



# RESEARCH THAT TRANSFORMS LIVES

EDUCATE | INNOVATE | TRANSCEND

# 2021

*Annual publication, with data and information until December 2020.*

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# 2021





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# Introduction

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For Tecnológico de Monterrey research is a strategic activity and pillar of its mission. It is the engine that generates innovative solutions for the economic, social and environmental development of our regions and country. We are committed to the idea that scientific, applied research and tech transfer should be used to generate impact to a society. To make that possible, our objective is to develop research focused on high impact topics through open, collaborative and interdisciplinary innovation linked with national and international stakeholders. Knowledge generation, new-talent development, international collaboration, interdisciplinary applications are our basis elements for a knowledge economy and connected to competitiveness.

Our focus is in eight main strategic research areas: biotechnology and food; mechatronics and engineering; information technology, sustainability; public policy and social sciences; business; medicine; and humanities and education. To do so, some actions have been defined and operated: Competitive intelligence strategies, Orientation to increase the research impact, Development and attraction of research talent, and increase of external funding for research.

Therefore, the challenge is to enable a positive connection to bridge these gaps with value creation in order to address the most demanding global challenges our society is facing: global health, water, energy, environment, food security, education, sustainable growth and poverty. Open research and innovation models are key to address these challenges with a sense of community, collective knowledge and capacity to develop activities.

This report gives an overview of Tecnológico de Monterrey's main strategic elements and the most important results for the scientific and technological activity. A general summary of the research, innovation and academic activities' main results from 2015 to 2019 is presented, reviewing:

- Main research areas and topics and its Scientometric Impact.
- Undergraduate and Graduate programs and the impact generated.
- International collaboration networks.
- Industrial agreements, and projects.
- Patent application results.
- The institution's standing in the major world university rankings.

These elements are aligned to the eight focus-strategic areas.



**Arturo Molina, PhD**  
Vice Rector for Research  
and Technology Transfer



ABOUT  
**TEC DE MONTERREY**



# Tecnológico de Monterrey

- Privately funded in 1943, non-profit, independent.
- Through educational experiences we form people who become agents of change willing to be even more competitive in order to benefit all, with a clear focus on being instead of having, on serving others instead of possessing things; people who are responsible for their own lives, aware of the fact that their actions may promote the transformation of others.



Eugenio Garza Sada (1892-1973) was born into a business family, the son of the man who founded the Cuauhtémoc Brewery in Monterrey in 1890. His experience at MIT was the basis for the organization of Tecnológico de Monterrey, which he established along with a group of Monterrey businessmen.

With a prophetic vision, Garza Sada devoted considerable effort to the expansion of the city of Monterrey. He was a tireless defender of private and free enterprise. His leadership in Monterrey was very clear and fruitful, both in the field of business, and in education and social welfare. Both, a successful businessman and an active promoter of community development, Eugenio Garza Sada consistently acted with great simplicity and humanity, focused on the progress of those around him, without distinction. The significance of this great man, industrialist and humanitarian, is undeniable and imperishable.

# Tec de Monterrey

## MÉXICO



**26**  
Campuses

**6**  
Multi-campus  
National Schools



# 18 International liaison offices





# FACTS & FIGURES 2021

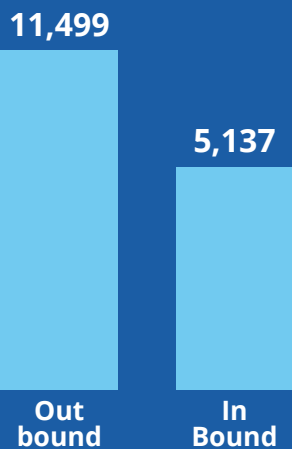
10,013

Professors

92,645

Students

## Student mobility



58% of graduate students had an international experience

## Alumni

317,435

246,324

undergraduate

71,111

graduate

# FACTS & FIGURES 2020

**Alumni Associations Worldwide**



**317,435** alumni distributed in:

- |                    |            |                        |
|--------------------|------------|------------------------|
| Arizona            | Florida    | Peru                   |
| Austin             | France     | Quebec                 |
| Australia          | Germany    | San Antonio, Texas     |
| Boston             | Guatemala  | San Francisco Bay Area |
| Calgary            | Houston    | Scandinavia            |
| California         | Ireland    | Seattle                |
| Chicago            | Mexico     | Spain                  |
| China              | Michigan   | Tijuana-San Diego      |
| Colombia           | Montreal   | Vancouver              |
| Connecticut        | New York   | Washington DC          |
| Dominican Republic | New Jersey | Others...              |
| El Salvador        | Ontario    |                        |
|                    | Panama     |                        |



RESEARCH AT  
**TEC DE MONTERREY**



# RESEARCH FACTS & FIGURES 2021

## PEOPLE

1,484

RESEARCH  
Faculty

6,812

GRADUATE STUDENTS

72

Postdocs

508

PHD STUDENTS

13,915

Undergraduate students participating  
in research projects

672

Research professors in  
National Researches  
System (SNI)

# RESEARCH FACTS & FIGURES

## 2016 - 2020



### International Collaboration

Publications co-authored with institutions in other countries.

**48.3%**

(Average in Mexico is 39.2%)

### Publications in top 10% journals by SNIP

(Source Normalized Impact per Paper)

**24.4%**

(Average in Mexico is 12.5%)

### Academic Corporate Collaboration

Publications with both academic and corporate affiliations.

**1.4%**

(Average in Mexico is .8%)

# PATENTING FACTS & FIGURES

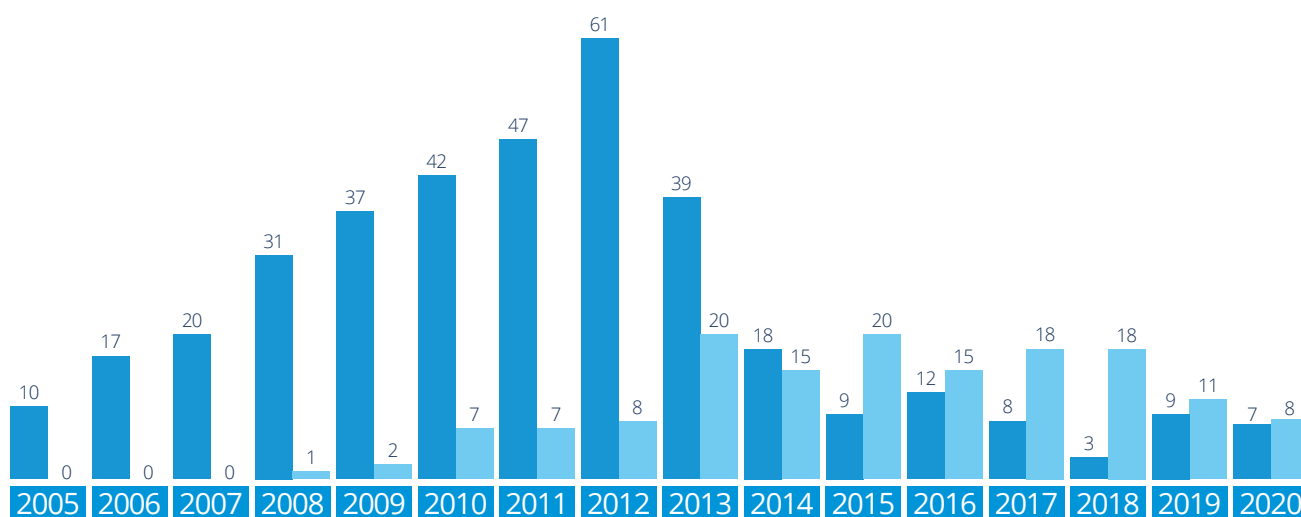
## 2005 - 2020

**PATENTS**

**49** transferidas

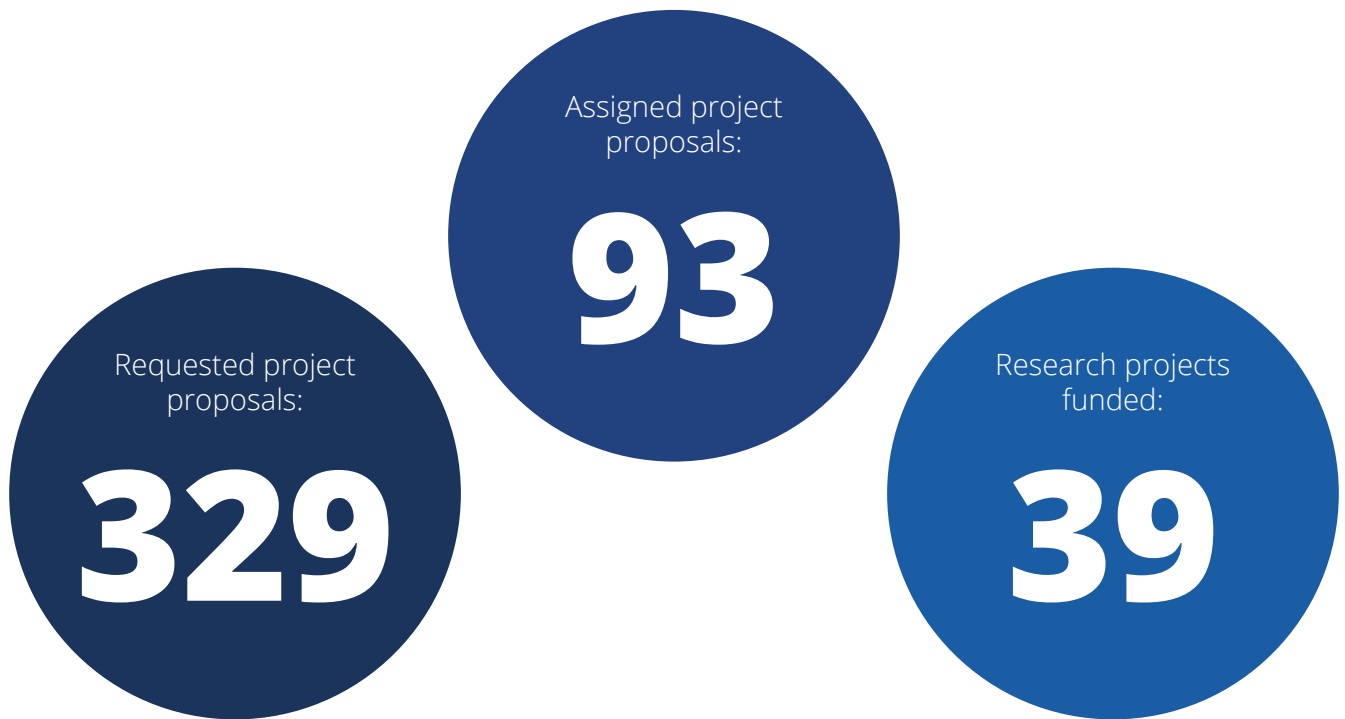
**370**  
FILED

**150**  
GRANTED



**Solicitudes de Patentes Ingresadas y Otorgadas al Instituto Mexicano de la Propiedad Industrial (IMPI)**

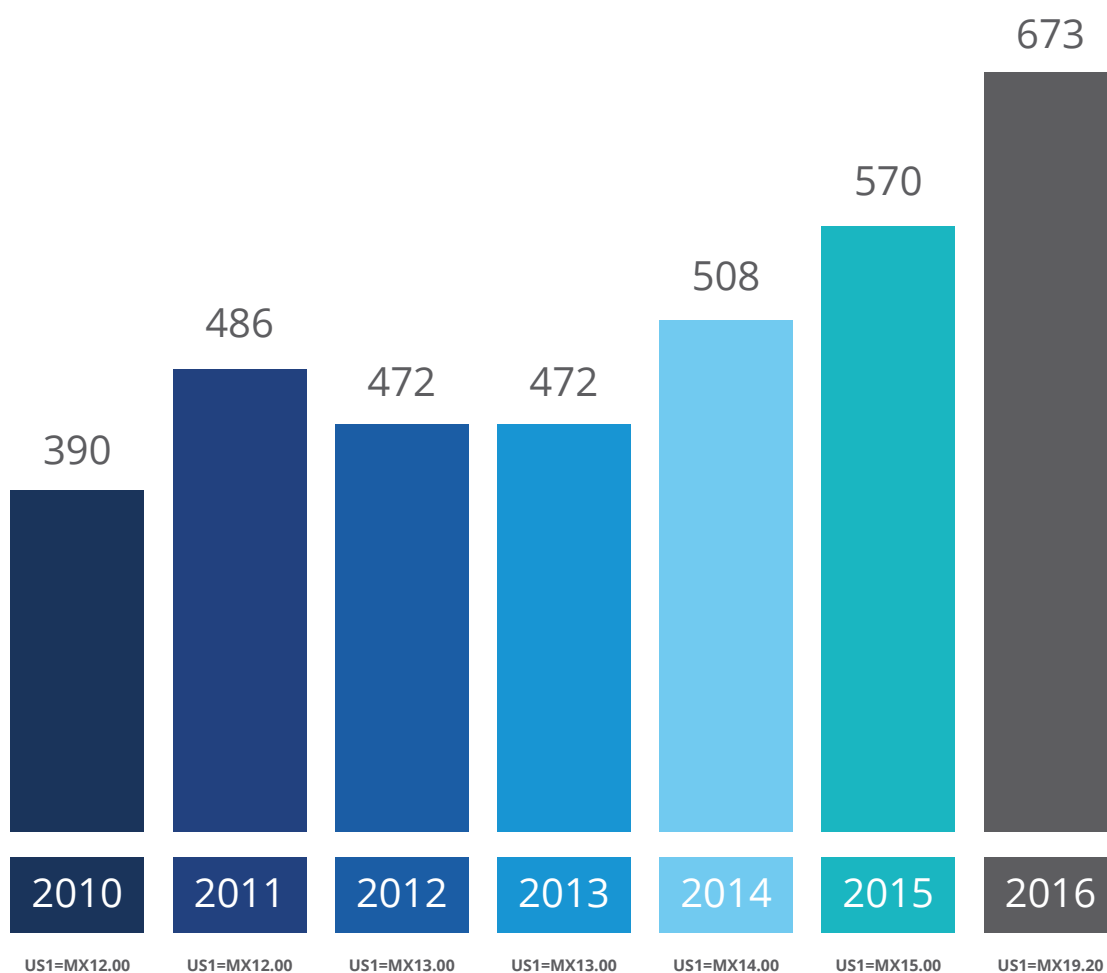
# RESEARCH PROJECTS 2020





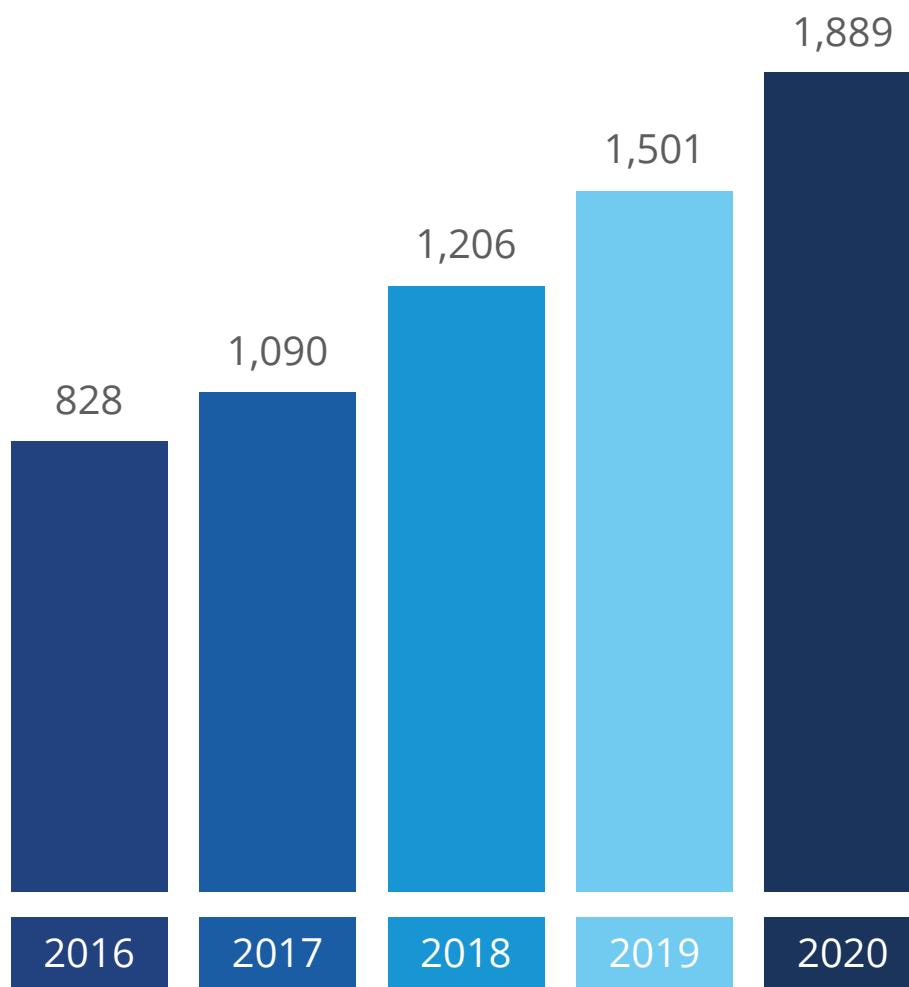
# RESEARCH EXPENDITURE

## TOTAL » \$3,453



Million MXN

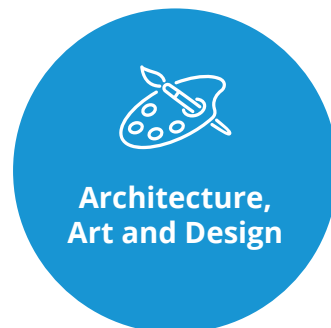
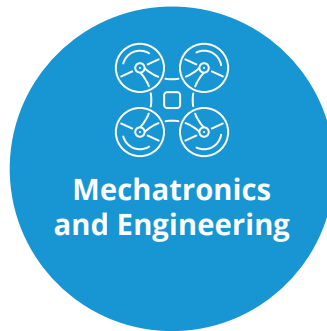
# RESEARCH PRODUCTIVITY: PUBLICATIONS 2016 - 2020



\*Scopus

# Tec de Monterrey

Research areas with strategic focus



# Tec de Monterrey

## Research groups with strategic focus

### Biotechnology

- Bioprocesses
- Biomedical Engineering
- Nutriomics and Emerging Technologies
- Traslacional Omics

### Mechatronics and Engineering

- Nano Sensors and Devices
- Robotics
- Advanced Manufacturing
- Optimization and Data Science
- Nanotechnology for Device Design
- Product Innovation
- Nanomaterials
- Automotive Consortium for Cyberphysical Systems

### Information Technologies, Electronics and Communications

- Photonics and Quantum Systems
- Machine Learning
- Intelligent Systems
- Telecommunications for the Digital Transformation

### Health

- Bioengineering and Regenerative Medicine
- Bioinformatics for Clinical Diagnosis
- Pathophysiology of Metabolic and Emerging Diseases
- Cancer Research
- Human Genetics
- Cardiovascular and Metabolomic Medicine
- Innovative Therapies in Visual Sciences
- Applied Biosciences for Health

### Architecture, Art and Design

- Sustainable Territorial Development

### Sustainable Development

- Water Science and Technology
- Energy and Climate Change

### Humanities and Education

- Educational Innovation
- Communication, Discourse and Culture
- Ethics and Human Flowering
- Science, Technology and Society

### Business

- Business Analytics
- Consumer Behavior and Conscious Marketing
- Entrepreneurship and Innovation
- Organizational Strategy and Management in Emerging Economies
- Finance and Macroeconomics
- Social Innovation
- Retail
- Family Business
- Leadership

### Public Policy and Social Sciences

- Access to Justice
- Democracy, Corruption and Global Issues
- Economic Development and Environment
- Government and Public Entrepreneurship

# STRATEGIC RESEARCH GROUPS

## SCHOOL OF ENGINEERING AND SCIENCE

### Bioprocesses



145 Publications in Scopus  
2 Granted patents  
4 Filed patents  
1 Book  
10 Advised thesis

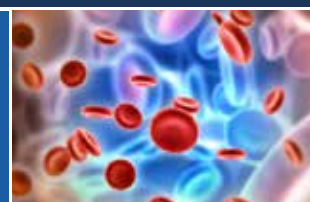
Our group focuses on the development of technology platforms based on bioprocesses and synthetic biology that generate new applications, new products and new production systems.

**Leader:**  
José Guillermo González -  
jose.gonzalez@tec.mx

### Biomedical Engineering

The mission of the group is to generate knowledge, new applications, and developments in the area of Pharmaceutical Biotechnology and Biomedicine by combining biological and engineering concepts.

**Leader:**  
Mario Moisés Álvarez -  
mario.alvarez@tec.mx



4 research lines:

- Biopharmaceutical biotechnology
- Micro and nanotechnologies
- Tissue Engineering
- Engineered biomaterials

### Traslational Omics



7 Research areas 8 Core researchers 16 Adjunct researchers

Through the convergence of different disciplines (biotechnology, genomics, synthetic biology and biomedicine), this group promotes emerging and innovative technologies, techniques and devices to solve health problems.

### Nutriomics and Emerging Technologies

This group performs cutting-edge research in nutrigenomics in order to identify phytochemicals preferably associated with Mexican native plants and foods that have the potential to prevent and treat cancer and chronic degenerative diseases.

**Leader:**  
Sergio Serna Saldívar -  
sserna@tec.mx



65 Publications in Scopus  
5 Granted patents  
5 Filed patents  
18 Graduated students  
11 Advised thesis  
4 Research lines

## Automotive Consortium for Cyberphysical System



This group focuses on the development of modern transportation systems, particularly associated with the automotive industry. The research topics of this group are: virtual prototyping, the use of new light materials and multimaterial components, the development of powertrains equipped with electric motors; the integration of structures and modular systems for vehicle design.

17 Publications in Scopus  
2 Filed patents  
3 Granted patents  
3 Graduated students

**Leader:**  
Horacio Ahuett Garza -  
horacio.ahuett@tec.mx

## Advanced Manufacturing

This group focuses on applied research related to the design and manufacture of products with high added value using disciplines such as competitive intelligence, circular economy, biomanufacturing, additive manufacturing, precision engineering and laser-based microprocessing.

**Leader:**  
Ciro Angel Rodríguez -  
ciro.rodriguez@tec.mx



Research lines:

- 3D printing of tissue
- Engineering scaffolds
- Electrospinning of nanofibers
- Laser microcutting and microwelding
- Soft lithography for microfluidics
- Microinjection molding
- Micromilling
- Metrology

## Optimization and Data Science



This group develops approaches, formulations and solutions to specific industrial engineering problems using a quantitative point of view. This group solve production and logistics problems such as planning and production scheduling, facility location, inventory, vehicle routing, territorial design, forest management and port logistics.

37 Publications in Scopus  
1 Granted patents  
4 Filed patents  
14 Graduated students  
10 Advised thesis

**Leader:**  
Neale Ricardo Smith  
Cornejo - nsmith@tec.mx

## Nanomaterials

This group focuses on the surface engineering by assisted plasma.

**Leader:**  
Joaquín Esteban Oseguera -  
joseguer@tec.mx



18 Publications in Scopus

Research lines:

- Prototype design and construction for the thermochemical treatment of steel parts.
- Nitriding, carbonitriding and oxy carbonitriding of steels.
- Thin film coatings on substrates for tribological systems, high performance components and metal.
- Development of piezoelectric materials used as sensors.
- Develops mathematical representation of kinetics growth in concomitant nitride layers.
- Performs the structural characterization of a wide variety of steels and thin films.

## Nanotechnology for Device Design



82 Scopus Publications  
2013 - 2017  
37 Articles in journal Q1  
2013 - 2017  
16.4 Publications per  
year 2013 - 2017

4 research lines: 1) The development and characterization of intelligent and morphing biocompatible polymeric materials reinforced with carbon nanotubes or nanoparticles. 2) The development of cutting edge technology to manufacture devices based on nanostructured materials. 3) The prediction of the dynamic response of linear and non-linear systems by using perturbation techniques, nonlinear modal analysis and cutting-edge experimental techniques. 4) The computer simulation of engineering components with Finite Element Analysis.

**Leader:**  
Alex Elías Zúñiga -  
aelias@tec.mx

## Product Innovation

This group investigate state of the art concepts and generate significant contributions related to identification of demand from Rapid Growing Markets as well as characterization and application of accelerating technologies for product and process innovations. Also design and create reference models, methodologies and tools for Rapid Product Innovation and Realization.

**Leader:**  
Arturo Molina -  
armolinagtz@tec.mx



40 publications in  
journals  
29 Filed patents  
10 Granted patents  
11 Book chapter

## Robotics



50 Publications in  
Scopus  
18 Patents  
6 Startups

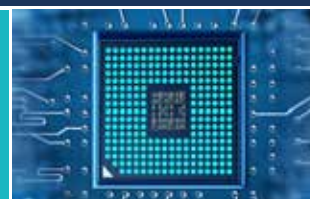
This group develops devices in the areas of bio-mechatronics and autonomous vehicles. In the bio-mechatronics area, the objective is to assist the human motion during rehabilitation and to help geriatric people with wearable robotics. In the case of autonomous vehicles focus on the assistance during natural disasters by using teams of heterogeneous robots.

**Leader:**  
José Luis Gordillo -  
jlgordillo@tec.mx

## Nano-sensors and Devices

This group develops micro/nanofabrication processes and novel miniaturized sensors and devices, particularly photonic and electrochemical sensors, and micro-labs on a chip. These sensors and devices are fabricated with various materials, such as metals, polymers and carbon, and can integrate ad-hoc microelectronic systems.

**Leader:**  
Sergio Omar Martínez -  
smart@tec.mx



The group deals mainly with:

- Applications related to environmental monitoring.
- Separation and processing of biological materials used for new drugs.
- The analysis of biological fluids for the prevention, detection and monitoring of diseases.
- Development of devices for monitoring and improving cell culture.



## Intelligent Systems



4 Posdocs  
15 PhD students  
10 Recent publications

Research lines:

- Nature inspired systems
- Context Intelligence

This group conducts basic and applied research to develop intelligent systems for solving problems across a wide range of application areas including optimization and logistics, ambient intelligence, web semantics, healthcare, forecasting and business intelligence, among others.

**Leader:**

Hugo Terashima Marín -  
terashima@tec.mx

## Machine Learning



The group is interested in applying computer technology for solving national priority problems. Currently, we focus mainly on issues such as security, business intelligence, education, logistics and bioinformatics.

**Leader:**

Raúl Monroy Borja -  
raulm@tec.mx

6 Posdocs  
2 PhD students  
8 Graduated students  
24 Recent publications  
in Scopus

## Photonics and Quantum Systems



8 professors  
2 posdocs  
3 Phd students  
11 Recent publications  
in Scopus

This group studies the application of light in micro-manipulation systems, quantum computing and characterization of micro and nanostructured materials including metamaterials. We develop special light profiles using lasers and other incoherent light sources.

**Leader:**

Julio César Gutiérrez - Vega  
juliocesar@tec.mx

## Telecommunications for the Digital Transformation



The group works on signal processing for image processing as well as on the convergence between optical communications networks and wireless networks.

**Leader:**

César Vargas  
cvargas@tec.mx

13 professors  
2 posdocs  
8 PhD students  
9 graduated students  
45 Recent publications  
in Scopus

## Energy and Climate Change



This group consolidates the research interest of the School of Engineering and Sciences in the broad area of sustainable use of energy and environmental resources.

24 professors  
2 Star professors  
7 posdocs  
26 PhD students  
47 recent publications in Scopus  
8 filed patents  
7 granted patents

**Leader:**  
Alberto Mendoza Domínguez -  
mendoza.alberto@tec.mx

## Water Science and Technology

This research group implements several activities related to the management of water resources and engineering for sustainable use.

**Leader:**  
Jürgen Mahlknecht -  
jorgen@tec.mx



This group works in the following areas:

a) Hydrological processes focused on the management of water resources in the area basin. b) Environmental process focused on developing biorefineries and new green technologies. c) Environmental geoprocesos focused on the study of the environmental impact in the subsoil related to human activities d) Environmental nanotechnology focused on the development of new and advanced materials.

# SCHOOL OF MEDICINE AND HEALTH SCIENCES

## Cardiovascular and Metabolomic Medicine



The objective of this group is characterize the molecular and cellular mechanisms that contribute to the development of cardiovascular and metabolic diseases in order to propose and evaluate new experimental therapies for prevention and treatment in preclinical models that will establish the scientific bases for the conduction of clinical studies with patients.

**Leader:**  
Gerardo García Rivas -  
gdejesus@tec.mx

7 research professors  
1 professor  
3 clinical professors  
2 specialists  
3 postdocs  
Relevant projects  
Generation of functionalized nanovectors with the protein sorcin as a novel strategy for the treatment of cardiac failure and arrhythmogenesis.  
Safety and efficacy assessment of immunomodulator molecules in patients with advanced cardiac failure.

## Cancer Research

This group develops research focused in the identification of useful biomarkers for the prevention, diagnosis and treatment of different cancer types, integrating genetic variability, environmental effects and lifestyle of individuals.

**Leader:**  
Rocío Ortiz López -  
rortizl@tec.mx



2 research professors  
5 professor  
3 clinical professors  
1 research technician  
1 postdocs

Relevant projects  
Validation of a genomic signature of triple negative breast cancer in order to determine its prognosis applicability with the survival rate of a patient.  
Immunological profiles characterization with IHC (proteins) and qPCR (mRNAs) in young women biopsies with breast cancer and their association with the clinical-pathological response.

## Human Genetics



This group development of research in different areas of Human Genetics as a primary discipline in biomedical research.

### Leader:

Rocío A Rojas Martínez -  
augusto.rojasmtz@tec.mx

4 research professors  
6 professor  
3 clinical professors  
1 Star professor  
2 postdocs  
2 specialist  
1 Genetist

Relevant projects  
Fetal damage from exposure to xenobiotics.  
Medicine studies of systems for congenital heart diseases.

## Pathophysiology of Metabolic and Emerging Diseases



This group develop applied research activities oriented to the prevention, diagnosis and treatment of diseases that affect the human population through interdisciplinary solutions to the principal health problems using a translational medicine in metabolic diseases approach.

### Leader:

José Guillermo Domínguez Cherit -  
guillermoc@tec.mx

2 research professors  
9 professor

Relevant projects  
Portable device for the generation of a microenvironment during intravitreal injections for the treatment of diabetic macular edemas.

System for the identification of potential cases of diabetic macular edema using image processing and artificial intelligence techniques.

## Innovative Therapies in Visual Sciences



This group develops research within technological and innovative spheres focused in the diagnosis, prevention and treatment of ophthalmic pathologies that represent national and worldwide health problems, with a multidisciplinary and translational approach using cutting edge technologies in areas such as: cellular therapy, tissue engineering, biomedical devices, nanotechnology, bioinformatic models, biomaterials, clinical and epidemiological research.

### Leader:

Jorge Valdez García -  
jorge.valdez@tec.mx

2 research professors  
3 professor  
6 clinical professors

#### Relevant projects

Development of artificial corneal tissue by tissue engineering techniques (corneal endothelium).

Pharmaceuticals development for affections within the ocular surface (Topical treatment for Pterygium).

## Bioinformatics for Clinical Diagnostics



This group improves life quality of the Mexican population through the exploration and design of computational tools that employ substantial sources of clinical, radiological, epidemiological, genomic and molecular information to discover and/or identify experimentally validated biomarkers that will allow positive decision-making within clinical practice and public health

### Leader:

Víctor Treviño Alvarado -  
vtrevino@tec.mx

4 research professors  
1 clinical professor  
1 postdoc  
1 specialist

#### Relevant projects

Biomarkers and mutations in breast cancer.

Biomarkers identification methods

## Bioengineering and Regenerative Medicine



4 research professor  
3 professor  
3 clinical professors  
2 postdocs  
1 specialist

Relevant projects  
Sequential transplant of autologous stem cells CD133+ to the frontal motor cortex in patients with amyotrophic lateral sclerosis (ALS).  
Generation and scale-up of insulin-producing cells from mesenchymal cells from adipose tissue.

Isolate, enrich, characterize and differentiate in vitro stem cells obtained from different biological sources through the implementation of flexible bioengineering platforms for their application in regenerative medicine as a treatment for neurological, metabolic, traumatic, renal and pulmonary diseases.

**Leader:**  
Marco Antonio Rito  
Palomares  
mrito@tec.mx

## Applied Biosciences For Health

Has a multidisciplinary team of researchers that allows it to address health care problems from all perspectives, based on needs, the development of basic science, the mechanism necessary to establish pre-clinical study models and the development of clinical research with a view to transferring the solution.

**Leader:**  
Leader: Arturo Santos  
García  
arturo.santos@tec.mx



# SCHOOL OF HUMANITIES AND EDUCATION

## Communication, Discourse and Culture



21 Research professors  
13 PhD students  
21 Recent publications in Scopus  
3 Recent books  
6 Advised thesis

This group study the term "cultural industry" from a broad perspective that involves the production of cultural goods and services in a non-restrictive and inclusive manner. Its study covers production generated through traditional sectors such as editorial print, analogue or advertising audiovisual, but also via digital media.

**Leader:**  
María de la Cruz Castro -  
maricruz.castro@tec.mx

## Educational Innovation

This group focuses its research on innovation in education in three main areas: management of educational institutions; sociocultural contexts of the digital technology; and teaching and learning processes for a knowledge-based society in diverse areas with an emphasis on science, mathematics, engineering and technology.

**Leader:**  
Katherina Edith Gallardo  
Córdova  
katherina.gallardo@tec.mx



17 Research professors  
3 PhD students  
24 Recent publications in Scopus

## Science, Technology and Society



7 Research professors  
12 Professors  
30 PhD students

We study the paradigm shift from the monetary base of industrial and material culture to intangible base (ideas and emotions) of the knowledge culture. We generate social innovation through creation of value based primarily, on intellectual capital.

**Leader:**

Francisco Javier Serrano -  
fjavierserrano@tec.mx

## Ethics and Human Flowering

Peace studies cover different approaches and disciplines to build cultures of peace. Involve a reconceptualization of what is peace and violence and personal level intervention, social and international. Ethics involves thinking about the world in which we live looking for a more just place, looking for the good and happiness of the people.

**Leader:**

Dora Elvira García -  
dora.garcia@tec.mx



17 Research professors  
3 PhD students  
24 Recent publications in Scopus  
3 Books  
6 Advised thesis  
6 Conferences presentations

# SCHOOL OF SOCIAL SCIENCES AND GOVERNMENT

## Access to Justice



2 core researchers  
12 adjunct researchers

Modern states entrust to the law the consolidation of more just societies, respect for democratic values and the full protection of human rights, in an environment of legality.

**Leader:**

Roberto Garza Barbosa  
rgb@tec.mx

## Democracy, Corruption and Global Issues

Contribute to the rigorous analysis of everything that an effective and credible democracy implies.



5 core researchers  
adjunct researchers



## Government and Public Entrepreneurship



2 core researchers  
6 adjunct researchers

This GIEE has been very innovative, using as a tool what is now called data science, which includes artificial intelligence and machine learning, among others

**Leader:**  
Edmundo Molina Pérez  
edmundo.molina@tec.mx

## Economic Development and Environment



10 core researchers  
20 adjunct researchers

This GIEE is aimed at interpreting reality and proposing public policies that increase the chances of success of sustainable economic and social development.

**Leader:**  
Rocío García Díaz  
rociogarcia@tec.mx

# BUSINESS SCHOOL

## Business Analytics



4 Research professors  
4 Doctoral students  
1 Adjunct researcher

We study the use of business analytics and digital technologies to understand and improve business performance and process efficiencies.

**Leader:**  
Raúl Francisco Montalvo Corzo  
rmontalvo@tec.mx

## Consumer Behavior and Conscious Marketing



5 Research professors  
1 Star professor  
4 Research lines  
4 Recent publications

We study consumer behavior in order to develop effective business strategies that promote responsible consumption and social welfare.

**Leader:**  
Jorge Luis Graciano Vera Martínez  
jorge.vera@tec.mx

## Entrepreneurship and Innovation



This research group focuses, enhances and disseminates scholarship on entrepreneurship and leadership which strengthen economic and social development in Mexico.

José Ernesto Amorós  
Espinosa - amoros@tec.mx

6 Research professors  
1 Star professor  
2 Doctoral students  
3 Research lines  
7 Recent publications

## Retail

This group seeks to develop the retail trade in Mexico in order to achieve international competitiveness by developing strategic thin-king that improves competitiveness through: store experience, operational optimization, use of technology and brand value.

Eva María González  
Hernández  
emgonzal@tec.mx



2 Research professors  
8 Adjunct researchers  
1 Star professor  
6 Research lines  
4 Recent publications

## Finance and Macroeconomics



We contribute to the development of Mexican companies through their integration into national and international financial markets. We promote a better understanding of the relation between companies and global macroeconomic conditions

Leader: René Cabral Torres -  
rcabral@tec.mx

14 Research professors  
2 Star professors  
14 Doctoral students  
6 Recent publications

## Social Innovation

We engage in basic and applied research aimed at understanding the functioning of corporate social responsibility within the context of both large multinational corporations as well as small and medium-sized enterprises. In addition, we study social, multifaceted entrepreneurship.

Leader: Bryan William  
Husted Corregan -  
bhusted@tec.mx



7 Research professors  
2 Star professors  
16 Doctoral students  
7 Research lines  
4 Recent publications



### Family Business



Leader:  
Edgar Rogelio Ramírez Solís  
edgar.ramirez@tec.mx

4 Adjunct researchers


### Leadership



Leader:  
Elliot Tyler Kruse  
etkruse@tec.mx

## SCHOOL OF ARCHITECTURE, ART AND DESIGN

### Strategy and Management of Organizations in Emerging Economies



In the context of emerging economies, we focus on the research processes and practices related to: strategy development and implementation, organizational capabilities, knowledge transfer, governance and human resources management. We apply strategies and management theories through models and tools designed for decision making and sustainable development for organizations in emerging economies.

Leader:  
Anabella del R. Dávila Martínez  
anabella.davila@tec.mx

- 4 Research professors
- 1 Star professors
- 7 Doctoral students
- 4 Research lines
- 9 Recent publications

### Sustainable Territorial Development



It is the space dedicated to the generation of knowledge and aims to develop research that addresses the great challenges of society and its territory, thus strengthening the strategic axes that School of Architecture, Art and Design has defined: "City and Territory" and "Design for the social innovation "

Leader:  
Aleksandra Krstikj Bajar  
correo.sandra.krstik@tec.mx

- 1 core researcher
- 17 adjunct researchers
- 3 Research lines

- Resilience and adaptation to climate change
- Analysis of territorial dynamics
- Equitable cities

# INSIGNIA PROFESSORS

Insignia award is the largest distinction in research for a Tec de Monterrey professor. Is the principal recognition of Investigation and Innovation prize Rómulo Garza, and is granted every year by Tecnológico de Monterrey and Xignux.

This award recognizes the researchers scientific career, their contributions to the institutional life and the community, and their professional distinctions over the years.

Romulo Garza Prize was created 40 years ago in memory of Mr. Rómulo Garza, who was an important research promoter in the community.



## 2020

Jorge Welte Chanes



Professor Insignia Rómulo Garza 2020. Jorge Welte Chanes is an academic with almost forty years of experience in teaching, research and academic administration. He is a Doctor in Sciences and his research and consulting work is oriented to the analysis and design of products and processes for the food industry with a strong engineering focus. He is member of the National System of Investigators (Nivel III) and of the Mexican Academy of Sciences. He has been president of different international organizations in the areas of Food Science and Engineering. He is the author of more than 150 scientific publications and 15 book.

She is member of the National Researchers System, level 3.  
jwelts@tec.mx

2019

**Dora Elvira García González**

She is the leader of the Research Group Ethics and Human Flowering. She specializes in ethics, political philosophy, hermeneutics and the philosophy of culture. Her research lines include ethics, the culture of peace, human rights and sustainable cities.

2018

**Dr. José Luis González Velarde**

His has a master in Mathematics from the Instituto Politécnico Nacional and a doctorate in Industrial Engineering and Operations Research from the University of Texas, Austin. His specialties include computational optimization and algorithm design for logistics and manufacturing. He has participated in over 15,000 peer-reviewed publications and has had his work published in important journals.

2017

**Dr. Bryan William Husted**

Professor at EGADE Business School Monterrey.

Leader of the Strategic Research Group in Social Innovation.

Has written academic articles in several journals.

2016

**Dr. Mario Moisés Álvarez**

Leader of the Strategic Research Group in Biomedical Engineering. His research specialties include design of bio-reactors, transport phenomena and mathematical modeling of biological systems. Has published more than 100 articles in prestigious international journals in his field.

2015

**Dr. Marco Antonio Rito Palomares**

Leader of the Strategic Research Group in Bioengineering and Regenerative Medicine. Member of the Mexican Academy of Sciences and president of the Mexican Society of Biotechnology and Bioengineering, NL. Has published more than 80 research papers and book chapters and holds five patents.

2014

**Dr. Julio César Gutiérrez Vega**

Leader of the Strategic Research Group on Photonics and Quantum Systems. Has authored and co-authored more than 185 articles in international journals, conference proceedings and books. The first Mexican to be named senior member of the International Society of Optics and Photonics.



**EXPERT CORE**  
Tecnológico de Monterrey

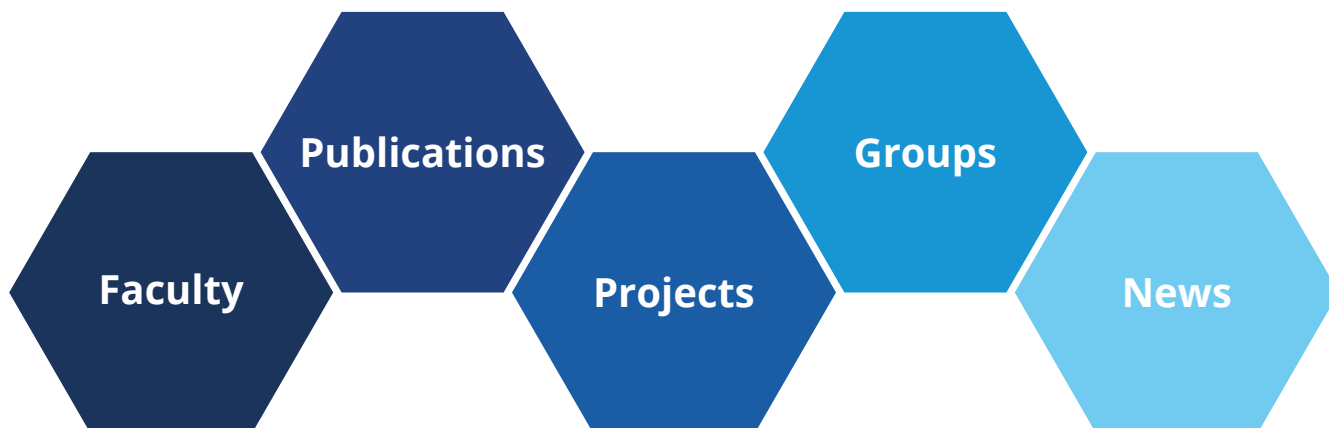
Visit: [research.tec.mx](https://research.tec.mx)



Expert core is the platform which gathers the most noteworthy information about our professors; their experience, achievements and main projects. Hours of talent and effort devoted to the transformation and improvement of the lives of thousands of young men and women lie beneath each story.

# EXPERT CORE

Tec de Monterrey's scientific expert site





# RESEARCH CENTERS



The center focuses on training researchers and specialized consultants involved in identifying and answering questions arising out of product design and engineering globalization, intelligent and reconfigurable manufacturing processes, and logistics systems. The center uses its intellectual capital, infrastructure, and strategic alliances with key technology providers and prestigious universities around the globe to obtain the best possible results.

Director: Ing. Sergio Uribe Gutiérrez - [sergio.uribe@tec.mx](mailto:sergio.uribe@tec.mx)  
[www.centroinnovacion.org](http://www.centroinnovacion.org)

**CIDYT**  
 Center for Innovation in  
 Design and Technology

**CAALCA**  
 Water Center for Latin  
 America  
 and the Caribbean

The center conducts research and provides consulting for the purpose of generating and disseminating knowledge and providing education regarding the sustainable management and use of water resources in Latin America and the Caribbean.

Director: Dr. Alberto Mendoza Domínguez [mendoza.alberto@tec.mx](mailto:mendoza.alberto@tec.mx)  
[www.centrodelaagua.org](http://www.centrodelaagua.org)



This is currently one of the most prestigious research centers in the country with the highest scientific production in the Tecnológico de Monterrey system. Over 40 researchers and 100 graduate and undergraduate students work here in more than 100 different high-impact biotechnology projects. Research in the FEMSA Biotechnology Center moves around three main areas: bioprocess engineering, synthetic biology and food and pharmaceutical biotechnology, generating patents, state-of-the-art technological solutions for the industry, technology transfer and spin-offs.

**CB-FEMSA**  
 Biotechnology-FEMSA  
 Center

**CITES**  
 Center for Innovation  
 and Transfer in Health

The center specializes in health research, innovation, and transfer. Its main lines of research include cardiology, cell therapy, hematology and cancer, ophthalmology, nutrition, and health system administration.

Director  
 Dr. Marco Antonio Rito Palomares  
[mrito@tec.mx](mailto:mrito@tec.mx)



# INTERNATIONAL COLLABORATION



## MECHATRONICS AND ENGINEERING

- Massachusetts Institute of Technology
- Rice University
- Mechatronics University Of California, Irvine
- UMD Maryland
- NUS university of Singapore
- University of the Andes



## INFORMATION TECHNOLOGIES, ELECTRONICS AND COMMUNICATIONS

- Cornell University
- Texas A&M University
- St. Jude Children ´ s Research Hospital
- UMD Maryland
- University of the Andes



## BIOTECHNOLOGY

- Cornell University
- Texas A&M University
- St. Jude Children ´ s Research Hospital
- UMD Maryland
- University of the Andes



## SUSTAINABLE DEVELOPMENT

- Arizona State University
- University of Calgary
- University Of California, Berkeley
- UMD Maryland



## PUBLIC POLICY AND SOCIAL SCIENCES

- Princeton University
- Fudan University
- UMD Maryland



## BUSINESS

- Babson College
- Northeastern University
- UMD Maryland



## HEALTH

- Johns Hopkins University
- Houston Methodist Leading Medicine
- USP Universidade de Sao Paulo
- UMD Maryland



## HUMANITIES AND EDUCATION

- University Of California, Berkeley
- UNESCO
- UMD Maryland



STRATEGIC  
**INITIATIVES**



# STRATEGIC INITIATIVES



TEC . NANO



ENERGY



EDUCATION



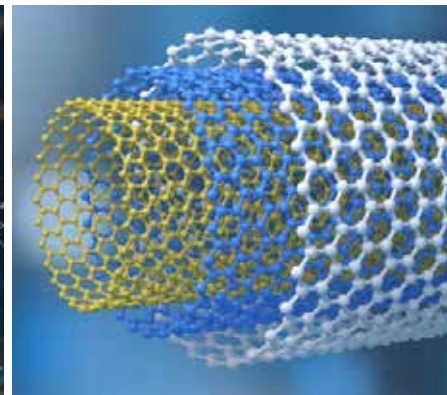
LEADERSHIP &  
ENTREPRENEURSHIP



# STRATEGIC INITIATIVES: **TEC.NANO**

Initiative with the aim of supporting research in areas of nanoscience and nanotechnology through interdisciplinary projects in:

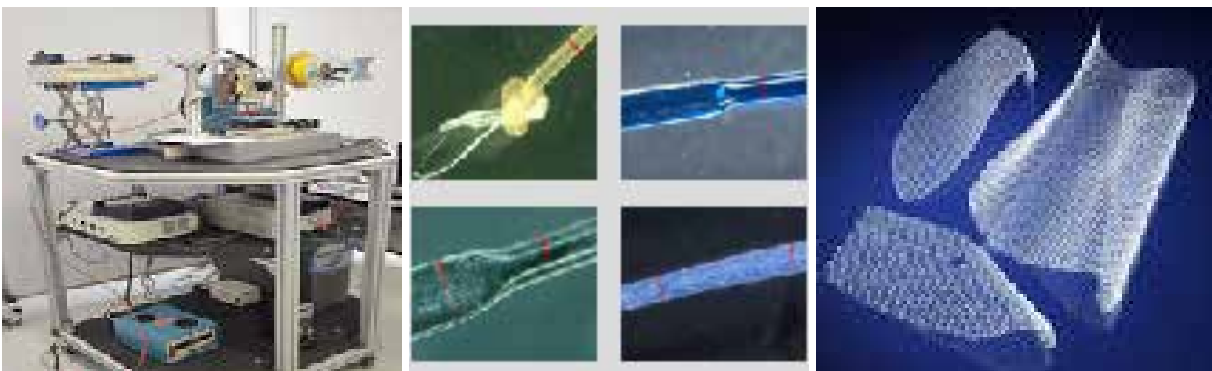
- Biotechnology
- Mechatronics
- Sustainability
- Information and Communication Technologies
- Health
- Education
- Entrepreneurship
- Public Policy



# STRATEGIC INITIATIVES: TEC.NANO

## ON GOING PROJECTS AT TECNOLÓGICO DE MONTERREY

- Chemical and electrochemical synthesis of metallic nanoparticles
- New constitutive models of nanostructured materials
- Intelligent surgical meshes
- 3D printing for scaffolds in tissue engineering
- Surface engineering
- Biomems: C-MEMs, dielectrophoresis, CD-microfluidics
- Micromachines and micro-factories
- Development of micromixers for mass transfer in microfluidic cells
- Nanoelectronics (nanosystems; low-power consumption, statistical circuit theory)
- Quantum information processing
- Design of nanostructures for sensor development
- Design of nanoplatforms for controlled release of genetic material and drugs
- Nano-optics: Interaction of light with nano-systems
- Interactions between nano-optical systems



# MIT - TECNOLÓGICO DE MONTERREY

## Research Agreement



Tecnológico de Monterrey has signed an agreement with one of the most prestigious universities in the world in a vanguard topic, nanotechnology. In 2014, effectively, an important event in Tec history took place: an agreement in perpetuity was signed with the Massachusetts Institute of Technology, MIT.

The agreement consists of developing capacities in nanotechnology in concordance with the great gamble this world class institution is making with its project MIT. Nano.

In this context, the agreement contributes to Tecnológico de Monterrey's new strategy of attracting talent, infrastructure, and strategic partnerships. These alliances will allow Tecnológico de Monterrey to confront the great challenge it is facing to position itself as a research university. These kinds of agreements contribute mainly to:

- Developing and attracting highly specialized and world-quality human assets.
- Maximizing the scientific production and leadership of Tec's researchers.
- Boosting creativity and active learning to take advantage of the most important research network in the world.
- Developing and improving proficiency and capacities to deal with highly competitive industry, environmental sustainability and the improvement of society's quality of life

**In the next five years, the following Impact indicators are anticipated:**

**10 future professors in internships at MIT in nano topics**  
**10 researcher professors from Tec de Monterrey in elite research groups**  
**10 graduate students in co-advising with MIT researchers**  
**50 undergraduate students in short training stays in micro and nanofabrication techniques**  
**2 distinguished professors from MIT**  
**50 scientific articles of high impact published in co-authorship with MIT researchers**  
**Funds for 2 million US dollars in mutual research proposals**



Professors from Tecnológico de Monterrey in the MIT intensive workshop.

# MIT - TECNOLÓGICO DE MONTERREY

## Research Agreement



### MIT.NANO RESEARCH AREAS:

- Personal Medicine
- Energy Systems
- Ubiquitous Computing
- Multiscale Manufacturing
- Sustainable Infrastructure
- Quantum Science and Technology



### TEC.NANO Research Areas:

- Personal Medicine
- Energy systems
- Multiscale Manufacturing
- Quantum Science and Technology



# STRATEGIC INITIATIVES: **ENERGY**

Our goal is to contribute to the competitive development of the energy sector in México.  
Research:

- Research in political economy of the Mexican energy reform
- Assessment of social impact, urban risk and strategic opportunities at the local level with energy projects
- Public policy analysis for renewable energy
- Impact analysis of hydraulic fracture technology

Outreach:

- Regional strategic plan for the energy sector
- Capital budgeting in gas & oil
- Identifying business opportunities for the value chain energy sector



# STRATEGIC INITIATIVES: **EDUCATION**

Serve as a reference for how to educate in order to have an impact on learning processes at different levels:

- Educational policy
- Management of educational institutions
- Curriculum design
- Processes of teaching and learning in the classroom (intensive use of educational technology as a learning mediator) Projects:
- Assessment for improving external educational evaluation system for public schools with low academic achievement
- Virtual Learning Center
- Center for improvement and educational innovation
- Institutional repository
- Resource Center for Academic Writing
- Culture of legality in primary and secondary schools





# OBSERVATORY OF EDUCATIONAL INNOVATION



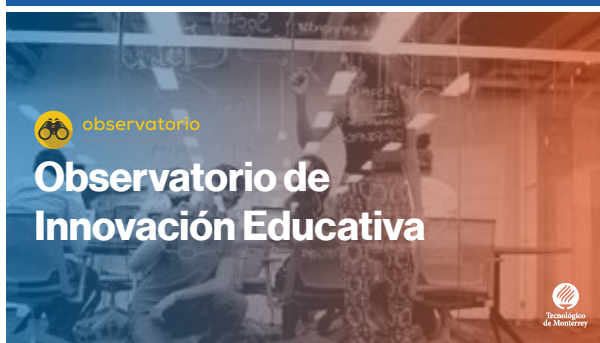
**observatory**  
of Educational Innovation

**Website:** [observatory.tec.mx](http://observatory.tec.mx)

**About us:** We are a prospective, intelligence, and organizational learning unit at Tecnológico de Monterrey devoted to the analysis and dissemination of educational trends that are shaping the future of learning.

- **Observe:** Identify and analyze high-impact educational trends.
- **Share:** Communicate efficiently and timely what happens in educational innovation.
- **Foster:** Boost and promote innovation in the Tecnológico de Monterrey and globally.

**Awards:** Open Education Awards Winner. Category: Best OER Collection 2017 | Open Education Consortium



## Our Products:

**Weekly Report:** Our weekly newsletter is a curated media synthesis of the most relevant articles and stories on education, technology, and innovation.

**Edu Trends:** In-depth analysis of trends with the highest potential to impact on Higher Education.

**Edu News:** The most relevant news and articles in the world of education.

**Edu Bits:** Articles about teaching experiences and practices; from teachers to teachers.

**Webinars:** A virtual interaction with an expert in educational innovation.

**Podcast:** Listen to Tec de Monterrey's international journey of discovery and creation of the future of higher education.

# The International Conference on Educational Innovation



is a forum designed to help you learn more about the trends and practices that are currently revolutionizing education around the world.

Through this important event, that has been organized every year since 2006, the Tecnológico de Monterrey is focusing on promoting and facilitating experimentation and innovation among teachers, directors, entrepreneurs and all those interested in education, offering them the opportunity to learn more about the best national and international experiences, connecting them with experts and showcasing what other teachers are doing in the area of educational innovation.

## Objectives

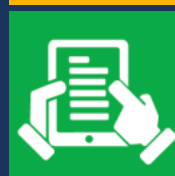
- To learn about the trends and practices in educational innovation that are transforming education around the world.
- To network with world-class experts.
- To identify resources to help improve the teaching-learning process.
- To share their teaching experiences.
- To collaborate with colleagues and institutions on topics of common interest.
- To consolidate joint working agreements.
- To be recognized by their colleagues for their innovation in teaching.

<http://ciie.itesm.mx/en/>

## TOPICS



**EDUCATIONAL TRENDS**



**EDUCATIONAL TECHNOLOGIE**



**ACADEMIC HEALTH INNOVATION**



**EDUCATIONAL INNOVATION MANAGEMENT**



# STRATEGIC INITIATIVES: LEADERSHIP & ENTREPRENEURSHIP

**The Eugenio Garza Laguerre Institute**  
the largest entrepreneurship ecosystem in Latin America

Visit: <http://ieegl.itesm.mx/>

## Mission

Develop and strengthen the entrepreneurial spirit in all the students and teachers of the Tecnológico de Monterrey. Promote and support the creation and development of companies. Accelerate the ecosystem of innovative entrepreneurship.

## AREAS

**enlace**

**TecFounders**  
VENTURE CAPITAL FOR STUDENTS, PROFESSORS AND ALUMNI

**INCmty**  
is for everyone  
.....

### ZONE EI

Develop and strengthen the entrepreneurial spirit in all the students and teachers of the Tecnológico de Monterrey. Promote and support the creation and development of companies. Accelerate the ecosystem of innovative entrepreneurship.

### LINK +

LINK + boost your talent to consolidate and scale your business. Supporting you with a network of more than 360 active mentors nationwide, connecting with an extensive group of leading companies and investors, seeks to make your company a benchmark for success in Mexico.

### TECLEAN

TecClean is a high impact entrepreneurship program focused on startups seeking to develop with repeatable and scalable business models, as well as innovators, taking advantage of current technologies and platforms, making a synergy between entrepreneurs and large corporations.

### TEC FOUNDERS

It is a Venture Capital fund committed to entrepreneurs. We help validate and develop innovative projects around the university ecosystem.

### INCMTY

LINK + boost your talent to consolidate and scale your business. Supporting you with a network of more than 360 active mentors nationwide, connecting with an extensive group of leading companies and investors, seeks to make your company a benchmark for success in Mexico.

### INNOVATIVE SOCIAL ENTREPRENEURSHIP HUB

Support program for social and / or environmental ventures in early stages that seek to develop an innovative impact model.

**Contact:** [egl.comunica@servicios.itesm.mx](mailto:egl.comunica@servicios.itesm.mx)

# INCmty IS FOR EVERYONE



## We boost and promote entrepreneurship

For those who want to be better, for those who seek inspiration and ideas, for those who seek to awaken a passion and connect with those who offer solutions, with those who dare to create a better future!



Entrepreneurs

We promote and foster entrepreneurship. We are a transformative platform available to anyone who dreams of an idea and dares to share it to transcend the entrepreneurial ecosystem



Investors

Be part of the exclusive Angel Investment event, which brings together businessmen and high-ranking executives to learn how to diversify their income through investment in Startups.



General Public

Live the best experience for your stage of entrepreneurship! Connect with entrepreneurship leaders and entrepreneurs like you, who are looking to interact, grow or take the next GREAT step.



SMEs

Attend and learn strategies and tools for growing businesses to succeed at the next level! For employees of industrial, commercial and service companies to have better performance, use of resources, processes and grow their business.



Corporate Sector

Only for those looking for innovation and growth

## Live the Festival!

- Learn
- Connect
- Brainstorm
- Partner
- Celebrate

# INCmty

is for everyone



# INDUSTRIAL PARTNERSHIPS



motorola  
foundation



Cuauhtémoc  
Moctezuma



# EXAMPLES OF RESEARCH INDUSTRIAL PROJECTS

Navistar



Project: Road Load Data Acquisition

The project has a multi-year horizon and has the primary purpose of developing RLDA (Road Load Data Acquisition) systems that allow collection of information, data and knowledge about the behavior of vehicles on Mexican roads, with the aim of providing feedback to the design process and finding different failure causes in durability and load during operation

Bocar



Is a Company that produce pieces and complex assembles for automotive industry. The research projects related to this area in Tec de Monterrey are:

- Production optimization based in simulation
- On line measurement
- Diagnosis of a high speed mechanized center

Roberto rocca  
Research chair



- Energy efficiency in electric and thermal industrial applications
- Energy conversion and power electronics

# EXAMPLES OF RESEARCH INDUSTRIAL PROJECTS

## Industrial Consortium in Energy

Companies: Schneider Electric, Ternium, TenarisTamsa, AMI-GE, Cerrey, Prolec-GE, Nutec Bickley, Tenova, Acciona Energy, Diram Main research areas: Power electronics, design of electrical equipment, optimal dispatch of energy in interconnected power systems, combustion systems, heat transfer and modeling and simulation of industrial processes

Examples of projects:

- Power control optimization of AC electric arc furnaces
- Heat transfer simulation of windings in power transformers for estimation of hot spots
- Compliant mechanisms in miniature circuit breakers



## FEMSA



Project: Emerging Contaminant Biodegradation by Enzymatic Processes

This project focuses on the study of the potential use of enzymatic processes for bioremediation of aquatic systems by enzymes extracted from a microorganism obtained from the northwestern region of Mexico, to implement processes of degradation of various compounds. The investigation is focused on kinetics, the major way of degradation of the analysis of interest and toxic by-products.

## Metalsa



Project: Design and development of electric propulsion system and semi-active suspension for a light load vehicle

In this project Tecnológico de Monterrey designed a control system for a semi-active suspension in an embedded architecture based on a CAN network. The goal of the algorithm is comfort and individual surface grip on each corner of the car, besides a control system that coordinates each independent corner. The control system is based on the specification and modeling of electrohydraulic dampers, including tolerance to some faults. The system was validated in a commercial vehicle.

# LEADERSHIP INSTITUTE

Leadership has been one of the fundamental pillars at Tecnológico de Monterrey since its foundation. The world needs leaders prepared to face the challenges of this new era. This is why we are committed to a leadership oriented to human flowering, developing leaders with a positive vision that contribute to the flourishing of others.

The Leadership Institute emerged with the mission of making leadership a science in order to develop a new responsible, receptive leadership model to address the challenges faced by the world and to fulfill one of the six institutional strategies: Drive Leadership Development.



## Principles

1. We value the existence of others.
2. We prioritize human development.
3. We harmonize the complexity of our reality with that of others.
4. We place our potentialities at the service of others.
5. We foster hope and purpose of life in others.

## Human flourishing

Is the conscious, positive development of individuals, achieving their full potential in their physical, intellectual, emotional, spiritual and social dimensions.



## Lines of action



Research



Leadership Development



Leadership Observatory



Strategic Projects

## Reach

- Leadership and Student Training (LIFE)
- National Schools
- Collaborators
- Teachers
- EXATEC
- Society in general



## Leadership Observatory

The Leadership Observatory is an active site, designed to support you with information, resources and a series of services that will favor your development and enable you to interact with the community interested in this important, relevant topic. Visit us!

**Contact us:** [institutodeliderazgo@tec.mx](mailto:institutodeliderazgo@tec.mx)



SCIENTIFIC, ECONOMIC AND  
**EDUCATIONAL IMPACT**



# EDUCATION IMPACT

## EDUCATION MODEL TEC 21



Tec21 allows you develop solid and integral competences which will help you solve present and future challenges in an strategically and creatively way.



### What is it?

Our new educational model, exclusive worldwide, activates and boosts your innovation capacity and allows you not only to stay current but also to be an agent of change in unprecedented times in which education is experimenting a complete transformation.

### Why is it unique?

Our learning process based in challenges has its foundations in 4 main components:

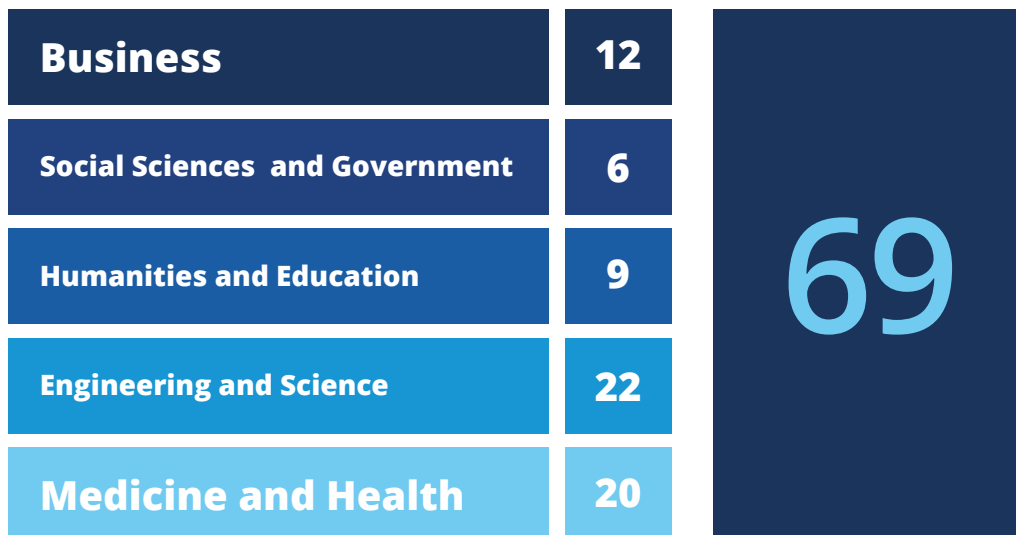
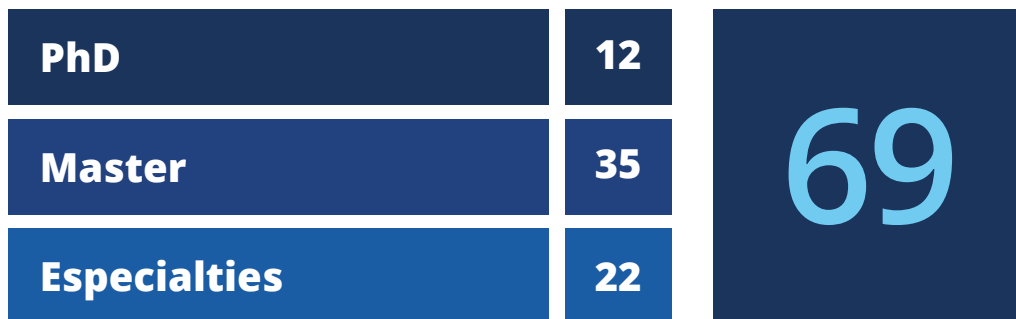


**Visit:** <https://tec.mx/es/modelo-tec21>



# EDUCATION IMPACT

## GRADUATE PROGRAMS



# EDUCATION IMPACT

## **UNDERGRADUATE STUDENTS WITH RESEARCH EXPERIENCE**



José Ignacio González Salazar

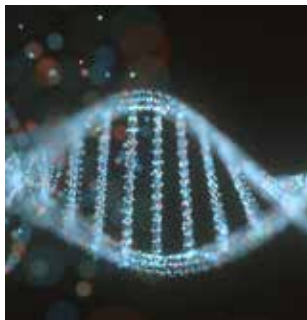
How effective are acoustic therapies to treat chronic and refractory tinnitus?

Professor: David Ibarra  
School: Engineering and Science

Ilse Ivette Briones Niño

Volunteering as a potentializer of the emotional intelligence of innovative women

Professor: Gabriela Monforte García  
School: Business



Raúl Chío León

Representative gene expression signatures of selected autoimmune diseases using Kallisto, an open source pseudo-alignment tool

Professor: Raquel Cuevas Díaz  
School: Medicine

# AWARDS & PRIZES

## QS STARS REIMAGINE EDUCATION AWARDS



Reimagine Education is a global conference and competition, open to educational innovators from all around the world. The conference brings together edtech startups, academic faculty from top institutions, Chief Innovation Officers, university leadership, teachers, and other stakeholders in the future of teaching and learning.

The Reimagine Education Awards (the 'Oscars' of Education) reward innovative approaches that enhance student learning outcomes and employability, offering \$50,000 in funding to the overall winners.

Tec de Monterrey has won these awards:

### 2019

**"Hands-on experience with Star Wars robotics".**

**Awards:**

- Latin America Award (Silver Winner)
- Engineering & IT (Silver award)

### 2017

**"Open Innovation Laboratory for Rapid Realization of Sensing, Smart and Sustainable Products"**

**Awards:**

- Latin America Award (Silver Winner)
- Engineering and IT Award (Gold Winner)
- Hybrid Learning Award (Silver Winner)

**"Touching Math: From concepts to reality through 3D tools"**

**Awards:**

- Latin America Award (Bronze Winner)
- Presence Learning Award (Bronze Winner)
- Natural Sciences Award (Gold Winner)

**"Research Path: Inducing Curiosity, Research and Innovation in Undergraduate Students"**

**Award:**

- Cultivating Curiosity Award (Silver Winner)

### 2016

**"Incubation Cells: Researchers and Entrepreneurs"**

**Award:**

- Nurturing Employability category (first place).

**"Semester i, A new way of learning"**

**Awards:**

- Hybrid Learning Innovation-Poster in Latam región (first place)

**"Professor Avatar: Telepresence Model"**

**Award:**

- Best use of ICT Tools (second place)

Visit:

<https://www.reimagine-education.com/>

# SCIENTIFIC IMPACT - 2019

## MOST CITED PUBLICATIONS

Multitarget Strategies to Reduce Myocardial Ischemia/Reperfusion Injury: JACC Review Topic of the Week. (2019), vol. 73, pp. 89-99. Davidson S.M., Ferdinandy P., Andreadou I., Bøtker H.E., Heusch G., Ibáñez B., Ovize M., Schulz R., Yellon D.M., Hausenloy D.J., Garcia-Dorado D. Document type: Review. Cited by 55.

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Environmentally-related contaminants of high concern: Potential sources and analytical modalities for detection, quantification, and treatment. (2019), vol. 122, pp. 52-66. Rasheed T., Bilal M., Nabeel F., Adeel M., Iqbal H.M.N. Document type: Review. Cited by 48.

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Emerging contaminants of high concern and their enzyme-assisted biodegradation – A review. (2019), vol. 124, pp. 336-353. Bilal M., Adeel M., Rasheed T., Zhao Y., Iqbal H.M.N. Document type: Review. Cited by 44.

Hazardous contaminants in the environment and their laccase-assisted degradation – A review. (2019), vol. 234, pp. 253-264. Bilal M., Rasheed T., Nabeel F., Iqbal H.M.N., Zhao Y. Document type: Review. Cited by 42.

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Effect of remote ischaemic conditioning on clinical outcomes in patients with acute myocardial infarction (CONDI-2/ERIC-PPCI): a single-blind randomised controlled trial. (2019), vol. 394, pp. 1415-1424. Hausenloy D.J., Kharbanda R.K., Møller U.K., Ramlall M., Aarøe J., Butler R., Bulluck H., Clayton T., Dana A., Dodd M., Engstrom T., Evans R., Lassen J.F., Christensen E.F., Garcia-Ruiz J.M., Gorog D.A., Hjort J., Houghton R.F., Ibanez B., Knight R., Lippert F.K., Lønborg J.T., Maeng M., Milasinovic D., More R., Nicholas J.M., Jensen L.O., Perkins A., Radovanovic N., Rakhit R.D., Ravkilde J., Ryding A.D., Schmidt M.R., Riddervold I.S., Sørensen H.T., Stankovic G., Varma M., Webb I., Terkelsen C.J., Greenwood J.P., et al. Document type: Article. Cited by 24.

Chemical, physical, and biological coordination: An interplay between materials and enzymes as potential platforms for immobilization. (2019), vol. 388, pp. 1-23. Bilal M., Iqbal H.M.N. Document type: Review. Cited by 23.

Agarose-chitosan hydrogel-immobilized horseradish peroxidase with sustainable bio-catalytic and dye degradation properties. (2019), vol. 124, pp. 742-749. Bilal M., Rasheed T., Zhao Y., Iqbal H.M.N. Document type: Article. Cited by 23.

# SCIENTIFIC IMPACT - 2019

## MOST CITED PUBLICATIONS

Dexamethasone Implant for Diabetic Macular Edema in Naive Compared With Refractory Eyes: The International Retina Group Real-Life 24-Month Multicenter Study. The IRGREL-DEX Study. (2019), vol. 39, pp. 44-51. Iglicki M., Busch C., Zur D., Okada M., Mariussi M., Chhablani J.K., Cebeci Z., Fraser-Bell S., Chaikitmongkol V., Couturier A., Giancipoli E., Lupidi M., Rodríguez-Valdés P.J., Rehak M., Fung A.T.-C., Goldstein M., Loewenstein A. Document type: Article. Cited by 22.

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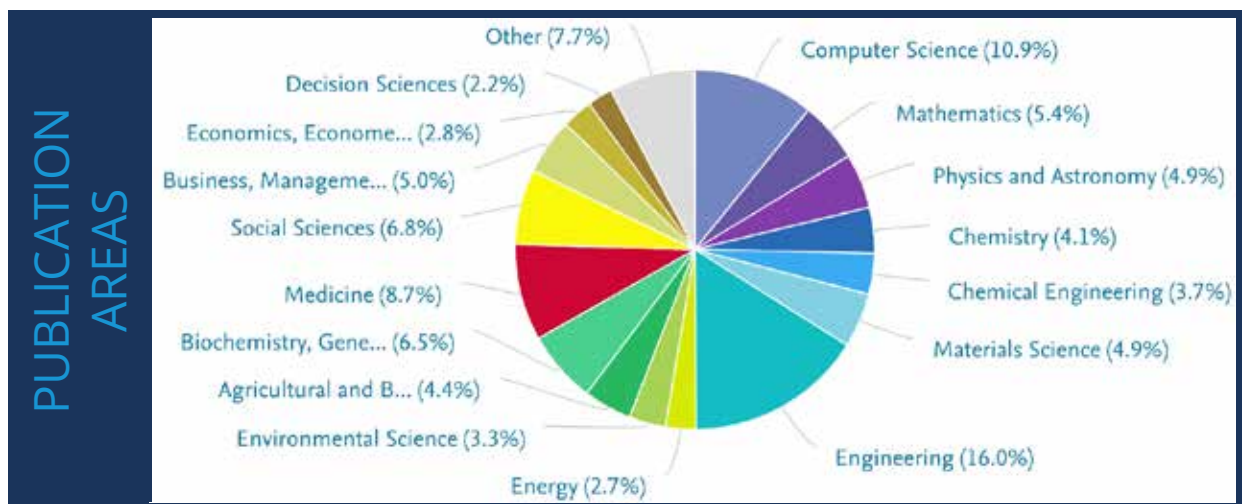
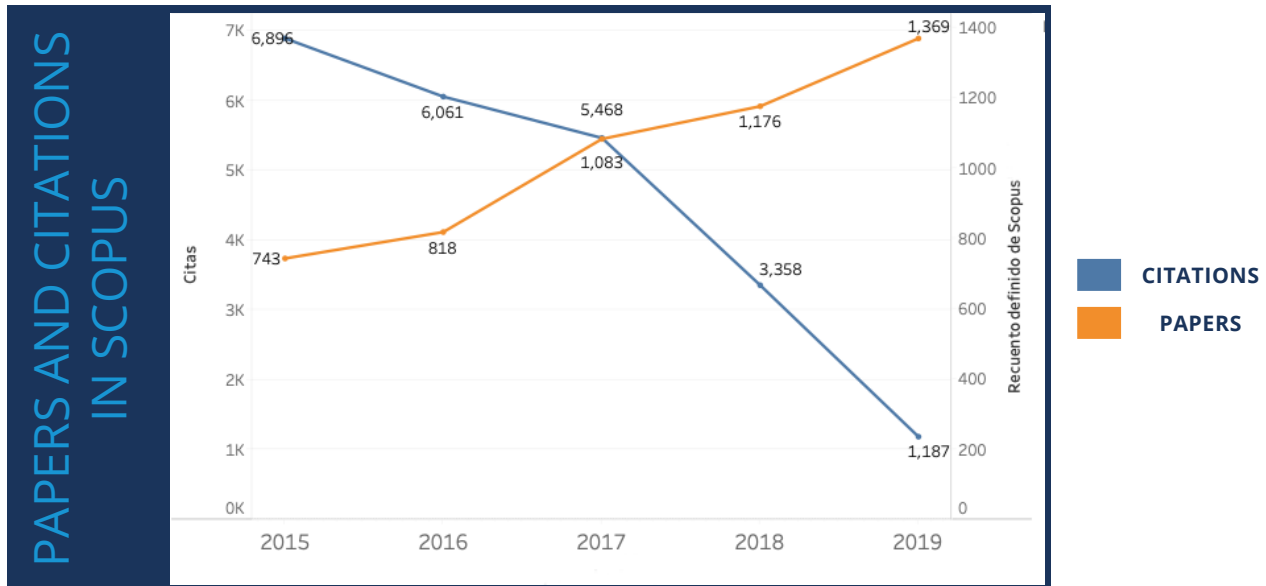
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# SCIENTIFIC IMPACT

## Papers and Citations in Scopus



# ECONOMIC IMPACT

## Technology Transfer Office Network

**12** P&TTOS

**10** Certified P&TTOS

### Commercial Portfolio:

Licensing opportunities  
Visit [redottec.com](http://redottec.com)

2005 - 2020

PATENT APPLICATIONS

**370**

PATENTS GRANTED

**150**

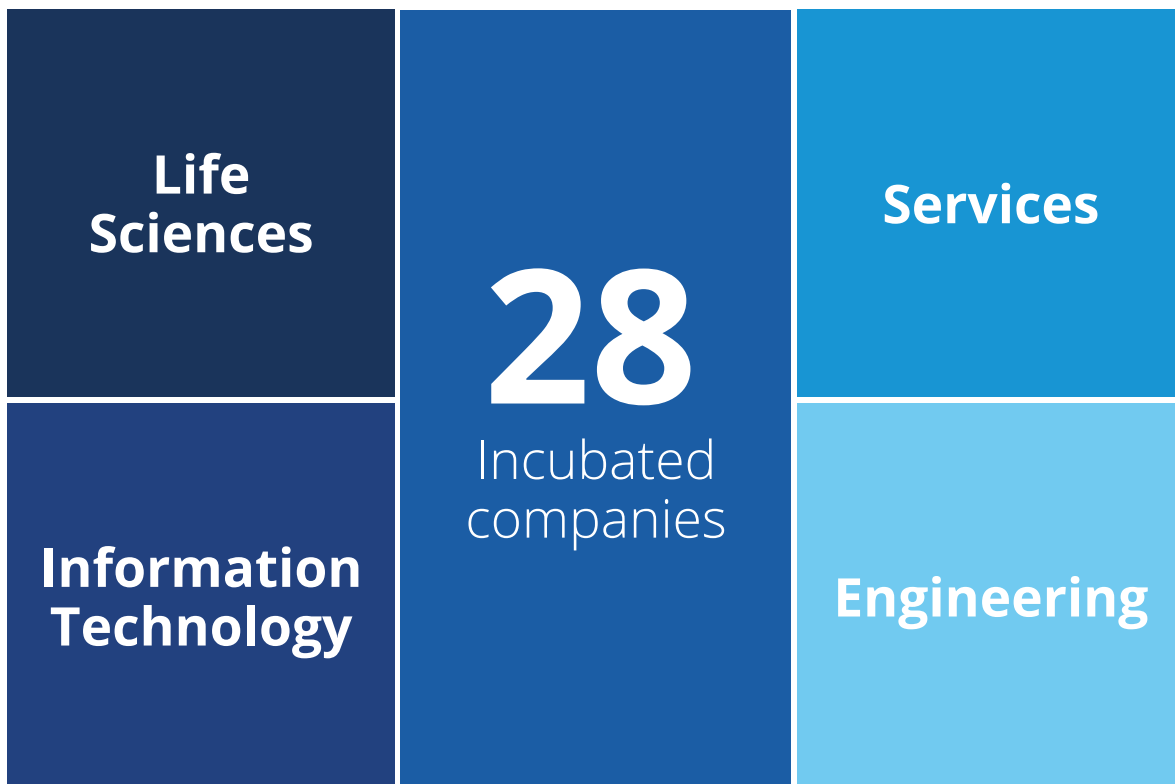
PATENT TRANSFERRED

**49**



# ECONOMIC IMPACT

Technology-based companies  
incubated by professors and  
students per sector





# ECONOMIC IMPACT

## Examples of tech-based companies



### Onko Solutions S. de R.L. de C.V.

A high technology company that aims to establish a progressive dynamic for the development and commercialization of technology based on the use of innovative technology in medical devices. At present Onko is commercializing a cervical cancer medical diagnosis device that is reliable, affordable, portable, user-friendly, and minimally intrusive.

Jesus Seañez de Villa - [jesusseanez@gmail.com](mailto:jesusseanez@gmail.com)



### WeaRobot S.A.P.I. de C.V.

Devoted to designing, developing and producing rehabilitation devices. The use of muscle and brain signals to control robotic rehabilitation can help greatly in the rehabilitation of limbs to supplement control over crucial parameter movement therapy. Aukera Foundation (the social partner of WeaRobot) is an online open innovation platform and crowdfunding offering free prosthetics, orthotics and exoskeletons.

Ernesto Rodríguez Leal - [ernesto.rodriguez@itesm.com](mailto:ernesto.rodriguez@itesm.com)



### Bio-Recombine Technologies, S. de R. L. de C.V.

A biotechnology company devoted to designing, developing and producing biomolecules of high commercial value (recombinant proteins) to serve the biopharmaceutical market developing vaccines and drugs, and the diagnostic and food sectors through diseasing enzymes with high commercial value.

Luis Mario Rodríguez - [lmrm7@hotmail.com](mailto:lmrm7@hotmail.com)



### EZKATEC S. de R.L. de C.V.

A biotechnology company devoted to innovating, researching and developing probiotic formulations that do not require cold chain for the dairy and pharmaceutical industries. The technology is an integrated high performance process to obtain biomass of probiotic lactic acid bacteria (probiotic), a dairy-based nutritional serum product that improves the quality and health of the general population.

Ernesto Aguirre Ezkauriatza - [eezkauriatza@itesm.mx](mailto:eezkauriatza@itesm.mx), [ernesto.aguirre@ajtzakbio.com](mailto:ernesto.aguirre@ajtzakbio.com)



### Automatische Technik S.A.P.I. de C.V.

Its the first mexican Company oriented in the production of Delta robotic arms. They can be used to pack, unpack or re-pack any kind of products in small bokes. This company offers solutions oriented to increase production and reduce operation costs, besides, this technology help companies to level up their economies and increase their products quality.

Juan Pablo Martínez - [contacto@atechnik.com.mx](mailto:contacto@atechnik.com.mx)



### Global Nano Aditives, S.A. de C.V.

A nanotechnology company devoted to the development of nanofluids for coolants and lubricants. These refrigerants contain nanoparticles dispersed and stabilized to provide better heat conduction properties and wear reduction; applications in electrical transformers, automotive systems, and the metalworking industry in general. This technology was recognized as a TechConnect Global Innovation Awardee at the "TechConnect National Innovation Summit", Washington, D.C., 2014.

Edgar Ramon Raygoza - [edgar.raygoza@gmail.com](mailto:edgar.raygoza@gmail.com)

# ECONOMIC IMPACT

## 10 Technology Parks and Industrial Sectors

### TECHNOLOGY PARKS NET (AND MAJOR IMPACT SECTOR)



# TEC DE MONTERREY HIGH IMPACT RESEARCH PROJECTS 2021

▶ <https://www.youtube.com/playlist?list=PLTDb4lGETMixHSsNWkhmaUQqkT0mEwnvv>



## Mechanical Fan

Researchers from Tec de Monterrey developed a mechanical fan that is easy to manufacture and low cost, with innovative features. It has generated several scientific articles and received an innovation award.



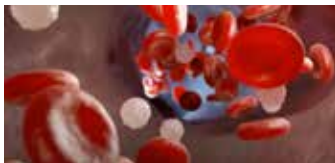
## Method for detection of Covid-19 in waste water

This project makes it possible to locate cases of Covid-19, in order to prevent outbreaks of this disease. Researchers take waste samples from different campuses and analyze them with PCR techniques.



## Covid-19 Portable Diagnostic System

Researchers from Tec de Monterrey developed an effective, fast, simple and inexpensive method to diagnose Covid-19. It is performed with saliva samples and results are available in 30 minutes.



## Nanosystems for Drug Delivery (NADDON)

This research project consists of a biocompatible device that maximizes the therapeutic effects of drugs. It works as a nano-coating that locates the inflamed tissues and delivers the drug to the specific area.



## High flow oxygenation system (SPE8)

Tec researchers developed a high-flow oxygenation system delivered through a nasal cannula to avoid invasive intubation in Covid patients.



## MexiCovid-19

It is a technological platform that provides free and accessible information on the pandemic, with thematic maps and accurate data provided by the Ministry of Health. It also includes a section with scientific reports to understand the economic, political and social impact of the pandemic.

## ▶ PREVIOUS PROJECTS

**2020** <https://www.youtube.com/playlist?list=PLnncon5XHt5r9BiY8ZdXCbN6DDu48IDBb>

**2019** [https://www.youtube.com/playlist?list=PLnncon5XHt5oi9FDLneu2jR62rsh\\_yV7y](https://www.youtube.com/playlist?list=PLnncon5XHt5oi9FDLneu2jR62rsh_yV7y)

**2018** <https://youtu.be/vRuj8XycimY>

**2017** <https://www.youtube.com/playlist?list=PLnncon5XHt5pZFPir1YIsAVZCW9xPIUEe>

**2016** <https://www.youtube.com/playlist?list=PLnncon5XHt5onevVMgQxz75WSrdYpLns9>

# RANKINGS



20  
22

**161**  
Worldwide

**2**  
in Mexico



20  
22

**4**  
in Latam



20  
22

**26** **1** **1**  
Worldwide in Mexico in Latam



20  
22

**601-800**  
Worldwide

**1**  
in Mexico



20  
21

**1**  
in Mexico

**4**  
in Latin America



20  
19

**79** **1** **1**  
Worldwide in Mexico in Latam



20  
20

**2**  
in Mexico



20  
20

**8** **56** **1297**  
in Mexico in Latam Worldwide



20  
21

**840** **30**  
Worldwide in Latam



20  
19

**201-300** **301-400** **301-400**  
Mechanical Engineering Business Administration Management



20  
19

**5** **35** **926**  
in Mexico in Latam Worldwide

