

The section header "Summary of work activities" in a bold, white, sans-serif font, set against a blue background.The author's name "Daniel Eibach" in a white, sans-serif font, set against a blue background.The programme name "European Public Health Microbiology Training Programme (EUPHEM), 2011 cohort" in a white, sans-serif font, set against a blue background.The section header "Background" in a bold, blue, sans-serif font.

According to the European Centre for Disease Prevention and Control's (ECDC) advisory group on public health microbiology ('national microbiology focal points'), public health microbiology is a cross-cutting area that spans the fields of human, animal, food, water, and environmental microbiology, with a focus on human population health and disease. The primary work function is to use microbiology to improve the health of populations in collaboration with other public health disciplines, in particular epidemiology. Public health microbiology laboratories play a central role in the detection, monitoring, outbreak response, and provision of scientific evidence to prevent and control infectious diseases.

European preparedness for responding to new infectious disease threats requires a sustainable infrastructure capable of detecting, diagnosing, and controlling infectious disease problems, including the design of control strategies for the prevention and treatment of infections. A broad range of expertise, particularly in the fields of epidemiology and public health microbiology, is necessary to fulfil these requirements. Public health microbiology is required to provide access to experts with expertise and experience in all relevant communicable diseases at the regional, national and international level in order to mount rapid responses to emerging health threats, plan appropriate prevention strategies, assess existing prevention disciplines, develop or assist in the development of microbiological guidelines, evaluate/develop new diagnostic tools, arbitrate on risks from microbes or their products, and provide pertinent information to policy makers related to the above issues from a microbiology perspective.

According to articles 5 and 9 of ECDC's founding regulation (EC No 851/2004) 'the Centre shall, encourage cooperation between expert and reference laboratories, foster the development of sufficient capacity within the community for the diagnosis, detection, identification and characterisation of infectious agents which may threaten public health' and 'as appropriate, support and coordinate training programmes in order to assist Member States and the Commission to have sufficient numbers of trained specialists, in particular in epidemiological surveillance and field investigations, and to have a capability to define health measures to control disease outbreaks'.

Moreover, article 47 of the Lisbon Treaty states that 'Member States shall, within the framework of a joint programme, encourage the exchange of young workers.' Therefore, ECDC initiated the two-year EUPHEM training programme in 2008. EUPHEM is closely linked to the European Programme for Intervention Epidemiology Training (EPIET). Both EUPHEM and EPIET are considered 'specialist pathways' of the two-year ECDC fellowship programme for applied disease prevention and control.

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This report summarises the work activities undertaken by Daniel Eibach of the cohort 2011 of the European Public Health Microbiology Training Programme (EUPHEM) at the Centre Hospitalier Universitaire Lyon, France.

All EUPHEM activities aim to address different aspects of public health microbiology and underline the various roles of public health laboratory scientists within public health systems.

Material and methods

This report accompanies a portfolio of the outcome of different activities conducted during the EUPHEM fellowship. The activities comprised specific projects, activities and theoretical training modules.

Specific projects included epidemiological investigations (outbreaks and surveillance), applied public health research, applied public health microbiology and laboratory investigation, biorisk management, quality management, teaching and public health microbiology management, summarising and communicating scientific evidence, and activities with a specific microbiological focus.

The outcomes include publications, presentations, posters, reports and teaching materials prepared by the fellow. The portfolio presents a summary of all work activities conducted by the fellow, unless prohibited due to confidentiality regulations.

Results

Objectives of these core competency domains were achieved partly by project/activity work and partly by participation in the modules. Results are presented according to the EUPHEM core competencies as can be found in the EUPHEM scientific guide¹.

1. Epidemiological investigations

1.1. Outbreak investigations

A. Investigation of a mumps outbreak in the Lyon rugby team

An outbreak of mumps occurred in October 2011 among members of the professional Lyon rugby team. A seroprevalence study, which included all 38 players and seven coaches, revealed an attack rate of 35%. As immediate measures, vaccinations were given to 17 non-vaccinated team members, symptomatic patients were quarantined, and rugby games were cancelled for a period of two weeks. No new cases occurred after the notification to the public health authorities was made. Team doctors of all professional rugby teams in France were advised to check the player's vaccination status for mumps.

B. Outbreak of *Mycoplasma pneumoniae* in Lyon, France

In February 2012, several northern European countries indicated an increase of *Mycoplasma pneumoniae* infections over the past two years. An analysis of the laboratory database in Lyon showed a similar pattern, with a higher proportion of respiratory samples positive for *M. pneumoniae* by real-time PCR in paediatric patients, notably in children aged 5–15 years. The data showed that in 2010 and 2011, France experienced the first epidemic peak of *M. pneumoniae* infections since 2005, similar to other European countries. Regional and national public health authorities, as well as medical practitioners in Lyon were informed of these findings.

C. Measles outbreak in Lyon, France, 2010 to 2011

In 2010 and 2011, the city of Lyon experienced an outbreak of measles, with an incidence of 97.9 cases per 100 000 population. This study aimed to describe the measles outbreak in the Lyon area in order to plan future public health prevention strategies. Data were collected from the mandatory notification system of the regional public health agency and from the virology department of the Lyon University Hospital. Overall, 407 cases were diagnosed, with children of less than one year of age accounting for the highest proportion (32%), followed by individuals between 17 and 29 years (31%). Women of childbearing age constituted a specific population at high risk to contract measles during this outbreak. Thirteen cases of measles were identified among pregnant women. This study highlighted the importance of being vaccinated with two doses of measles vaccine, the only measure which could prevent and allow elimination of the disease.

D. Modules

The EPIET/EUPHEM introductory course familiarised participants with the methods and logistical aspects of outbreak investigations. The module 'computer tools in outbreak investigations' taught essential data management

¹ <http://ecdc.europa.eu/en/publications/Publications/microbiology-public-health-training-programme.pdf>

skills (entering, validating, cleansing data), dataset management, and how to perform case-control studies (descriptive and cohort studies, including stratified analyses).

Educational outcome: Participation in outbreak team meetings and teleconferences, involvement in outbreak investigations (case definitions, active case finding, data collection, data analysis, on-site visits), writing of reports and scientific articles, implementation of prevention measures.

1.2. Surveillance

A. Route of transmission for nosocomial influenza infections among geriatric patients

An influenza A (H3N2) outbreak during the 2011–12 influenza season affected the geriatric department at the Hôpital Edouard Herriot Lyon. The aim of this study was to trace the transmission chain for this outbreak through sequence analysis and identify preventive measures. Incidence by group was calculated and possible epidemiological links were analysed using a questionnaire. Neuraminidase and hemagglutinine genes of culture-positive samples and community influenza samples were sequenced and clustered to detect patients with identical viral strains. The sequence analysis confirmed three independent influenza clusters with transmission from healthcare workers to patients. A higher vaccination rate among hospital staff, isolation measures for patients, and better hand hygiene were recommended to prevent future hospital outbreaks during influenza seasons.

B. A new case definition for the national influenza surveillance system in France

In order to improve regional accuracy and save resources, it was planned to merge the two French surveillance networks for influenza into one unified network. Therefore a new unified and universal influenza case definition for France was needed. The study describes the virological and clinical features of the 37 000 confirmed and subtyped influenza cases from 2003 to 2012 as recorded in the 'Groupe Régional d'Observation de la Grippe' (GROG) surveillance database. Logistic regression was used to study predictive clinical symptoms for influenza in order to develop the new influenza case definition with a sensitivity of ~90% and a specificity of ~30%.

C. Epidemiological review of the situation of monophasic *Salmonella* Typhimurium in the European Union (EU) and European Economic Area (EEA) countries

Increasing number of cases and foodborne outbreaks drew attention to monophasic *Salmonella* Typhimurium 4,[5],12:i:- in recent years. The aim of this study was to describe the epidemiological and microbiological information for monophasic *S. Typhimurium* 4,[5],12:i:- in the Epidemic Intelligence Information System (EPIS) and The European Surveillance System (TESSy) with a focus on national reporting practices in order to verify an increase in cases or detect changes in the notification behavior. EPIS and TESSy databases showed increased notifications of monophasic *S. Typhimurium* 4,[5],12:i:-, most likely induced by increased awareness and changes in the serotype coding. Monophasic *S. Typhimurium* 4,5,12:i:- isolates have been, and may still be, misclassified as *S. Typhimurium*, leading to underreporting of this serotype. Complete serotyping with subsequent notification of the full antigenic formula is essential for the surveillance of existing and emerging *Salmonella* serotypes.

D. Modules

The EPIET/EUPHEM introductory course familiarised participants with the basic knowledge for developing, evaluating and analysing surveillance systems. Building on this course, the module on 'multivariable analysis' demonstrated the principles, application, and interpretation of multivariable analysis and its role in field epidemiology.

Educational outcome: Participation in disease-specific networks at the national and European levels; analysis of laboratory-based surveillance systems at the hospital, country and European levels; familiarity with multivariable analysis; phylogenetic analysis in order to provide surveillance systems with microbiological support; scientific articles; formulation of specific public health recommendations.

2. Applied public health microbiology research

A. Retrospective analysis of macrolide resistance against *Mycoplasma pneumoniae* between 2009 and 2012 in Lyon, France

The objective of the study was to analyse the development of macrolide resistance rate between 2009 and 2012. The domain V of the *M. pneumoniae* 23S rRNA gene from 113 respiratory samples was sequenced and screened for point mutations, associated with macrolide resistance, at positions A2058, A2059 and A2062. Two macrolide resistant *M. pneumoniae* genotypes (1.8%) from the year 2010 were detected. With only a low number of macrolide resistant bacteria detected, the study strengthens the recommendation to use macrolide antibiotics as first-choice treatment for *M. pneumoniae* infections in Lyon.

B. Prospective prevalence study in regional and university hospitals in France on methicillin-resistant Staphylococcus aureus containing the novel mecC gene

In June 2011 the new *mecA* homologue, *mecC* has been detected in MRSA and found to be undetectable with specific *mecA* molecular diagnostic methods. A prospective multicentre study was conducted in France to measure the prevalence of *mecC* and obtain an overview of diagnostic methods currently used in laboratories to perform susceptibility testing and confirmation of MRSA. Out of 2434 MRSA strains collected, no *mecC* isolates have been detected, resulting in a *mecC* prevalence <0.04% in France; however, a high diversity of circulating multisusceptible MRSA strains, thought to originate from hospital, community and livestock sources, was observed. Momentarily, there is no need to adjust diagnostic methods for *mecC* detection; however, continued *mecC* surveillance is necessary to detect increases in a timely manner.

C. Contamination of endocavity vaginal ultrasound probes with high-risk human papillomavirus

Endocavity ultrasound may result in nosocomial transmission of genitourinary pathogens, such as high-risk human papillomavirus (HR-HPV) if disinfection is not done properly. This project aimed to evaluate the currently recommended low-level disinfection (LLD) procedure which uses wipes containing quaternary ammonium compounds for covered endocavity ultrasound probes. Study results revealed that a considerable number of ultrasound probes are contaminated with HR-HPV DNA, despite LLD and probe cover. Endovaginal ultrasound procedure must therefore be considered a source for nosocomial HR-HPV infections when only LLD is performed. It was recommended that high-level disinfectants be used, such as glutaraldehyde or hydrogen peroxide solutions.

D. Modules

While the EPIET/EUPHEM introductory course focused on the development and presentation of study protocols, 'initial management in public health microbiology' focused on laboratory aspects, time management, and collaboration as a team.

Educational outcome: Preparation of study protocols; questionnaire design; organisation of a multicentre study; interpretation of typing results; data analysis; writing of scientific articles; scientific presentation at a conference.

3. Applied public health microbiology and laboratory investigations

Therapeutic efficacy of artemether-lumefantrine treatment for Plasmodium vivax infections in a prospective study in Guyana

A worldwide increase of chloroquine resistance in *Plasmodium vivax* raised doubts on the efficacy and usefulness of malaria treatment guidelines in Guyana. A therapeutic efficacy study was conducted using artemether-lumefantrine + primaquine against *P. vivax* to evaluate a treatment alternative for chloroquine. Artemether-lumefantrine showed excellent clearance of parasites on day 1, with only two patients (3%) having recurrence of parasites on day 28, suggesting relapse. No *pvm-dr1* Y976F polymorphism, a molecular marker for resistance, was detected. The study concluded that, in Guyana, artemether-lumefantrine represents an adequate treatment option against *P. vivax* when combined with primaquine.

Educational outcome: Application of laboratory methods to analyse and interpret resistance polymorphisms; understand limitations of laboratory methods; analysis of clinical trial data; scientific presentation at a conference; writing of a scientific article.

4. Biorisk management

A. Biorisk management module, Institut Pasteur, Paris

This three-day module provided techniques for biorisk/biosafety assessment and mitigation, including WHO recommendations on biosafety management in laboratories. One day focused on international regulations on the transport of dangerous goods as set up by ICAO (International Civil Aviation Organization).

B. Theoretical and practical biosafety level 3 (BSL3) training, Hospices Civils de Lyon, Lyon

The training consisted of a two-day theoretical part and a 10-day practical part, which took place in the BSL3 laboratory of the national influenza reference centre of southern France.

Educational outcome: Understand processes associated with BSL3/BSL4 laboratories; experience different personal protective equipment; understand the principles and practices of biorisk management; biorisk assessment and biorisk mitigation.

5. Quality management

A. Quality management module, Institut Pasteur, Paris

This two-day module gave an overview of quality management concepts in diagnostic laboratories, according to the ISO 15189 standard. Topics discussed were factors influencing quality in laboratories, internal and external quality control, norms and accreditation, assessments and audits, documentation and record keeping, sample management, stock purchase and inventory management, management of equipment and temperature-controlled devices, process improvement, customer service, and international health regulations.

B. Assessment of *Staphylococcus aureus* antibiotic susceptibility testing methods in France

A proficiency panel was designed to assess *S. aureus* antibiotic susceptibility testing and identification methods used in France and evaluate the competency of regional laboratories in order to perform antibiotic susceptibility testing on rare and difficult-to-analyse *S. aureus* strains (*mecC*, VISA). The study revealed a high number of misidentified susceptibilities for *mecC* MRSA and VISA strains. Both types of strains are very rarely identified in French laboratories – which explains the lack of experience in this area. Laboratories should not hesitate to send strains to the national reference laboratory for identification and susceptibility testing.

C. Preparation and participation in the external audit for the influenza laboratory

The influenza laboratory of the 'Laboratoire de Virologie Est' is currently accredited under EN ISO15189 standards. The fellow prepared and participated in a one-day external accreditation audit of the influenza laboratory.

Educational outcome: understand the principles and practices of quality assurance; prepare and analyse an external quality assessment; contribute to an external accreditation audit; understand local and European accreditation procedures.

6. Teaching and pedagogy

A. Epidémiologie de la grippe en France

Lecture within the programme 'Master Santé publique, Epidémiologie et Gestion des risques (EPIRIS)', University Claude Bernard Lyon 1.

B. *Mycoplasma spp./Ureaplasma spp.* infections: pathogenesis, clinical features, diagnostics and therapy

Lecture for medical students at the University Claude Bernard Lyon 1.

C. Diagnostic techniques in a clinical microbiology laboratory – detecting medically important microorganisms

Lecture for medical students at the University Claude Bernard Lyon 1.

Educational outcome: Plan and organise lectures; define learning objectives; teach laboratory and microbiology topics to epidemiologists.

7. Public health microbiology management

A. Initial management in public health microbiology module, ECDC, Stockholm, Sweden

This one-week module focused on the understanding of roles and responsibilities in public health management. Topics included the identification of different management styles, team roles and team evolution, the delegation of tasks, and the provision of structured feedback.

B. Public health microbiology management components as part of regular projects

Public health microbiology management was an integral component of all projects and activities during the fellowship. This includes laboratory management, ethical and integrity considerations, team building and coordination, research collaborations, time management, management of cultural differences in international contexts, as well as working in a multidisciplinary team with microbiologist, physicians, laboratory technicians, epidemiologists, statisticians, government officials, public health officers, and logisticians.

Educational outcome: Work in a multidisciplinary public health team; understand team management; plan, schedule and organise research projects.

8. Communication

A. Peer-reviewed articles

1. Eibach D, Casalegno JS, Escuret V, Billaud G, Mekki Y, Frobert E, Bouscambert-Duchamp M, Lina B, Morfin F. Increased detection of *Mycoplasma pneumoniae* infection in children, Lyon, France, 2010 to 2011. *Euro Surveill.* 2012; 17(8):pii=20094.
2. Eibach D, Ceron N, Krishnalall K, Carter K, Bonnot G, Bienvenu AL, Picot S. Therapeutic Efficacy of Artemether-Lumefantrine treatment for *Plasmodium vivax* infections in a prospective multicentre study in Guyana. *Malaria Journal* 2012; 11:347
3. Huoi C, Casalegno JS, Bénét T, Neuraz A, Billaud G, Eibach D, Mekki Y, Rudigoz R, Massardier J, Huissoud C, Massoud M, Gaucherand P, Claris O, Gillet Y, Floret D, Lina B, Vanhems P. A report on the large measles outbreak in Lyon, France, 2010 to 2011. *Euro Surveill.* 2012; 17(36):pii=20264.
4. Casalegno JS, Le Bail Karval K, Eibach D, Valdeyron ML, Lamblin G, Jacquemoud H, Mellier G, Lina B, Gaucherand P, Mathevet P, Mekki Y. High Risk HPV Contamination of Endocavity Vaginal Ultrasound Probes: An underestimated route of nosocomial infection? *PLoS ONE.* 2012; 7(10): e48137.
5. Memish Z, Hakeem RA, Neel OA, Danis K, Jasir A, Eibach D. Invasive meningococcal disease in the Kingdom of Saudi Arabia, 1995–2011: Effect of the Hajj vaccination policy. (submitted to *Eurosurveillance*)
6. Eibach D, Casalegno JS, Bouscambert M, Bénét T, Regis C, Brigitte C, Byeul-A K, Vanhems P, Lina B. Routes of transmission during a nosocomial influenza A(H3N2) outbreak among geriatric patients and health care workers. (submitted to *Journal of Hospital Infection*)
7. Eibach D, Gossner C, Martinez Urtaza J, Westrell T, Takkinen J, Jasir A. Situation analysis of monophasic *Salmonella* Typhimurium in the EU/EEA, 2007–2011 (in final preparation)

B. Reports

1. Eibach D. Surveillance report. Invasive meningococcal disease in the Kingdom of Saudi Arabia, 1995–2011, for the Ministry of Health of the Kingdom of Saudi Arabia, 2012
2. Eibach D. Mumps outbreak report. Hospices Civils de Lyon, 2012

C. Conference presentations

Oral presentations

1. Eibach D, Ceron N, Krishnalall K, Carter K, Ringwald P, Picot S. A Common treatment for *Plasmodium vivax* and *Plasmodium falciparum*: Therapeutic efficacy of artemether-lumefantrine + primaquine in a prospective multicentre study in Guyana. *ICTMM 2012*, September 2012, Rio de Janeiro, Brazil
2. Eibach D, Mekki Y, Casalegno JS, Le Bail Carval K, Valdeyron ML, Mellier G, Lina B, Gaucherand P, Mathevet P. Risk of nosocomial transmission of high-risk human papillomavirus by endocavity ultrasound probes following low-level disinfection. *ESCAIDE 2012*, November 2012, Edinburgh, United Kingdom
3. Eibach D, Hakeem R, Kholedi A, Abdalla OM, Memish Z. Surveillance for invasive meningococcal disease in the Kingdom of Saudi Arabia, 1995–2011. *ESCAIDE 2012*, November 2012, Edinburgh, United Kingdom

Invited talks

1. Eibach D. High-risk HPV contamination of endocavity ultrasound probes following low level disinfection: An underestimated route of nosocomial infection? 10. Ulmer Symposium Krankenhausinfektionen, March 2013, Ulm, Germany
2. Eibach D. Situation analysis of monophasic *Salmonella* Typhimurium in the EU/EEA, 2007–2011. 5th European Food- and Waterborne Diseases and Zoonoses network Meeting, April 2013, Uppsala, Sweden

Poster presentations

Eibach D, Bouscambert-Duchamp M, Casalegno JS, Gazeu A, Escuret V, Mekki Y, Frobert E, Morfin F, Lina B. Clinical characteristics and macrolide resistance of *Mycoplasma pneumoniae* infections before and during the current European epidemic, 2009–2012, France. *ECCMID 2013*, April 2013, Berlin, Germany

D. Submitted abstract (ESCAIDE 2013)

Eibach D, Gossner C, Westrell T, Martinez Urtaza J, Takkinen J, Jasir A. Monophasic *Salmonella* Typhimurium in the EU: Emerging pathogen or increased awareness?

E. Other presentations

1. Eibach D, Casalegno JS. Descriptive analysis of the «Groupe Régional d'Observation de la Grippe» (GROG) Influenza surveillance database in France, 2003–2012. Institut de Veille Sanitaire, December 2012, Paris, France
2. Eibach D. Invasive meningococcal disease in Saudi Arabia, Ministry of Health of the Kingdom of Saudi Arabia, May 2012, Riyadh, Saudi Arabia
3. Eibach D. Soutien épidémiologique pour les camps de réfugiés dans Maban County, Sud-Soudan, Centre de Biologie et Pathologie Est, July 2013, Lyon, France

Modules: All modules contained communication sections and advised on communication of public health messages to different audiences, principles of scientific writing and presentations, as well as different oral communications techniques.

Educational outcome: Field investigation (outbreak) reports, scientific papers for peer-reviewed journals, oral and poster presentations at international conferences.

9. International missions

A. Epidemiological support to the Médecins sans Frontières (MSF) projects in Maban County, South Sudan

The refugee camps in Maban County experienced the start of a hepatitis E outbreak in July 2012. The fellow supported the coordination team of the three MSF projects in Maban County, South Sudan. The activities included the coordination of hepatitis E notifications and the management of the hepatitis E outbreak line list, coordination of the mortality surveillance as well as an assessment of outreach team activities (surveillance, data collection, health education) in the three camps. Mortality and hepatitis E outbreak reports were distributed on a weekly basis to the Ministry of Health of South Sudan, UNHCR and MSF headquarters.

B. Invasive meningococcal disease in Saudi Arabia

Saudi Arabia is at constant high risk for outbreaks of *Neisseria meningitidis*, due to the annual Hajj pilgrimage. The fellow worked as a consultant epidemiologist for the Saudi Ministry of Health. He prepared a plan of analysis, engaged in data cleansing, and conducted analyses based on data in the invasive meningococcal disease (IMD) surveillance database. Results show a shift away from hajj-related cases towards non-Hajj related ones, combined with a shift in the age distribution of cases, with the disease now affecting the younger age groups. A decline in the number of cases as well as an absence of new epidemics was observed following the introduction of the ACYW vaccine in 2002. Regular analysis of the surveillance database, at least annually, is necessary to implement public health measures in a timely manner and to avoid new epidemics in the future.

Educational outcome: Coordination of surveillance and active case finding activities; collaboration with the Ministry of Health; analysis of surveillance databases; writing of surveillance reports and scientific articles; scientific presentation at a conference.

10. EPIET/EUPHEM modules attended

- EPIET/EUPHEM introductory course, Menorca, Spain (three weeks)
- Computer tools in outbreak investigations, Robert Koch Institute, Berlin, Germany (one week)
- Multivariable analysis, Instituto de Salud Carlos III, Madrid, Spain (one week)
- Biorisk and quality management module, Institut Pasteur, Paris, France (one week)
- Initial management in public health microbiology, ECDC, Stockholm, Sweden (one week)
- Vaccinology, Public Health England, London, United Kingdom (one week)
- Project review module, ECDC, Stockholm, Sweden (two weeks)

11. Other courses

- Theoretical and practical biosafety level 3 (BSL3) training, Hospices Civils de Lyon, Lyon, France (12 days)
- *Salmonella spp.* subtyping methods, Instituto de Salud Carlos III, Madrid, Spain (one week)

Discussion

A. Coordinator's conclusions

One of the main goals of the EUPHEM programme is to expose the fellows to different public health experiences and activities, thus enabling them to work across various disciplines.

This report summarises all activities and projects conducted by Daniel Eibach during his two-year EUPHEM fellowship (cohort 2011) at the Centre Hospitalier Universitaire Lyon, France.

The projects described here show the breadth of public health microbiology. Outbreak and surveillance activities ranged from small local community and hospital outbreaks to the analysis of national and European surveillance databases. Outside of Europe, international missions to Saudi Arabia and South Sudan contributed to the understanding of important international public health issues. Laboratory research projects covered bacterial, viral and parasitic pathogens across a variety of disease programmes, such as vector-borne diseases, sexually transmitted diseases, respiratory tract infections, and healthcare-associated infections. Projects involved different professional groups, for example physicians, laboratory technicians, epidemiologists, statisticians, government officials, public health officers, and logisticians, strengthening the fellow's ability to work in a multidisciplinary team.

Activities were in line with the 'learning by doing' approach of the EUPHEM programme and followed the core competency domains described for mid-career and above professionals. Activities were complimented by nine training modules providing theoretical knowledge. Projects had a clear educational outcome, with results communicated in scientific journals and at conferences.

The fellow has succeeded in performing all his tasks to a very high standard and with a professional attitude.

B. Supervisor's conclusions

During the two-year fellowship, Daniel Eibach acquired a large repertoire of skills and a profound knowledge in the field of public health microbiology. He accomplished all assigned tasks in a highly competent manner, with a high degree of independence, responsibility and accuracy. We were impressed by the commitment and initiative shown by Daniel Eibach, who is also a good team player and highly appreciated by his colleagues and superiors.

C. Personal conclusions of fellow

The EUPHEM programme presents the unique opportunity to work in diverse projects across various departments, thus covering the entire field of public health microbiology in a two-year period. The fellowship successfully bridges the gap between microbiology and epidemiology by maintaining a close connection to the European Programme for Intervention Epidemiology Training (EPIET) network. EUPHEM fellows benefit from the fact that they are not restricted to conduct laboratory-based research, but instead learn to conduct field studies with the help of a multidisciplinary team. The EUPHEM programme strongly contributes to the creation of a growing public health microbiology community, enabling the fellows to establish personal networks between European public health laboratories.

Acknowledgements of fellow

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Finally, I would like to thank my EUPHEM co-fellows, EUPHEM alumnae, and EPIET colleagues from cohort 2011 for their friendship and for creating a great team spirit.