

## Scientific Life Microbiology Managers: Managerial Training in the RItrain Project

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**Leaders of research infrastructures (RIs) in Europe who are scientists require competencies in management. RItrain has addressed this issue by identifying skills required, locating relevant courses and finding gaps, whilst establishing a Master of Management programme. We describe how one contributing microbiology RI determined the most relevant skills.**

Many readers will have encountered excellent researchers, including microbiologists, who may not be leaders of people. Some of these scientists manage large research groups or whole organisations, often on the basis that they have a PhD and years of laboratory experience. Imagine the challenge for those who have no experience of running a business in writing a meaningful business plan, or taking decisions for the RI and having them implemented by other employees within the organisation. Most important, effective management means leading the organisation towards results and being accountable to its constituencies. This is true particularly of service providers supplying, for example, access to archives and resources such as DNA and protein sequencing to the scientific

community. We contend that there is a need for microbiologists and other scientists to be trained in management and leadership ‘competencies’ regardless of specialism.

A competency is “an observable ability of any professional, integrating multiple components such as knowledge, skills, values and attitudes” [1]. Importantly, an individual’s scientific and technical knowledge form only a small proportion of the profile; the remainder of the competencies are generic – those skills essential for employment and personal development.

Throughout Europe there are research infrastructures (RIs) – either single-sited or distributed – functioning over numerous countries, working with different legal and cultural systems, making it especially challenging to fund and perform ‘big science’. In some fields, this issue has been partially overcome by establishing inter-governmental organisations. These enable Europe to compete effectively on a global scale in areas such as particle physics (CERN), space science (ESA), and molecular life sciences (EMBL), founded in 1954, 1964, and 1974 respectively. More recently the European Commission has established the European Research Infrastructure Consortium (ERIC) and several newly established, mainly distributed, RIs have chosen this legal instrument. Most of these new RIs were established as part of the ESFRI roadmap for RIs (Box 1). One of the advantages is to have a legal instrument formally recognized in all EU Member States, which includes VAT (tax) exemption.

### Box 1. ESFRI Roadmap

The ESFRI Roadmap has given rise to ~50 emerging RIs which are at various development stages. The most mature have become legal entities and are operational; over the next 10 years they will expand to incorporate nodes in multiple European countries. The need for skilled staff within these infrastructures to maximise effective access is urgent. Also, several new infrastructures have started their planning phase. They will benefit enormously from the experience of the established RIs; only few people have established a distributed infrastructure under the new EC legal instrument for this purpose – the European Research Infrastructure Consortium (ERIC), or alternatives.

Managers within pan-European RIs need excellent, state-of-the-art leadership and management skills if they are to succeed. RIs are primarily service organisations; they need to operate as businesses with a client base: microbiologists would benefit from possessing such competencies in international business and management, especially relating to delivering research within Europe.

RIs as a context for management and leadership skills are made distinctive by the circumstances of delivering world-class, unique research services to the scientific community on a global scale and of accountability to many funding countries at the national and international levels. The location of research facilities, within one or different national innovation ecosystems, is another important factor influencing the peculiarity of management practice within RIs. Complexity is also related to the number and variety of stakeholders involved, and to the integration of assets/competencies of existing self-governing research centres in achieving shared services.

The RItrain project [2] – funded by H2020 – is tasked with addressing this issue, enabling managers of RIs to perform optimally by encouraging scientists, including microbiologists, to undertake these important management roles. The overarching goals are the identification of competency requirements for professional management of European RIs and designing training programmes to fulfil these requirements. They need a distinct set of competencies to deal with (i) multinational operations, (ii) transnational access and data flow, (iii) different social

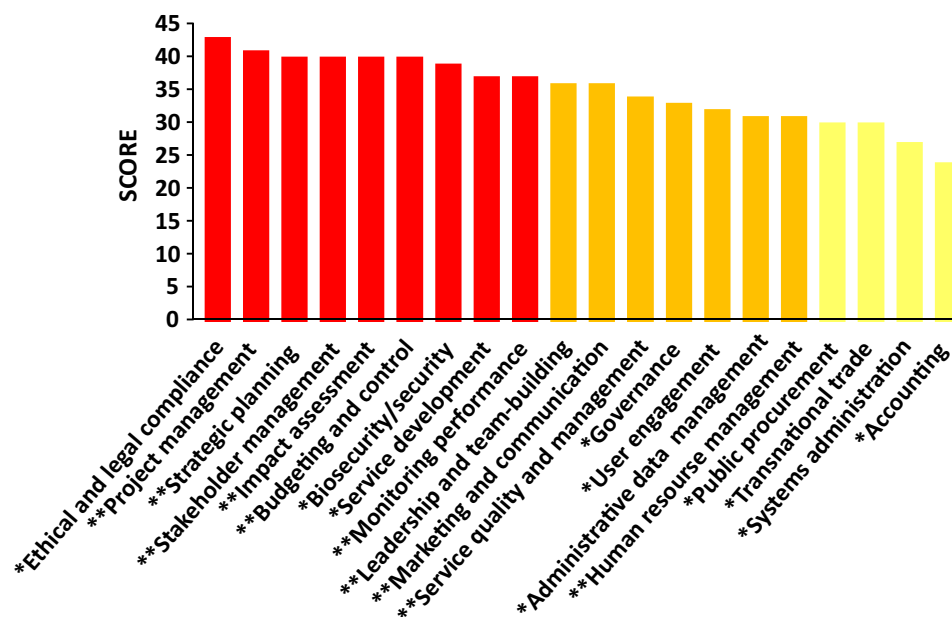
security systems, (iv) different cultures, and (v) different legal systems. There are many RIs at various stages of development in the EU. Some are fully functioning, for example, molecular life sciences by EMBL; others are at intermediate or preparative stages.

The RItrain consortium has identified five major objectives for the project:

- (i) Definition of required competencies in RIs from preparatory to operational phases.
- (ii) Mapping of these competency requirements to existing training courses and programmes (see: [www.on-course.eu](http://www.on-course.eu)).
- (iii) Development and piloting of a comprehensive curriculum at Master's level incorporating existing training opportunities and creating new content to fill gaps.
- (iv) Development of webinars based on how real challenges in RIs have been overcome.
- (v) A staff-exchange programme.

RItrain has developed a flagship Executive Master's programme, enabling managers of RIs across all domains to gain expertise on governance, organisation, financial and staff management, funding, IP, service provision and outreach in an international context. The Master's programme has been designed with direct input of RI managers via a survey and 2-day workshop resulting in an Organisational Competency Framework for RI managers ([www.ritrain.eu](http://www.ritrain.eu)), which has been used to develop the RI Empowerment model as the basis for intended learning outcomes of the Master's programme. Delivery will be by the University of Milano-Bicocca, Italy, in collaboration with the University of Minho, Portugal and Imperial College London, UK. The faculty is composed of highly experienced academics and experts who have established and managed RIs, from concept to maturity, which will ensure excellence in academic teaching and the application of leadership competencies in real-world situations.

The Master's programme has been tailored to meet the needs of RIs in the planning, construction, and operation phases. It has three delivery routes: (i) professionals working in RIs can take the full Master's certificate or dip into the content; (ii) management teams can take the course as an organisation, dividing modules between groups, to gain a certificate for the RI; or (iii) recent graduates and others wishing to enhance their employability can take the full Master's. Course content will include webinars led by academics and senior managers of RIs. A staff-exchange programme will catalyse exchange of best practice and foster cooperation to develop a mobile work force effective across many RIs, and especially across disciplines. The Microbial Resource Research Infrastructure (MIRRI; represented by the University of Minho, Portugal) relates most to microbiology of the 12 partners in the RItrain consortium, which took a unique opportunity to present the questionnaire under discussion herein to their members.



Trends in Microbiology

**Figure 1.** Hierarchical Display of the Scores of 15 MIRRI Participants Comprising 20 Competencies. The scores were divided into high (red bars), medium (orange bars) and low (yellow bars) importance. The two general areas are Managing RIs within the EU (\*) and Managing in interdisciplinary/intercultural environments (\*\*).

MIRRI coordinates the European collections of microbes, which are currently individual national culture collections, but have common goals and practices that could be made more efficient by becoming a European RI. This young RI has completed the preparatory phase of the requirement. It will be a unique pan-European, high-performance platform, adding value to microbial biodiversity and exploiting novel sources and knowledge, which will be discovered and disclosed for the bioscience economy. It is anticipated that the organization will contribute fully to the search for new pharmaceuticals from bioprospecting [3]. Current MIRRI education and training requirements of microbial resources are focused on technical areas [4] or informatics rationalisation [5]: more technical competencies for operators of RIs are tackled in the Life Sciences cluster project CORBEL funded also through H2020. Biosecurity issues have also been addressed [6–8] – an area of relevance to management of RIs (Figure 1). Other competencies have also been discussed by Smith *et al.* [9], who developed a business plan for MIRRI related to operational planning. In addition, some valid technology-related skills have been discussed as relevant to MIRRI [10,11], but in order to move MIRRI forward it is important to understand which nontechnical competencies of managers are needed to move the organization from preparation to operational. These issues are faced by culture collections in the USA [12], where US culture collections only recently participated in scientific meetings of their activities, rather than as an adjunct of other research. Another goal of this new collaboration was to save US culture collections vulnerable to closure. The continued development of the World Data Centre for Microorganisms is a useful model in these changing times [13].

A questionnaire was devised concerning what the 15 MIRRI participants considered the most important competencies (Figure 1). The list of competencies were

voted on, which were taken from the original RItrain project proposal [2] and was divided into two parts to reflect the information provided in the proposal: “Managing RIs within the EU” and “Managing in interdisciplinary/intercultural environments” (Figure 1). “Ethical and legal compliance” was given the highest rating of 41. In addition, “Biosecurity/security” (see [6,7]) was in the high-priority group and “Service development” was rated highly.

RItrain, through the Organisational Competency Framework, identifies several core competencies that all science professionals in RIs need to become more actively involved in during the planning and delivery of RI’s services, when the project as a whole is considered. These competencies are grouped into three broad domains: leading the organisation, engagement within and beyond the organisation, and professional conduct (Table 1).

The competency framework can be used in RIs as a compass to design training programmes, assist appraisal and recruitment, support personal development planning, and facilitate career progression of science professionals.

All of the identified competencies will have learning modules in the Masters Programme. While the curriculum includes some of the standard elements of management education, the modules are designed and delivered in a way that focusses on the specificity of RIs. Each module will also be accessible individually to allow best use of its resources and scientists to broaden their managerial skills by adopting a learning empowerment approach. Hence, the development of competencies will vary according to (i) the positions held by individuals within the organisation (e.g., middle or top management), (ii) their level of training and experience, and (iii) the stage of the RI (i.e., planning, construction, or operation). We anticipate that this approach will apply to all microbiologists and scientists, but will tend to be more appropriate for those in management roles.

The RItrain project puts leadership and management skills centre stage, challenging all RIs to reflect how these are practiced or required in their individual organisation. Simultaneously, the complex environment of RIs requires the educational community to investigate and debate this novel area of training.

Table 1. Organisational Competency Framework for RI Managers

Competency domain	Core competence
Leading the organisation	<ul style="list-style-type: none"> <li>• Strategic vision and operational planning</li> <li>• Innovation and business development</li> <li>• Stakeholder management</li> <li>• Financial management</li> <li>• Staff recruitment, management and development</li> <li>• Service provision</li> <li>• Impact assessment</li> <li>• Acting as a role model</li> <li>• Risk assessment</li> <li>• Advocacy and ambassadorship</li> <li>• Ethical and legal compliance</li> </ul>
Engagement within and beyond the organisation	<ul style="list-style-type: none"> <li>• Communication and outreach</li> <li>• Negotiation, collaboration and networking</li> <li>• Leading change</li> <li>• Promoting diversity</li> </ul>
Professional conduct	<ul style="list-style-type: none"> <li>• Integrity</li> <li>• Accountability</li> <li>• Responsible decision-making</li> </ul>

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### References

1. Winterton, J. (2006) *Typology of Knowledge, Skills and Competences: Clarification of the Concept and Prototype (Cedefop Reference Series: 64)*, Office for Official Publications of the European Communities
2. Rltrain (2015) *EC Research Infrastructures Training Programme Proposal*.
3. *Bioprospecting. Success, Potential and Constraints*. Paterson, R.R.M. and Lima, N., eds), 2017.Springer
4. Antunes, A. (2016) Fueling the bio-economy: European culture collections and microbiology education and training. *Trends Microbiol.* 24, 77–79
5. Casaregola, S. *et al.* (2016) An information system for European culture collections: the way forward. *Springerplus* 5, 772
6. Rohde, C. *et al.* (2013) Code of conduct on biosecurity for Biological Resource Centres: procedural implementation. *Int. J. Syst. Evol. Microbiol.* 63, 2374–2382
7. Paterson, R.R.M. and Lima, N. (2010) The weaponisation of mycotoxins. In *Mycotoxins in Food, Feed and Bioweapons* (Varma, A. and Rai, M.K., eds), pp. 367–384, Springer
8. Smith, D. *et al.* (2016) Microorganisms: good or evil, MIRRI provides biosecurity awareness. *Curr. Microbiol.* 74, 299–308
9. Smith, D. *et al.* (2014) Investment into the future of microbial resources: culture collection funding models and BRC business plans for biological resource centres. *Springerplus* 3, 81
10. Stackebrandt, E. *et al.* (2015) The microbial resource research infrastructure MIRRI: strength through coordination. *Microorganisms* 3, 890–902
11. Schüngel, M. and Stackebrandt, E. (2015) Microbial Resource Research Infrastructure (MIRRI): infrastructure to foster academic research and biotechnological innovation. *Biotechnol. J.* 10, 17–19
12. McCluskey, K. *et al.* (2016) The U.S. culture collection network lays the foundation for progress in preservation of valuable microbial resources. *Phytopathology* 106, 532–540
13. Wu, L. *et al.* (2017) World data centre for microorganisms: an information infrastructure to explore and utilize preserved microbial strains worldwide. *Nucleic Acids Res.* 45, D611–D618