Dedicated training activities in animal cell culture technology

Acronym: ACTraining Network

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Rationale:

Since the mid-1980s, the use of animal cell technology in both industry and academia has increased rapidly. In academia, the main drivers of this increase were the advent of monoclonal antibody and recombinant protein technology, the need for cell culture models in molecular biology and the increasing importance of cellular biology. In industry, the use of animal cell technology expanded rapidly for the production of biopharmaceuticals and vaccines.
In the latter half of the 1990s, the academic and industrial need for bench top or industrial scale cell cultures increased even further with expanding research into gene therapy, molecular biology and tissue engineering. In addition, the societal and regulatory need to replace, reduce or refine the number of animal experiments has led to an increase in the development of eukaryotic cell models. Since the early 2000s the proliferation of research efforts into genomics and proteomics, including the integration of high-throughput and cell-based testing in the early phases of the drug discovery and development process (toxicogenomics), further emphasises the scientific and economic importance of (animal) cell culture technology.

In the near future, with the further integration of biotechnology, genomics, proteomics, metabolomics, toxicogenomics and other 'X-omics' into the compound discovery and development process, and the associated increase in industrial scale cell culture capacity, the European need for skilled cell culture technicians and researchers is expected to rise substantially. Already, academia and industry are reporting difficulties in finding qualified employees in this area.

With this expression of interest ACTIP, the Animal Cell Technology Industrial Platform, representing Europe's industry using animal cell culture technologies, together with ESACT, the European Society for Animal Cell Technology, representing individual scientists working in the field, would like to draw attention to the current and future shortage of qualified personnel at all levels (technician, engineer, PhD) in animal cell culture technologies. This shortage could severely hamper Europe's scientific and industrial competitiveness and should be addressed by a dedicated "training through research" programme relevant for the biotech industry active in Animal Cell Technology including cell-biology and screening methods, to be executed in both academia and industry, for all levels (from technicians to PhD students).
Because of the specialised nature of the profession and the shortage of national facilities in this field in most EU member states, a co-ordinated European effort is the only realistic option.
Therefore, ESACT and ACTIP would like to seek support from the European Commission for dedicated "training through research" activities in animal cell culture technology to adequately support Europe's goal of becoming, in the coming years, a world leader in science and technology.
In this context it should be mentioned that training alone is not sufficient because university and industry have to generate new knowledge via fundamental and applied research (excellence). This knowledge has to be created by trained scientists (i.e. PhDs, post docs, and confirmed investigators), managing their groups consisting of trained engineers and technicians. This indicates that the training has to be organised in a way that all levels in this knowledge creating chain are included, by adjusting the training programmes to the particular niveau.

Objectives, curriculum, and organisational structure of the proposed training activity:

In order to best adapt the training programme to the needs of the biotech industry, this programme should be organised on three levels:
1. Technician level: duration of the training (theoretical and practical): 3 months, the practical training will be essentially performed in university labs, the theoretical training (workshop type of training) has a duration of about 1 week.
2. Engineer level: duration of the training (theoretical and practical): 6-10 months, the practical training will be preferably performed in industry labs, the theoretical training can be somewhat longer than for the technician level: 1-3 weeks, as a block (preferable) or intermittently.
3. PhD level: duration: 3 years. This should be an industrial PhD, indicating that the practical training should be preferably performed in industry labs or partly in university and industry labs. The theoretical training can be even longer than for the other levels: 1-4 weeks per year.
The theoretical training is preferably organised in a block-wise, centralised form, at a university institution. The participants are located together and follow together this workshop type of training. The practical training should be performed in university as well as in industrial laboratories. The implementation of industry labs is very important in order to assure that the trainees get the « industrial touch » and understand the particular needs of industry.

- The following matters should figure in the curriculum of the theoretical courses:

* Cell banking
* Different cell lines, presentation and characterisation of cells important for the biotech industry, implementation of new cell lines
* Cell engineering, metabolic engineering, vector technology in relation to cell types (e.g. promoters, plasmids, etc.)
* Attached versus suspension cells
* Transient expression (e.g.: baculovirus expression system)
* Medium development and optimisation : serum containing versus serum free media - implications for process development and biological safety
* Cell Culture Engineering:
* Bioreactor design
* Reactor characterization, scale-up and down-scaling
* Process development and optimisation
* Operation principles (batch, fed batch, perfusion culture), culture kinetics (cell growth and production kinetics)
* Bioprocessing
* Biopharmaceutical development and production process chain (time-dependence, what is key, what are the priorities, what are the pitfalls)
* Product quality and how cell culture conditions can affect it
* Analytics (product quality/glycosylation,...) and quality control
* Safety, and regulatory issues.
* Validation, GMP
* New analytical methods (i.e. DNA-array)
* Modelling
* Tissue engineering
* Genomics/proteomics in bioprocessing.
* Bioinformatics
The depth of training curriculum has to be adapted to the course levels. The main course curriculum is different for different levels but essentially the same for the same level.

- Financing: Presently, there is no final proposal for the financing of this training programme, however, a first proposition can already be indicated:
- The technicians' level of training: The network offers training for students for practical work according to a curriculum. Practical work will last 3 months, and covers various aspects. Many universities charge for this, so a budget of 24000 Euros is proposed for the duration of three months. In addition, should a

company immediately after the training period hire the student, then the company will refund the project 50% of the training costs. The network proposal will have a budget featuring costs for the curriculum development, the workshop (housing, teachers' fees, travel costs for the students), costs for practical work (travel, housing, salary, daily subsistence for the students, and remuneration for the labs), costs for advertising (through ESACT and ACTIP, but also in scientific journals, on the web and mailings to universities).
- The engineers' level of training: As this training programme is dedicated to the "production" of industrial engineers, the costs have to be carried in a first instance by the interested industrial company, however, with a support from the European Union (50% support of the costs directly associated with the practical training programme). With respect to the theoretical training programme, the same rule as for the technician level is proposed.
- The PhDs' level of training: As this training programme is dedicated to the "production" of industrial PhDs, the costs have to be carried in a first instance by the interested industrial company, however, with a support from the European Union (50% support of the costs directly associated with the practical training programme). With respect to the theoretical training programme, the same rule as for the technician level is proposed.
- The absolving persons have an obligation to work in the company, which has financed/co-financed the training, for at least three years following the training, except in the case, that the company is not interested.
- Selection of the candidates: the candidates are selected on their CV, on their letter of interest/motivation, and after personal interview.
- An evaluation has to be performed after the termination of the training course: written examination for the technician level, diploma thesis and final examination for the engineers level, PhD thesis and final examination for the PhD level.

Participating laboratories and companies:

Private/public research laboratories in principle interested to participate in such training activities:

S. Agathos (Univ. Catholique de Louvain/B); FAX 003210473062
M. Al-Rubeai (Univ. Birmingham, Birmingham/UK); FAX: 00441214145324
M. Carrondo (IBET, Oeiras/P); FAX: 00351214421161
O. Danos/O.-W. Merten (Généthon, Evry/F); FAX: 0033169472838
F. Franek (Inst. Exp. Botany, Lab. Growth Regulators, Prague/CZ); FAX: 00420267008329
M. Fussenegger (ETH Zürich, Zürich/CH); FAX: 004116331051
F. Godia (Univ. Autonoma Barcelona, Bellaterra/E); FAX: 0034935812013
L. Häggström (Royal Inst. Technol., Stockholm/S); FAX: 0046855378323
H. Hauser (GBF, Braunschweig/D); FAX: 00495316181458
H. Katinger/F. Hesse (Agric. Univ. of Vienna, Wien/A); FAX: 004313697615
J. Lehmann (Univ. Bielefeld, Bielefeld/D); FAX: 00495211066328
C. MacDonald (Univ. Paisley, Glasgow/UK); FAX: 00441418483116
A. Marc (LCGS CNRS, Nancy/F); FAX: 0033383327308
R. Pörtner (Technical Univ. Hamburg-Harburg, Hamburg/D); FAX: 00494077182909
T. Scheper/C. Kasper (Technical Univ. Hannover, Hannover/D); FAX 00495117623004
J. Tramper/D.E. Martens (Agric. Univ. Wageningen, Wageningen/NL); FAX: 0031837082237
R. Wagner (GBF, Braunschweig/D); FAX: 00495316181488
C. Wandrey/T. Noll (FZ Jülich/Heinrich Heine Universität Düsseldorf, Düsseldorf/D); FAX: 00492461613870
F. Wurm (EPFL, Lausanne/CH); FAX: 0041216936140

Participating biopharmaceutical companies: in principle the ACTIP members (individual commitment will be sought with a full proposal), but the training action will be open to any company with activities in this field:

4c Biotech Belgium

Akzo Nobel NV	The Netherlands
Archport Ltd.	Ireland
AstraZeneca Biotech Laboratory	Sweden
Aventis Pasteur	France
Bayer AG	Germany
BioInvent Production AB	Sweden
BioReliance	Scotland
Biovitrum AB	Sweden
Boehringer Ingelheim Pharma KG	Germany
Chiron Behring GmbH & Co	Germany
Covance Laboratories	United Kingdom
DSM Biologics	The Netherlands
GlaxoSmithKline	United Kingdom
GlaxoSmithKline Biologicals	Belgium
Innogenetics NV	Belgium
Inveresk Research	Scotland
LONZA Biologics	United Kingdom
Merkc KGaA	Germany
Novartis Pharma AG	Switzerland
Novo Nordisk A/S	Denmark
Q-One Biotech Ltd.	United Kingdom
RBM / LCG	Italy
Sanofi-Synthélabo	France
Sartorius AG	Germany
Schering AG	Germany
Serologicals Corporation	United Kingdom
Serono S.A.	Switzerland
Texcell	France

Integration and structuring effects:

The points developed under " Objectives, curriculum, and organisational structure " indicate clearly that these training courses are inscribed in a pan-European approach. The students at all levels will work both individually and interact with each other during the theoretical training courses. In this way, the activity will
contribute to the building of a valuable network of young technicians, engineers and PhD scientists in animal cell technology. It will also increase knowledge about the realities of working in university and industry, contributing to increased mobility, and strengthening in European-wide contacts and interactions.
In order to even increase the exchange between the engineer and PhD level students during their practical training, one or two meetings of all students per year will be organised in order to assure a scientific exchange. This will take place in the same moment when the theoretical courses will take place (as a reminder: 1-4 weeks per year for the PhD students, 1-3 weeks for the engineer students).
In order to strengthen the European dimension of this training network it is desirable that the students perform at least a part of their practical work in a foreign laboratory.

Dissemination:

The diploma and PhD thesis should be made publicly available. The programme director has to establish an annual report on the performance of the programme (number of candidates, number of absolving students, budget,...)