

# The TRAMA Project

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**Abstract.** The Project TRAMA Network was born with the aim of training researchers in the field of quantitative analysis of movement creating a Network among all the Institutions involved in the Project. The aims of the Project were: a) Training about the use of the equipment usually present in a Motion Analysis Lab, about the use of new experimental set-ups for movement analysis and about the development of new methodologies; b) Training via web and in practical session in the Labs, about the evaluation of the data acquired in motion analysis Labs and their clinical meaning; c) Network realization for a continue teaching assistance within different Institutions involved in the Project. TRAMA Project was one of the project of Programme  $\alpha$ LFA (America Latina - Formacion Academica), a programme of co-operation between higher education institution of the European Union and Latin America.

## 1 Introduction

Motion Analysis (MA), or computerized multifactorial and integrated analysis of human movement, is a rapidly expanding field of considerable interest from a clinical perspective: the study of postural and motor changes in patients with movement disorders can yield, in fact, crucial information in establishing the degree of functional limitation, associated to a specific pathology, in identifying the rehabilitative program specific for a particular patient, and in following its evolution over time. Furthermore, posture and motion assessment can provide elements important for the evaluation of the effectiveness of rehabilitative programs aimed at reducing the functional limitation due to pathology.

In clinical settings, the movement evaluation is generally conducted using video recording; however, this method has some limits, as it is only able to supply a qualitative description of the movement. This approach is sufficient to evidence gross abnormalities in movement; however, as functional limitation and movement complexity increase with organic pathology, objective analysis becomes necessary. The availability of MA with innovative techniques and advanced equipment for the description, quantification and evaluation of motion achieves precisely this objective.

MA is in fact able to supply clinicians with quantitative, non-invasive, three-dimensional information relating both to kinematic and kinetic aspects of motion and to the pattern of muscle activation during movement. Thanks to these features, MA has a great

role in clinical applications: in fact, the quantitative assessment of a patient's movement provides crucial information of functional limitation related to the pathology. It provides elements useful for the identification of rehabilitative and rehabilitative programs and for the evaluation and monitoring of their effects over time, too.

The great importance of MA in clinical centres is demonstrated by the increasing number of Motion Analysis Labs (MALs), placed in clinical settings; in recent years, a large number of clinical centres, especially those involved in rehabilitation, have set up MALs and carried out motion evaluations in different pathological situations, both in Europe (EU) and in Latin America (LA).

Even though MA is a powerful tool in a clinical environment, its use requires the clinicians and the operators working in a MAL to solve from a practical point of view a lot of obstacles, which sometime limit the routine use of this methodology. Standardized experimental sets-up, data representation and common data evaluation are more and more required.

For this reason, a shared operational methodology is necessary to allow the MA to spread throughout clinical centres and to overcome the existing difficulties related to the use of different instruments and work practices. Furthermore, key managerial and organizational skills are required to assure sustainability of MALs service role to clinical centres. Competencies needed to manage and operate them effectively require the establishment of devoted training programs.

In this panorama, our idea has been the realization of an international network aimed to:

1. the training of specialized personnel able to operate in MALs
2. the exchange of data and methodologies to establish standardized working practices.

From this idea the TRAMA (TRAINing in Motion Analysis) Project has been thought. TRAMA Project was an international project, approved and financed by the European Community in the field of Programme Alpha (a programme of co-operation between higher education institutions of the European Union and Latin America; [http://ec.europa.eu/europeaid/where/latin-america/regional-cooperation/alfa/index\\_en.htm](http://ec.europa.eu/europeaid/where/latin-america/regional-cooperation/alfa/index_en.htm)), lasting three years (from 2007 to 2010).

## 2 Participants

The Coordinator of the project has been the Bioengineering Department (now Department of Electronics, Information and Bioengineering) of Politecnico di Milano (Italy) (Fig. 1) and partners from EU (Italy, Sweden and Belgium) and from LA (Chile, Colombia and Mexico) have been involved, both Higher Educational Centers (Full Partners) and Clinical Centers (Associate Partners) (Fig. 2).

This international network has worked during these three years in order to train researchers about the use of the equipment of MALs, the clinical use of MA data, the use of new experimental technologies for movement analysis and their transferability in clinical field and development of new methodologies. In particular, the Full Partners



Fig. 1. Politecnico di Milano.

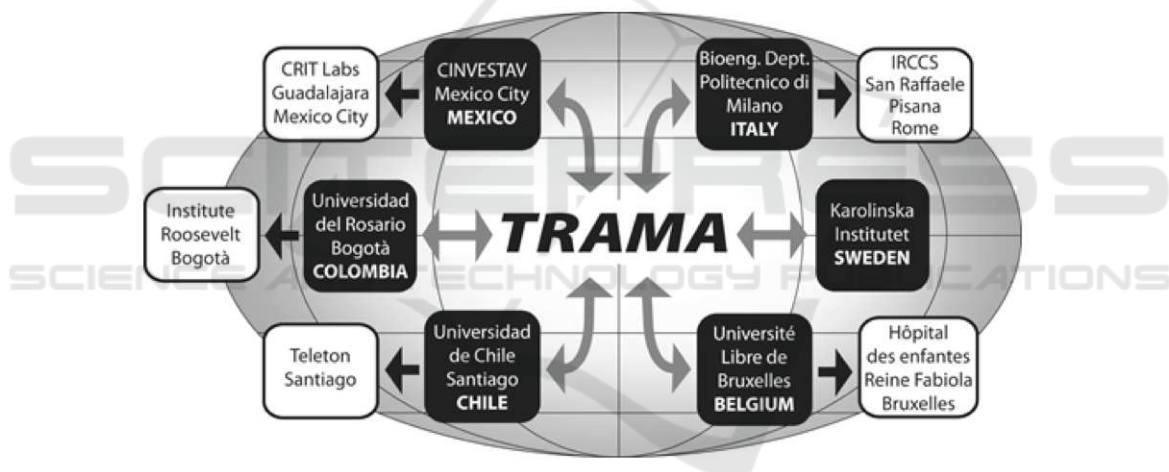


Fig. 2. Partners of the TRAMA project. In grey the Full Partners and in white the Associate Partners are highlighted.

with valuable experiences in MA have shared protocols and practices with the Associate Partners already utilizing MALs. On the other hand, Associate Partners used the protocols and the learned concept in their daily clinical practice, improving their clinical services.

The partner involved in the Project are described following, country by country.

## 2.1 Italy

### POLITECNICO DI MILANO

The Politecnico di Milano was established in 1863 by a group of scholars and entrepreneurs belonging to prominent Milanese families. Its most eminent professors over the years have included the mathematician Francesco Brioschi (its first Director), Luigi Cremona, and Giulio Natta (Nobel Prize in Chemistry in 1963). The Politecnico di Milano is now ranked as one of the most outstanding European universities in Engineering, Architecture and Industrial Design, and in many disciplines is regarded as a leading research institution worldwide. In Italy, the term "Politecnico" means a state university consisting only of study programmes in Engineering and Architecture. The Politecnico di Milano is nowadays organized in 12 departments and a network of 6 Schools of Engineering, Architecture and Industrial Design spread over 7 campuses over the Lombardy region with a central administration and management. The 6 schools are devoted to education whereas the 12 departments are devoted to research.

The number of students enrolled in all campuses is approximately 40.000, which makes the Politecnico di Milano the largest institution in Italy for Engineering, Architecture and Industrial Design.

Inside the Politecnico di Milano, the Department of Electronics, Information and Bioengineering is present. The mission of Bioengineering section (ex Bioengineering Department) is to progress the knowledge of biomedical engineering through the multidisciplinary research, starting from the molecular and cellular level up to the complex living organism, aiming at the design, realization and optimization of devices, equipment and systems in the studying of different physiological and clinical aspects for diagnosis, therapy and rehabilitation. Theoretical and practical contributions are also intended to be dedicated towards the structures and services involved in the management of health and environment. Further, it constitutes the coordination of the intellectual and material resources of Polytechnic University in Milano for developing and providing didactical and training activity at the level of Bachelor (3 year track), Master Degree (overall 5 year track), Master Courses (generally 1 year track), PhD Courses (3 year post-graduate course) and continuous training activity to students and professionals in biomedical engineering, in other areas of engineering studies, in biology, medicine and living sciences. Finally, the section fulfils the task of making available proper methods, tools and knowledge to hospitals and private and public health organizations, both at a national and international level, in technical supporting systems, advisory, consulting, research and development as well as transfer of innovative products, systems and technologies.

### IRCCS "SAN RAFFAELE PISANA", TOSINVEST SANITÁ, ROMA

IRCCS "San Raffaele Pisana" belongs to a select and distinguished circle of Institutes (Tosinvest Sanitá) which are highly specialized and represent a reference point at the national level, capable of providing treatment to patients suffering from any type of disabilities.

Thanks to the intense and distinguished clinical and research work it is carried out for years in the area of the rehabilitation, it has been recognized by the Health Ministry as a Scientific Institute for Research, Hospitalization and health Care (IRCCS).

In a building surrounded by greenery and provided with 298 beds for inpatients as well as outpatients, the following working units operate:

- cardiologic rehabilitation
- neuro-motor rehabilitation
- otolaryngological rehabilitation (for hearing, balance, voice, speech and deglutition disorders)
- paediatric rehabilitation - Centre for Child Development
- respiratory rehabilitation
- internal medicine

The clinical and research activities are supported by the presence of the following laboratories and services:

- Neuro-physiopathology laboratory
- Gait Analysis laboratory
- Cardiac functionality laboratory
- Audiology, vestibology, speech therapy and deglutition laboratory
- Respiratory functionality laboratory
- Clinical pathology laboratory
- Hydrokinesitherapy service
- Occupational therapy service
- Functional educational service
- Diagnostic imaging service

The IRCCS "San Raffaele Pisana" carries out intense and distinguished research work in the area of rehabilitation and, more in general, of Neuroscience. For this reason, it has equipped itself with a modern Research centre with clinical and basic research laboratories which avail themselves of the most recent technologies and of the collaboration of numerous Italian as well as foreign researchers.

In particular, the Child Adult Aging Development Centre turns to children, teenagers and adults with cognitive retard, motor coordination problems and behaviour-learning difficulties. These symptoms could be caused by different inborn factors (i.e. genetic syndrome) or acquired factors that act in pre, peri or post-natal age: patients are followed in a longitudinal prospective, from childhood to adulthood during aging.

The Child Adult Aging Development Centre has a multidisciplinary staff dedicated to the evaluation and spotting of a diagnosis and to the elaboration of a multilevel rehabilitation program that involves therapists, psychologists, social assistants and caregivers.

Inside this aim, Gait Analysis lab plays a fundamental role giving an important help in decision-making process in term of quantitative movement analysis that, together with biomechanical data, studies neuro-physiological parameters during movement.

## 2.2 Sweden

### THE KAROLINSKA INSTITUTET, STOCKHOLM

Karolinska Institutet (KI) is a leading medical University, dedicated to improve people's health through research and higher education. It developed from a school of army surgeons in 1810 to a medical university, celebrating 200 years anniversary 2010.

KI's mission statement is "to be Europe's leading medical university and the Nordic region's foremost innovation centre in the life sciences, and as such, it comprises an important driving force for the development of the country and the Stockholm region". According to an international ranking in December 2009, KI is the 30th best university in the world.

Karolinska Institutet has two main campuses, one in Solna and one in Huddinge.

A considerable amount of teaching and research is also carried out on other sites in Stockholm in collaboration with the Stockholm County Council and the health care sector. This includes primary health care facilities and the main hospitals: Karolinska University Hospital in Solna and Huddinge, Danderyd Hospital, Söder Hospital, St Görans Hospital and St Erik's Eye Hospital. Some courses are also run in cooperation with Stockholm University, The Royal Institute of Technology (KTH) and Södertörn University College. Karolinska Institutet has two Science Parks, one at Campus Solna and one at Campus Huddinge in Flemingsberg.

In keeping with Alfred Nobel's testament, the Nobel Assembly at Karolinska Institutet selects the winner of the Nobel Prize in Physiology or Medicine. Actually, five of eight Swedish Nobel Prize Laureates in Physiology or Medicine are from Karolinska Institutet.

Research and education bridging from molecule to patient is carried out in 22 departments with 9 research fields such as Cancer, Circulation and respiration, Infection, Inflammation and immunology, Neuroscience, Public and international health, Reproduction, growth and development, and Tissue and motion. In 2008 researchers at KI published 3,000 original articles and 1,000 other publications. External research funding accounts for 80 % of Karolinska Institutet's total income. There are 3,600 employees and 600 research groups with 1,500 researchers/university teachers. About 2,100 PhD students are enrolled at the different departments and 5,300 students are enrolled in higher education at KI stretching from undergraduate programs (Bachelor level), Advanced programs (Master level), Specialist nursing programs, Single-subject courses and contract education. Karolinska Institutet has developed an integrated infrastructure for health care, education, research and development with the Stockholm County with the goal of increasing the caregivers' competence and reducing the time from experimental discovery to clinical application.

The University library is the largest medical library in the Nordic countries and has premises in Huddinge and Solna. The mission of the university library is to support scientific communication, support the learning process, manage scientific information resources, and provide a forum for study, dialogue and networking. The library is visited by an average of 3,000 people a day and provides access to over 10,000 journals and periodicals, about 100 databases and a large number of e-books.

### **2.3 Belgium**

#### **THE UNIVERSITÉ LIBRE DE BRUXELLES (ULB)**

The city of Brussels is the capital of a federal state which has three different administrative regions based on language and has been at the heart of Europe since 1957. It naturally follows that the city should have a university in keeping with its standing and

the ULB, with its 21.000 students, 29 % of whom come from abroad, and its very cosmopolitan body of staff, is an intrinsically international institution open to both Europe and to the whole world.

It was at the heart of the creation of a network of major universities from different European capitals - UNICA - and is involved in international programs for research and development and for mobility. ULB is a multicultural institution, which has 8 faculties and a range of schools and institutes and is, at the same time, a comprehensive university providing academic tuition in all disciplines and study cycles. With its 3 Nobel Prize winners, a Fields medal, three Wolf Prize, two Marie Curie Prizes and 29 % of the Francqui prizes awarded, the university is also a major research centre which is recognized by the academic community the world over. Nor does it shirk its social, societal and scientific commitments, which it meets through combining broad access to higher education with excellent quality research and through its role in furthering economic development in the regions where it is located (Brussels and Wallonia). ULB also has a teaching hospital - Hôpital Erasme, a specialist institute for studying cancer - Institut Bordet, and an extensive hospital network.

For about a decade now the university has been actively involved in maximizing research potential in both Brussels and Charleroi, where it has set up a biotechnology park around its renowned Institute for Biology and Molecular Medicine (IBMM) & Institute of Medical Immunology (IMI) In terms of partnerships, it is part of the Alliance for Higher Education and Research, together with the Mons University and, in conjunction with 5 Hautes écoles, the Royal military school, 2 institutes for architectural studies and 2 colleges for fine arts, it also makes up the Brussels partners of the Alliance. As a private university, which is recognized and subsidized by the Belgian authorities, ULB receives government funding today to the tune of 58 % of its overall budget. Founded on the principle of freethinking analysis that advocates independent reasoning and the rejection of dogma in all its forms, ULB has remained true to its original ideals - an institution free from any form of control which is committed to defending democratic humanist values, an approach it also extends to the way that it is run.

#### HOSPITAL UNIVERSITAIRE DES ENFANTS REINE FABIOLA (HUDERF), BRUXELLES

Inaugurated in 1986, the HUDERF is the only Belgian university hospital entirely reserved for children's medicine: all is conceived for them and for their parents. From birth to adolescence, the children receive there the most complete care in respect of the charter of hospitalized child's rights. As a medico-surgical hospital of 168 beds, the HUDERF accommodates more than 11.000 children per annum in hospitalization. The ambulatory sector (consultations and emergencies) is one of most important in Belgium and receives more than 100.000 patients per annum. HUDERF is also a public hospital (Brussels network IRIS) guaranteeing quality care and modern medicine accessible to all children. HUDERF is a reference centre for children with cerebral palsy. This centre is called "CIRICU". The goal of CIRICU is to optimize the follow-up of the children with cerebral palsy by elaborating an individualized treatment plan. It is necessary to have a good communication between the centre, the patient, his family and all the therapists in charge of the child. The intervention of CIRICU is organized in this way:

104

- Elaboration of a multi-disciplinary assessment, which is the base for the treatment plan;
- Regular evaluations and upgrade of this treatment plan;
- Occasional advises in the field of communication, adaptations . . .

## 2.4 Chile

### UNIVERSIDAD DE CHILE, SANTIAGO DE CHILE

The University of Chile with more than three centuries of history is a Public University founded in 1842 as a continuation of the Universidad Real de San Felipe (1738). Its first Rector, Don Andrés Bello, Chilean-Venezuelan humanist, knew how to give a seal guarantor of classical culture, humanist and secular. The history of the University of Chile is parallel to the country's history. It has become progressively until our days, in one of the main and largest Universities in the country. In their classrooms have been formed most of Chilean Presidents, their National Awards and two Nobel Prizes we have had in our country.

Originally had five Faculties; currently has fourteen Faculties, four Institutes and a Clinical Hospital, covering all the areas of knowledge.

Its nearly 30.000 students are divided into Pregraduate, Magister and Doctor Degrees.

Ranks in first or second place in virtually all national and international rankings, according to the parameters used. It has the largest number of accredited doctoral programs in the country, in all disciplinary areas, currently training more than 900 doctors in 30 accredited programs.

It is the first University in research in our country, representing 37 % of the ISI index of the country and 40 % of research competitive funds.

**Faculty of Medicine:** The Faculty of Medicine creation goes back to the opening of the University of Chile, being one of the five Faculties that gave origin.

With about 5,200 pre-graduate students, has in our days eight careers in health area: Medicine, Nursing, Nutrition and Dietetics, Medical Technology, Physical Therapy, Speech therapy, Obstetrics Nurse and Occupational Therapy.

His extensive postgraduate activity is represented with five accredited doctoral programs, several Magister and more than 60 programs of Medical Specialties. Currently are now 1.100 physicians in training, representing 51 % of the country's medical training. It has the only specialist-training program in Physical Medicine and Rehabilitation of the country; since 1964 more than 150 physicians have acquired this specialty. Research is one of the largest institutional missions of the Faculty of Medicine that has the largest trajectory of research in the country. Currently has multiple work lines, numerous laboratories and a scientific productivity of front line.

**Hospital Clinico Universidad de Chile:** Founded in 1952, is the main University Hospital of the country. This is a highly complex hospital, with over 600 beds, 300 medical journey and 32 postgraduate programs, with 240 residents.

This place gives attention to 400.000 outpatients, 26.000 discharges and more than 23.000 surgeries every year. The University of Chile has no laboratory for motion analysis. For the quantitative evaluation studies the MAL of the Teletón centre is used, which



is described in the next paragraph. Since many years, a scientific collaboration is active between the University of Chile and Teletón.

**INSTITUTO DE REHABILITACIÓN INFANTIL TELETÓN, SANTIAGO DE CHILE**  
 The "Instituto de Rehabilitación Infantil Teletón Chile (IRI Teletón Chile)", is a non-profit Institution, for the rehabilitation of children and young people up to the age of 20, with motor disabilities. However, the upper age limit is 24 years for spinal cord injury patients and other traumatic acute injuries. It was founded in 1947 in Santiago Chile, and from 1978 it began to grow quickly due to large annual, televised fund raising event known as TELETÓN Campaigns. Now they are ten Institutes around the country and give medical rehabilitation assistance to around 26.000 (Dec 2008) patients throughout the country, with approximately 3.500 new patients each year and the 52 % of patients before 3 years old.

The most frequent diagnoses are Cerebral Palsy (9575 patients), Neuromuscular Diseases, Congenital Spinal Cord Injuries (Mielomeningocele) and Amputees. The socio-economic situation of our patients is 80 % low income families, 63 % are living in conditions of extreme poverty. During the last year (2008) gave 122.565 medical consultations and 961.339 therapeutic attentions.

The Mission is the Comprehensive Rehabilitation of children and young people with invalidating diseases. Our strong emphasis is on their independence and autonomy in order to improve their integration into the family, school, social and work environment: "To Rehabilitate in order to Insert into the Community".

The Future Vision is to be the leader in Chile in Comprehensive Rehabilitation. The strategic objectives are:

- Quality service
- Effective model of rehabilitation
- Modern and efficient administration
- To be an agent of change within the community
- Qualified human resources; continuous improvements policy performance management
- To maintain community support through the Teletón.

The main activity is the comprehensive rehabilitation, but work too, in academics activities at pre graduate and post graduate levels, clinical researches and community activities. The therapeutic model is a Bio Psycho Social Model, with the followings programs:

- Medical Programs: Diagnosis and Treatments
- Psycho-Social Education Programs
- High Motivation Programs Arts and Sports

The aims are to achieve the maximum development of functional, physical, psychological, emotional and social abilities, independence, autonomy, and familial and social integration of our patients and, to establish support networks within the community.

## 2.5 Colombia

### COLEGIO MAYOR DE NUESTRA SEÑORA DEL ROSARIO, BOGOTÁ

The Universidad del Rosario is an autonomous, private, secular, non-profit institution founded in 1653, accredited for its high quality and evaluated in 2006 for European University Association. Since then it has fulfilled the mission of forming individuals with a strong sense of responsibility in the benefit of society and has established five fundamental purposes: the integral, ethical and humanistic education; the academic requirements and academic quality; the investigation, the consolidation of the educative community; and the social responsibility.

The organizational framework of the university consists of the Board of Trustees (rector, vice-rector, counsellors, trustees, and the secretary general), Academic Board (deans of respective schools) and the Executive Board (Chancellery). The Board of Trustees and the Academic Board are responsible, with a participative model, for short, medium and long term planning; the Executive Board is in charge of applying the strategies and programs defined by said planning. The University has a staff close to 1.500 people and is financed mainly (73%) by student tuitions.

The University has seven Schools: Jurisprudence; Medicine and Health Sciences School; Natural Sciences, Economy; Political Science, Government and Foreign Affairs; Business; and Human Sciences. Each School is in charge of undergrad programs (22 in total), graduate programs (97 in total) and house research centers for 24 different workgroups.

In the present Integral Development Plan 2004-2015, the vision expresses three emphases: growth, which refers to the qualitative and quantitative development of the University; identity; strengthening the differentiating characteristics of the institution; and quality, understood on the basis of global, national and institutional referents and elaborated under the principle of university autonomy with social responsibility.

Since the middle of the XX century, the University has concentrated its activities in the social, human and health sciences. The present PID foresees the fact that the university should give priority to, strengthen and consolidate the existing facts, and, at the same time, opens up new action fronts in natural and exact sciences. For the beginning, these will help impelling the current programs, and in the next future, it will constitute options to broaden the offer of academic programs. This qualitative growth will lead to a more comprehensive realization of the "being of the University".

Concerning the investigation areas that the University emphasizes, each School works in the definition and consolidation of the priority and strategic areas of their own investigation groups and lines. Seen under a wider perspective, the most salient developments in investigation are found in jurisprudence, medicine and economy.

The Universidad del Rosario's School of Medicine and Health Sciences, created the Health Sciences Research Centre to develop, to adapt and transfer new knowledge in the field of the health sciences with a commitment towards promoting, encompassing and developing research projects and looking for the resolution of high-priority health problems fulfilling the most demanding national and international research regulations regarding research with human beings.

The GiSCYT research group is attached to the Health Sciences Research Centre, the GiSCYT research group studied the problematic of health in work environments from

a dual approach: health and work. First, it is necessary to adopt an external perspective that explains the dynamics of this relation, integrated at the same time the point view that emerges from the logic of the worker, from the collective and the organization productive.

We can then consider what health and work results of a co-construction of two opposing logics: the first which refers to the pursuit of productive efficiency through the involvement of the workers (the logic of productivity) and the other hand the pursuit of health in the middle of changes the tasks and activities (the logic of work) which raises a questions concerning the consequences of this involvement of the worker. It is therefore necessary to know how the sense of the individual involvement in the pursuit of productive efficiency (requested) from exposure of every worker to the risks in the work (defined by each worker).

The GiSCYT research group, have the motion laboratory "ergomotion" to apply the motion analyses in work environments. This is a research unit oriented to study of human movement in productive activity from an ergonomics and biomechanics perspective; the laboratory is responsible for producing models and protocols for the study of human movement in work activities. These models can contribute to development of theories about the action strategies for manage occupational hazards and also to design tools for prevention of lesions associated with human movement and demand intensive joint structures.

#### INSTITUTO DE ORTOPEDIA INFANTILE ROOSEVELT, BOGOTÁ

The Institute of Pediatric Orthopaedics Roosevelt is a hospital open to children since 50 years ago; at the beginning it was built to help children with orthopaedic diseases mainly poliomyelitis, a frequent disease at the middle of the last century. When poliomyelitis began to disappear as result of vaccination campaigns, the next in frequency neurological disease was cerebral palsy. Soon we notice that the knowledge about this disease and the results was not what we expected; eighteen years ago the study of cerebral palsy and of the gait disease produced by this pathology took our team to follow publications by Dr James Gage, who strongly recommended the use of gait laboratories to analyse these patients and to have diagnosis and a plan of treatment. The most interested physician at that time was Dr Camilo Turriago, who started, 20 years ago, to use gait analysis and multilevel orthopaedic surgery following Dr Gage concepts.

## 2.6 Mexico

#### CINVESTAV, ELECTRICAL ENGINEERING DEPARTMENT, BIOELECTRONICS, MEXICO

The Centre for Research and Advanced Studies of IPN (CINVESTAV) is a public organism dedicated to promoting, developing and teaching scientific investigation. The Institution counts 37 Academic Departments, separated in 4 areas of research: Exact Sciences, Biology and Medicine, Technology and Engineering and Social Sciences & Humanities.

CINVESTAV is integrated by 9 Centres across the country, offering 53 Academic programs and more than 500 research topics. All the Academic Programs are considered

by the Mexican National Council of Science and Technology with high level and twenty one programs are classified as competent at an International level.

#### CENTRO DE REHABILITACION INFANTIL TELETÓN, MEXICO CITY

The Children's Rehabilitation Center Teletón of the State of Mexico (CRIT-EM) provides care to disabled children carriers of neural-muscle-skeletal diseases. The main goal of the CRIT-EM is to offer an integral rehabilitation program for the patients of the centre, promoting their development and integration into the society. To achieve this goal the medical model of the CRIT-EM is based in the follow premises: prevention, interdisciplinary care and attention in a process, which includes the patient, family, school and social environments. Within this model, the use of high technology has had a prominent place as a tool for functional assessment and treatment.

The CRIT-EM is part of system rehabilitation centres of the Fundacion Teleton, which consists of 13 rehabilitation centres. The centres of Fundacion Teleton are located in different cities of the Mexican Republic and actually give attention to more of 18.200 children with ages ranging from 0 to 18 years old. Only the CRIT-EM provides services to 3.500 (19%) children.

#### CENTRO DE REHABILITACIÓN INFANTIL TELETÓN OCCIDENTE, GUADALAJARA

The Centro de Rehabilitacion Infantil Teletón offers integral management for the rehabilitation of children with neuromuscular problems. The attention model is based in the management by clinical groups, where children with pathologies as: light to moderate cerebral palsy, severe cerebral palsy, neuromuscular diseases, osteoarticular diseases, congenital and genetic diseases and spinal cord injury are treated.

It counts with auxiliary studies for Diagnosis in Specialized Radiology, Electroneurophysiology, Urodynamics and Gait Analysis and Human Movement Laboratory.

### 3 Activities

As concerns the activities of the three years of the project, courses and seminars devoted to training specialized MA personnel and to share the knowledge about the use of MA for clinical applications have been conducted. In addition, the mobility of researchers between European (EU) and Latin American (LA) countries has been promoted.

In particular, the Grant Holders (GH) - i.e. researchers involved in a MAL activity in a Full or Associate Partner, with an experience in the field of rehabilitation or with a technical education, like medical doctors, physiotherapists, engineers... - have been selected, at the beginning of the project, 3 for each LA country, 1 for each EU country. During the three years, as the interest for the project increased more and more, the number of the GHs involved in the project rose, mainly in LA, and many people took part to the actions proposed during the project.

They were mainly involved in the didactical activity, both theoretical and practical. They were trained not only in the basic technical and clinical competencies needed for everyday operation of MALs, but also in advanced technical topics, including the definition and implementation of new protocols. Both EU and LA GHs spent a period

in LA and EU Labs respectively, to take part in everyday MALs activity, to learn and share the practical management of experimental session and data interpretation. All the activities and the meetings are summarized in Table 1.

**Table 1.** Summary of all the activities of the TRAMA Project year by year.

MEETING	PLACE	PERIOD
<i>FIRSTYEAR</i>		
Start-up meeting	Milan	11th May 2007
Basics in Motion Analysis	Milan	10th-12th September 2007
Practical session	Milan	13th-22nd September 2007
Motion Analysis and clinics	Bruxelles	14th-17th January 2007
Motion Analysis Lab set up and running	Chile	10th-14th March 2008
<i>SECONDYEAR</i>		
The role of Motion Analysis in rehabilitation: decision making and treatment outcomes evaluation	Rome	21st-23rd May 2008
MALs management and organization	Milan	4th-6th June
Practical sessions in EU MALs		May, June, September 2008 (1 month)
Practical sessions in each own MAL	Own MAL	September 2008-February 2009
<i>THIRDYEAR</i>		
Final practical activity in LA MALs	Mexico City, Bogotá, Santiago	June 2009
MAL business plan simulation	Milan, Mexico City	September/October 2009
Final meeting	Bogotá	10th-12th March 2010

In particular, the training program of the project had a three-year schedule, comprising of alternating theoretical courses and practical sessions. The first year courses were focused mainly on training LA GHs in the basic skills of MA in the clinical setting. The aim was to supply the EU and LA GHs with a common background of basic competencies needed to establish a MAL from a technical point of view and to perform MA evaluations. At the beginning of the first year a start-up meeting was organized in May 2007 in Italy with all the partners' coordinators for in-depth analysis of required competencies and expertise for GHs selection and to agree on basic course contents. In the first year of training, there were three theoretical courses. The first two courses

were held in EU countries (in Italy, September 2007; in Belgium, January 2008) with two practical staying in EU after each course; the third course was held in LA (Chile).

**Table 2.** Summary of the theses prepared by Grant Holders during the TRAMA Project.

<b>Name of the Institution</b>	<b>Title of the thesis</b>
<i>ITALY</i>	
Politecnico di Milano - IRCCS "San Raffaele Pisana", Roma	Postural control in children, teenagers and adults with Down Syndrome.
<i>COLOMBIA – SWEDEN</i>	
Universidad Colegio Mayor de Nuestra Señora del Rosario, Bogotá, Colombia	Movement analyses in load lifting tasks-comparison of two methods for capturing and analyses of trunk kinematics.
Karolinska Institutet, Stockholm, Sweden	
Instituto de Ortopedia Infantil Roosevelt, Bogotá, Colombia	Intertrochanteric extension osteotomy to treat hip flexion deformity in walking children with spastic cerebral palsy.
<i>CHILE</i>	
Facultad de Medicina, Universidad de Chile, Santiago	Description of kinematic characteristics in children with lumbar and lumbosacral mielomeningocele and calculation of new indexes for a comprehensive evaluation.
Sociedad pro ayuda del Niño Lisiado Instituto de rehabilitación infantil Teletón Santiago	
<i>MEXICO</i>	
Centro de Investigación y de Estudios Avanzados del IPN - CINVESTAV, Mexico City	Falling risk in elderly.
Centro de Rehabilitación Infantil TELETÓN CRIT, Mexico City	Kinematic upper limb assessment of children with hemiparetic CP during a reaching functional task.
Centro de rehabilitación infantil Teleton Occidente, Guadalajara	Analysis of trunk mobility in children with scoliosis.

The second year was characterized by two theoretical courses in Italy (in Rome, May 2009; in Milano, June 2009) and by repeated practical sessions both in EU and LA labs for training in selected MA experimental set-ups and performance. The first course was aimed to give more detailed information about the use of motion analysis for clinical application to the LA GH; the second one was aimed to produce trained staff able to manage each aspect of MAL organization from fund-raising through to experimental sessions organization. The LA GHs spent their practical staying in Italy and in Sweden.

The third year was focused on checking the outcomes of previous years teaching and practical training. In particular, the activities were mainly dedicated to prepare educational material to give a scientific and didactical support to the GHs, as well as to

disseminate the results of the Project, and to prepare the GHs' theses, which were presented during the Final Meeting and included in the final hand book of the project. The GHs were involved in two practical sessions: the first one focused on completing their training in data collection and interpretation and the second one focused on simulating business plan to assure sustainability of a MAL. Both of sessions were aimed to the production of their personal thesis. The year was closed by a Final Meeting in Colombia in March 2010 where all the GHs presented their thesis.

During the period spent in their own MALs, all the GHs worked on new protocols and the results of this activity have been presented in theses (Table 2), collected in a book [1].

During the Final Meeting the general satisfaction for the three years project has been investigated by the TRAMA Project satisfaction, a questionnaire asked to be filled by all the participants (both professors and GHs) at the end of the Final Meeting; the same questionnaire was sent by e-mail to the TRAMA Project's participants not present at the event.

Following the questions were reported (score 1= poor, 2= adequate, 3=good, 4= excellent):

1. Which is your opinion regarding the TRAMA Project organisation ( staff, travel booking, residence)?
2. Which is your opinion regarding the contents and the argument of the Project?
3. Were the arguments of Courses/practical sessions/Seminars adequate for your knowledge level?
4. Will be the contents learned during the Project useful for your activity in your Institution?
5. Are you generally satisfied of the Project?
6. If in the future there is a new opportunity of an international project on Movement Analysis, are interesting in being involved and taking part to it?

Following the results of the TRAMA Project satisfaction (Fig. 3)

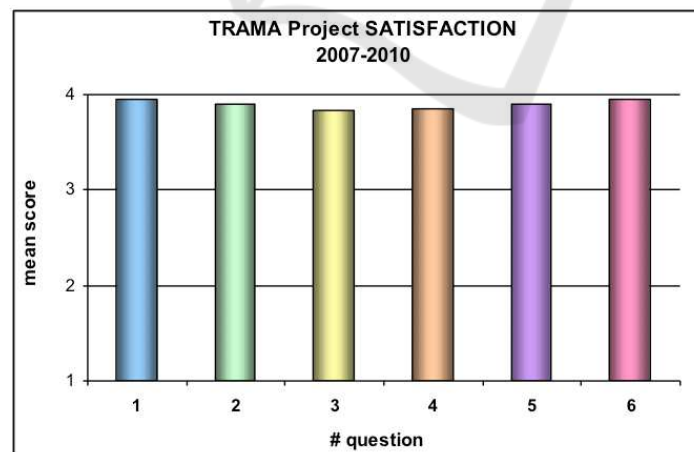


Fig. 3. Results of the TRAMA Project satisfaction questionnaire.

## 4 Conclusion

In conclusion, all the planned activities of the three year have been conducted and completed and a general satisfaction was present, by the Coordinator of the project and by the Partners.

We think that, thanks to TRAMA project, the knowledge about the use of Motion analysis and about MAL management is increased producing a more efficient use of Motion analysis for clinical applications.

In this way, MAL can improve the support service to clinical centers and so patients will benefit in diagnosis and follow up evaluations.

All the details about the Project program during these three years are summarized in the website [www.biomed.polimi.it/trama/](http://www.biomed.polimi.it/trama/).

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## References

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