

By immunoblotting, a single band with the apparent molecular weight 58 000 was detected (Fig. 4). This was interpreted as additional evidence supporting vimentin presence in human spermatozoa and its reaction with the antibody used as a specific probe.

Detection of vimentin in the equatorial segment of human sperm heads was in accordance with several reports (Virtanen et al., 1984; Seppälä-Lehto and Lehto, 1993; Paleček et al., 1999) and the observed changes in abnormal spermatozoa corresponded to our earlier results (Marinova et al., 1996). However, the asymmetric distribution that was the focus of this study has not been mentioned in the literature available to us. Because necks and midpieces in the same samples showed symmetric reaction for vimentin, the asymmetric labelling of the heads was unlikely to be artefactual. Another human sperm head component, the epidermal growth factor receptor, studied by us using the same method, revealed no asymmetry in its localization (Markova and Marinova, 1999).

It is well known that rodent sperm heads are asymmetric (in fact, bilaterally symmetric with a single plane of symmetry). The sperm heads of other eutherians are usually considered as "bi-radially" symmetric, with two perpendicular planes of symmetry and equivalent opposite sides. However, some studies have also detected sperm head asymmetry in the rabbit, pig, cow, sheep and horse, and this phenomenon has been suggested to determine the penetration path through zona pellucida (Bedford, 1998, and references therein).

At the electron microscopic level, we observed the asymmetry as a difference between the two broad sides of the spatulate human sperm head. By immunofluorescence these sides cannot be distinguished, because the cell is fixed on the slide lying on one of them. Therefore, the failure to detect asymmetry in most cells by immunocytochemistry at the light microscopic level should not be surprising.

Our findings seem to support the hypothesis that the surfaces of the mammalian sperm head are functionally non-equivalent. To our knowledge, they are the first structural data of that kind concerning human spermatozoa. It is also interesting that asymmetry in vimentin distribution correlates with distinct sperm structural defects.

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