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EDITORIAL

Editorial

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I would like to bring to your attention three recent publications in "Journal of Industrial Microbiology and Biotechnology" (JIMB) and one by JIMB Senior Editor Erick Vandamme in another report that I believe will be of interest to a broad spectrum of SIM members, JIMB readers, and the industrial microbiology/biotechnology community in general. The first two are recent reviews published in JIMB dealing with our old friends the actinomycetes, their manipulation for strain improvement and natural products. The third IS a review on current uses of continuous culture techniques. The fourth is a major "Position Paper" on biomass and its uses recently published by the Belgian Royal Academy of Science and the Arts, Class of Technical Sciences. These reports are all "state of the art"; I think you will enjoy all four.

The first review is, "Current approaches to exploit actinomycetes as a source of novel natural products" by O. Genilloud, I. Gonzalez, O. Salazar, J. Martin, J.R. Tormo, and F. Vicente.

J Ind Microbiol Biotechnol (2011) 38:375–389, doi:10.1007/s10295-010-0882-7. http://www.springerlink.com/content/wq17383723148826/fulltext.html.

Abstract

For decades, microbial natural products have been one of the major sources of novel drugs for pharmaceutical companies, and today all evidence suggests that novel molecules with potential therapeutic applications are still waiting to be discovered from these natural sources, especially from actinomycetes. Any appropriate exploitation of the chemical diversity of these microbial sources relies on the proper understanding of their biological diversity and other related key factors that maximize the possibility of successful identification of novel molecules. Without doubt, the discovery of platensimycin has shown that microbial natural products can continue to deliver novel scaffolds if appropriate tools are put in place to reveal them in a cost-effective manner. Whereas today innovative technologies involving exploitation of uncultivated environmental diversity, together with chemical biology and in silico approaches, are seeing rapid development in natural products research, maximization of the chances of exploiting chemical diversity from microbial collections is still essential for novel drug discovery. This work provides an overview of the integrated approaches developed at the former Basic Research Center of Merck Sharp and Dohme in Spain to exploit the diversity and biosynthetic potential of actinomycetes, and includes some examples of those that were successfully applied to the discovery of novel antibiotics.

The second review is "Strain improvement in actinomycetes in the postgenomic era" by Senior Editor Richard H. Baltz. J Ind Microbiol Biotechnol (2011) doi:10.1007/s10295-010-0934-z. http://www.springerlink.com/content/mm02855532776506/fulltext.html.

Abstract

With the recent advances in DNA sequencing technologies, it is now feasible to sequence multiple actinomycete genomes rapidly and inexpensively. An important observation that emerged from early Streptomyces genome sequencing

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projects was that each strain contains genes that encode 20 or more potential secondary metabolites, only a fraction of which are expressed during fermentation. More recently, this observation has been extended to many other actinomycetes with large genomes. The discovery of a wealth of orphan or cryptic secondary metabolite biosynthetic gene clusters has suggested that sequencing large numbers of actinomycete genomes may provide the starting materials for a productive new approach to discover novel secondary metabolites. The key issue for this approach to be successful is to find ways to turn on or turn up the expression of cryptic or poorly expressed pathways to provide material for structure elucidation and biological testing. In this review, I discuss several genetic approaches that are potentially applicable to many actinomycetes for this application.

The third is a review by our Senior Editor Alan T. Bull "The renaissance of continuous culture in the post-genomics age" J Ind Microbiol Biotechnol (2010) doi:10.1007/s10295-010-0816-4. http://www.springerlink.com/content/l5068738m0vn667p/fulltext.html.

Abstract

The development of continuous culture techniques 60 years ago and the subsequent formulation of theory and the diversification of experimental systems revolutionized microbiology and heralded a unique period of innovative research. Then, progressively, molecular biology, and thence genomics and related high-information-density omics technologies, took center stage and microbial growth physiology in general faded from educational programs and research funding priorities alike. However, there has been a gathering appreciation over the past decade that if the claims of systems biology are going to be realized, they will have to be based on rigorously controlled and reproducible microbial and cell-growth platforms. This revival of continuous culture will be long lasting because its recognition as the growth system of choice is firmly established. The purpose of this review, therefore, is to remind microbiologists, particularly those new to continuous culture approaches, of the legacy of what I call the first age of continuous culture, and to explore a selection of researches that are using these techniques in this post-genomics age. The review looks at the impact of continuous culture across a comprehensive range of microbiological research and development. The ability to establish (quasi-) steady-state conditions is a frequently stated advantage of continuous cultures thereby allowing environmental parameters to be manipulated without causing concomitant changes in the specific growth rate. However, the use of continuous cultures also enables the critical study of specified transition states and chemical, physical, or biological perturbations. Such dynamic analyses enhance our understanding of microbial ecology and microbial pathology for example, and offer a wider scope for innovative drug discovery; they also can inform the optimization of batch and fed-batch operations that are characterized by sequential transitions states.

The paper by Erick J. Vandamme, Chief Author and Editor, is a major "Position paper" on biomass and its uses just published by the Belgian Royal Academy of Science and the Arts, Class of Technical Sciences, BACAS, (www.kvab.be), entitled : "Industrial Biomass: Source of Chemicals, Materials and Energy!". Vandamme Erick J., Anthonis Tom, Dobbelaere Sofie et al., February 2011, p.40; KVAB D/2011/0455/02 ISBN 978906569077 http://www.kvab.be/standpunten.aspx.

Although this report is Euro-centric, it should be of great interest to all working in the areas of renewable fuels, materials, and chemicals. Erick J. Vandamme is also a Senior Editor for JIMB.

Executive summary of this report

Biomass seemed a very promising resource for substituting fossil hydrocarbons as a renewable source of energy and as a sustainable raw material for various industrial sectors. However, during the first decade of the 21st century, competition between the use of biomass for food and feed on the one hand, and for energy and industrial applications on the other hand, became a controversial issue. Dramatic food price rises in the first half of 2008 were blamed on the use of arable land for the production of first-generation biofuels at the expense of food and feed. On purpose, the present report does not focus on the food and feed issue, but examines thoroughly the implications and limitations of the use of non-food (industrial) biomass as a source of chemicals, materials, and energy. For its analysis, the BACAS report started from the now widely accepted "5 F-Cascade", a list of priorities regarding the use of biomass:

1. Food and feed
2. Fine and bulk chemicals and pharma
3. Fiber and biomaterials
4. Fuels and energy
5. Fertilizers and soil conditioners

The authors have covered the impact of an increasing use of industrial (or technical) biomass as a renewable resource for various industrial sectors and for energy generation. The use of biomass as a renewable primary energy source will be of key importance for achieving the 20/20/20 targets of the European Union (EU), i.e., use of at least 20% of renewables for energy production, 20%

less greenhouse gas emissions, and 20% more efficient energy use by the year 2020: biomass is expected to provide two-thirds of the renewable energy target by 2020. The report starts with an overview of state-of-the-art chemical, thermochemical, and bio-processes and technologies for converting and "bio-cracking" industrial biomass. Next, it focuses in detail on the "5 F-Cascade" of applications of biomass and on the legislation affecting the bio-based economy. Finally, a number of recommendations are formulated meant for government, industry, research, and development agencies. The EU's Common Agricultural Policy (CAP) should develop an integrated policy for the bio-based economy, including the removal of the still-existing trade barriers, a scientifically substantiated policy with regard to genetically modified crops and sustainability criteria. The public and private scientific communities are urged to set up public–private partnerships in order to support coordinated research programs, in particular with regard to feedstock yields and biomass optimization in view of maximizing the efficiency of processes converting biomass into energy or/and industrial products.

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