

# **Evaluation of research and professional activity of research-oriented institutes of the Czech Academy of Sciences for the period 2015–2019**

## **Final Report**

**Name of the Institute: Institute of Analytical Chemistry of the CAS, v. v. i.**

**Evaluated teams and their leaders:**

1. Trace Element Analysis (Jan Kratzer)
2. Fluid Phase Separations (Michal Roth)
3. Environmental Analytical Chemistry (Pavel Mikuška)
4. Electromigration Methods (Pavel Kubáň)
5. Bioanalytical Instrumentation (Frantisek Foret)

## Part A: Evaluation of the institute

### Strengths:

Institute has modern facilities and equipment, and has generated some new methods in analytical chemistry.

### Weaknesses:

Portfolio is too broad with many areas below critical mass.

### Opportunities:

New trends in analytical chemistry open new areas in chemistry and related disciplines.

### Threats:

Attraction of talent, especially at the senior level is difficult. Competitors are large and well-funded.

## Main criterion: 1. Quality of results (H1.1-H1.5)

<b>H1.1</b>	<b>Quality of selected outputs of Phase I</b>
The Phase 1 outputs, and the self-representation of the Institute interpret the same data differently. Whereas the Institute cites a high level of publishing activity with high impact, the Phase 1 analysis of the same publication record finds the Institute to be operating at a level on par with comparable activities in the Czech Republic and significantly below the EU15 level. The diverging views probably comes from the baseline against which one chooses to evaluate performance.	
<b>H1.2</b>	<b>Contribution of workers on the outputs reached</b>
The outputs are produced by the Institute's workers.	
<b>H1.3</b>	<b>Quality of all outputs and results</b>
See above. The principal outputs are publications.	
<b>H1.4</b>	<b>The most valuable discoveries and findings in the fields, their importance for the field</b>
Pre-analysis methods like the liquid-phase microextraction and epitachophoretic concentrators are innovative enablers for modern analytical methods. The ultra-trace analysis, especially for arsenic, has a specific and important application, although the problem, and the approach are, in a large part, mature areas.	
<b>H1.5</b>	<b>Contribution of the participation of the authors in large collaborations</b>
The Institute works mainly in small collaborations, when outside parties are involved.	

## Main criterion: 2. Societal relevance (H2.1-H2.5)

<b>H2.1</b>	<b>Societal relevance of outputs and results pursuant to CAS and institute mission</b>
Some of the activities, especially with regard to environmental monitoring, have a specific importance for the local setting, for example, aerosol composition and sources in old industrial areas (Ostrava). Work in this area is necessary, and it needs to be done locally.	

While it is not the highest profile <i>scientific</i> study, it is a mission that belongs to a public agency. It is difficult to weight this mission against competing priorities focused on publications and basic science in an international context.	
<b>H2.2</b>	<b>System functionality for knowledge transfer into practice, its usefulness for society. The impact of the institute's activity on proper practice in society in the area of social sciences and humanities</b>
With the Institute's novel technological developments in analytical chemistry, we are surprised that industrial collaboration is as limited as the Institute documents. In the presentation, the Institute documents industrial collaborations with Roche, Agilent, Protein Simple, and Lumito, with a volume of "over 100 kEur/year." We are surprised that this number is not (much) larger, given that the Institute works mainly on producing <i>methods</i> and <i>instruments</i> , which should be of immediate interest to corporate partners. For whom does the Institute build, for example, a miniaturized, battery-operated liquid chromatograph, and what kind of financial return can the Institute expect?	
<b>H2.3</b>	<b>Relation to practice</b>
See above. The Institute is probably not the unit which should be building a Knowledge & Technology Transfer (KTT) unit. In the evaluation of another Institute, the information was provided that the CAS is developing a centralized KTT unit, which is, in our opinion, a good initiative. As in the case with the other Institute, we recommend that the work flow for protecting IP, financing IP protections, seeking external partners, negotiating contracts, and bringing practical insights back into the Academy be developed centrally and applied within the Institute in a consistent manner. Uncoordinated efforts would be expensive and produce inconsistencies that undermine an effective KTT policy. We recommend that the CAS partner with European public-sector entities that have had good track records of KTT. (US models, for example, may not be the most appropriate.)	
<b>H2.4</b>	<b>Participation in AV21 strategy</b>
Not visible in the presentation.	
<b>H2.5</b>	<b>Cooperation with regions of the Czech Republic</b>
The environmental work in the Ostrava area is important. Interestingly, the Institute, while located in Brno, indicated that their cooperation with analytical chemistry groups at the university in Brno was not large. By their own representation, the university groups were larger and (in part) better funded. This is a troubling admission.	

#### Further criterion: 1. Position in international and national context (D1.1-D1.3)

<b>D1.1</b>	<b>Comparison of the teams and the institute with similar international and national institutes</b>
There are areas of excellence in the Institute, but also many projects which do not stand out.	
<b>D1.2</b>	<b>Scope and quality of international and national cooperation and the role of the institute in such cooperation; engagement in broad international cooperation</b>
The Institute lists international collaborations with a number of predominantly European partners, with a scattering of collaborations in Asia and elsewhere. The collaborations appear to be limited to the extent of joint publications during the evaluation period.	

<b>D1.3</b>	<b>Participation of the workers in scientific community activities (organizing of conferences and workshops, invited lectures, awards)</b>
Insufficient data to assess.	

## Further criterion: 2. Vitality, sustainability and strategy (D2.1-D2.9)

<b>D2.1</b>	<b>Direction in line with the perspective of the planned research directions</b>
With finite resources, the Institute needs to focus in order to avoid subcritical staffing of the best work. Portfolio is too broad.	
<b>D2.2</b>	<b>Assessment of the previous research objectives and their achievement</b>
Insufficient information to assess at the Institute level.	
<b>D2.3</b>	<b>Assessment of implementation of recommendations from past evaluation</b>
Insufficient information to assess at the Institute level.	
<b>D2.4</b>	<b>Success in receiving grants</b>
Curiously, data on the grants applied for, and grants received, are scattered in the individual departmental documents. At the Institute level, the information is not consolidated.	
<b>D2.5</b>	<b>Adequacy of instrumental equipment</b>
Good, also mechanical workshops.	
<b>D2.6</b>	<b>Effectiveness of management</b>
Insufficient information to assess at the Institute level as much of the relevant data were collected and presented at the Department level.	
<b>D2.7</b>	<b>Assessment of professional structure, development strategy and the strategy of keeping best scientists, age structure, career and qualification growth</b>
Demographic structure is good, with a healthy amount of turnover.	
<b>D2.8</b>	<b>Creating work-life balance conditions, assessment of approach towards possible gender issues</b>
Insufficient information.	
<b>D2.9</b>	<b>Relation of the institute with regard to the integration, development and sustainability of the research centre funded by the National Programme of Sustainability II.</b>
Insufficient information.	

## Further criterion: 3. Cooperation with universities and participation in education (D3.1-D3.6)

<b>D3.1</b>	<b>Scope of cooperation with universities on national and international level</b>
Collaborations appear to be project-oriented at the level of individual groups.	

<b>D3.2</b>	<b>Effectiveness of joint research centres</b>
Not highlighted in the documentation.	
<b>D3.3</b>	<b>Success rate in supervision of PhD students</b>
Data are collected at the Department level.	
<b>D3.4</b>	<b>Participation of PhD students in the outputs</b>
See above.	
<b>D3.5</b>	<b>Participation of the institute in master or bachelor studies</b>
Data are collected at the Department level.	
<b>D3.6</b>	<b>Assessment of cooperation intensity with universities in the form of teaching</b>
Data are collected at the Department level.	

#### Further criterion: 4. Outreach activities (D4.1-D4.3)

<b>D4.1</b>	<b>Sufficiency of media strategy and activities in the area of research popularisation</b>
Data are presented at the Department level.	
<b>D4.2</b>	<b>Publishing activities and its quality</b>
Publication activity is high in absolute terms.	
<b>D4.3</b>	<b>Participation in professional organisations in the area of research and development</b>
Little data at the Institute level were presented. The participation of scientists in the Institute in professional organizations and meetings are documented at the Department level, where they seem to be fine.	

#### Other comments of the commission:

The pre-recorded video presentations were received negatively by the commission. While the text was no doubt generated by the Institute leadership, it left nevertheless a poor impression. Overall, the presentation of the Institute was weak. The presentations by the individual Departments were better, with more information relevant to the evaluation. The written documentation provided by the Departments in advance of the evaluation was better yet, with regard to the information we needed to do an evaluation.

## Part B: Evaluation of teams

### 1. Trace Element Analysis

#### Strengths:

A motivated team with a good age-structure. Internationally recognized in their area of expertise. Large number of collaborations with other international and Czech research institutions. Well equipped

#### Weaknesses:

The real breakthroughs in their research field are limited. Distant location from the rest of the institute. Limited space

#### Opportunities:

Located close to other research institutes and Universities. Possibilities of extensive and long-term collaboration.

#### Threats:

Small team. Growth in size is difficult.

#### Main criterion: 1. Quality of results (H1.1-H1.5)

<b>H1.1</b>	<b>Quality of selected outputs of Phase I</b>
The publications selected have a high quality, in line with the top European groups in the field. Not only the publications have been published in top ranked journals but they also have received a large number of citations.	
<b>H1.2</b>	<b>Contribution of workers on the outputs reached</b>
All the selected publications have been carried out in collaboration with national or international groups. In all of them, the role of the researchers from this group are crucial for the results obtained in the publications.	
<b>H1.3</b>	<b>Quality of all outputs and results</b>
In principle, the previous comments are applicable to this question.	
<b>H1.4</b>	<b>The most valuable discoveries and findings in the fields, their importance for the field</b>
The team expertise is in the field of trace analysis, designing and improving strategies for increasing the sensitivity of the AAS. They have large experience in trace analysis of arsenic (As) and have used this experience to other hydride forming elements. This has been possible because they have a deep knowledge of the mechanism of atomization in the dielectric barrier discharge (DBD) atomizer. Understanding the atomization mechanism of these elements is key to improve the selectivity and sensitivity of the analysis.	
<b>H1.5</b>	<b>Contribution of the participation of the authors in large collaborations</b>
No comment.	

## Main criterion: 2. Societal relevance (H2.1-H2.5)

<b>H2.1</b>	<b>Societal relevance of outputs and results pursuant to CAS and institute mission</b>
Contamination of water by elements such as arsenic (As) poses a major health risk. Having sensitive methods to determine trace amounts of these elements are vital in environmental research. Also, it is vital to assess the impact of these elements in biology.	
<b>H2.2</b>	<b>System functionality for knowledge transfer into practise, its usefulness for society. The impact of the team's activity on proper practice in society in the area of social sciences and humanities</b>
See above.	
<b>H2.3</b>	<b>Relation to practice</b>
The have large collaborations with other research groups that require their expertise in trace analysis.	
<b>H2.4</b>	<b>Participation in AV21 strategy</b>
No comment.	
<b>H2.5</b>	<b>Cooperation with regions of the Czech Republic</b>
No comment.	

## Further criterion: 1. Position in international and national context (D1.1-D1.3)

<b>D1.1</b>	<b>Comparison of the team with similar international and national institutes</b>
The team is well positioned internationally. Their quality levels reach those of other internationally relevant teams.	
<b>D1.2</b>	<b>Scope and quality of international and national cooperation and the role of the team in such cooperation; engagement in broad international cooperation</b>
They have an extensive and intensive network of international and national collaborations.	
<b>D1.3</b>	<b>Participation of the workers in scientific community activities (organizing of conferences and workshops, invited lectures, awards)</b>
Activity at the expected level.	

## Further criterion: 2. Vitality, sustainability and strategy (D2.1-D2.9)

<b>D2.1</b>	<b>Direction in line with the perspective of the planned research directions</b>
The team's plan is to improve the sensitivity of the analysis of several relevant elements, to even reach the ultra-trace level by using strategies that have been previously tested for other elements, while increasing the knowledge on the performance of the different parts of the selected analytical techniques. A second area is to serve as a reference centre for the analysis of several species.	

<b>D2.2</b>	<b>Assessment of the previous research objectives and their achievement</b>
The previous objectives were achieved satisfactorily.	
<b>D2.3</b>	<b>Assessment of implementation of recommendations from past evaluation</b>
Previous recommendations have been correctly and fully implemented.	
<b>D2.4</b>	<b>Success in receiving grants</b>
Given the size of the team, they have been awarded a large number of grants.	
<b>D2.5</b>	<b>Adequacy of instrumental equipment</b>
Their instrumental equipment is up to date.	
<b>D2.6</b>	<b>Effectiveness of management</b>
It seems adequate.	
<b>D2.7</b>	<b>Assessment of professional structure, development strategy and the strategy of keeping best scientists, age structure, career and qualification growth</b>
It is a small team with a well-balanced age structure with two senior members and several junior scientists.	
<b>D2.8</b>	<b>Creating work-life balance conditions, assessment of approach towards possible gender issues</b>
The team is mostly composed by men.	
<b>D2.9</b>	<b>Relation of the team with regard to the integration, development and sustainability of the research centre funded by the National Programme of Sustainability II.</b>
No comment.	

### Further criterion: 3. Cooperation with universities and participation in education (D3.1-D3.6)

<b>D3.1</b>	<b>Scope of cooperation with universities on national and international level</b>
The team has a broad cooperation network with national universities and is well positioned in this area.	
<b>D3.2</b>	<b>Effectiveness of joint research centres</b>
Not applicable.	
<b>D3.3</b>	<b>Success rate in supervision of PhD students</b>
The number of supervised PhD students is high for size of the team.	
<b>D3.4</b>	<b>Participation of PhD students in the outputs</b>
The participation of the PhD students in the outputs is adequate.	
<b>D3.5</b>	<b>Participation of the team in master or bachelor studies</b>
Because of their extensive teaching collaboration with Charles University, the number of supervised master and bachelor students is high.	



<b>D3.6</b>	<b>Assessment of cooperation intensity with universities in the form of teaching</b>
It seems adequate.	

**Further criterion: 4. Outreach activities (D4.1-D4.3)**

<b>D4.1</b>	<b>Sufficiency of media strategy and activities in the area of research popularisation</b>
The team participates in outreach activities regularly, especially in Science Fairs which reach a large audience.	
<b>D4.2</b>	<b>Publishing activities and its quality</b>
It is adequate.	
<b>D4.3</b>	<b>Participation in professional organisations in the area of research and development</b>
It is adequate.	

**Other comments of the commission:**

## 2. Fluid Phase Separations

### Strengths:

Favourable age structure.

### Weaknesses:

Not enough depth on each topic. Not enough Ph.D.s nor funding.

### Opportunities:

New focus topics that can allow them to gain some traction, where they would be the one of few to start to study, rather than competing in a field with many researchers.

### Threats:

Lack of funding with moderate grant success.

### Main criterion: 1. Quality of results (H1.1-H1.5)

H1.1	Quality of selected outputs of Phase I
As determined in Phase 1, the department submitted 20 papers, FTE=10.12. All papers are clustered around the Quality 2 and 3. Over the period 2015 to 2019, 48 papers have been published in journals with impact factors and 3 book chapters and 14 conference proceedings. The team are generally hitting the mid-range journals with some good journals (e.g. Analytica Chimica) and should continue to push papers towards these and higher journals with an overall drive to increase the quality.	
H1.2	Contribution of workers on the outputs reached
These metrics can be found from the Phase 1 evaluation report.	
H1.3	Quality of all outputs and results
The team have submitted 56 papers with most of their papers in the 2 and 3 quartile. A concerted effort in the next period should be to develop a research publication strategy to ensure the quality is shift to 1* and 1 and reduce the tail, i.e. 4 and n.a.	
H1.4	The most valuable discoveries and findings in the fields, their importance for the field
<p>Some good findings have been reported by the group, for instance:</p> <ul style="list-style-type: none"> <li>• <i>Instrument developments of capillary liquid chromatography.</i> Nanolitre-scale cells based on L-shaped silica capillary and optical fibre for absorption photometric detection in capillary liquid chromatography. Published in a good journal. Other work in this area: Compact optical detector utilizing light emitting diodes, 50 nL L-shaped silica capillary cell and CCD spectrometer for simultaneous multi-wavelength monitoring of absorbance and fluorescence in microcolumn liquid chromatography.</li> <li>• <i>Electrokinetic injection.</i> Covering both fundamental aspects and the development of head-column field-amplified sample stacking, this sub-topic is of note.</li> <li>• <i>Novel formats of fused silica capillaries from etching with supercritical water.</i> The uniqueness is evidenced by the department being the only workplace where this ability of near and supercritical water has been used for this purpose.</li> </ul>	
H1.5	Contribution of the participation of the authors in large collaborations

The team do not partake in large collaborations.

## Main criterion: 2. Societal relevance (H2.1-H2.5)

<b>H2.1</b>	<b>Societal relevance of outputs and results pursuant to CAS and institute mission</b>
The work of the department clearly meets the Institute's mission. The work is both applied and fundamental in nature. There is clear societal relevance to what is undertaken.	
<b>H2.2</b>	<b>System functionality for knowledge transfer into practise, its usefulness for society. The impact of the team's activity on proper practice in society in the area of social sciences and humanities</b>
We saw neither any patents nor working with companies, so knowledge exchange/transfer is limited, despite the clear potential for knowledge and technology transfer.	
<b>H2.3</b>	<b>Relation to practice</b>
<p>The team focus on a range of areas that falls under applied research:</p> <ul style="list-style-type: none"> <li>• Electromigration methods for pre-concentration and separation of bioparticles</li> <li>• Isoelectric points of pl markers from capillary isoelectric focusing</li> <li>• Synthesis and testing of monolithic silica capillary columns</li> <li>• Instrument developments of capillary liquid chromatography</li> <li>• Pressurized hot water extraction of plant materials</li> <li>• Novel formats of fused silica capillaries from etching with supercritical water (+ SEM)</li> <li>• Interactions of amphiphilic substances with biomembranes</li> <li>• Electrokinetic injection</li> <li>• Heart proteomics</li> <li>• Thermodynamic models of systems with supercritical fluids</li> </ul>	
<b>H2.4</b>	<b>Participation in AV21 strategy</b>
No data was submitted. From our own investigation the work fits the AV21 strategy.	
<b>H2.5</b>	<b>Cooperation with regions of the Czech Republic</b>
Cooperation is through pedagogical activity, as identified in the Master's teaching at Masaryk University.	

## Further criterion: 1. Position in international and national context (D1.1-D1.3)

<b>D1.1</b>	<b>Comparison of the team with similar international and national institutes</b>
Competitive in the Eastern European/Czech setting, but rather limited in the wider research content. Metrics should be set to document the competitiveness in greater depth.	
<b>D1.2</b>	<b>Scope and quality of international and national cooperation and the role of the team in such cooperation; engagement in broad international cooperation</b>
Karel Šlais, DrSc., has ended his long term as the chairman of the Commission for the Defences of the "Research Professor" Scientific Degree in the field of analytical chemistry.	

Further, throughout the period under evaluation, Dr. Karel Šlais has served as a member of the Commission for Doctoral (Ph.D.) Studies in Agricultural Chemistry at the Faculty of Agronomy of the Mendel University in Brno. Throughout the period under evaluation, Doc. RN Dr. Michal Roth, CSc., has been a member of the Council for Doctoral (Ph.D.) Studies in Chemistry at the Faculty of Science of the Masaryk University in Brno, and a member of the Commission for the State Final Exams in Analytical Chemistry at the Department of Analytical Chemistry of the Faculty of Science of the Palacky University in Olomouc.	
<b>D1.3</b>	<b>Participation of the workers in scientific community activities (organizing of conferences and workshops, invited lectures, awards)</b>
During this period, we received no documentation that conferences or workshops have been organised.	

## Further criterion: 2. Vitality, sustainability and strategy (D2.1-D2.9)

<b>D2.1</b>	<b>Direction in line with the perspective of the planned research directions</b>
Planned research fits the planned research directions of the institute.	
<b>D2.2</b>	<b>Assessment of the previous research objectives and their achievement</b>
The assessment is that these have been largely achieved.	
<b>D2.3</b>	<b>Assessment of implementation of recommendations from past evaluation</b>
Two recommendations: <i>Need to bring more junior enthusiastic co-workers (graduate students),</i> <i>and</i> <i>Lack of support by the EU.</i> In the first case, the team has tried to address this – the age structure of the team shows this. In the second case, one grant was submitted. More need to be submitted.	
<b>D2.4</b>	<b>Success in receiving grants</b>
No data was provided.	
<b>D2.5</b>	<b>Adequacy of instrumental equipment</b>
Could not be evaluated due to COVID-19.	
<b>D2.6</b>	<b>Effectiveness of management</b>
Unable to determine due to COVID-19, no evidence provided in the documentation.	
<b>D2.7</b>	<b>Assessment of professional structure, development strategy and the strategy of keeping best scientists, age structure, career and qualification growth</b>
A HR policy is given to grow ECRs and support maternity leave. We think more can be done though to develop the team.	
<b>D2.8</b>	<b>Creating work-life balance conditions, assessment of approach towards possible gender issues</b>
Due to COVID19 we are unable to determine this.	
<b>D2.9</b>	<b>Relation of the team with regard to the integration, development and sustainability of the research centre funded by the National Programme of Sustainability II.</b>

No evidence given.

### Further criterion: 3. Cooperation with universities and participation in education (D3.1-D3.6)

D3.1	Scope of cooperation with universities on national and international level																		
Evidence is not forthcoming. We suspect there are cooperations, given the publications, but the evidence to the panel was poor.																			
D3.2	Effectiveness of joint research centres																		
The department has not been involved in the joint research centres with universities. In the period 2015–2019, cooperation with the Masaryk University in Brno proceeded through joint grant projects funded by the Ministry of Interior of the Czech Republic.																			
D3.3	Success rate in supervision of PhD students																		
Metrics:																			
Supervision of students																			
<table><tr><th>Type of study</th><th>No. of supervisors</th><th>No. of consultants</th><th>Theses defended 2015-2019</th></tr><tr><td>Bachelor</td><td></td><td></td><td></td></tr><tr><td>Master</td><td>4</td><td>1</td><td>3</td></tr><tr><td>Doctoral</td><td>1</td><td></td><td>1</td></tr></table>				Type of study	No. of supervisors	No. of consultants	Theses defended 2015-2019	Bachelor				Master	4	1	3	Doctoral	1		1
Type of study	No. of supervisors	No. of consultants	Theses defended 2015-2019																
Bachelor																			
Master	4	1	3																
Doctoral	1		1																
Rather low number.																			
D3.4	Participation of PhD students in the outputs																		
One Ph.D. Very poor.																			
D3.5	Participation of the team in master or bachelor studies																		
Master's only supported.																			
D3.6	Assessment of cooperation intensity with universities in the form of teaching																		
Teaching to Master's students at Masaryk Uni is evident.																			

### Further criterion: 4. Outreach activities (D4.1-D4.3)

<b>D4.1</b>	<b>Sufficiency of media strategy and activities in the area of research popularisation</b>
Little evidence provided. There is mention of Open Doors Day, and 2 members attended a secondary school.	
<b>D4.2</b>	<b>Publishing activities and its quality</b>
No evidence provided.	

<b>D4.3</b>	<b>Participation in professional organisations in the area of research and development</b>
Michal Roth, CSc., has been a member of the Council for Doctoral (Ph.D.) Studies in Chemistry at the Faculty of Science of the Masaryk University in Brno, and a member of the Commission for the State Final Exams in Analytical Chemistry at the Department of Analytical Chemistry of the Faculty of Science of the Palacky University in Olomouc.	

**Other comments of the commission:**

### 3. Environmental Analytical Chemistry

#### Strengths:

Relevant research topic.

#### Weaknesses:

Large number of research lines for the actual size of the team, lack of international collaborations. Difficulties in recruiting new members.

#### Opportunities:

Incorporation of new researchers with international contacts, possibilities of increasing the financial support from grants.

#### Threats:

Retirement of senior researchers.

#### Main criterion: 1. Quality of results (H1.1-H1.5)

<b>H1.1</b>	<b>Quality of selected outputs of Phase I</b>
The quality has increased from previous evaluation. However, it still requires some improvements for reaching an optimal level.	
<b>H1.2</b>	<b>Contribution of workers on the outputs reached</b>
The contributions of the researchers of the team to the outputs is correct.	
<b>H1.3</b>	<b>Quality of all outputs and results</b>
The number of outputs has increased significantly from previous evaluation. However, the impact it is still below average for this type of team and research field.	
<b>H1.4</b>	<b>The most valuable discoveries and findings in the fields, their importance for the field</b>
Two major contributions can be highlighted: the effect of nanoparticles on living organisms, especially the selective concentration in certain organs, and the characterization of the aerosols collected in different conditions.	
<b>H1.5</b>	<b>Contribution of the participation of the authors in large collaborations</b>
Not applicable.	

#### Main criterion: 2. Societal relevance (H2.1-H2.5)

<b>H2.1</b>	<b>Societal relevance of outputs and results pursuant to CAS and institute mission</b>
The research topic: atmospheric contamination and its effect on the living organism is has a major societal relevance, especially in regions that have been suffering historically from severe atmospheric contamination. The research in this area has a high impact in the society.	

<b>H2.2</b>	<b>System functionality for knowledge transfer into practise, its usefulness for society. The impact of the team's activity on proper practice in society in the area of social sciences and humanities</b>
N/A	
<b>H2.3</b>	<b>Relation to practice</b>
As aforementioned, the research topic can have a large and immediate impact in society.	
<b>H2.4</b>	<b>Participation in AV21 strategy</b>
No comment on this issue.	
<b>H2.5</b>	<b>Cooperation with regions of the Czech Republic</b>
No comment on this issue.	

#### Further criterion: 1. Position in international and national context (D1.1-D1.3)

<b>D1.1</b>	<b>Comparison of the team with similar international and national institutes</b>
Although the team is well positioned in the national level, it necessitates to create a network of contacts in international institutions complementing its research interests.	
<b>D1.2</b>	<b>Scope and quality of international and national cooperation and the role of the team in such cooperation; engagement in broad international cooperation</b>
The team has no relevant international cooperation with foreign research institutions. Being located in a region which has suffered from important environmental problems, it would be desirable to establish contacts with institutions situated in regions with similar problems.	
<b>D1.3</b>	<b>Participation of the workers in scientific community activities (organizing of conferences and workshops, invited lectures, awards)</b>
The activity is moderate and concentrated mainly in national events.	

#### Further criterion: 2. Vitality, sustainability and strategy (D2.1-D2.9)

<b>D2.1</b>	<b>Direction in line with the perspective of the planned research directions</b>
Being a small group, the researchers should concentrate their efforts in one or two central research topics, which should be the most relevant and with the highest potential impact, those which have been previously more successful and produced the higher impact.	
<b>D2.2</b>	<b>Assessment of the previous research objectives and their achievement</b>
The achievement of previous objectives was correct.	
<b>D2.3</b>	<b>Assessment of implementation of recommendations from past evaluation</b>
The recommendations were correctly implemented.	
<b>D2.4</b>	<b>Success in receiving grants</b>



The number of grants is not very high. Giving the societal impact of the research topic, the team should focus its efforts in increasing the number of grants.	
<b>D2.5</b>	<b>Adequacy of instrumental equipment</b>
The equipment is correct.	
<b>D2.6</b>	<b>Effectiveness of management</b>
There is no comment on this issue.	
<b>D2.7</b>	<b>Assessment of professional structure, development strategy and the strategy of keeping best scientists, age structure, career and qualification growth</b>
The age structure of the team is somehow unbalanced because there are two members close to retirement age, or already retired, which can put at risk the continuity of the team. However, an adequate hiring policy can bring new life in the team, especially if the new members have international contacts.	
<b>D2.8</b>	<b>Creating work-life balance conditions, assessment of approach towards possible gender issues</b>
All present researchers are male.	
<b>D2.9</b>	<b>Relation of the team with regard to the integration, development and sustainability of the research centre funded by the National Programme of Sustainability II.</b>
N/A	

### Further criterion: 3. Cooperation with universities and participation in education (D3.1-D3.6)

<b>D3.1</b>	<b>Scope of cooperation with universities on national and international level</b>
The team should increase their cooperation with universities to increase the possibility of having new PhD students.	
<b>D3.2</b>	<b>Effectiveness of joint research centres</b>
No applicable.	
<b>D3.3</b>	<b>Success rate in supervision of PhD students</b>
The number of supervised PhD students is low. The team should try to increase its number.	
<b>D3.4</b>	<b>Participation of PhD students in the outputs</b>
The participation of the PhD students in the outputs is correct.	
<b>D3.5</b>	<b>Participation of the team in master or bachelor studies</b>
The number of master thesis supervised is adequate for the size of the team.	
<b>D3.6</b>	<b>Assessment of cooperation intensity with universities in the form of teaching</b>
In comparison with other teams with the same size, their cooperation is slightly below the mean value.	

#### Further criterion: 4. Outreach activities (D4.1-D4.3)

<b>D4.1</b>	<b>Sufficiency of media strategy and activities in the area of research popularisation</b>
It seems correct.	
<b>D4.2</b>	<b>Publishing activities and its quality</b>
It seems correct.	
<b>D4.3</b>	<b>Participation in professional organisations in the area of research and development</b>
The team members participate in national organizations. They should make an effort to increase its involvement in international organizations.	

**Other comments of the commission:**

## 4. Electromigration Methods

### Strengths:

Well established team, correct age distribution, excellent command of their field of research

### Weaknesses:

Small team

### Opportunities:

The appointment of a new head should bring new perspectives in their research.

### Threats:

The loss of one member may result in a significant diminution of their activity. Growth in size is difficult.

### Main criterion: 1. Quality of results (H1.1-H1.5)

<b>H1.1</b>	<b>Quality of selected outputs of Phase I</b>
The selected publications have an excellent quality. They are recognized as experts in their area of work. Citations are also high.	
<b>H1.2</b>	<b>Contribution of workers on the outputs reached</b>
The contributions of the workers are high. In the case of outputs from international collaborations, they role of the members of the team are necessary for the final results.	
<b>H1.3</b>	<b>Quality of all outputs and results</b>
Same as H1.1 and H1.2	
<b>H1.4</b>	<b>The most valuable discoveries and findings in the fields, their importance for the field</b>
The contributions to the theory of electromembrane extraction, especially those devoted to the effect of the pH and the conditions to increase the yield.	
<b>H1.5</b>	<b>Contribution of the participation of the authors in large collaborations</b>
N/A	

### Main criterion: 2. Societal relevance (H2.1-H2.5)

<b>H2.1</b>	<b>Societal relevance of outputs and results pursuant to CAS and institute mission</b>
Although the main topics may appear as too technical, the final goal is to increase the selectivity and yield of the separation processes that lead to higher selectivity and sensitivity of the analytical methods, especially those requiring volumes of sample in the microliter regime. This has a high impact in the analysis of many analytes with biological relevance.	

<b>H2.2</b>	<b>System functionality for knowledge transfer into practise, its usefulness for society. The impact of the team's activity on proper practice in society in the area of social sciences and humanities</b>
The team has also a research line devoted to the implementation and automation of analytical methods into commercial devices.	
<b>H2.3</b>	<b>Relation to practice</b>
The team has large international cooperation strategies.	
<b>H2.4</b>	<b>Participation in AV21 strategy</b>
No comment of this point.	
<b>H2.5</b>	<b>Cooperation with regions of the Czech Republic</b>
No comment of this point.	

#### Further criterion: 1. Position in international and national context (D1.1-D1.3)

<b>D1.1</b>	<b>Comparison of the team with similar international and national institutes</b>
The team is positioned amongst the top groups in the world in its area of expertise.	
<b>D1.2</b>	<b>Scope and quality of international and national cooperation and the role of the team in such cooperation; engagement in broad international cooperation</b>
The have an excellent network of international cooperation in the area. They are recognized as a leading group which attracts international collaborations.	
<b>D1.3</b>	<b>Participation of the workers in scientific community activities (organizing of conferences and workshops, invited lectures, awards)</b>
The number of invited lectures is according to the level of the team. However, the members of the team should increase their involvement in international organization of meetings and relevant scientific organizations.	

#### Further criterion: 2. Vitality, sustainability and strategy (D2.1-D2.9)

<b>D2.1</b>	<b>Direction in line with the perspective of the planned research directions</b>
The team has appointed a new head after the retiring of the previous one. However, the trajectory of the group has not suffered from the change and the new head has been able to continue with the previous level of excellence.	
<b>D2.2</b>	<b>Assessment of the previous research objectives and their achievement</b>
The previous objectives were satisfactorily achieved.	
<b>D2.3</b>	<b>Assessment of implementation of recommendations from past evaluation</b>
The recommendations were implemented correctly.	

<b>D2.4</b>	<b>Success in receiving grants</b>
There is no data on this matter.	
<b>D2.5</b>	<b>Adequacy of instrumental equipment</b>
The instrumental equipment is adequate.	
<b>D2.6</b>	<b>Effectiveness of management</b>
No comment on this issue.	
<b>D2.7</b>	<b>Assessment of professional structure, development strategy and the strategy of keeping best scientists, age structure, career and qualification growth</b>
The age structure of the team is correct, and they should continue attracting new and talented young researchers.	
<b>D2.8</b>	<b>Creating work-life balance conditions, assessment of approach towards possible gender issues</b>
There is no comment on this issue.	
<b>D2.9</b>	<b>Relation of the team with regard to the integration, development and sustainability of the research centre funded by the National Programme of Sustainability II.</b>
N/A	

**Further criterion: 3. Cooperation with universities and participation in education (D3.1-D3.6)**

<b>D3.1</b>	<b>Scope of cooperation with universities on national and international level</b>
Please enter your comment here.	
<b>D3.2</b>	<b>Effectiveness of joint research centres</b>
N/A	
<b>D3.3</b>	<b>Success rate in supervision of PhD students</b>
The number of PhD thesis is low. The team should make efforts to increase the number.	
<b>D3.4</b>	<b>Participation of PhD students in the outputs</b>
The participation of the PhD students in the outputs is adequate.	
<b>D3.5</b>	<b>Participation of the team in master or bachelor studies</b>
The number of master thesis is low. Efforts should be made to increase it.	
<b>D3.6</b>	<b>Assessment of cooperation intensity with universities in the form of teaching</b>
It seems appropriate.	

#### Further criterion: 4. Outreach activities (D4.1-D4.3)

<b>D4.1</b>	<b>Sufficiency of media strategy and activities in the area of research popularisation</b>
The team is regularly involved in science dissemination activities.	
<b>D4.2</b>	<b>Publishing activities and its quality</b>
The quality of the publishing activities is high.	
<b>D4.3</b>	<b>Participation in professional organisations in the area of research and development</b>
N/A	

Other comments of the commission:

## 5. Bioanalytical Instrumentation

### Strengths:

Long term experience and continuity.

### Weaknesses:

Wide research area necessity to close projects not leading to publications quickly.

### Opportunities:

Instrumentation development —(industrial) collaborations

### Threats:

Not growing and increasing research volume. Potential to merge with other departments that are similar (in this institute).

### Main criterion: 1. Quality of results (H1.1-H1.5)

H1.1	Quality of selected outputs of Phase I
26 outputs submitted and an FTE of 13. Only one output a Quality 1 with the majority at 2 and 3. In the reporting period however, 96 papers have been submitted, with the majority of outputs ranked around quartile 2 and 3 and 4.	
H1.2	Contribution of workers on the outputs reached
Please see Phase 1 metrics.	
H1.3	Quality of all outputs and results
Generally good, but as evidenced above, a research strategy needs to be developed to increase the quality and volume at the higher quartiles and reduce the tail.	
H1.4	The most valuable discoveries and findings in the fields, their importance for the field
Some exciting research, including DNA analysis working with ROCHE. This should be supported further. Other exciting work is on fluorescein labelled DNA and biomarkers in EBC. This is a growing area which the team could start to lead on with collaborations with medical/clinical staff.	
H1.5	Contribution of the participation of the authors in large collaborations
<p>Since 2017 - Roche, Inc., Pleasanton, CA, USA – joint research on DNA focusing (Dr. Yann Astier) Financial support of 300 000 USD, instrument donation ~ 50 000 USD; joint patent applications, joint publications</p> <p>Since 2014 - Agilent Inc., Waldbronn, Germany – joint research on CE-MS (Dr. T. van de Goor) Financial support 10 000 EUR, Instrument donation – 2x CE instrument (~100 000 EUR), TOF/MS instrument (~150 000 EUR). Two master's degree theses defended by the German students working in Brno.</p>	

## Main criterion: 2. Societal relevance (H2.1-H2.5)

<b>H2.1</b>	<b>Societal relevance of outputs and results pursuant to CAS and institute mission</b>
All the work has a clear societal relevance and output, for example EBC work could revolutionise healthcare/people.	
<b>H2.2</b>	<b>System functionality for knowledge transfer into practise, its usefulness for society. The impact of the team's activity on proper practice in society in the area of social sciences and humanities</b>
Some great examples here, with ROCHE and Agilent. This is excellent and should be supported more. This helps the knowledge exchange/transfer of the department and institute.	
<b>H2.3</b>	<b>Relation to practice</b>
<b>H2.4</b>	<b>Participation in AV21 strategy</b>
No evidence given, but clearly aligns.	
<b>H2.5</b>	<b>Cooperation with regions of the Czech Republic</b>
Masaryk University and University of Pardubice cooperate with the department.	

## Further criterion: 1. Position in international and national context (D1.1-D1.3)

<b>D1.1</b>	<b>Comparison of the team with similar international and national institutes</b>
The team are leading nationally and to some extent international. Future planning should help to increase the later.	
<b>D1.2</b>	<b>Scope and quality of international and national cooperation and the role of the team in such cooperation; engagement in broad international cooperation</b>
Good evidence of international collaboration on all research fronts.	
<b>D1.3</b>	<b>Participation of the workers in scientific community activities (organizing of conferences and workshops, invited lectures, awards)</b>
<p>Since 2004 the department organizes the yearly organization of the CECE - International Interdisciplinary Symposium on Bioanalysis - <a href="http://www.ce-ce.org">www.ce-ce.org</a></p> <p>The department also Co-Chairs the International Symposium on High-Performance Liquid Phase Separations and Related Techniques – HPLC2017 Prague, Czech Republic (over 1700 participants) - <a href="http://www.hplc2017-prague.org">www.hplc2017-prague.org</a></p> <p>And COST Action CA 16215, OPEN SOURCE CAPILLARY ELECTROPHORESIS WORKSHOP Brno, Czech Republic, October 15-16, 2018 - <a href="http://portasap.eu/training-school---brno-2018.html">http://portasap.eu/training-school---brno-2018.html</a></p> <p>Good evidence and great to see, it raises your profile.</p>	



## Further criterion: 2. Vitality, sustainability and strategy (D2.1-D2.9)

<b>D2.1</b>	<b>Direction in line with the perspective of the planned research directions</b>
<p>The department activities will continue to be focused on two primary directions.</p> <p>i) Basic research in the area of bioanalysis using newly designed instrumentation</p> <p>ii) Industrial collaborative research. This planned research is innovative and fits that of the institute.</p>	
<b>D2.2</b>	<b>Assessment of the previous research objectives and their achievement</b>
These have been met.	
<b>D2.3</b>	<b>Assessment of implementation of recommendations from past evaluation</b>
<p>The past evaluation of the Department was to continue with the research directions focused on (a) sensors and miniaturized detectors for CE or LC; (b) development of sample enrichment strategies and microreactors; (c) coupling CE with MS; and (d) proteomics for cancer research.</p> <p>The department has done this and expanded the work with new microfluidics directions – droplet chemistry, upconversion nanoparticles.</p>	
<b>D2.4</b>	<b>Success in receiving grants</b>
No evidence provided.	
<b>D2.5</b>	<b>Adequacy of instrumental equipment</b>
Appears adequate.	
<b>D2.6</b>	<b>Effectiveness of management</b>
Appears to be effective, but due to COVID19 we cannot fully evaluate.	
<b>D2.7</b>	<b>Assessment of professional structure, development strategy and the strategy of keeping best scientists, age structure, career and qualification growth</b>
More effort is needed. The evidence is rather limited.	
<b>D2.8</b>	<b>Creating work-life balance conditions, assessment of approach towards possible gender issues</b>
Unable to evaluate due to COVID19.	
<b>D2.9</b>	<b>Relation of the team with regard to the integration, development and sustainability of the research centre funded by the National Programme of Sustainability II.</b>
No evidence.	

## Further criterion: 3. Cooperation with universities and participation in education (D3.1-D3.6)

<b>D3.1</b>	<b>Scope of cooperation with universities on national and international level</b>
Clear evidence of cooperation.	

D3.2	Effectiveness of joint research centres																
<p>The evaluation period partially overlapped with the Center of Excellence by GACR formed together with the group of Prof. Z. Glatz (Department of Biochemistry, Faculty of Science, Masaryk University, Brno) and Prof. Z. Hurak (Department of Advanced Algorithms for Control and Communications, FEL, Czech Technical University in Prague).</p> <p>The research in the center was focused on new principles, instrumentation, and technologies for bioanalyses applicable in life sciences. In particular, it investigated micro separation utilizing microfluidics and nanotechnologies with mass spectrometry and laser-based detection, molecular biorecognition, advanced feedback control, parallel non-contact manipulation by shaping the force and/or potential fields.</p> <p>The group of BI at IACH was the coordinator of the Center for Advanced Bioanalytical Technologies. The cooperation between the partners included student exchanges between the laboratories, presentations, and organization of yearly international interdisciplinary conferences – <a href="http://www.ce-ce.org">www.ce-ce.org</a>. The mutual contacts continue after the successful finish of the Center, with the main benefits being the extension of our knowledge into different fields. Thus the electrical engineers now use also chemical systems in their projects, and we, chemists, use extensively electrical control devices developed in-house with the help of the electrical engineers.</p> <p>Two department members and six students are also members of the research group at CEITEC Masaryk University headed by F. Foret. The CEITEC laboratories are located at the IACH and are equipped with the CEITEC instrumentation, including an electron microscope, mass spectrometer, and Zetasizer particle analyzer.</p>																	
D3.3	Success rate in supervision of PhD students																
<p>8 PHD completions, which is excellent</p> <p><b>Supervision of students</b></p> <table><tr><th>Type of study</th><th>No. of supervisors</th><th>No. of consultants</th><th>Theses defended 2015-2019</th></tr><tr><td>Bachelor</td><td></td><td>2</td><td>3</td></tr><tr><td>Master</td><td></td><td>3</td><td>6</td></tr><tr><td>Doctoral</td><td>2</td><td>2</td><td>8</td></tr></table>		Type of study	No. of supervisors	No. of consultants	Theses defended 2015-2019	Bachelor		2	3	Master		3	6	Doctoral	2	2	8
Type of study	No. of supervisors	No. of consultants	Theses defended 2015-2019														
Bachelor		2	3														
Master		3	6														
Doctoral	2	2	8														
D3.4	Participation of PhD students in the outputs																
<p>The majority of the research in the department involves the participation of Ph.D. students. Out of the 26 reported papers, 15 include our students, and an additional three were prepared with our foreign postdocs.</p> <p>This is excellent to see.</p>																	
D3.5	Participation of the team in master or bachelor studies																
<p>The team undertake pedagogical activity with 2 University’s at the doctoral level.</p>																	
D3.6	Assessment of cooperation intensity with universities in the form of teaching																
<p>See above.</p>																	

#### Further criterion: 4. Outreach activities (D4.1-D4.3)

<b>D4.1</b>	<b>Sufficiency of media strategy and activities in the area of research popularisation</b>
Could not evaluate a media strategy but out research is a key output of this department.	
<b>D4.2</b>	<b>Publishing activities and its quality</b>
Evidence of dissemination of out research is clear.	
<b>D4.3</b>	<b>Participation in professional organisations in the area of research and development</b>
2 of the team holds numerous editorial positions.	

#### Other comments of the commission:

The team is rather small, and it is up to the Institute if they want to grow this. Currently you have small departments, which we would say are groups due to their size. Merging this group with other underperforming groups/departments would be beneficial.

This department need to increase the volume and research intensity and continue on their quest of basic science and knowledge exchange with various companies already identified.

**Final report was elaborated by:**

**Commission 3.1 - Chemical sciences**

**Evaluated teams No.: 1, 2, 3, 4, 5**

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