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**Sex ratio of offspring as a criterion of occupational hazard,
with reference to welding.**

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Sex ratio of offspring as a criterion of occupational hazard, with reference to welding

Concern has been expressed about the fertility of men occupationally exposed to heat (1, 2), for example, welders (3, 4). Such suspicion is supported by the significantly high proportion of welders with poor sperm quality (5). This finding has been replicated by Bonde (6) who noted that sperm quality declined with increasing exposure and increased after a break in exposure. He also noted low testosterone and high follicular stimulating hormone in welders (6, 7). Smith & Rodriguez-Rigau (8) have reported that such a hormone profile characterizes men with low sperm counts. Thus there is considerable suspicion that welding has a deleterious effect on the male reproductive system.

I have gathered substantial quantities of data to support the hypothesis that the sex of human offspring is partially controlled by the hormone levels of both parents at the time of conception, high levels of gonadotropin and low levels of testosterone favoring the production of daughters (9-11).

There are several male occupations for which offspring sex ratios (proportion male) and hormone profiles have been reported. Table 1 gives such data, and also includes welding. It shows that (in accordance with the hypothesis) the sex ratios for the offspring of divers, drivers, and dibromochloropropane applicators are significantly low. The sex ratio for the offspring of welders is not. However, it is worth noting that, if welding were to diminish the offspring sex ratio by the same degree as that estimated for driving, then a standard power analysis would indicate that, for a 90% chance of detecting a decrease in gender ratio at the significance level of 0.05, a sample of more than 40 000 children of welders could be needed (21). The sample of Bonde et al (19)

numbered 2241. Therefore it would seem prudent at present to keep an open mind on the question of whether welding has some slight effect on the sex ratio of offspring.

Sex ratio as a criterion of occupational hazard has the advantage that it is cheaply and painlessly ascertained, and it is not subject to the measurement errors and biases which characterize assessments of sperm quality and hormone assays. However the present example shows that sex ratio (when based on realistic numbers) may not be an infallible guide to occupational hazard.

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Table 1. Sex ratios and their 95% confidence intervals (95% CI) for the offspring of men in selected occupations for which poor sperm quality, high gonadotropin levels, or low-testosterone levels, or some combination of the three, have been reported.

Occupation ^a	Reports of poor sperm quality and/or high gonadotropin and/or low testosterone	Reports of sex ratios ^b	Offspring (N)	Sex ratio	95% CI
Professional diver	Röckert & Haglind (12)	Lyster (13), Röckert (14)	190	0.342	0.275-0.409
Professional driver	Sas & Szollosi (15)	Dickinson & Parker (16)	32 177	0.507	0.502-0.512
DBCP applicator	Whorton et al (17)	Potashnik & Yanai-Inbar (18)	36	0.278	0.132-0.424
Welder	Mortensen (5), Bonde (6), Bonde (7)	Bonde et al (19)	2 241	0.523	0.502-0.544

^a Another male occupation with substantial exposure to heat and reportedly associated with a significant excess of daughters is that of carbon setter (20).

^b Reported sex ratios for live births in large Caucasian populations vary within very close margins. It is therefore valid to contrast the ratios in this table with expected population values within the range of 0.513-0.515.

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