Dear readers,

2013 can be seen as the consolidation year for IIT against the Italian and international scientific backdrop. The activities foreseen in the third scientific plan (2012-2014) moved forward and the recruiting and assessment process for researchers was further implemented. In particular, the Tenure Track process was definitely put in place, which aims at selecting and retaining the best talents and presenting researchers from all over the world with a model based on international best practices. The activities and projects linked to the business and productive world expanded too.

In 2013 57 inventions were made and 73 patent applications submitted, thus taking IIT overall portfolio to 242 patent applications, with smart materials and robotics taking the lead among nanotechnologies, followed by activities relating to life sciences. The interest in the productive sector led to the creation of 3 new start-ups and the success of 2 business ideas in dedicated contests.

ANVUR (Agenzia Nazionale per la Valutazione del Sistema Universitario e della Ricerca – the Italian agency tasked with the assessment of our national university and research system) has examined the quality of the activities carried out by IIT between 2004-2010. Our performance has been evaluated as excellent, which is quite a good result considering that in the first 2 years of the examined period (2004-2006) we were not operative yet.

From 2006 to date the overall portfolio of projects has exceeded 90 million Euros, including more than 90 European projects and more than 110 industrial projects. In 2013 only, IIT secured financing of 19 European projects (11,7 million Euros approx.), 16 projects in partnership with national and international agencies/institutions (10 million euros approx.) and 44 industrial projects (3,7 million Euros approx.).

Participation in the 10-year-long European Flagship called Graphene is one of the most significant projects IIT has been able to gain a strong foothold in, along with the project managed with INAIL which focusses on the future distribution and industrialization of devices in the field of rehabilitation and prosthesis. At the end of the year we secured a final success by receiving 3 European Research Council grants awarded to our researchers.

Roberto Cingolani, Scientific Director
Acronyms

The following list contains the acronyms used to indicate the scientific platforms (i.e., the thematic areas on which the scientific plan is based) departments and centers of the IIT's multidisciplinary network.

Departments of the Central Research Laboratory- Genoa

<table>
<thead>
<tr>
<th>Acronym</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>ADVR</td>
<td>Advanced Robotics</td>
</tr>
<tr>
<td>D3</td>
<td>Drug Discovery and Development</td>
</tr>
<tr>
<td>NACH</td>
<td>Nanochemistry</td>
</tr>
<tr>
<td>NAPH</td>
<td>Nanophysics</td>
</tr>
<tr>
<td>NBT</td>
<td>Neuroscience and Brain Technologies</td>
</tr>
<tr>
<td>NSYN</td>
<td>Synaptic Neuroscience (Unità del Dipartimento NBT)</td>
</tr>
<tr>
<td>NTECH</td>
<td>Neurotechnologies (Unità del Dipartimento NBT)</td>
</tr>
<tr>
<td>PAVIS</td>
<td>Pattern Analysis &amp; Computer Vision</td>
</tr>
<tr>
<td>RBCS</td>
<td>Robotics, Brain and Cognitive Sciences</td>
</tr>
<tr>
<td>GRAPHENE</td>
<td>Graphene Labs</td>
</tr>
<tr>
<td>RTECH</td>
<td>RehabTechnologies</td>
</tr>
</tbody>
</table>

Platforms

- Computation
- D4 (Drug Discovery, Development and Diagnostics)
- EHS (Environment, Health and Safety)
- Energy
- Neuroscience
- Robotics
- Smart Materials
<table>
<thead>
<tr>
<th>Network Centers</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>CNCS@UniTn</td>
<td>Center for Neuroscience and Cognitive Sciences, Università degli Studi di Trento, TRENTO</td>
</tr>
<tr>
<td>CGS@SEMM</td>
<td>Center for Genomic Science, Campus IFOM-IEO, MILANO</td>
</tr>
<tr>
<td>CNST@PolMi</td>
<td>Center for Nano Science and Technology, Politecnico di Milano, MILANO</td>
</tr>
<tr>
<td>CSHR@PolTo</td>
<td>Center for Space Human Robotics, Politecnico di Torino, TORINO</td>
</tr>
<tr>
<td>BCMSC@UniPr</td>
<td>Brain Center for Motor and Social Cognition, Università degli Studi di Parma, PARMA</td>
</tr>
<tr>
<td>CMBR@SSSA</td>
<td>Center for MicroBioRobotics, Scuola Superiore Sant'Anna, PISA</td>
</tr>
<tr>
<td>CN@NEST</td>
<td>Center for Nanotechnology Innovation, Scuola Normale Superiore, PISA</td>
</tr>
<tr>
<td>CLNS@SAPIENZA</td>
<td>Center for Life Nano Science, Università degli Studi di Roma La Sapienza, ROMA</td>
</tr>
<tr>
<td>CABHC@CRIB</td>
<td>Center for Advanced Biomaterials for Health Care, Università degli Studi di Napoli Federico II, NAPOLI</td>
</tr>
<tr>
<td>CBN@Unile</td>
<td>Center for Biomolecular Nanotechnologies, Università degli Studi del Salento, LECCE</td>
</tr>
</tbody>
</table>
2013: 8 year report

In the course of 2013, scientists at IIT carried on the activities included in the third scientific plan (2012-2014) with a technological approach aimed at improving human life. The research projects have in common the study and transfer of the physical, chemical and mechanical characteristics of nature into devices and prototypes (biomimetics). The mechanism of action of antibodies and viruses has led to the fabrication of nanoparticles for the “smart” delivery of drugs; the motility of certain unicellular organisms is the model for the design of micro-robots; the vegetal world has inspired the “Plantoid” project (BOX 1); animals and humans are points of reference for animaloid, humanoid and rehabilitation robotics projects.

The development of ambitious projects would not be possible without the contribution and the exchange of knowledge and discoveries from different sciences: materials science, neurosciences, pharmacology, multi-scale computational modeling and nanoscience are integrated into a synergistic design.

2013 was a year of consolidation: consolidation of the career path for scientists and of the “net-like” structure of centers and departments, of the presence of IIT in the international scientific community and of its relationship with industries and the productive fabric.

The career path for scientists

Back in 2012, a tenure track system was launched to select and retain the best talents and to offer researchers from all over the world a model based on the international best practices. Tenure Track is a stabilization process lasting 10 years maximum, during which the scientist is evaluated by an international expert panel. The essential principles of this process are:

• International calls; selection through letters of reference and interviews with the international panel.
• Levels of entry depending on the seniority of the candidate, named stage 1, stage 2 and stage 3, equivalent to academic positions such as assistant professor, associate professor and full professor.
• Entry, advancements of rank and final exams based on letters of reference and interviews by external referees.
• Possibility of tenured positions only for stages 2 and 3 (associate and full professor).
• Full scientific and financial independence of tenure-track scientists.
• Number of tenure-track scientists, when the system is fully operational, not exceeding 15% of the total IIT staff.
• Specific gender policy for the tenure track (e.g. “stop the clock for maternity”).

The assessment process is entirely conducted by IIT Scientific and Technical Committee with the collaboration of various administrative and support offices, as well as a panel of international experts (Standing Committee of External Evaluators, SCEE) counting almost 200 members to this date, who are in charge of reviewing the scientific production of candidates in a transparent and independent manner.

In 2013 an interim evaluation period was launched for the assessment of resources that were already in the staff of IIT: after a screening of 150 Principal Investigators (PI) based on their scientific and technological performance, about 20 scientists are now in tenure or tenure-track positions.

A 13% “success rate” demonstrates strict selection processes, in agreement with the intent of retaining a few key talents without changing the characteristically dynamic international research environment: turnover of young people on a three-year basis and average age below 34.
A workshop aimed at studying the vegetal world and implementing artificial prototypes that imitate their intelligence was held in London on 29 July 2013, on occasion of the Living Machines International Conference, promoted and organized by Barbara Mazzolai and Lucia Beccai of IIT Center for Micro-Bio Robotics (CMBR) in Pisa. Plant-inspired robotics is in fact a research line conducted by IIT researchers at the center of a European project led by Barbara Mazzolai.

Plants are the living beings that are most capable of exploring and conquering the soils of our planet, thanks to a structure and an intelligent behavior that have not been considered enough so far in robotics. The scientific community has therefore an interest in understanding their functioning principles, which are rather different from the other living beings, and to convert them into new materials and structures and, as a consequence, into an entirely new technology.

The European project named Innovative Robotic Artifacts Inspired by Plant Roots for Soil Monitoring (PLANTOID), funded within the Future and Emerging Technologies (FEET-Open) scheme of the European Commission and launched in 2012, has the purpose of designing and developing plant-inspired robots – named Plantoid – which imitate the behavior of root apices by combining a new generation of hardware and software technologies.

Each Plantoid shall be comprised of a root apex provided with sensors, actuators and control units and with a robotic trunk, mechanically connected via a long structure. The ultimate aim of the project is to develop a network of sensorized robotic roots able to reproduce the capabilities of exploration, environmental adaptation and coordination typical of the plant kingdom, and to provide a model of artificial plant comparable to those found in the natural world, also in terms of energy efficiency and sustainability.

Along with CMBR the project involves the University of Studies of Florence, the Institut de Bioenginyeria de Catalunya (IBEC), the École Polytechnique Fédérale de Lausanne (EPFL).
The “net-like” structures of centers and departments

During the year, site visits were made for the evaluation of certain departments and the network of national centers (network centers) by independent panels:

PAVIS: 29-30 April

NBT: 9-10 September
Panel: E. Bizzi, P. De Camilli, E. Raviola

For both departments of the Central Laboratory of Genoa the evaluations were positive with the recommendation of enhancing certain strategic research areas.

IIT network centers were also evaluated, about four years after their establishment, taking into consideration both the administration and management aspects and the scientific results. Each center has been visited by a specific panel of scientists (see table), who provided specific recommendations on the development of research and projects and indicated that the following centers should be stabilized: CNST, CSHR, CNCS, CMBR, CABHC, CBN.
These units will therefore carry on their activity beyond the five years indicated by the convention, on the basis of which they were established, and they will be evaluated on a regular basis (every 2-3 years) like all other structures belonging to the Central Laboratory.

For the CNI and CGS units, although the scientific evaluation was positive, stabilization was deemed to be premature considering the recent reorganization of the research groups; a new assessment is to be made in three years.

CNST@POLIMI: G. Margaritondo, J. Assad, G. Ruocco
CGS@SEMM: G. Margaritondo, J. Assad, A. Cavalli
CSHR@POLITO: G. Margaritondo, D. Caldwell, G. Metta
CNCS@UNITN: E. Bazzi, G. Berlucchi
CNI@NEST: G. Margaritondo, J. Assad, G. Gigli
CMBR@SSSA: G. Margaritondo, J. Assad, N. Tsagarakis
CABHC@CRIB: G. Margaritondo, J. Assad, G. Ruocco
CBN@UNILE: G. Margaritondo, J. Assad, G. Ruocco
IIT within in the international scientific community

The total portfolio of projects contractualized by IIT has exceeded 90 Million Euro (Meu) from 2006 to this date. This portfolio includes over 90 European programs and over 110 industrial projects, with the following being active in 2013:

- 57 European Projects
- 26 National Projects PON, POR, FIRB, INAIL and Ministry of Health
- 11 Competitive Projects financed by Italian or European foundations
- 6 Projects financed by U.S.A. organizations
- 83 Industrial Projects

These are, in particular, the new projects acquired in 2013:

- 19 European Projects (over 11.7 Meu)
- 16 from ministerial organizations and/or national and international agencies (about 10 Meu)
- 44 Industrial projects (about 3.7 Meu)

At European level, the scientific activity of the 2 FET Flagship projects (“Brain” and “Graphene”) was launched at the beginning of the year, for ten years duration and funding for 10 Meu awarded by the European Commission. IIT is a partner of the program regarding the studies of graphene with a specific role in the Energy and Technological Transfer sector. In the wake of this success “Graphene labs” was born, a multidisciplinary laboratory aimed at exploring the potential of this innovative material and its applications.

In December 2013 IIT and the Italian National Institute for Insurance against Accidents at Work (INAIL) started an important scientific collaboration for the development of robotic technologies in the field of rehabilitation and prosthetics, aimed at the future industrialization and diffusion of the devices being developed.

In particular, two state-of-the-art projects will be launched, with high social impact, respectively aimed at the development of a powered exoskeleton for letting paraplegics walk and of an advanced prosthetic system.

The resources to be contributed by the two institutes under the three-year agreement total 11.5 million Euro altogether.

The consolidation of the reputation of IIT at national level has increased also in the light of the presentation of the general evaluation report of Italian research made by the Italian National Agency for the Evaluation of the University and Research System (ANVUR) for the seven-year period 2004-2010 on behalf of the MIUR [Italian Ministry of University and Research] in July 2013 (www.anvur.org). The assessment of the situation of national research was based on a complex multi-parametric model taking into account a number of factors, including bibliometric analyses, technology transfer, dimension of the structure, attractiveness for researchers, internal mobility.
The classifications have been produced by subdividing the organizations into small, medium-sized and big, depending on the number of people working in each area. IIT is generally considered to be middle-sized.

IIT (physical, chemical and biological sciences and engineering): a national normalized average value (National Average Area Grade) and an average percentage of excellent publications have been determined for each of these. In the 4 areas listed above the results of the evaluation of IIT’s products have always been excellent with above average grades which place IIT always in the first position of the relevant ranking lists.

In particular, the values for IIT are the following:

<table>
<thead>
<tr>
<th>Subject</th>
<th>Average IIT/Grade grade</th>
<th>%IIT/average</th>
<th>Position IIT in the area ranking list</th>
</tr>
</thead>
<tbody>
<tr>
<td>Physics</td>
<td>1.28</td>
<td>1.77</td>
<td>2</td>
</tr>
<tr>
<td>Chemistry</td>
<td>1.28</td>
<td>1.62</td>
<td>2</td>
</tr>
<tr>
<td>Bio</td>
<td>1.95</td>
<td>2.27</td>
<td>1</td>
</tr>
<tr>
<td>Engineering</td>
<td>1.36</td>
<td>1.53</td>
<td>2</td>
</tr>
</tbody>
</table>

The national average area grade, combined with other 6 parameters that calculate different performances of the organization (such as attraction of resources, internationalization, training), results in a final indicator (IRFS1) on the areas of activity. IRFS1 allows to assess the performance of the organization compared to the expected average value and the percentage of improvement compared to the expected parameters.

<table>
<thead>
<tr>
<th>Organization</th>
<th>Dimension</th>
<th>Expected value</th>
<th>IRFS1</th>
<th>%improvement</th>
</tr>
</thead>
<tbody>
<tr>
<td>IIT</td>
<td>Medium</td>
<td>1.05</td>
<td>2.55</td>
<td>144.1</td>
</tr>
</tbody>
</table>

The performance of IIT is, overall, among the best of medium-sized and big research centers: a remarkable result, also considering the fact that in the first years of the period examined (2004-2010) activities had not started.
The development of new robotic solutions for rehabilitation and prosthetics is the center of the scientific collaboration established between IIT and INAIL in December 2013. The project will have three years duration and will permit to set up an interdisciplinary team of roboticists, health workers and doctors, who will design and implement advanced robotic devices, of efficacy directly verified with patients, and economically viable for the national health system. The focus will be on the construction of a powered exoskeleton for lower limbs and a hand-wrist prosthetic system.

The construction of the exoskeleton - a robotic structure wearable by paraplegic patients to regain the mobility of their lower limbs - will be based on the clinic expertise of INAIL and the results obtained by IIT in the humanoid robotics field with Coman and iCub projects. In fact, advanced engineering solutions have been adopted for the two humanoids, for the control and performance of confident and compliant (not rigid) movements, for walking and for better balance on slopes or rough terrain, as well as under external driving forces.

The hand-wrist system will consist of an artificial poly-articulated hand and a wrist capable of interfacing the best technologies available today for prostheses of the upper part of the arm. The new system will be easier to use and with a good level of reliability and performance, compared to the many poly-articulated hands that are currently on the market. IIT’s technological-scientific expertise is substantiated by the design and implementation of a number of poly-articulated hands: the hand of the humanoid robot iCub provided with tactile sensors and the Soft Hand, developed in collaboration with Piaggio Research Center of the University of Pisa, which has an innovative design based on the study of the characteristic “synergies” of a human hand, and it is strong and flexible at a time.

The two projects are included in the Research Plan 2013-2015 of the INAIL Prosthesis Center of Vigorso di Budrio (Bologna), which will contribute with its own personnel and scientific and clinic experience gained at direct contact with patients, also making the most of the collaboration with IIT in the Volterra Rehabilitation Center for the development of a robot for ankle rehabilitation. Under the agreement the resources to be provided by the two institutes amount to a total of 11.5 million Euro.
The relationship with industry and productive fabric

In 2013, 57 inventions were produced and 73 patent applications were filed, which brings the total portfolio of IIT to 242 patents at January 2014. The distribution of patent applications by departments and network centers (picture 4.3) proves similar efforts by all IIT structures for the protection of intellectual property. The most active sectors in the production of ideas are nanotechnologies of smart materials and robotics, followed by the pharmacological field (fig. 11).

The scientific vitality and technological focus of IIT have drawn the attention of several industries, from the textile to the energy sector, which has led to the stipulation of sale or research agreements. In addition to the 44 industrial projects signed, IIT has started collaborations with leading businesses in the field of the production of laboratory instruments, which have placed state-of-the-art equipment at the disposal of the researchers, in order to submit them to further technological improvements.

In 2013, technological transfer activities led to the development of the guidelines related to the creation and participation of IIT in start-up initiatives, under which IIT does not become part of the business organization, but supports it for the first 36 months. During the earlier period when the start-up has to find investors, IIT ensures the maintenance of the position of researchers-entrepreneurs in the staff, the creation of a team capable of developing the business idea and the regulated use of instruments for the implementation of the first prototypes.

The attention directed towards the integration with the productive fabric has led to the launch of new start-ups and the favorable response given to 3 business ideas during specially-designed competitions.

HiQ-Nano

HiQ-Nano was born from the experience acquired by a group of researchers of the Center for Bio Nanotechnologies in Lecce. This latter is a business that accommodates the increasing interest for and use of nanoparticles in various sectors of the market. HiQ-Nano produces nanoparticles of excellent quality, made with different material and in various sizes, as well as with different chemico-physical properties to satisfy the requests coming from the academic and the industrial world. The business is characterized by an interdisciplinary approach to high-level scientific research and by the ability to transfer know-how and manufacturing methods from the laboratory to businesses, that is, to pass from small-scale production to a larger, industrial and commercial scale.

SEM+

SEM+ is the result of the activity on soft materials of the Center for Micro BioRobotics in Pontedera (PI). This start-up develops innovative touch modules that can sense the position of multiple contacts and the intensity of each contact: the module is therefore able to feel the strength of each touch. The SEM+ are strong and flexible, therefore able to be used in applications outside consumer electronics, such as technological clothing and industrial pc.
Awards

March: Una donna fuori dal coro (A woman standing out from the crowd), prize awarded by Terziario Donna and Ascom Confindustria to Athanassia Athanassiou (NAPH)
May: MIT Technology Review: “TR35 - Giovani Innovatori” (Young Innovators) to Paolo Bianchini (NAPH)
June: Intel Prize to SEM+ IIT start-up, first place in Europe
June: Premio Nazionale dell’Innovazione (National Innovation Prize) to the Microturbina project, an IIT start-up
September: “Farmindustria Prize 2013” awarded by Farmindustria and by the Division of Medicinal Chemistry of the Italian Chemical Society to Chiara Pagliuca (D3)
September: Prize of the American Chemistry Society (ACS) to Liberato Manna
September: Smart Cup Liguria Prize to On-Iris and DualCam
September: Start Cup Puglia Prize to HiQNano (honorable mention)
October: Prize of the Pio Manzù Foundation to Barbara Mazzolai
October: “John Atanasoff award” awarded by the president of Bulgaria to Petar Kormushev (ADVR)

Manna awarded prize by American Chemistry Society

In 2011 he ranked among the first 100 chemists in the world for the impact obtained by his publications in the last 10 years, holding the 24th position according to Thomson Reuters; in 2013 it was the Physical Chemistry Division of the American Chemistry Society (ACS) that rewarded Liberato Manna with the “2013 Early-Career Award in Experimental Physical Chemistry”. The prize has been given for the first ten years of excellent activity as a researcher, certified for Liberato Manna, who is only 42, by 184 scientific publications and 11 patents obtained, and by his position of manager of the Nanochemistry department of the Italian Institute of Technology.

The reason of the award made known by the ACS is this: “for the use of physical chemistry instruments and approaches that create and control the properties of inorganic nanocrystals”. The award ceremony was held in September during the autumn meeting of the ACS in Indianapolis, USA, where Mr. Manna gave a lecture on the progresses obtained in the synthesis and assembly of inorganic nanocrystals.

The Physical Chemistry Division of the ACS rewards every year those who operate in the field of experimental and theoretical physical chemistry and have achieved scientific results of high significance during their career.

The “2013 Early-Career Award in Experimental Physical Chemistry” is in addition to the several other prizes received by this chemist from Puglia in 10 years of career, including the “Lawrence Berkeley Lab (LBL) Technology Transfer” award (2002); the “INFM giovani ricercatori”(2007); the “R&D 100 award” (2009); the grant obtained from the European Research Council (ERC) in 2009 and the price of the Journal of Materials Chemistry Lectureship in 2011.
Smart Cup Liguria 2013

On -Iris won the 2013 edition of Smart Cup Liguria. It takes origin from the excellent scientific results, known at international level, obtained by the team of Neuroscience and Brain Technologies (Genoa) and Center for Nano Science and Technology in Milan; the project will focus on the development, production and sale of a biocompatible retinal implant. The “artificial retina” aims at treating blindness in patients with pathologies characterized by the degeneration of photoreceptors, such as retinitis pigmentosa.

DualCam won the price for the “Industrial” category of the 2013 edition of Smart Cup Liguria: the business idea of the researchers of the Pattern Analysis and Computer Vision department (Genoa) is centered on the development, production and marketing of the first optical-acoustic video camera that integrates all requirements of a surveillance system into one device. The DualCam device can be included in a network of heterogeneous systems, capable of analyzing audio and video signals, at limited costs and in environmental conditions that would be prohibitive for other sensors; also, thanks to automatic image processing algorithms, it can register, localize, classify and notify anomalous or alarming events, in real time and without interruptions.
Science cafe “IIT si racconta”

Started in the autumn of 2012, the IIT science cafes involved the Genoese in monthly evening events throughout 2013 and a summer band concert of IIT in piazza Fossatello. Nanophysics, smart materials, robotics, artificial intelligence systems, pharmacology were the subjects presented by the researchers to the public, with a simple language and in an informal atmosphere. The aim was to create an opportunity for researchers and citizens to meet, thus promoting the exchange of scientific knowledge and a debate on the technologies that will characterize our future. The meetings have been received with excellent interest by the public, with an average of 60 participants at each cafe and about 250 people attending the first meeting, with the presentation by Roberto Cingolani, Scientific Director of IIT and the participation of the President of the Chamber of Commerce of Genoa. The initiative was born from an idea of the young group of Ascom-Confcommercio of Genoa and IIT Outreach Manager Prof. Alberto Diaspro and has obtained the support of the Chamber of Commerce of Genoa.

Visit of Prime Minister Enrico Letta

On 30 August 2013, Prime Minister Enrico Letta, accompanied by the President of Regione Liguria, visited IIT headquarters in Genova; he was welcomed by the President, Gabriele Galateri, the Scientific Director Roberto Cingolani and the General Manager Simone Ungaro. During the visit to the laboratories President Letta assisted to the presentation of some of the most advanced researches developed by IIT in robotics, optical microscopy and in the new “smart” materials. At the end of the visit to the laboratories, the Prime Minister remained for some time with the guests and in the presence of the press in the meeting room of the Institute, where the Chairman, Mr. Galateri and the Scientific Director, Mr. Cingolani shortly illustrated the strategic lines of IIT Foundation, its growth and the important scientific results achieved.

During the meeting with the press Mr. Letta declared: «I am happy to be here […]. We know that Italy lags behind in scientific research, but all is not lost. Italy is a country where we must reward those who do research, those who deserve it. The experience of IIT proves that with the commitment of everyone, the trend can be reversed. I am glad to see there is a good team game here in Genoa. Success, competition and merit exist if there is a global, international environment and here I can feel there is. Good luck in your work and your will to look at the future». (ilgiornaledisiciliia.it)
WALK-MAN

Developing humanoid robots capable of operating in real environments damaged by natural disasters or man-made accidents: the European Project WALK-MAN (www.walk-man.eu) is led by IIT, it started in October 2013 and will have four years duration. WALK-MAN is coordinated by Nikos Tsagarakis of the Advanced Robotics Department of IIT and was born with the aim of developing the existing humanoid robots, such as Coman, iCub (of IIT) and Armar (of the Karlsruhe Institute of Technology), into high-performance robots, suitable for damaged industrial or civil environments, such as factories, offices and houses. In these contexts, the WALK-MAN robots will be able to walk like a human being and to balance, moving in altered workplaces, over rough terrain, in narrow places and through the crowd, or crawling over piles of rubble.

The development of humanoid robots under this project will lead to implementing robots which, in the society of the future, will be proper “collaborators”, artificial alter-egos to be entrusted with tasks in situations that would be dangerous for human beings. In order to achieve this result, the researchers will focus on new, high-performance implementation systems, on the development of a compliant robotic body, and on the design of hands, by relying on the most recent results in the field of materials and of mechanics. The work will lead to build robots being less fragile and delicate than the existing ones, and capable to adapt to various environments and situations. A key point in the development of the WALK-MAN robots will be their ability to deal with obstructions in the surrounding environment: walls, railings, furniture, etc., so that the robots obtained will be well-balanced and reliable in their movements, while performing manual tasks with the strength needed in disaster areas.

The practical results of the WALK-MAN project will be tested by considering realistic scenarios, also with the advice of civil defense agencies.

Along with IIT other partners in the project are the University of Pisa, the École Polytechnique Fédérale de Lausanne (EPFL) in Switzerland, the Karlsruhe Institute of Technology (KIT) in Germany and the Université catholique de Louvain (UCL) in Belgium.
Perovskite: low-cost, high efficiency solar cells

Producing low cost and high efficiency solar energy will be soon possible through polycrystalline semiconductors with perovskite structure used in the next-generation solar cells. An international research team, comprised of scientists of the IIT Center for Nano-Science and Technology (CNST) in Milan and of the Oxford University, has revealed the operating mechanisms of these promising solar cells. Perovskite, an inorganic crystal named after its discoverer (the Russian mineralogist Lev Aleksevich von Perovski), has captured the attention of the scientific community in the last year because, when used as a semiconductor, it allows the fabrication of hybrid solar cells with an efficiency of about 15%, which makes it a likely candidate to replace silicon. Perovskite-based solar cell generation is still in embryo, when compared to silicon-based generation; however, the study proves its promising nature both from the energy efficiency and from the cost-efficiency point of view.
The costs of production are, in fact, low, due to the abundance in nature of the active materials and to the simple manufacturing methods, which take place at low temperatures and can be applied to more extensive areas. The researchers have proved that it is possible through the accurate design of the perovskite crystals to implement a solar device with high conversion efficiency, simple and cost-affordable at the same time. In particular, the team has studied the processes that occur inside the crystal when it interacts with light, and has enhanced its chemical composition in such a way that photo-generated electric charges can travel distances exceeding 1 micrometer in the device – which are significant if compared with the nanometric dimensions (a thousand times smaller) of the crystalline structure.
Beyond Science. Science in a shot is a photographic exhibition promoted, conceived and organized by IIT within its outreach activities, with the aim of describing the encounter between science and images to non-experts and of involving researchers in science popularization activities. The exhibition, comprised of over fifty shots representing objects and realities not visible to the naked eye, instruments and robots that unveil the existence of non-ordinary worlds, was hosted in the Loggia degli Abati of Palazzo Ducale, Genoa, from 6 December 2013 to 19 January 2014, with the support of the Genoa Chamber of Commerce and the Palazzo Ducale Foundation of Genoa. It was a free-entry exhibition and was visited by more than 7000 people.

The exhibition was the final result of a photo contest that IIT proposed to its researchers, both of the Genoa headquarters and the ten network centers in order to encourage consideration of the importance of images in science and of their role in communicating science to non-experts: to be beautiful, in order to be looked at, and to be significant, in order to convey results. Color or black and white, acquired
through optical and electronic microscopes and cameras, images are at the center of scientific research because they show biological or artificial realities that would not be visible to the naked eye, display complex results, testify to an activity of exploration of nature that needs to be recorded as well as proved. Through the shots of ITT researchers, therefore, the displayed pictures presented the progress of scientific knowledge to the public: spearhead research in the sectors of biology, nanotechnology, neurosciences, robotics, pharmacology, materials sciences. The fifty pictures displayed were selected from over hundred received, by a panel of experts who evaluated them, on a voluntary basis, with criteria of originality, technical ability and visual impact. The panel was comprised of: Massimiliano Clausi (photographer), Andrea Paolella (chemist and photographer), Laura Sicignano (stage director and manager, Cargo Theater), Giovanni Spataro (editor, Le Scienze magazine).