin's Foundation Science Program, the first Project coordinated at national level of techonology transfer, I achieved the creation of companies and a venture capital funds. In 2009, the Rector of the Universidad Carlos III, at Madrid, commissioned the development of a Degree in Biomedical Sciences and Bioengineering in a Department of Aeroespacial Engineering which, currently, requires for joining one the highest mark cut-off. Since 2015, I am codirector of the Science-Law Program supported by the Foundation for Research in Law and Bussiness & Garriges Foundation. In 2016, The Rector of the Universidad de Cantabria, at Santander, commissioned the development a Center of System Complexity.

Regarding research papers we must indicate that the publication «Research and Surgery» (*Act Urol Esp* 2008; 32 (1): 3-23) was posted by *BioMedLib* ® as number one of the *Top 10* articles published in the same topic since its publication; and the paper «Normal biochemistry values in baboons (*Papio C. Cinocephalus*)», *Comp. Biochem. Physiol* 1990; 96 B (4): 647-649, was cited by T.E. Starzl in his publication of the first primate-humane liver xenotransplantation.

Special mention to *Paz y Bien. La Biomedicina en España, y Pedro García Barreno*, edited by Jesús Ávila, Joan J. Guinovart and M.^a Teresa Miras. In 2010, the Spanish academy fraternity presented to him, as a token of their gratitude and recognition, a *Liber amicorum* containing numerous distinguished contributions from eminent professors and researchers in the field of biomedicine.