HEALTH AND TECHNOLOGIES

Section "Positions and scholarships" integrated on 28/05/2020
Section "Positions and scholarships" integrated on 04/06/2020
Section "Positions and scholarships" integrated on 10/06/2020

Coordinator	Prof. Claudio Borghi Dept. of Medical and Surgical Sciences Via Massarenti 9 - Bologna claudio.borghi@unibo.it
Starting date of the PhD Programme	01/11/2020
Duration	3 calendar years
Language of the PhD Programme	Italian and English
Mandatory stay abroad	Yes (3 months)

Research subjects

- Biomechanics
- Neurocognitive system
- Diagnostics
- Therapeutics
- Methodologies
- Devices and services

PhD positions and scholarships

Position n.	Financial support	Description	Positions linked to specific research subjects
1	PhD Scholarship	Totally funded by the University of Bologna general budget	Dedicated to the development of a research topic chosen by the candidate among those listed at the end of this document.
2	PhD Scholarship	Totally funded by the University of Bologna general budget	Dedicated to the development of a research topic chosen by the candidate among those listed at the end of this document.
3	PhD Scholarship	Totally funded by the University of Bologna general budget	Dedicated to the development of a research topic chosen by the candidate among those listed at the end of this document.
4	PhD Scholarship	Totally funded by the University of Bologna general budget	Dedicated to the development of a research topic chosen by the candidate among those listed at the end of this document.
5	PhD Scholarship	Totally funded by the University of Bologna general budget	Dedicated to the development of a research topic chosen by the candidate among those listed at the end of this document.
6	PhD Scholarship	Totally funded by the University of Bologna general budget	Dedicated to the development of a research topic chosen by the candidate among those listed at the end of this document.
7	PhD Scholarship	Funded by the University of Bologna general budget and co-funded by the Department of Industrial Engineering	Dedicated to the development of a research topic chosen by the candidate among those listed at the end of this document.
8	PhD Scholarship	Funded by the the Department of Industrial Engineering with funds made available by the projects H2020 STRITUVAD and H2020 COMPMIOMED2 (Prof. Marco Viceconti)	Development and pre-clinical validation of a computer-assisted predictor of the risk of vertebral
9	PhD Scholarship	Funded by the the Department of Industrial Engineering with funds made available by the project H2020 MOBILISE-D (Prof. Marco Viceconti)	Credibility of digital health predictors of human movement
10	Inter-sectoral doctorate	Position reserved for employees of the Istituto Scientifico Romagnolo per lo Studio e la Cura dei Tumori (IRST) S.r.l., IRCCS	
11	PhD Scholarship	Funded by RCF Spa	Acoustic reduction of environmental and undesired noise

12	PhD Scholarship	Funded by Policlinico Sant'Orsola	Hospital Operations Management: optimization of production areas and patient logistics
13	PhD Scholarship	Funded by I.M.A. - Industria Macchine Automatiche S.p.A.	Multipurpose faciAl maSk for Control of Covid Diffusion MASC2D (Progetto MASQUERADE)
14	PhD Scholarship	Funded by Fondazione Istituto Italiano di Tecnologia (IIT)	
15	PhD Scholarship	Funded by Pietro Galliani Spa	Application of noble metals for health protection
16	PhD Scholarship	Funded by the Department of Medical and Surgical Sciences in partnership with AccYouRate Corporate Solutions S.r.l.	Artificial intelligence-enabled algorithms through wearable devices in cardiopulmonary area

Positions linked to specific research subjects: during the oral examination, applicants may express their interest in the positions linked to specific research subjects. Considering the expressions of interest above, the Admission Board will establish if the applicants can be considered eligible for the allocation of the scholarships linked to specific research subjects, taking into account their skills, experience, aptitude and their research project.
The positions with scholarships linked to specific research subjects will be awarded on the basis of the eligibility stated by the Admission Board, and of the sub-ranking generated by each specific research subject. Should one or more of the abovementioned positions remain vacant, eligible applicants from the general ranking list may be contacted.

Admission requirements

Please, see art. 2 of the Call for applications

Mandatory documents to be attached to the application

Please, see art. 3 of the Call for applications

Further qualifications that may be attached to the application, if in possession of the applicant (only qualifications attested by documents drawn up in Italian, English, French, German and Spanish shall be considered as valid and assessed by the Admission Board)

- Abstract of the second cycle master's degree thesis. Undergraduate applicants may submit the draft of the thesis approved by their supervisor (please, note that abstract cannot exceed 5.000 characters, including spaces and formula possibly used. The above figure does not include: the title of thesis, the outline, and images such as graphs, diagrams, tables etc. - where present);
- No more than 2 reference letters signed by Italian and international academics and professionals in the research field, which do not form part of the Admission Board, attesting the suitability of the applicant and his/her interest for the scientific research.
  Please, note that the above letters cannot be uploaded by applicants. When filling the online application form on http://studenti.unibo.it, applicants will be only allowed to provide the email accounts of the requested academic/professional. The latter shall receive an email from the University of Bologna providing for the instructions for uploading. Only letters in pdf format submitted before the expiry date and time of the Call shall be accepted.
- Multi-annual research project, with special emphasis on the activities to be completed during the first-year course, that the applicant would to carry out within the PhD Programme, regarding one of the research topics described in section "PhD positions and scholarships". The proposal must meet the following requirements:
  - It must indicate in the cover page the research topic of the PhD Programme covered by the research project proposal and for which the applicant is applying;
  - It cannot exceed 20.000 characters, including spaces and formula possibly used. This figure does not include: the title of project, the outline, references and images (such as graphs, diagrams, tables etc - where present);
  - It must include: description of the project; expected results; lead-time for implementation; (proposed) criteria to be used to assess the findings obtained.

  The research projects that successful applicants shall carry out during their doctoral career may possibly differ from the project proposed at the application stage. This shall be defined together with the supervisor and approved by the Academic Board.
- Motivational letter. This must include the reasons prompting the applicant to attend the PhD Programme and those relevant experiences and research interests, that make the applicant suitable for the specific PhD Programme (3.000 characters maximum, including spaces).
- List of the publications (monographs, articles published on scientific journals, volume's chapters).
- List of the minor publications (conference papers, etc.).
- List of the abstracts and posters presented during national and international conferences, etc.
- Professional Master courses (1st or 2nd level) relevant to the PhD Programme.
- Postgraduate vocational training programmes/specialisation programmes relevant to the PhD Programme.
- Summary of the thesis defended within the framework of Specialization Schools. The summary cannot exceed 1.500 characters
- Teaching activity carried out at university level
- Research activity of any kind - whether basic, applied, translational, etc. - carried out in any capacity, including when

covered by research grants, and as a staff member of research projects
- Work activity
- Vocational internships
- Curricular and non-curricular training and guidance internships
- Documents attesting the knowledge of foreign languages
- Study periods completed by students outside their countries of origin (e.g. Erasmus programme or other similar mobility programmes)
- Other qualifications attesting the suitability of the applicants (scholarships, prizes, etc)

Admission exams (art. 4 of the Call for applications)

<table>
<tr><th>Examination type</th><th colspan="2">Schedule (please, note that applicants shall not receive any communication concerning the exams schedule)</th><th>Examination results publication (please, note that applicants shall not receive any communication concerning the publication of results)</th></tr>
<tr><td>Qualifications and research project evaluation</td><td colspan="2">Non-presential.</td><td>The results of the qualifications and research project evaluation shall be available online starting from 15/06/2020 at the page http://studenti.unibo.it (please, select: “summary of the requests in progress” - “see detail” and open the pdf file “risultati valutazione titoli e progetto”)</td></tr>
<tr><td rowspan="3">Oral examination</td><td>Date</td><td>18/06/2020
In case that the oral examination cannot be completed in one day due to the large number of applicants, the oral exam schedule shall be made available at the webpage http://studenti.unibo.it together with the results of the qualifications and research project evaluation</td><td rowspan="2">The results of the oral examination shall be available on the webpage http://studenti.unibo.it starting from 06/07/2020 (please, select “summary of the requests in progress” - “see detail” and open the pdf file “risultati prova orale”)</td></tr>
<tr><td>Time</td><td>9:00 a.m. (local time)</td></tr>
<tr><td colspan="3">Applicants shall take the exam remotely. For further details please refer to the relevant provision laid down in art. 4 of the Call for applications.</td></tr>
</table>

Evaluation criteria

Points will be allocated to applications out of a total of 100 on the basis of the following weighting:

1. **Qualifications and research project**
   - Minimum for admission to the oral exam: 30 points
   - Maximum: 50 points

   Only qualifications relating to the last 5 calendar years prior to the calendar year of publication of the Call for applications shall be taken into consideration, with the exception of the University Degree (Diploma di laurea). Please, note that qualifications must be consistent with the PhD Programme.
   Points relating to qualifications shall be allocated on the basis of the following criteria:
   - Graduation final mark; undergraduates shall be evaluated on the basis of the Weighted Average Mark (WAM), if possible: max 7 points; score related to the degree mark will be assigned as follows:
     110 cum laude: 7 points
     110: 6 points
     from 108 to 109 included: max 5 points
     from 106 to 107 included: max 4 points
     from 103 to 105 included: max 3 points
     from 100 to 102 included: max 2 points
     from 90 to 99 included: max 1 point
   - Publications: max 8 points
   - Abstract of the second cycle master’s degree thesis or equivalent: max 6 points
   - Letters of presentation: up to 1 point (half point for each reference letter)
   - Research activity, research grants, and participation in research projects: max 3 points
   - Other qualifications: max 2 points

   Points relating to the research project shall be allocated on the basis of the following criteria:
   - Scientific value and ground-breaking nature of the proposal: max 18 points
   - description and structure of the proposal: max 2 points
   - proposal feasibility: max 3 points
2. **Oral examination**
   - Minimum for inclusion in the final ranking list :30 points
   - Maximum: 50 points

   Oral examination includes the presentation of the research project and is intended to assess the suitability of the applicant to pursue scientific research as well as the general knowledge of issues connected to the PhD Programme.

During the oral examination, knowledge of English language shall be assessed.
The oral examination is carried out in Italian or in English.

Points relating to the oral examination shall be allocated on the basis of the following criteria:
- knowledge of the english language: max 10 points
- research project presentation: max 20 points
- general knowledge of issues connected to the PhD Programme: max 20 points

Possible evaluation sub-criteria will be available on the Unibo website, selecting the relevant PhD Programme → "PhD programme information" at the bottom of the page in the section "Notices".

Final ranking list and enrolment (arts.6 and 7 of the Call for applications)

After the publication of the results of the oral exam, the final ranking list will be available on the Unibo website, selecting the relevant PhD Programme → "PhD programme information" at the bottom of the page in the section "Notices".
Following the publication of the final ranking list, successful applicants must enroll on http://studenti.unibo.it by the deadline indicated on the Unibo website, selecting the relevant PhD Programme → "PhD programme information".

RESEARCH TOPICS TITLES AND SUMMARIES

1) "Big data" toward personalized and precision medicine (TECH degree requested)
This project aims to train a new professional figure who, starting from bioinformatics skills, will know how to adapt and design new machine learning tools specifically designed for personalized and precision medicine. The project is organized in three activities: (i) Data-mining and AI instruments for the spontaneous speech analysis: focus on the early detection of the cognitive decline; (ii) AI-based personalized profiling for the prediction of the functional outcome in patients with spinal cord injury; (iii) Data-mining and AI instruments to ameliorate the predictive value of disease animal models. Machine Learning approaches will be developed to transfer learning ability for being able to have a common ground for all patients and specialise the model for specific patients with smaller data sets. Moreover, a methodology for integrating symbolic prior knowledge from human experts into data driven models will be investigated.

2) Biomechanical evaluation of knee mechanical behaviour and interface stresses with a new concept of alignment for total knee arthroplasty (NEW-KNEE) (TECH degree requested)
At least one knee replacement out of 5 are dissatisfactory due to continuous pain. This is mainly related to inadequate joint kinematics with the current paradigm for prosthesis alignment, causing painful patellar motions and poor balance of soft tissue. Recently, a different rationale has been proposed based on kinematical alignment (KA). This PhD student will work under the joint supervision of an orthopaedic surgeon focusing on knee replacement, and of two engineers with a background in biomechanical *in vitro* testing, and numerical modelling respectively. During these three years, the PhD student will develop a numerical to estimate how the knee joint loads are affected by implant positioning, and a series of in vitro tests to measure how this affects the implant-bone interaction.

3) Understanding the causes of junctional failure in lumbar spine fixation through retrospective clinical analysis and *in vitro* tests (TECH degree requested)
Fixation of the lumbar spine is associated with a high failure rate, both in young and in elderly patients. This project is expected to improve the general understanding of spinal biomechanics, the effect of different treatment options, including the detrimental effect of some surgical treatments. The main focus will be on the failure of the disc caudal to the fixation (junctional pathology).
This project will start from a retrospective analysis of clinical cases available within the Rizzoli database. The focus will be on the determinants for failure after corrective spinal surgery, including both patient-specific ones (anatomical, radiographical, etc.) and surgical ones (type of correction used).
On the experimental side, we will apply digital image correlation (DIC, a powerful experimental technique to measure deformations during *in* vitro mechanical tests) to analyze functional spinal units (FSU) and multi-vertebrae segments. DIC allows investigating both hard and soft tissue at the same time, providing a full-field view of the spine specimen. The focus will be on the biomechanical condition of the intervertebraldi scs after a range of spine surgery procedures.

4) Development of an in silico trial for the risk analysis of new hip replacement designs (TECH degree requested)
The aim of this project is to develop an in silico trial to conduct a risk analysis of the most common failure modes on new design of total hip replacements (THR) before their clinical evaluation.

5) Effect of pathological pelvic version on the risk of impingement or dislocation in total hip replacement patients (BIOMED degree requested)
Lumbar spine surgery patients undergoing total hip replacement can develop a pathological version of the pelvis, because of surgery itself, or postural compensation for the spine pathology. It relates to a higher incidence of complications related to the hip range of motion in these patients. In this project the candidate will access a large body of outcome data in the RIPO registry which, combined with detailed clinical records of patients at the Rizzoli Institute will provide a first robust evidence of such increased risk in this patients population. The candidate will then use a CT-based hip surgery simulator developed at the Rizzoli's Medical Technology Lab to estimate the so-called "safe zone" per acetabular orientation as a function of the pelvic orientation. Last, but not least a prospective study will be conducted on a small group of patients to be recruited in Prof Faldini department. The main outcome of this project will be a clinical recommendation for stratification.

6) Artificial intelligence and augmented reality for the automated co-registration of 3D virtual models to guide robotic radical prostatectomy (TECH degree requested)

3D virtual models obtained from processing of multiparametric magnetic resonance imaging (mpMRI) have been proposed as innovative aids for urological surgery, particularly for renal and prostatic surgery. 3D models are useful to guide the surgeon during crucial surgical steps. Recent research activities to improve 3D-guided robotic surgery focus on the development of augmented reality (AR) systems able to visualize 3D virtual models in the surgical field with in vivo co-registration during robotic surgery. The 3D model does not follow automatically the real organ during its mobilization and traction during surgery. Thus, this non-automated AR may increase the surgical time due to the need of several re-adjustments of the 3D model over the surgical field during the dissection.

The aim of the project is to design, develop, test and validate an artificial intelligence(AI)-based AR system able to automatically co-register in real time the 3D-model and the surgical field.

7) Design of cold atmospheric plasma sources and processes for the containment and control of cardiac implantable electrical device infections (TECH degree requested)

Use of Cardiac Implantable Electrical Devices (CIED) is rapidly growing in view of the broadening of indications and population aging. Despite the recognized effectiveness of CIED to treat cardiac arrhythmias and heart failure in selected patients, they are associated with complications. Infection of CIED system is considered one of the more dangerous issues with relevant impact on patients' outcomes and healthcare costs, especially when it involves the intravascular portion of the CIED system. Historical attempts to save an infected CIED system, based on antibiotic therapy or CIED pocket revision, were associated with poor outcomes leading to consider complete removal of the entire CIED system as the only feasible approach. Despite the improvements in CIED extraction, patient management is still tricky with relevant complications for many. This project will focus on the study of an innovative treatment of bacteria using cold atmospheric pressure plasmas (CAP) and plasma activated liquids (PALs). CAP, with its blend of reactive oxygen and nitrogen species (RONS), UV rays and electric fields is known to be used for the inactivation of microbes. Moreover, the exposure of liquids to a CAP enables the production of PAL containing RONS exerting antimicrobial activity. Thus, the use of CAP or PALs could be a novel and safe adjuvant strategy for the treatment of infections limited to CIED pocket.

8) Electrospun scaffolds for the regeneration of tendons and ligaments (TECH degree requested)

Degenerative or traumatic lesions of tendons and ligaments are difficult to repair. Post-operative failures affect between 15% and 40% of cases (depending on initial indications). We developed a prototype of an electrospun scaffold replicating the hierarchical morphology and the mechanical properties of tendons and ligaments. This PhD project will further develop the prototype by increasing the bioactivity and enhance the integration of the constituent material with the surrounding tissues, and will bring this technical solution towards clinical application.

The following aspects will be investigated: optimization of the polymeric biomaterial and its functionalization to improve cell adhesion, recruiting and differentiation and to prevent inflammatory response, optimal technique for effective sterilization; means of surgical attachment to the host tissue.

The collaboration between the technical area (engineering and chemistry) with the clinical counterpart (orthopaedic surgery) will be a key point of this project.

9) Development of a platform of highly bioactive and biomimetic materials for musculoskeletal tissue regeneration (BIOMED or TECH degree requested)

The research project aims at developing a platform of biomimetic and highly bioactive materials for musculoskeletal tissue regeneration. The platform will include nanofibrous mats and composites, the latter obtained by alternating fibrous mats to hydrogel layers in a multi-layered scaffold, or impregnating electrospun mats with hydrogels that are then crosslinked within the fibrous matrix. In order to endow the materials with the biomimetic properties required for the tissue regeneration, a wide range of natural (i.e. collagen, silk, elastin, alginate, gelatin) and synthetic biomedical grade polymers (polylactic acid, polyglycolic acid, polycaprolactone, etc), as well as their combinations will be investigated; furthermore, fabrication techniques, such as electrospinning and 3D printing, will be employed to provide scaffolds with biomimetic morphology. The bioactive properties will be achieved by incorporating, inside the fibrous mat, H2S-releasing molecules, able to induce the polarization of M2 phenotype and, therefore, a higher pro-healing efficiency of macrophages, with the consequent acceleration of the tissue regeneration. The materials will be characterized *in vitro* through 2D and 3D cultures to highlight its ability to support cell growth and osteogenic differentiation.

10) Elastomers with tunable degradation as small diameter blood vessel substitutes for peripheral artery disease (TECH degree requested)

The research project aims to develop a small diameter (< 6 mm) synthetic vascular graft suited for arterial revascularization in patients with peripheral arterial disease (PAD) and critical limb ischemia (CLI). To allow limb savage and prevent vascular death, open surgery bypass revascularization using autologous vein grafts is the gold standard. When it is not possible, any other approach gives unsatisfactory result.

Therefore, developing a tunable synthetic vascular prosthesis made up of new or modified elastomers represents a possible solution. The graft will be composed by a nanofibrous scaffold of elastomers with controlled hydrolysable properties; the scaffold will be biocompatible and will present a fast degrading internal portion and a slow degrading external part for blood contention; a non-thrombogenic surface will be established through plasma ionized gases technology; thanks to its controlled hydrolysable properties a rapid graft integration with human blood and vascular cells will be achieved. The small diameter synthetic vascular grafts should be able to substitute the autologous vein when donor site morbidity and limited autograft availability occur.

11) Development of a hydrogel construct engrafted with thrombogenic agents to prevent endoleaks' occurrence following Endovascular Abdominal Aortic Aneurysm Repair (BIOMED degree requested)

Endovascular aortic aneurysm repair (EVAR) is currently the most common method for the elective treatment of abdominal aortic aneurysm (AAA), a common disease of elderly. Although the technical success rate for abdominal aortic endografting is high, reinterventions due to endoleak (EL), a persistent flow of blood into the aneurysm sac after device placement, are frequent. Since persistent type II EL (ELII) is associated to increased probability of AAA rupture and vascular death, AAA sac embolizationwithmetallic coils is undertaken to reduce its development.

This treatment exposes patients to unwanted metallic load and interference, as metal spirals are radiopaque, in diagnostic imaging procedures that are used in post-procedural follow-up.

In the present research project, we propose to develop an innovative injectable, biocompatible hydrogel in which thrombogenic agents are engrafted to augment hemostasis locally. This construct may allow a selective intraprocedural sac embolization to reduce post procedural pELII and possible AAA rupture.

12) Developing models for detection of early biomarkers of psychosys: an integrative use of computational modelling, machine learning, EEG and neurostimulation (BIOMED degree requested)

This research project will provide a novel approach for the investigation of early biomarkers of psychosis, aimed at tailored plans for prevention in the healthy population at risk and interventions in the psychiatric population.

According to the continuum hypothesis, decision-making abilities, known to be altered in schizophrenia, will be tested in people with low and high levels of schizotypy.

An integration of computational modelling, machine learning, dense EEG signal analysis and innovative neurostimulation protocols will be implemented to test the fronto-parietal disconnection hypothesis. *Computational Modelling* will provide a mathematical model for the understanding and prediction of the precise mechanisms underlying cognitive disorders present in psychosis; *EEG* signal analysis will be used to valid the proposed model and will also inform the machine learning and neurostimulation approaches; *Machine Learning* will aim at decoding composite biomarkers best predicting psychosis risk and *Neurostimulation* will aim at contrasting psychosis risk factors by modulating plasticity of long-range fronto-parietal connectivity.

13) Quantification of 3D joint loading of daily living activities in ambulatory and ecological conditions for therapy, rehabilitation, and functional monitoring: a novel solution based on wearable technology (TECH degree requested)

The project will develop and validate a novel technological solution based on the use of wearable sensors for the functional assessment, monitoring, and home rehabilitation in ambulatory and ecological conditions of patients affected by musculoskeletal pathologies, potentially requiring surgical treatment.

In particular, the present project will address the still unresolved problem of the quantification of joint loading during exercise and daily living activities out of thelab. This will require to develop an innovative approach allowing th e tailoring of a mechanical model to the characteristics of each patient, taking into account anthropometric and functional differences as well as the constraints associated to different clinical application (e.g. ambulatory functional assessment, support to diagnosis, treatment outcome evaluation, home rehabilitation monitoring and guidance).

The expected final outcome is the design and prototyping of the novel assessment platform.

14) Developing image-based biomarkers from multi-parametric MRI studies of prostate cancer using clinical and radiomic features (TECH degree requested)

Prostate Cancer (PCa) is the second most common cancer worldwide, and the fifth most common cause of cancer death among men. Although PCa can be often indolent and non-clinically significant (NCS), it can suddenly become aggressive (CS). Early PCa detection is promoted in men over 50's through screening that can lead dubious cases to be submitted to further investigations by needle biopsy and multi-parametric Magnetic Resonance Imaging (mpMRI). However, they both may provide non-resolutive responses, this demanding new detection and prognostic approaches. To this purpose, medical image phenotyping, recently called "Radiomics", has shown to be effective to extract imaging biomarkers, by analysing a high number of features through machine learning methods. This project aims at detecting imaging biomarkers by setting up retrospective studies on cohorts of patients from S.Orsola Hospital (SOH) to select most promising radiomic features among those conceived by the Computer Vision Group (CVG) of DISI, to be subsequently validated with prospective studies. Finally, the reproducibility of biomarkers is assessed with a multicentre study, also involving the collaborating hospitals.

15) Development of new *in vitro* models to evaluate drug absorption and metabolism (BIOMED or TECH degree requested)

The development of new drugs is characterized by a long and very expensive multistep process with a large failure, potentially exposing patients to possible health risk related to side effects and pharmacological interaction during the registration trials. Traditional in vitro models (monolayer cells) do not strictly represent the complex kinetic of drugs in human tissues. On the other side, animal models are progressively considered unethical and, one more time, not always strictly representative of human physiology and pathophysiology. In this context, the development of new in vitro models reproducing the histological structure and functional activity of tissues are strongly needed, both to improve prediction of drug effects in humans, to plan more targeted clinical trials, and to improve the selection of more bioavailable and safe drugs and drug-association to be clinical developed. This could be particularly useful to evaluate the absorption and metabolism of new and old (combined) drugs, especially in liver, bowel and lung tissues.

16) Early and multidimensional characterization of the ageing process through big data and artificial intelligence (TECH degree requested)

The purpose of this 3-year project is to contribute to the design of innovative epidemiological studies on ageing. A thorough analysis of current gaps and needs in the field will pave the ground to identifying a feasible data collection, management and processing framework enabled by technologies such as IoT, Big Data, Artificial Intelligence.

The PhD student will work within an extremely stimulating and naturally multidisciplinary research group. He/she will be supervised and supported by a network of clinical and technological experts who will allow him/her to define and characterize the complex interactions between the factors linked to the aging process. The specifications for defining the necessary data collection strategy, database structuring and implementation, data processing will derive from this understanding of the phenomenon.