



---

Defining Dyslexia

Author(s): Willem J. M. Levelt, E. Paulesu, J.-F. Démonet, F. Fazio, S. F. Cappa, G. Cossu, C. D. Frith, U. Frith

Source: *Science*, New Series, Vol. 292, No. 5520 (May 18, 2001), pp. 1300-1301

Published by: American Association for the Advancement of Science

Stable URL: <http://www.jstor.org/stable/3083748>

Accessed: 18/12/2009 03:59

---

Your use of the JSTOR archive indicates your acceptance of JSTOR's Terms and Conditions of Use, available at <http://www.jstor.org/page/info/about/policies/terms.jsp>. JSTOR's Terms and Conditions of Use provides, in part, that unless you have obtained prior permission, you may not download an entire issue of a journal or multiple copies of articles, and you may use content in the JSTOR archive only for your personal, non-commercial use.

Please contact the publisher regarding any further use of this work. Publisher contact information may be obtained at <http://www.jstor.org/action/showPublisher?publisherCode=aaas>.

Each copy of any part of a JSTOR transmission must contain the same copyright notice that appears on the screen or printed page of such transmission.

JSTOR is a not-for-profit service that helps scholars, researchers, and students discover, use, and build upon a wide range of content in a trusted digital archive. We use information technology and tools to increase productivity and facilitate new forms of scholarship. For more information about JSTOR, please contact [support@jstor.org](mailto:support@jstor.org).



American Association for the Advancement of Science is collaborating with JSTOR to digitize, preserve and extend access to *Science*.

## SCIENCE'S COMPASS

~250 ug/l (1). This safe level plus a five-fold safety margin make up the present drinking water standard of 50 ug/l.

Within a factor of 2, the safe level of arsenic remains the same if good and reproducible science of the intervening 100 years is used (2). That requires weeding out controversial studies such as the one from northwestern Taiwan (3), which is highlighted in the news article.

Results presented in Table 4 of that study show 3, 3, 2, and 7 cases of urinary cancer and 1, 1, 2, and 6 cases of transitional cell carcinoma at arsenic levels below 10, 10 to 50, 50 to 100, and above 100 ug/l, respectively. Numbers of cases at the three levels below 100 ug/l are so small that no positive interpretation of increased cancer risk is possible. The claim that "cancer risk rose with arsenic levels even at these low exposures" is incorrect. There are hundreds of arsenical skin cancers on record and thousands of cases of the typical arsenicism, fully reproduced at levels above 200 ug/l. These cases and the complete absence of arsenical skin disease in the United States should be used to identify the safe level and to set a drinking water standard.

GERHARD STÖHRER

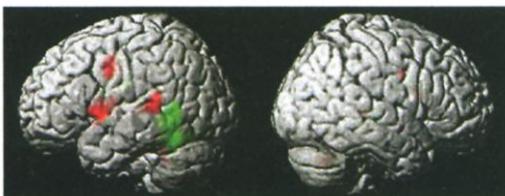
Risk Policy Center, 20 Stafford Place, Larchmont, NY 10538, USA

### References and Notes

1. Royal Commission on Arsenic Poisoning., *Lancet*, Dec. 1903, pp. 1674-1676, 1746-1748.
2. G. Stohrer, *Arch. Toxicol.* 65, 525 (1991).
3. H.-Y. Chiou *et al.*, *Am. J. Epidemiol.*, 153, 411 (2001).

## Defining Dyslexia

**DYSLEXIA IS CALLED "THE LANGUAGE DISORDER** that makes reading and writing a struggle" by Laura Helmuth in her News of the Week article "Dyslexia: same brains, different languages," (16 Mar., p. 2064). Although she is in the good company of many cognitive neuroscientists and educational psychologists, her terminology is in error. Evolution prepared us for language, but not for reading or writing. Indeed, Western cultures have demanded that all their normal children acquire script only within about the past 100 years. It is surpris-



Green areas of the brain are significantly less active in dyslexics compared to normal individuals when reading simple words.

ing and satisfying that most children do develop a reasonable reading skill—but many children don't. Most of them would never have become diagnosed as "language disordered" in an oral culture; they have speech and language skills that are entirely in the normal range. Calling dyslexics "language disordered" shows a lack of evolutionary and historical awareness and it risks being considered discriminatory.

The wonderful report by E. Paulesu *et al.* does not make this error ("Dyslexia: cultural diversity and biological unity," p. 2165).

Still, in the Paulesu *et al.* report, developmental dyslexia is called a "disorder of genetic origin," and the authors discuss "brain abnormalities" that are apparently involved. The implicit assumption is that our brains should normally allow for the acquisition of reading. If they don't, then there must be an abnormality. The question is whether this "abnormality" is still within the normal evolutionary range.

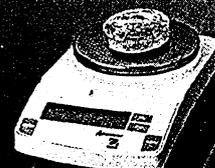
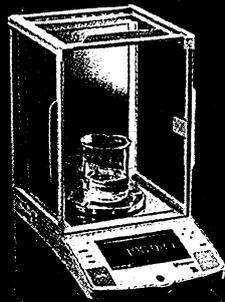
In other words, would our ancestors with such brains have become normally speaking and normally functioning hunter-gatherers? If so, it is a misnomer to denote dyslexics as neurologically abnormal. It

CREDIT: ERAIDO PAULESU/UNIVERSITY OF MILAN BICOCCA

# Ohaus Electronic Balances

From Analytical and Portable to Moisture Analysis -

Get the Ohaus Advantage.



Wherever your application takes you, there's an Ohaus balance for you. Ohaus offers a full range of laboratory balances to suit your most demanding requirements.

From moisture analysis to basic weighing, high capacity to high resolution, portable to analytical, Ohaus balances can provide the solution to your scientific needs.

And with applications including animal weighing, pipette calibration, formulation, parts counting, checkweighing and moisture analysis, Ohaus balances make your job easy.

All Ohaus balances feature:

- Ease of use and simple calibration
- Ergonomic design
- Durable construction

Add it all up and Ohaus delivers a truly great combination of features and exceptional value.

Circle No. 16 on Readers' Service Card  
Experience the advantage of Ohaus.

1-800-672-7722  
Fax: 973-593-0359  
www.ohaus.com

## SCIENCE'S COMPASS

should not be the arbitrary prevalent culture that defines what is neurologically normal or deviant.

WILLEM J. M. LEVELT

Max Planck Institute for Psycholinguistics, Nijmegen, The Netherlands. E-mail: pim@mpi.nl

### Response

**SINCE READING REPRESENTS HIGHLY ARTIFICIAL** behavior, and is of historically recent origin, Levelt concludes that a dyslexic would be well off in a nonreading world, and he therefore assumes that the dyslexic's altered pattern of brain response does not represent an underlying neurological abnormality.

However, reading difficulties can no longer be considered a necessary or a sufficient sign of dyslexia (1). The primary and enduring cognitive consequences of dyslexia are subtle deficits in speech/language processing. Affected individuals, from early childhood onwards, have problems in tasks that tap phonological skills (e.g., word repetition, verbal short-term memory) and tasks that require the rapid retrieval of words (e.g., object naming, digit naming). Phonological competence is part of linguistic competence and has a basis in the brain (2), plausibly with a heritable component (3). It

is manifest with the ease by which we learn new words in our mother tongue and when we learn a foreign language (4). These are skills that even hunter-gatherers may have found useful for communication with their neighbors. The spectacular rise of writing systems in the last 5000 years testifies to the existence of a strong human instinct for communication.

Given that reading problems by themselves do not distinguish dyslexics from those who are merely at the tail end of the normal distribution, we suggest that the combination of cognitive neuropsychology and neuroimaging may provide a better criterion. Our results show that the brain activation pattern in dyslexics, identified as possessing impaired phonological skills, is different while they are reading simple words (5).

Why is reading affected at all in these people? In adult normal readers, the neural systems for reading largely overlap with those for object naming (6, table 2e); learning to read may imply a systematic moulding of that part of the neural system that allows the brain to name objects. We propose that dyslexic brains are not able to mould connections between the sight, sound, and meaning of a word as efficiently as other

brains (7). In a preliterate world, this disorder would not lead to the same kind of social exclusion, but it could have subtle consequences for an individual's status in societies that value verbal ability.

E. PAULESU,<sup>1,2\*</sup> J.-F. DÉMONET,<sup>3</sup> F. FAZIO,<sup>4</sup>

S. F. CAPPÀ,<sup>5</sup> G. COSSU,<sup>6</sup> C. D. FRITH,<sup>7</sup> U. FRITH<sup>8</sup>

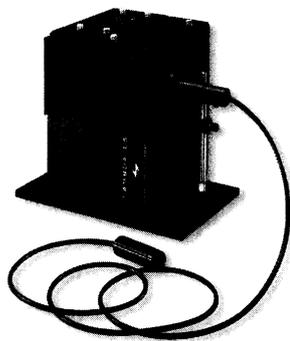
<sup>1</sup>Psychology Department, University of Milan Bicocca, Milan, Italy; <sup>2</sup>INB-CNR, Scientific Institute H San Raffaele, Milan, Italy; <sup>3</sup>INSERM U455, Hôpital Purpan, Toulouse, France; <sup>4</sup>Neuroscience and Biomedical Technologies Department, University of Milan Bicocca, Milan, Italy; <sup>5</sup>Psychology Department, University Vita e Salute H San Raffaele, Milan, Italy; <sup>6</sup>Institute of Human Physiology, University of Parma, Parma, Italy; <sup>7</sup>Wellcome Department of Cognitive Neurology, Institute of Neurology, London, UK; <sup>8</sup>Institute of Cognitive Neuroscience, University College London, London, UK

\*To whom correspondence should be addressed. E-mail: eraldo.paulesu@unimib.it

#### References and Notes

1. U. Frith, *Dyslexia* 5, 192 (1999).
2. J. Démonet, J. Fiez, E. Paulesu, S. Petersen, R. Zatorre, *Brain Lang.* 55, 352 (1996).
3. E. M. Wijsman et al., *Am. J. Hum. Genet.* 67, 631 (2000).
4. A. Baddeley, S. Gathercole, C. Papagno, *Psychol. Rev.* 105, 158 (1998).
5. E. Paulesu et al., *Science* 291, 2165 (2001).
6. E. Paulesu et al., *Nature Neurosci.* 3, 91 (2000).
7. E. Paulesu et al., *Brain* 119 (no. 1), 143 (1996); T. Klingberg et al., *Neuron* 25, 493 (2000).

## A New Xenon Arc Lamp for Fluorescence Microscopy



Powerful: 175Watts  
Compact: Internal power supply  
Cool: IR eliminating cold mirror  
Flexible: Adapters for most microscopes

PRECISION INSTRUMENTATION FOR THE SCIENCES



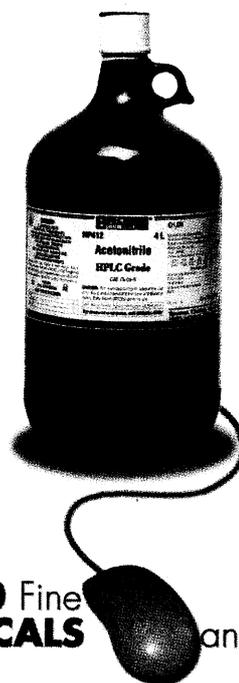
### SUTTER INSTRUMENT COMPANY

51 DIGITAL DRIVE, NOVATO, CA. 94949  
PHONE: 415.883.0128 FAX: 415.883.0572  
EMAIL: INFO@SUTTER.COM WWW.SUTTER.COM

Circle No. 48 on Readers' Service Card

## Spectrum Laboratory Products

just a... **CLICK** away



**11,000 Fine CHEMICALS** and **SUPPLIES**

[www.spectrumchemical.com](http://www.spectrumchemical.com)

Circle No. 46 on Readers' Service Card