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expectedly in a brittle fashion at alarmingly low stresses, often after having sustained much higher stresses for a substantial time. For a given hydrogen potential, the susceptibility to hydrogen brittleness generally increases as the basic strength of the steel is increased.

A hydrogen economy would require a substantial increase in the capability to contain and transport hydrogen. It is not at all clear that this can be accomplished by a straightforward expansion of current technology. Nor is it clear that proponents of the hydrogen economy are sufficiently aware, or indeed aware at all, of hydrogen's degrading effects. The brittleness induced by hydrogen is not an insurmountable barrier to a hydrogen economy, but to date the problem has not received sufficient attention to allow, for example, a rational design for a hydrogen pipeline network.

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## Drug Abuse

The letter from Michael M. Baden (29 Sept. 1972, p. 1152) which is critical of the excellent summary by Thomas H. Maugh of research on narcotic antagonists (Research News, 21 July, p. 241) is itself in need of criticism. Baden may be correct in his two points that (i) abuse of methadone and overdose deaths more frequently result from oral administration than from injection and (ii) the amount of paregoric being abused is only a very small fraction of the total amount being consumed. However, Baden does not appreciate the contribution of parenteral abuse to problems associated with present oral administration nor why a more useful parenteral deterrent is essential.

The effect of methadone, when it is taken parenterally by addicts, is either indistinguishable from that of heroin (1) or may indeed be preferred to that of heroin (2). Accordingly, attempts have been made to prevent parenteral methadone abuse. Patients who have take-home privileges are provided either with solutions (for example, Tang) or with some solid dosage (such as the Disket), which, because of irritating properties when it is directly ingested orally, must be dissolved before use. These forms of dosage, which have been designed to prevent parenteral abuse, unfortunately

have not accomplished their objective, as they are either directly injectable (3) or can readily be prepared for injection (2, 4). Worse, however, is that their use has led to many deaths from methadone overdose. When given methadone in solution, the patient is not told the concentration in the mixture, nor is the bottle labeled. A solution containing 40 milligrams procured one day by a street addict may provide satisfaction and relief from withdrawal effects. On another day, a solution of identical appearance but containing 100 milligrams may be lethal. Tang solutions or Disket solutions are pleasant-smelling and attractive-looking. Young children drink them "eagerly" with disastrous results (5). Naloxone combined with methadone in a truly non-filterable dosage form would prevent parenteral abuse, eliminate the need for all liquid preparations, and undoubtedly result in fewer lethal doses administered by both oral and parenteral means.

The paregoric question also needs to be clarified. Effective 4 June 1972, a prescription was required for paregoric in all 50 states (6). The reason, as described in the *Federal Register* (7), is that "abuse of paregoric by addicts who process it into a form for intravenous administration is well known and well documented in the medical literature . . . it is in the public interest for paregoric to be restricted to prescription sales." The housewife who previously obtained a few cents worth of the popular old remedy from her corner pharmacy must now incur the additional expense and trouble of an appointment with a physician and a prescription for the drug—all because of a small degree of addict abuse. Both the Food and Drug Administration and the Bureau of Narcotics and Dangerous Drugs have expressed interest in returning paregoric to over-the-counter status if abuse can be prevented. As little as 1 milligram of naloxone in each 100 milliliters of paregoric can make such abuse a thing of the past.

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