CYANONEWS

Volume 13 Number 1 July 1997

CYANONEWS - a newsletter intended to provide cyanobacteriologists with a forum for rapid informal communication, unavailable through journals. Everything you read in this newsletter is contributed by readers like yourself. Published occasionally, two or three times per year.

SUBSCRIPTIONS - No charge for electronic version. $10/year for hard copy (see address label for expiration date). See last page for details.

CONTRIBUTIONS - Expected every couple of years: a new result, an upcoming meeting or a summary of a past meeting, a post-doctoral opening, a new publication, a request for strains, a change of life... something. See last page for addresses you can send news to.

HOW TO FIND OUT MORE ABOUT SOMETHING YOU READ Each news item contains, prominently displayed, the name of a contact person. A Directory of Cyanobacteriologists is distributed every two years or on request.

INSTRUCTIONS TO AUTHORS - Send news.

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Cyanobacteria on the World Wide Web

The past couple of issues of *CyanoNews* have featured different sites on the world wide web having some relation to cyanobacteria. What follows is a continuation of what must be considered a highly incomplete listing. If you have run across a web site (maybe your own!) that describes some aspect of cyanobacteriology, please send it in.

CYANOSITE: In addition to useful protocols and other matters of cyanobacterial concern, Cyanosite now makes available a bibliography of references of interest to the cyanobacterially inclined. The list, called CyBib v1.0, contains 4148 references at last count, is downloadable in formats compatible with most platforms, and can be directly imported into commercial reference managing programs. It cannot at this time be searched directly at the web site. To download the bibliography, you must have UNZIP (or equivalent), a program that can bring compressed files back to their original form. Also, be warned that the file is huge, causing problems for those who are unable to receive large files.
http://WWW-Cyanosite.Bio.Purdue.Edu

TOXIC CYANOBACTERIA SITE: Ben Long is trying to expand the site to include a page devoted to common methods used in cyanotoxin research. If you have a protocol or method that you wish to share with others or ia request for help on a particular subject, contact Ben (FAX: 61-3-9479-1188; E-MAIL: BotBML @Lure.Latrobe.Edu.Au) and he'll post it on the web page.
http://Luff.Latrobe.Edu.Au/~BotBML/Cyanotox. Html

CYANOBASE SITE: The complete sequence of *Synechocystis* PCC 6803 is now available. So is much else regarding analysis of the sequence. You can scan the sequence on line, looking for regions similar to a sequence you submit.
http://www.kazusa.or.jp/cyano/cyano.html

RECONSTRUCTION OF *SYNECHOCYSTIS*: Those who want some help in wading through the 3.57 Mb sequence of *Synechocystis* (see CYANOBASE) might also pay a visit to a site put together by Natalia Maltsev and Bob Haselkorn. They have attempted to reconstruct the metabolic capabilities of *Synechocystis* through an analysis of its sequence. The site is still evolving, and anyone with additions or corrections is invited to submit them to Natalia (Maltsev@mcs.anl.gov).

Genes organized by metabolic function:
www.mcs.anl.gov/home/compbio/wit/Summaries/Synechocystis_sp./metabolism.html

Discussion of metabolic pathways:
www.mcs.anl.gov/home/compbio/wit/synechocystis.html

PASTEUR CULTURE COLLECTION: The PCC now has a web site describing strains within its collection.
http://www.pasteur.fr/Bio/PCC/

ALGAL TOXINS FORUM: The Foundation for Water Research / Algal Toxins Forum has as its aim to facilitate the coordination of research activity on algal toxins occurring in recreational and potable waters in the UK.
http://www.atlas.co.uk/listons/algaltox.htm

NUTRITIONAL ALGAE: Those interested in the nutritional uses of *Aphanizomenon flos-aquae* can pay a visit to a page featuring the comments of William Barry. Links from this page puts you in contact with other aspects, both medicinal and business.
http://www.dnai.com/~algae/algae70.html

Matters Arising

The 1997 Directory of Cyanobacteriologists is available in draft form from the FTP site given below. After a couple of months to allow additions and corrections to accumulate, a final version will be posted at the FTP site, CyanoSite, the Toxic Cyanobacteria site, and perhaps elsewhere.

FTP SITE: Cyanonew@Servax.Fiu.Edu
CYANOSITE: WWW-CyanoSite.Bio.Purdue.Edu
TOXIC CYANOBACTERIA SITE: Luff.Latrobe.Edu.Au / ~BotBML / Cyanotox.Html

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Micronostix, currently a private lab but soon to be a nonprofit foundation, is the brainchild of Norman Lazaroff. The foundation will obtain, maintain, and distribute cultures of axenic, photoinducible cyanobacteria. At present, most strains in the collection are Nostocaleans chosen for their abilities to form motile hormogonia in response to red-light and for their interesting morphogenetic characteristics. In addition, there are also antibiotic or regulatory mutants. If you think you might someday wish to avail yourself of the cultures in the collection, now is an excellent time to say so, since expressions of interest may be used to convince funding agencies to support the endeavor.

CONTACT: Norman Lazaroff, Micronostix, 312 Front St., Vestal, NY 13850 U.S.A. TEL,FAX: 1-607-785-3093;
E-MAIL: Nostoc@Bingvmb.Cc.Binghamton.Edu

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Uli Fischer has brought to our attention that there exists an extensive culture collection of unicellular and filamentous cyanobacteria (about 80 strains) at the Marine Microbiology Department at Bremen University. The organisms were isolated and enriched from German shallow coastal waters of the southern Baltic Sea. Characterization and classification of the isolates were done with axenic cultures.

CONTACT: Uli Fischer, Universität Bremen, FB2, Zentrum für Umweltforschung und Technologie, Abteilung Marine Mikrobiologie, Leobener Strasse, 28359 Bremen, GERMANY.
TEL: 49-421-218-7221; FAX: 49-421-218-7222;
E-MAIL: Marina@Biotec.Uni-Bremen.De

As part of an ongoing effort to assess the effects of water treatment processes on algal toxin release, Bill Parr is surveying reputed anatoxin-a producers for their abilities to produce toxin. He has found many strains now produce negligible concentrations ($< 10\ \mu g / l$) of toxin either intracellularly or extracellularly, as judged by HPLC. Others (e.g. Geoff Codd and Jeff Zeicus) have also found that their anatoxin-a-producing strains spontaneously stopped producing this toxin.

Bill would like to extend the survey to other anatoxin-a-producing strains whose ability to produce the toxin has recently been demonstrated or reconfirmed. Anyone willing to send him such strains should contact him.

CONTACT: Bill Parr, Water Research Centre Plc, Henley Road, Medmenham, Marlow, Bucks SL7 2HD, U.K.
TEL: 44-1491-571531; FAX: 44-1491-579094);
E-MAIL: Parr_W@Wrcplc.Co.Uk

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Pascal Meunier has put together a hefty collection of references (2200 at present) related to photosynthesis, but it's still not large enough for his tastes. He wants to know if others might like to pool their references with his to create a giant, freely distributable data base. His collection is in Reference Manager format..

CONTACT: Pascal Meunier, Dept. of Biological Sciences, Purdue University, West Lafayette, IN 47907 U.S.A. TEL: 317-494-0560; FAX: 317-496-1496; E-MAIL: PMeunier@Bilbo.Bio.Purdue.Edu

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A pamphlet entitled *A Decade of Cyanobacterial Research in India (1985-'95)* has been published, based on information compiled by P. Malliga and G. Subramanian. The pamphlet is broken up into three parts: published articles (subdivided into areas of interest), culture collections (listing several hundred strains), and addresses of researchers. The ultimate goal is to maintain the database in a form accessible electronically.

CONTACT: G. Subramanian, National Facility for Marine Cyanobacteria, Bharathidasan University, Tiruchirapalli - 620 024, INDIA. TEL: 91-431-896351; FAX: 91-431-96245

The Journal of Scientific & Industrial Research has published a special issue (Volume 55, Numbers 8-9, Aug-Sep 1996) devoted to Cyanobacterial Photosynthesis: Concepts and Applications. It contains fifteen reviews on topics of both theoretical and practical interest, encompassed by a very liberal interpretation of "photosynthesis". In the first category, for example, are general reviews on electron transport, cyanobacterial toxins, and the ecology of freshwater and terrestrial cyanobacteria. Articles in the second category include reviews of biotechnological applications of cyanobacteria in pollution control and applications of genetic techniques towards various applied goals. A single copy costs US$100.

CONTACT: Publications & Information Directorate, KS Krishnan Marg, New Delhi 110 012, INDIA. TEL: 91-11-5746024; FAX: 91-11-5787062; E-MAIL: Pid@Sirnetd.Ernet.In

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Cyanobacterial Nitrogen Metabolism & Environmental Biotechnology (ISBN 3-540-61305-6), is a newly released volume edited by Ashwani K Rai. It combines basic as well as applied aspects, both environmental and biotechnological.

CONTACT: Springer for Science, P.O.Box 503,1970AM Ijmuiden, THE NETHERLANDS; E-MAIL: Orders@Springer.De

OR Narosa Publishing House, 6 Community Centre, Panchsheel Park, New Delhi-110017, INDIA

Spirulina Platensis (Arthrospira): Physiology, Cell-biology and Biotechnology, edited by Avigad Vonshak, has just been published. The first part of the book focuses on the physiology, morphology, photosynthesis and genetics of laboratory cultures. Part two discusses the practical uses of *Spirulina* in biotechnology. Chapters discuss the cultivation of the cyanobacterium in closed photobioreactors, mass cultures in open outdoor ponds, and uses in wastewater treatment, offering critiques of the problems encountered and discussions of the future commercial prospects for large scale production.

TO ORDER, CONTACT: Taylor & Francis, Rankine Road, Basingstoke, Hampshire RG24 8PR, U.K. TEL: 44-1256-813000; FAX: 44-1256-479438; E-MAIL: BookOrders@Tandf.Co.Uk; WEB: www.tandf.co.uk

FOR MORE INFORMATION, CONTACT: Huw.Neill@Tandf.Co.Uk

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Volume 4 of *Advances in Photosynthesis*, edited by D.R.Ort and C.F.Yocum, entitled *Oxygenic Photosynthesis: The Light Reactions*, has now been released by Kluwer Academic Publishers. Its ISBN is: 0-7923-3684-4 (paper back); 0-7923-3683-6 (hard-cover).

CONTACT: Kluwer Academic Publishers, 101 Philip Drive, Norwell, MA 02061, U.S.A.

or PO Box 322, 3300 AH Dordrecht, The Netherlands.

Meetings

(Anyone wishing to contribute a report on any meeting of cyanobacterial relevance is cordially invited to do so!)

Perhaps it's not too late to get to the VIth INTERNATIONAL PHYCOLOGICAL CONGRESS in Leiden, Netherlands, 9-16 Aug, 1997. There will be several contributions of cyanobacterial interest, including talks ranging from photosynthesis to integrated water management. The cost of registration is Dfl 550 (Dutch guilders), or Dfl 275 for students.

CONTACT: Leids Congress Bureau P.O. Box 16065 2301 GB Leiden The Netherlands. Tel: 31-71-5148203; Fax: 31-71-5128095, E-mail: Prudhomme@RuLrhb.LeidenUniv.NL or C.van.Hoek@Biol.Rug.NL; Web: Seaweed.Ucg.ie/Phycologia/SixthIPC. HTML

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Rounding out the summer is the IXth INTERNATIONAL SYMPOSIUM ON PHOTOTROPHIC PROKARYOTES, 6-12 September 1997, University of Vienna, Austria.

CONTACT: Symposium Secretariat, IXth ISPP Vienna 1997, Institute of Physical Chemistry, University of Vienna, UZA2, Althanstrasse 14, A-1090 Vienna, AUSTRIA. E-MAIL: Georg.Schmetterer@UniVie.Ac.At

An International Symposium on MARINE CYANOBACTERIA and related organisms is scheduled for 24-28 November 1997 at the Institut Oceanographique in Paris. The symposium will focus on new techniques that have become available over the past few years, such as molecular phylogeny and cell sorting, and symposia will be devoted to the following topics: taxonomy and phylogeny, environment, nutrient relations, productivity, harmful blooms and natural products, aquaculture and genetic manipulation. The registration fee is 2,000 French francs.

CONTACT: Looc Charpy, ORSTOM, Centre d'Océanologie de Marseille, Rue de la Batterie des Lions, 13007 France. FAX (before 18 Oct): 33-91.04.16.35; FAX (after 18 Oct): 33-04.91.04.16.35; E-MAIL: Charpy@Orstom.Rio.Net; WEB (French): htpp://com.univ-mrs.fr/orstom/charpy.html WEB (English): http://com.univ-mrs.fr/orstom/charpy_e.html

The VITH CYANOBACTERIAL WORKSHOP is scheduled for July 24-27, 1998. The Workshop has evidently found a home, since it, like its previous two incarnations, will be held at the Asilomar Conference Center, California

CONTACT: Susan Golden, Texas A&M University, Department of Biology, College Station, TX 77843-3258 U.S.A. TEL: 409-845-9824; FAX: 409-845-2891; E-MAIL: SGolden@Tamu.Edu

or Stephanie Curtis, Dept. of Genetics, Box 7614, North Carolina State University, Raleigh, NC 27695 U.S.A. TEL: 919-515-5747; FAX: 919-515-3355; E-MAIL: SECurtis@Ncsu.Edu

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The XITH INTERNATIONAL CONGRESS ON PHOTOSYNTHESIS will take place August 15-20, 1998, in Budapest, Hungary. Current information on the Congress and its satellites, including an electronic pre-registration form, can be obtained from either of the two web sites listed below. Potential participants seeking for financial assistance should approach the appropriate UNESCO regional or country offices.

CONTACT: Secretariat of the XIth International Congress on Photosynthesis, Biological Research Center, Hungarian Academy of Sciences, H-6701 Szeged, P.O.Box 521 HUNGARY. TEL: 36-62-433-131 or 432-232/ext 244; FAX: 36-62-433-434 or 432-576, E-MAIL: Photosyn@Everx.Szbk.U-Szeged.Hu
WEB: http://biophy.physx.u-szeged.hu/photosyn.htm
WEB: http://www.life.uiuc.edu/plantbio/ispr

The VIIITH INTERNATIONAL SYMPOSIUM ON MICROBIAL ECOLOGY will be held 9-14 Aug 1998 in Halifax. Some of the many topics that will be covered in symposia are molecular evolution and phylogeny, anaerobic ecosystems, biogeochemistry, plant-microbe interactions, and attached microorganisms.

CONTACT: Colin Bell, E-MAIL: ISME8@acadiau.ca;
WEB: Dragon.Acadiau.Ca/~CBell/isme8.html

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For those who are arranging their schedules for Fall of 1999, both the Second EUROPEAN PHYCOLOGICAL CONGRESS (EPC 2) and the 8th INTERNATIONAL CONFERENCE ON APPLIED ALGOLOGY (8th ICAA) will be held in Montecatini Terme (Italy), the EPC 2 on 20-26 September and the 8th ICAA on 26 September - 1 October 1999.

CONTACT EPC 2 Secretariat: Francesco Cinelli, Dipartimento di Scienze dell'Uomo e dell Ambiente, Università di Pisa, Via A. Volta, 6; I-56126 Pisa, ITALY. TEL: 39-50-23054; FAX: 39-50-49694; E-MAIL: Cinelli@Discat.Unipi.it

CONTACT 8th ICAA Secretariat: Mario Tredici, Dipartimento di Scienze e Tecnologie, Alimentari e Microbiologiche - Università di Firenze, P.le delle Cascine, 27, I-50144 Firenze, ITALY.
TEL: 39-55-3288306; FAX: 39-55-330431;
E-MAIL: Tredici@Csma.Fi.Cnr.it

Positions Offered

POSITION OFFERED: Post-Doc
CONTACT: Fevzi Daldal, University of Pennsylvania, Department of Biology, 204 Mudd Bldg., Philadelphia PA 19104-6018, U.S.A. TEL: 1-215-898-4394; FAX: 1-215-898-8780;
E-MAIL: FDaldal@Sas.UPenn.Edu;
WEB: http://www.sas.upenn.edu/biology/
RESEARCH: Structure, function, regulation and biogenesis of cytochrome complexes of photosynthetic bacteria, with emphasis on molecular genetic and biochemical approaches. [See references on cytochrome c_y [J Bacteriol (1995) 177:608-6139], cytochrome bc_1 complex [Biochemistry (1994) 34:15979-16012; Biochim Biophys Acta (1996) 1275:61-69], cytochrome cbb_3 oxidase [Biochem (1993) 33:3120-3127], and cytochrome *c* biogenesis [J Bacteriol (1996) 178:5279-5290].
REQUIREMENTS: Solid background in either bacterial molecular genetics or protein biochemistry and spectroscopy, and a desire to learn multi-disciplinary approaches.
SEND: CV, description of research accomplishments, and references.

POSITION OFFERED: Post-Doc
CONTACT FOR INFORMATION:
Tony Crofts, Center for Biophysics and Computational Biology, 388 Morrill Hall, 505 S. Goodwin, Urbana IL 61801, U.S.A.,
TEL: 1-217-333-2043;
FAX: 1-217-244-6615; E-MAIL: A-Crofts@Uiuc.Edu;
WEB: http://ahab.life.uiuc.edu/
or Govindjee, E-MAIL: Gov@Uiuc.Edu;
WEB: http://www.life.uiuc.edu/govindjee/
CONTACT TO APPLY: Colin Wraight, Director, Integrative Photosynthesis Training Grant, Department of Plant Biology, 190 ER Madigan Laboratory, 1201 West Gregory Drive, Urbana, IL 61801, U.S.A. Mark application CROFTS-GOVINDJEE position
RESEARCH: Biophysical, molecular engineering and biochemical studies of the mechanism of photoprotection by plants and algae.
REQUIREMENTS: U.S. citizen or permanent resident
SEND: Personal vitae, a brief statement of research interests and experience

POSITION OFFERED: Post-Doc (many available)
CONTACT: Patrick J. Burkhart, Office of the Senior Vice President and Provost, Arizona State University, Tempe, AZ 85287-3403, U.S.A.
WEB: Photoscience.La.asu.edu / photosyn / ingenhousz
RESEARCH: Aim is to catalyze interactive research between groups in engineering, the chemical and life sciences, and industry, applications
AVAILABLE: Initial appointments will be 1.5 - 2 years, extendible.
SEND: Letter, a detailed curriculum vitae, and list of the names, addresses and telephone numbers of three professional references

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POSITION OFFERED: Industrial Liaison
CONTACT: Patrick J. Burkhart, Office of the Senior Vice President and Provost, Arizona State University, Tempe, AZ 85287-3403, U.S.A.
WEB: Photoscience.La.Asu.Edu / Photosyn / Ingenhousz
REQUIREMENTS: Expected to have academic and industrial experience in a field related to light-driven biological or chemical processes, and / or to have extensive industrial experience and a keen interest in science.
SEND: Letter, a detailed curriculum vitae, and list of the names, addresses and telephone numbers of three professional references

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POSITION OFFERED: Post-Doc
CONTACT: Parag R. Chitnis, Department of Biochemistry and Biophysics, 4156 Molecular Biology Building, Iowa State University, Ames, IA 50011 U.S.A. FAX: 1-515-294-0453;
E-MAIL: Chitnis@iastate.Edu;
WEB: molebio.iastate.edu / bbhtml / chitnis.html
RESEARCH: Structure-function relations in photosystem I. The research will involve site-directed and random mutagenesis in *Synechocystis* sp. PCC 6803.
REQUIREMENTS: Experience in molecular biology, protein biochemistry, cyanobacterial molecular genetics, and / or photosynthesis research is desirable.
SEND: resume and the names, E-Mail addresses and phone numbers of three referees.

POSITION OFFERED: Post-Doc
CONTACT: Larry Orr, Admin. Associate, Dept. of Chemistry and Biochemistry, Arizona State University, Tempe, AZ 85287-1604, U.S.A.
TEL: 602-965-1963; FAX: 602-965-2747;
E-MAIL: Larry.Orr@ASU.edu;
WEB: photoscience.la.asu.edu / rtg
RESEARCH: Light-driven biochemical mechanisms and their application to the engineering of new electronic, optical, chemical, or biological devices. See the web site for more information.
REQUIREMENTS: U.S. citizen or U.S. permanent resident.

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POSITION OFFERED: Post-Doc
CONTACT: Mike Evans, Dept of Biology, University College London, Gower St, London WC1E 6BT, U.K. TEL: 44-171-380-7312; FAX: 44-171-380-7096;
E-MAIL: Mike.Evans@Ucl.Ac.Uk
RESEARCH: Spectroscopic analysis of the quinone (A1) binding site in photosystem 1, using EPR, ENDOR, pulsed EPR and FTIR to analyze quinone protein interactions in wild-type and mutant PS1 reaction centers.
REQUIREMENTS: A background in biophysics, biochemistry or physical chemistry, with experience of advanced spectroscopic techniques would be an advantage.
SEND: Application, including CV and names of two referees.

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POSITION OFFERED: Senior faculty (3 positions)
CONTACT: Patrick J. Burkhart, Office of the Senior Vice President and Provost, Arizona State University, Tempe, AZ 85287-3403, U.S.A.
WEB: Photoscience.La.Asu.Edu / Photosyn / Ingenhousz
RESEARCH: Highly visible programs in areas that may include light-mediated aspects of: molecular electronics, biomolecular devices, biotechnology, bioremediation, and biomedical research.
SEND: Letter, a detailed curriculum vitae, and list of the names, addresses and telephone numbers of three professional references

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KARIN NYHUS, formerly a graduate student in Himadri Pakrasi's lab at Washington University, St. Louis, is now at Veteran's Administration Hospital, Richmond, Virginia, investigating the possibility of using *Anabaena* in organ transplants… no, just a fantasy. Unfortunately she's left our field, having turned her attentions to pathogenic yeast.

Dept. of Research Services, Hunter Holmes McGuire Dept. of Veterans Affairs Medical Center, Box 151, Richmond VA

ALEXEY VEPRITSKIY is continuing his slow journey from the middle of the U.S. to its eastern seaboard, having moved from Peter Wolk's lab at Michigan State University to the lab of Tanya Kuritz in Oak Ridge, Tennessee, and now to New York, to work with Sandy Nierzwicki-Bauer.

Department of Biology, Science Center Building, Rensselaer Polytechnic Inst., Troy, NY 12180-3590 U.S.A. TEL: 1-518-276-8440; FAX: 1-518-276-2344; E-MAIL: VepriA@Rpi.Edu

WOLFGANG HESS has moved from Roscoff to Humboldt University-Berlin

Humboldt-University Berlin, Institute of Biology / Genetics, Chaussestr. 117, D-10115 Berlin GERMANY.
TEL: 49-30-2093-8144 / -8145 / -8146; FAX 49-30-2093-8141;
E-MAIL: Wolfgang=Hess@Rz.HU-Berlin.De or Wolf.Hess@Snafu.Berlin.De

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CONRAD MULLINEAUX is now at University College London, where he hopes to stay for the foreseeable future.

Dept. of Biology, University College London, Darwin Building, Gower Street, London WC1E 6BT, UK.
TEL: 44-171-387-7050 x2326; FAX 44-171-380-7096;
E-MAIL: C.Mullineaux@UCL.Ac.Uk

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SVEN JANSON has left Birgitta Bergman's lab in Stockholm for a post-doc with Jeff Elhai at University of Richmond, studying nitrogen fixation in the marine cyanobacterium *Microcoleus* sp.

Department of Biology, University of Richmond, Richmond VA 23173 U.S.A. TEL: 1-804-289-8412; FAX 1-804-289-8233;
E-MAIL: Sjanson@Richmond.Edu

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ANDREY MATVEYEV has also left Birgitta's lab for Stockholm West. He is working with Jeff Elhai on the association of a *Nostoc* with wheat.

Department of Biology, University of Richmond, Richmond VA 23173 U.S.A. TEL: 1-804-289-8412; FAX 1-804-289-8233;
E-MAIL: AMatveye@URVax.URich.Edu

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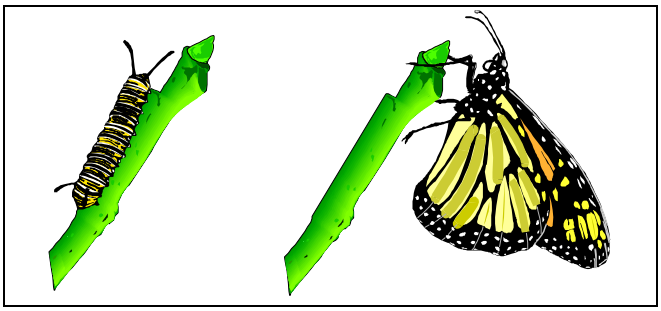
MARK SCHNEEGURT has traded a post-doc position at Purdue University for one a hundred miles north at Notre Dame, doing research in environmental microbiology.

Dept. of Biological Sciences, University of Notre Dame, Notre Dame IN 46556 U.S.A. E-MAIL: Mark.A.Schneegurt.1@ND.Edu



SHI LIANG has also switched post-doc positions, moving from Wayne Carmichael's lab at Wright State University to work with Peter Kennelly at Virginia Polytechnic. He will be studying protein phosphorylation in prokaryotes, including cyanobacteria.

Virginia Polytechnic Institute and State University, Dept. of Biochemistry and Anaerobic Microbiology, Blacksburg VA 24061 U.S.A. E-MAIL: LiangShi@Vt.Edu

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ANNICK WILMOTTE has returned to the academic life, leaving the Vlaamse Instelling voor Technologisch Onderzoek (VITO) for the University of Liège. She remains committed to the study of cyanobacterial taxonomy and evolution.

Lab of Algology, Mycology, and Experimental Systematics, Dept of Botany B22, University of Liège, B-4000 Liège, BELGIUM. TEL: 32-4-366-38-56; FAX 32-4-366-28-53;
E-MAIL:AWilmotte@ULg.Ac.Be

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TINEKE BURGER-WIERSMA has reversed Annick's path, leaving academia and the University of Amsterdam to work in a small consulting firm that specializes in the ecology and toxicology of surface waters.

AquaSense, P.O. Box 95125, 1090 HC Amsterdam, The NETHERLANDS. TEL: 020-5922244, FAX 020-5922249;
E-MAIL: TBurger@Aquasense.Com

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Anabaena knows where mosquitos live

The crystal protein found within *Bacillus thurengiensis* var. israelensis (*Bti*) is toxic to mosquitos, but its application to the control of populations is limited to the short persistence of *Bti* in waters where mosquitos breed. Wu Xiaoqiang and Sammy Boussiba (Ben Gurion U.) tells us of their efforts to extend the effectiveness of *Bti* toxin by expressing it in a cyanobacterium.

Genes *cryIVA*, *cryIVD*, and *cryIVR*, encoding the δ-endotoxin from *Bti*, was subcloned in various combinations into a plasmid, pRL488p, carrying the *Nostoc* replicon pDU1, placed downstream from the strong promoter of *psbA* taken from *Amaranthus hybridus*. The recombinant plasmids were transferred into *Anabaena* PCC 7120 by conjugation. The resulting strains were tested for their abilities to kill larvae of the mosquito *Aedes aegypti*. Plasmids carrying *cryIVA*, with or without the other *cry* genes, killed 95% to 100% of the mosquito larvae, while *cryIVD* alone was much less efficient.

Many groups have expressed *Bti* toxin and related toxins in laboratory strains of cyanobacteria [Chungjatupornchai (1990) Curr Microbiol 21:283-288; Murphy & Stevens (1992) Appl Environ Microbiol 58:1650-1655; Soltes-Rak et al (1993) Appl Environ Microbiol 59:2404-2410; Xu et al (1993) FEMS Microbiol Lett 107:247-250], but the question has remained whether these strains can persist in the field [Sangthongpitag et al (1996) Biotechnol Lett 18:175-180]. Wu and coworkers are working to move the plasmids they have tested to *Anabaena siamensis*, a strain originally isolated from a rice field in Thailand. The strain might be well suited to bring the toxin to the areas most affected by malaria.

Insecticidal peptides found in *Scytonema*

The cyanobacteria are a rich source of bioactive compounds, and a great deal of effort has been expended documenting their effects on humans and other mammals. Many laboratories have sought to expand the cyanobacterial arsenal by expressing in blue-greens genes encoding toxins from *Bacillus thurengiensis*, thereby making the organisms toxic to certain classes of insects. P. Sathiyamoorthy (Ben Gurion University) and S. Shanmugasundaram (Madurai Kamaraj University), wondered whether cyanobacterial toxins were already sufficient for that task. Their screen turned up a toxin from the cyanobacterium *Scytonema* MKU 106, active against a major agricultural pest.

The active substance was purified and found to be a glycine-rich peptide. The small peptide (molecular weight less than 12 kDa) had a UV absorption maximum at 228 nm. A 0.001% preparation of crude peptide killed 80% of a population of American boll worm (*Helicoverpa armigera*) after 84 h of treatment. Purified peptide gave a mortality rate half that of the crude preparation. A higher concentration (0.01%) was able to kill larvae of leaf rollers (*Stylepta derogata*) on cotton crops. The toxicity of the peptide to mammals has not been determined.

Livestock Poisoned from Surprising Source

Eight reported incidents since 1993 mark the first times that cyanobacteria have been implicated in the poisoning of livestock in the south and southwestern regions of South Africa. Bill Harding (Scientific Services, South Africa) has compiled a summary of these poisonings and notes some surprises.

First, although *Microcystis* and *Anabaena* species generally dominate cyanobacterial blooms in the region, some of the incidents could be attributed to toxic *Oscillatoria*. In these cases, the toxin was identified as a hydrophobic microcystin that was toxic at significantly lower levels than hydrophilic microcystins. In one case, the level of the hydrophobic microcystin was only 71 mg/l, while in cases with hydrophilic microcystins, the level was typically around 1500 mg/l.

Second, the cyanobacterial source of the toxin was sometimes identified as mats on the wall of dams or cement drinking troughs, rather than buoyant scums. Clearly, the agricultural community in South Africa must now have heightened vigilance towards the appearance of toxic cyanobacteria and must not be lulled into a false sense of security by the absence of obvious blooms

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The Origins of Genera

Where did what we now call “cyanobacteria” come from? That's a deep question, one that will occupy many of us for a long time to come. But, what we now call cyanobacteria – their names – where did *they* come from? This would seem to be the easier question, since we humans made up those names ourselves, and a relatively short time ago. But, as it turns out, not so.

The names of most cyanobacteria are readily comprehensible. Naturally enough, most generic names describe how the organism looks. Some filamentous cyanobacteria are *-thrixes* ("hairlike"): *Calo-* ("beautiful"), *Tolypo-* ("wooly"), or *Prochloro-* ("primitive and green"). Others are "*-nemas*" ("threads"): *Scyto-* (leathery) or *Plecto-* ("twisted"). Some cyanobacteria are named after a father of cyanobacteriology: *Fischerella* (B. Fischer, 1852-1915) or *Lyngbya* (HC Lynbgye, 1782-1837). Bergey's Manual is a good source for such insights.

One genus stands out, however. Bergey's Manual throws up its hands when confronted with *Nostoc* ("origin uncertain", it says, Greek for "haven't a clue"). It is difficult to guess even from what language the name comes.

Malcolm Potts has recently proposed a solution to this dilemma [Internatl J Syst Bacteriol (1997) 47:584], tracing the origins of "*Nostoc*" back to the 15th century alchemist, Paracelsus. Paracelsus was a native German speaker and not at all the stuffy academic. He was impressed by the characteristic appearance of what we now call *Nostoc commune*. I won't tell all of Malcolm's tale, but suffice to say that Paracelsus combined common English and German to form a most graphic and human evocation of green slime.

Tumor Killer Expressed in Cyanobacterium

Tumor Necrosis Factor (TNF) is a member of the class of proteins called cytokines and has been shown to selectively kill tumor cells. The difficulty in obtaining sufficient TNF from natural sources for research and therapy has led to the cloning of the gene encoding TNF and its expression in *E. coli*. Noting that *E. coli* can be expensive to grow and may contain toxic proteins, complicating efforts at purification of expressed protein, Liu Fen-Long (Academia Sinica, Beijing) has sought to express TNF in a cyanobacterium.

Liu placed cDNA encoding TNF from rhesus monkey downstream from the strong *psbA* promoter on a plasmid capable of replicating in both *E. coli* and *Anabaena* PCC 7120. The plasmid, pDC-TNF, which expressed high levels of TNF (15%) in *E. coli*, was transferred into *Anabaena* to obtain a strain that produced a protein recognized by TNF-alpha monoclonal antibody. Expression of the protein had no measurable effect on the growth of the cyanobacterium, but transfer of energy from phycobilisomes was altered.

Function Sought for HetR, Master Differentiation Switch

Many filamentous cyanobacteria, including those within the genus *Anabaena*, differentiate in response to nitrogen deprivation well spaced heterocysts, sites of nitrogen fixation. Mutant *Anabaena* defective in the gene *hetR* are blocked early in the process of differentiation, while strains that carry extra copies of the gene form an overabundance of heterocysts with irregular spacing [Buikema & Haselkorn (1991) Genes & Develop 5:321-330]. Although the gene product of *hetR* is clearly important in the regulation of heterocyst differentiation, surprisingly little is known about the protein, which bears no obvious similarity to other characterized proteins.

ZHOU Ruan-bao and ZHAO Jindong, hoping to shed some light on HetR function, have exploited antibodies raised against the protein. The *hetR* gene from *Anabaena* PCC 7120 was overexpressed in *E. coli* and the HetR protein purified to homogeneity. Sequencing of the N-terminus of the protein confirmed the identity of the protein and showed that the initial methionine residue was posttranslationally removed. Antibodies were raised in rabbit against purifed HetR and used for characterization of the native HetR protein in *Anabaena.*

Native HetR from *Anabaena* was compared with recombinant HetR overexpressed in *E. coli*. The two were found to have the same molecular mass, as judged by Western blotting, indicating that the start codon of the *hetR* gene assigned by Buikema and Haselkorn is correct. Although the native and recombinant proteins have approximately the same size, they differ in charge. Western blotting after isoelectrofucosing electrophoresis showed that HetR protein isolated from *Anabaena* starved for nitrogen exhibited an isoelectric point (pI) of approximately 3.5 while recombinant HetR exhibited a pI of 6.5. While Zhou and Zhao do not know the reason for the difference in charge, protein phosphorylation is one intriguing possibility.

Antibody against HetR was also used to study the regulation of *hetR*. Western blotting showed that *Anabaena* filaments grown in the presence of nitrate and ammonium contained detectable levels of HetR protein. Shifting the culture to a nitrogen-free medium resulted in an increase of HetR by a factor of about three. This small increase does not, however, reflect the true magnitude of induction, but rather an increase averaged over both vegetative cells and heterocysts. Hetrocysts alone contained about 20-fold more HetR than did vegetative cells grown with nitrate.

A clue as to HetR function may come from the observation that the purified protein is rapidly degraded in vitro. The degradation is blocked by phenylmethylsulfonyl fluoride (PMSF), a compound known to covalently bind to and inhibit serine proteases. PMSF was also found to react with a serine of HetR, and the sequence of amino acids around the binding site suggests that HetR is indeed a serine protease.

Overexpression of the protein offers the possibility of analyzing the structure of HetR. Recombinant HetR was found to form a homodimer in vitro upon removal of dithiothreitol from the solution. Circular dichroism spectrum taken of the protein indicated that the secondary structure of HetR expressed in *E. coli* contains 24% a-helices, 10% ß-sheets, and 20% turns. Several salts were able to crystallize HetR. The crystals formed were mostly diamond shaped, and they were large enough (>0.25mm) for X-ray diffraction.

Spirulina Movement Energized by Na^+ Gradient

Motility by many bacteria, e.g. *E. coli*, is driven by the electrochemical proton gradient, $\Delta\mu_{H+}$. Hirota and Imae [J Biol Chem (1983) 258:10577] demonstrated that motility of an alkalophyllic strain of *Bacillus* instead exhibits an energetic requirement for sodium and is partially resistant to uncouplers that deplete the proton gradient. Igor Brown, SG Karakis, and DI Pogorelov, of Odessa State University, considered the possibility that alkalophyllic cyanobacteria, faced with the similar conditions as the *Bacillus* strain, might have found a similar solution: using the electrochemical sodium gradient, $\Delta\mu_{Na+}$, to drive light-induced movement.

The maximal rate of light-induced movement of the alkalophyllic cyanobacterium, *Spirulina platensis* (*Arthrospira*) was observed when the medium had a pH between 10 and 12 and the sodium concentration was at least 10 mM. The pH for all further observations was set at 10.5.

If the proton gradient, $\Delta\mu_{H+}$, drives motility in *Spirulina* as it does in *E. coli*, then the proton ionophore carbonyl cyanide *m*-chlorophenyhydrazone (CCCP), a classical uncoupler, would be expected to block trichome movement. Brown and colleagues found that even at as high a concentration as 400 mM CCCP, *Spirulina* trichomes remained motile if 200 mM sodium were present. On the other hand, an 8-fold lower level of CCCP completely arrested motility in the presence of the sodium ionophore monensin. Monensin alone decreased motility only by 30%. The photosystem II inhibitor DCMU prevented CCCP-resistant movement of *Spirulina* trichomes that had been starved by extended preincubation in darkness.

Brown and his colleagues concluded that light-induced gliding of *Spirulina* is indeed driven by $\Delta\mu_{Na+}$ rather than by $\Delta\mu_{H+}$.

Cyanobacterial Phytochrome Unmasked

Tom Börner (Humboldt University) and John Hughes and Tilman Lamparter of Berlin's Free University have made considerable progress in understanding the phytochrome response in *Synechocystis* PCC 6803. First, they expressed in *E. coli* the putative phytochrome gene that had previously been detected by Kaneko et al [DNA Res (1996) 3:109-136] during the sequencing of the *Synechocystis* genome (see **CyanoBase** in BULLETIN BOARD). The soluble product thus obtained was able to fold spontaneously and bind the chromophore, phycocyanobilin, in vitro.

In these respects, the cyanobacterial gene product differs markedly from plant phytochrome, which does not fold correctly in *E. coli*. The resulting product was a chromoprotein, which behaved as a spectrally functional phytochrome after red/far red irradiation. A more detailed account of its properties has been published [Hughes et al (1997) Nature 386:683].

Their second step was finding a gene in *Synechocystis* that shows similarity to domains of phytochrome genes and to bacterial histidine kinases, including one from *Calothrix* [Kehoe & Grossman (1996) Science 273:1409-1412]. Knocking out this gene produced a mutant of *Synechocystis* that grows like the wildtype under red and far red light, slower than the wild-type under white light and, surprisingly, does not grow at all under blue light. This inability to grow under blue light could be overcome by addition of glucose to the medium. A report on this work has recently appeared [FEBS Lett (1997) 406:89-92].

Meeting Report: 2nd International Congress on Symbiosis

The congress, held at Woods Hole, U.S.A., April 13-18, 1997 started and ended (very suitably from our point of view) with presentations on the *Nostoc-Gunnera* symbiosis. First out was Birgitta Bergman who reported on the isolation of three genes from a subtractive cDNA library prepared from plant-induced mRNA of *Nostoc* PCC 9229. These genes were interpreted as encoding a protein kinase, anthranilate synthase (TrpE), and a receptor/transporter of carbohydrates. The induced expression of *trpE* by the plant led to speculations that the gene product could be involved in the synthesis by *Nostoc* of the plant hormone auxin.

The last speaker, Warwick Silvester, related some ways in which *Nostoc punctiforme* in association with *Gunnera* spp differs biochemically from free-living *Nostoc*. First, he showed data supporting the view that *Nostoc* within *Gunnera* do not have a functional photosystem II. Second, *Nostoc* leaks ammonia when provided with excess energy in the form of light (through photosystem I) . Finally, the activity of nitrogenase (as measured by acetylene reduction) is five-fold higher in associated *Nostoc* than in free-living isolates.

In between, Johanna Wouters and Birgitta Bergman presented a poster session describing a gene isolated from the previously mentioned subtractive cDNA library. The gene appears to encode an α-amylase and is apparently expressed during the infection process.

Cyanobacterial lichens were also duly represented. Eckhard Loos showed that the kinetics of glucose excretion by *Nostoc* sp. from *Peltigera horizontalis* decreased rapidly after isolation [Lichenologist (1996) 28:67-78]. That inspired him and his co-worker (R. Wastlhuber) to isolate a homologue to the glucose transporter (*gtr*) from *Synechocystis*, which they showed by reverse transcriptase-PCR to be expressed specifically in the lichen and in freshly isolated *Nostoc*.

Probably the oldest record of a cyanobacterial lichen was reported by Thomas Taylor, who found a 400 million years old fossil from the Lower Devonian Rhynie chert. This fossil shows remarkable resemblance to present day cyanolichens of the Lichinaceae family, containing unicellular *Gloeocapsa*-like cyanobionts.

One of the major themes in this congress was marine symbioses, and cyanobacterial associations were, on occasion, the center of attention. John Lee gave a plenary lecture on algal symbiosis in Foraminifera, reporting that the large *Amphisora* contains small unicellular cyanobacteria with conspicuous red pigmentation. In the poster session, John Lee and co-workers (S. Bacus and J. Morales) also reported that the giant protozoan, *Marginopora vertebralis*, contains in addition to dinoflagellates, two types of cyanobacteria, one unicellular and one with heterocysts (!). M. Sara concluded that the sponge *Petrosia ficiformis* contains both cyanobacteria and heterotrophic bacteria and that these affect the morphology and physiology of the sponge.

This congress had representatives from a broad span of disciplines, and many interesting systems were presented, even some not involving cyanobacteria (hopefully, these are being reported elsewhere). To hear more about them, try the 3rd International Congress on Symbiosis, to be held in the year 2000 in Marburg, Germany. For further information contact Hans Weber, FB Biology, Philips-University, Marburg, 35032, Germany.

Sven Janson and Johanna Wouters

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