

PLAN



# Action Plan 2010-2013

**Chemical Sciences  
and Technologies**

**EXECUTIVE SUMMARY**



N.B.: If you require any further information about the specific content of any particular Area 8 Centre or Institute's Strategic Plan, please ask for it by sending an e-mail to: [pe2010-13@csic.es](mailto:pe2010-13@csic.es). Thank you

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# Chemical Sciences and Technologies

## 1. GENERAL INFORMATION

### Description of the area

The Chemical Sciences and Technologies Area comprises 12 institutes in which basic scientific research coexists alongside more applied or technology-oriented research. The Area covers almost all the latest fields of chemistry and performs competitive research in various areas at the interface between chemistry and other disciplines, such as biology, medicine, energy, the environment and materials, among others. It therefore carries out research into organic synthesis, organometallic chemistry, the design and synthesis of new bioactive molecules with therapeutic applications, in catalysis and biocatalysis, and their application to a variety of processes, research related to fossil combustion technologies and renewable energy sources, materials chemistry and development and innovation in relation to physical chemistry methods and chemical instrumentation with a variety of applications. The area's concern with environmental issues is clear from the lines of research being pursued by various groups with the aim of preventing or minimising pollution at source. Section 3.b) describes the research lines performed by the Chemical Science and Technologies Area in more detail.

### Short history

(Covering the period 2006-2009)

During the period the Instituto de Investigaciones Químicas y Ambientales de Barcelona “Josep Pascual Vila” (IIQAB) was split to create two new Institutes:

1. Institute for Environmental Diagnosis and Water Studies). IDAEA
2. Catalonia Institute of Advanced Chemistry). IQAC

Finally, at its own request, the LITEC has been transferred to Area 5.

Also during the period, the Centro de Investigación de Nanomateriales y Nanotecnología (Nanomaterials and Nanotechnology Research Centre, CINN) was created from the INCAR nanostructured materials research group. This centre is assigned to the Materials Sciences and Technologies Area (CSIC, Asturias Regional Government and University of Oviedo), and it has prepared its own strategic plan.

Over the period 2010-2013 it is also envisaged that another new Institute –the Instituto de Síntesis Química y Catálisis Homogénea (Institute of Chemical Synthesis and Homogeneous Catalysis, ISQCH)– comprising sections belonging to the Chemistry Area (~40%) of the Instituto Ciencias de Materiales de Aragón (Aragón Institute of Materials Science) will be created. It is envisaged that this institute will be operational in 2010, so it has prepared its own strategic plan, replacing that of the ICMA.

### Mission and Vision

#### **Mission**

The mission of the Chemical Science and Technologies Area is to perform high quality scientific and technological research in various fields of specialisation within chemistry by stimulating high quality multidisciplinary research at the interface between chemistry and other fields and disciplines, such as biology, medicine, energy and materials science. It aims to contribute to society's scientific and technological development by transferring knowledge to the productive sector, adapting research to societal demands, offering solutions to problems from the field of chemistry and promoting the training of highly qualified personnel in order for them to join the R&D system and businesses in the industry.

#### **Vision**

The CSIC's Chemical Science and Technology Area aspires to be an international benchmark in terms of its research activities, and to stimulate its institutes to achieve a position of leadership in its fields of specialisation, performing basic and applied research in a way characterised by its high quality, flexibility and ability to adapt to new research trends in the chemistry field, while being committed to its social and productive environment.

### Institutes and Centres that comprise the Area

#### **Institutes:**

1. Institute of Carbon Chemistry (ICB, Zaragoza).
2. Catalysis and Petrochemicals Institute (ICP, Madrid).
3. Institute for Environmental Diagnosis and Water Studies (IDAEA, Barce-

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- lona). This institute also runs activities in the Natural Resources Area.
4. Chemical Research Institute (IIQ, a joint centre with the University of Seville, Seville).
  5. Natural Produce and Agrobiology Institute (IPNA, Tenerife). This institute also has activities in Areas 3 (Natural Resources) and 4 (Agricultural Sciences). The share of the institute corresponding to the Chemicals Science and Technology Area, in terms of numbers of scientific personnel, is 70%.
  6. National Coal Institute (INCAR, Oviedo)
  7. Catalonia Institute of Advanced Chemistry (IQAC, Barcelona)
  8. Rocasolano Physical Chemistry Institute (IQFR, Madrid).
  9. Institute of Medical Chemistry (IQM, Madrid).
  10. Institute of General Organic Chemistry (IQOG, Madrid).
  11. Institute of Chemical Synthesis and Homogeneous Catalysis (ISQCH, a joint centre with the University of Zaragoza. Currently forms part of the ICMA)
  12. Institute of Chemical Technology (ITQ, a joint centre with the Valencia Polytechnic University), Valencia.

### Centres

1. “Manuel Lora-Tamayo” Organic Chemistry Centre, (CENQUIOR), in Madrid, which is home to the General Organic Chemistry Institute, (IQOG), the Medical Chemistry Institute, (IQM), Industrial Fermentations Institute, (IFI), and the Polymer Science and Technology Institute, (ICTP).
2. Research and Development Centre, (CID), in Barcelona, which houses the Institute for Environmental Diagnosis and Water Studies, (IDAEA), the Catalonia Institute of Advanced Chemistry, (IQAC) and the Barcelona Institute of Molecular Biology, (IBMB).
3. “Isla de la Cartuja” Scientific Research Centre, (CICIC), which houses the Chemical Research Institute, (IIQ), Plant Biochemistry and Photosynthesis Institute, (IBVF), and Seville Materials Science Institute, (ICMS).
4. The creation of a new centre, the Aragón Centre for Chemistry and Materials Research, (CIQMA) is planned, which will serve the future Institute of Chemical Synthesis and Homogeneous Catalysis, (ISQCH) and the Aragón Institute of Materials Science, (ICMA).

## 2. CRITICAL ANALYSIS OF THE AREA

### SWOT ANALYSIS

#### Weaknesses

- Administrative rigidity with institutes having limited management autonomy.
- Bureaucratic overloading of scientific personnel.
- Shortage of technicians, research support personnel and administrative staff.
- Difficulty of attracting young pre-doctoral researchers.
- Limited space in some of the Area's institutes.
- Insufficient interaction between research groups.
- Excessive fragmentation of research groups.

#### Threats

- Competition from other research centres with more flexible management models.
- Negative image of chemistry in society, making it hard to attract researchers.
- The private sector's undervaluation of basic science and lack of demand for it.
- Drop in public resources for R&D during the period as a result of the economic situation.
- Drop in R&D investment by the private sector due to the economic situation.
- Difficulty accessing EU funds and drop in EU funding.

#### Strengths

- Highly qualified workforce.
- Ability to act at the interface of various disciplines.
- Broad multi-disciplinary research lines.
- Balance between fundamental and applied research.
- Capacity to train young researchers.

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- Strong presence in the European Research Area.
- Capacity to generate knowledge of interest to the productive sector.

### Opportunities

- Appearance of new emerging fields related to the Area's research.
- Entry into force of European environmental protection standards which will require R&D for their implementation.
- Participation of scientific personnel in thematic networks and technology platforms.
- Presence in new technology campuses encouraging collaboration with groups working in complementary areas through multidisciplinary projects.

### HORIZONTAL ANALYSIS OF THE RESEARCH LINES

The quality of the research lines and scientific output were rated as good to excellent by the external evaluation committees. Nevertheless, limitations and problems exist which need to be overcome in order for the Area to achieve its objectives in accordance with its vision for the future. The Area's SWOT analysis revealed these problems to include difficulties maintaining and upgrading medium-to-high cost scientific equipment, the shortage of space, the high average age of personnel at some of the Institutes, and the lack of coordination of efforts. Many of these problems were also identified by the external advisory commissions. In order to facilitate a critical analysis of the research lines being developed by the Area's Institutes, they have been grouped into broader horizontal lines constituting the Area's Research Lines.

Area of Research	
Thematic Area 1	Organic Synthesis
Thematic Area 2	Biological Chemistry and Medical Chemistry
Thematic Area 3	Organometallic Chemistry and Coordination Compounds
Thematic Area 4	Environmental Chemistry and Technology
Thematic Area 5	Energy and Energy Resources



<b>Thematic Area 6</b>	Catalysis and Chemical Processes
<b>Thematic Area 7</b>	Molecular Physical Chemistry, Surface Chemistry and Biological Physical Chemistry
<b>Thematic Area 8</b>	Materials Chemistry and Nanotechnology

### 3. ANALYSIS OF THE AREA'S 2006-2009 STRATEGIC PLAN

The level of fulfilment of objectives in the Area was close to 100%, with small ad hoc deviations due to temporary situations which have since been corrected.

### 4. OBJECTIVES 2010-13

#### GENERAL OBJECTIVES

1. Positioning the Area's Institutes as centres of excellence in the European context.
2. Strengthening knowledge transfer to the business world.
3. Contributing to dissemination of a positive vision of chemistry in society.

#### SPECIFIC OBJECTIVES

1. Stimulating collaboration between the different institutes in the Area
2. Promoting the institutes' external relations
3. Increasing the production of patents and the creation of technology-based companies.
4. Raising the international visibility of the Area's research
5. Promoting high quality training

### **5. RESEARCH STRATEGY AND ENVISAGED ACTIONS**

The SWOT analysis shows the weaknesses that need to be overcome and the threats that need to be neutralised in order to achieve the envisaged goals. A summary of the target indicators is shown at the end of the document. To this end the following actions are envisaged.

#### **6.1 Actions relating to scientific personnel and infrastructure.**

The new human resources distributed in the Area have been directed towards bolstering the more productive institutes and addressing topics of importance to society. The need exists to increase the weight of support personnel, while also setting up measures to create incentives to reward the work they do. The various modalities of the current JAE programme are viewed very positively. As regards scientific equipment, the Area's position is good, but programmes for the maintenance and upgrading of existing equipment are required.

#### **6.2 Actions to stimulate collaboration between the various institutes in the Area.**

The creation of thematic networks in the Area will be promoted in order to leverage the Area's multidisciplinary capacity. The most appropriate way in which researchers taking part in these internal networks can obtain added value from this participation will be examined.

#### **6.3 Actions to promote the institutes' external relations.**

The production of co-authored publications produced in conjunction with researchers from other institutes will be promoted. To this end, indicators will be introduced valuing these activities in the internal staff promotion and selection processes and the relevant guidelines given to selection tribunals

#### **6.4 Actions to increase knowledge transfer to business.**

The presence of patents and the creation of technology-based companies will be encouraged by increasing the value of these indicators in the internal staff promotion and selection processes, and the relevant guidelines given to selection tribunals.

#### **6.5 Actions to increase the visibility of research in the Area and attract new researchers.**

Popular science activities and those promoting science as a career will be bolstered. To this end, indicators will be introduced which value these activities in the internal staff promotion and selection processes.

### **6.6 New centres and institutes**

The protocols for the creation of a number of institutes are currently at various stages of study and/or approval. The most advanced is the ISQCH, which is due to come into operation, with all its governing bodies, in early 2010. Two joint institutes are also at the study stage: The Instituto de Materiales para la Energía (Institute of Materials for Energy, IMAE), with the University of Alicante, and the Instituto de Química y Desarrollo Sostenible (Institute of Chemistry and Sustainable Development, IQDS) with the University of Huelva. Several other institutes require new premises, or expansions and upgrades. The IQOC is at the limits of its available space in which to work and has serious problems taking on young scientists and installing new scientific equipment. The IQM, ICB, IIQ, ICP and ISQCH also need more space. The construction of a new building for the new institute is currently being discussed by the CSIC, the University of Zaragoza and the Aragón Regional Government.

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