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Letter to the Editors

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Sirs,

We would like to make some comments upon the interesting paper "Histochemistry of tartrate-resistant acid phosphatase and carbonic anhydrase isoenzyme II in osteoclast-like giant cells in bone tumours" by Toyosawa et al. (1991). In a study of 101 bone tumours we have determined the enzyme histochemical pattern of the osteoclastic giant cells of osteosarcoma, chondrosarcoma, fibrous dysplasia, malignant and benign giant cell tumour, Ewing's sarcoma, malignant fibrous histiocytoma, plasmacytoma, chordoma, aneurysmal bone cyst, osteoblastoma and non-ossifying fibroma (Metze et al. 1987b). The histoenzymatic reactions were performed on unfixed and undecalcified cryostat sections (Ciplea et al. 1985; Metze et al. 1987a). In all tumours the osteoclast-like giant cells revealed the same enzyme histochemical pattern which clearly distinguished them from multinucleated tumour cells: activity of tartrate-resistant acid phosphatase (TRAP), non-specific acid esterase, leucinaminopeptidase, NADH-tetrazolium oxidoreductase and a lack of demonstrable alkaline phosphatase. Additional electron microscopic examination of selected cases showed a typical pattern of organelles of these giant cells irrespective of the type of neoplasm. Quantitative microphotometry of relative enzyme activities in giant cells of six different bone tumours (fibrous dysplasia, proliferating giant cell tumour, metastasizing giant cell tumour, osteosarcoma after chemotherapy, malignant synovioma and Ewing's sarcoma) exhibited a uniform pattern: a progressive decline in the activities of non-specific esterase and NADH-tetrazolium oxidoreductase, but an increase of the TRAP activity with increasing cell size. Some of the very large giant cells, however, demonstrated a low density of the TRAP reaction product. Electron microscopic examination revealed signs of degeneration in the large giant cells (Metze et al. 1987a, b).

Toyosawa et al. (1991) mentioned a stronger TRAP activity in tumours with larger giant cells (giant cell tumour and chondroblastoma) than in tumours with smaller giant cells (osteoblastoma and osteosarcoma). This confirms the trend found in our study which, however, demonstrated this phenomenon within the giant cell population of an individual tumour. Therefore we believe that the population of giant cells in a single bone neoplasm must be considered to be a biological continuum without any abrupt changes. As we were not able to find any substantial difference in the ultrastructural and enzyme histochemical pattern of osteoclast-like giant cells between the various neoplasms, we think that the differences of enzyme staining between various tumours reported by Toyosawa et al. (1991) are mainly due to differences in the mean cell size of the giant cells, which may depend on the histological type. Thus, although we did not study the carbonic anhydrase isoenzyme II (CA-II), it is difficult for us to accept the separation of the osteoclastic giant cells in cells with and without CA-II as proposed by Toyosawa et al. (1991). Since, in their study, routinely embedded paraffin material was used, we presume that mineralized bone neoplasms such as osteoblastoma and osteoblastic osteosarcoma had been decalcified. Unfortunately the authors did not mention the decalcification time or the decalcifying agent used for the tumour specimens. During decalcification, especially with an increase in time, cells may suffer a loss of antigens. Therefore, the "absence" of CA-II in the giant cells of osteoblastomas and osteoblastic osteosarcomas may be due to a long exposure to a decalcifying agent wich has prevented the immunohistochemical detection of small amounts of CA-II. Other factors (such as the fixation time and paraffin temperature) should also be carefully examined.

From our study we would like to formulate the hypothesis that the activity of CA-II may depend on cell size, with low activities in smaller giant cells and an increase in the larger ones. We suggest examination of the activity of CA-II or the presence of its antigen in undecalcified cryostat sections of osteoblastomas and osteoblastic osteosarcomas. We do not believe that differences of enzyme activities or enzyme content of osteoclast-like giant cells should be considered a useful tool

in the diagnosis of bone tumours based on routinely processed material.

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Reply

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In reply to the comments made by Dr. Metze on our recent paper (Toyosawa et al. 1991), we would like to refer to two critical points.

To our knowledge, there have been few reports concerning the cell size of osteoclast-like giant cells in tumours and we have read their papers with great interest (Ciplea et al. 1985; Metze et al. 1987a, b). Among bone tumours containing osteoclast-like giant cells, that is to say, giant cell tumour (GCT), chondroblastoma, osteoblastoma and osteosarcoma, they have examined only GCT and osteosarcoma and only one case of each. In the 1987 paper (Metze et al. 1987a), they wrote: "Data reveal a similar distribution of cell size in each class of the different tumours" without actually showing data (such as a frequency distribution diagram). Moreover, they have analysed both cell size and tartrate-resistant acid phosphatase (TRAP) activity using an atypical or modified osteosarcoma after preoperative chemotherapy. It is well known that chemotherapy tends to change conventional osteosarcoma to atypical osteosarcoma mimicking the telangiectatic form in which large osteoclast-like giant cells are always present (Dahlin and Unni 1986; Mirra et al. 1989). Therefore, their opinion with respect to the cell size of osteoclast-like giant cells in bone tumours can not be justified by data or generalized for typical tumours. As Troup et al. (1960) have pointed out, large osteoclast-like cells may be encountered occasionally in conventional osteosarcoma, but their incidence in osteosarcoma is very low compared with that in GCT. In our study, we selected and used material which exhibited the typical histology of each lesion (as shown in Fig. 1 in our paper). In general, the osteoclast-like giant cells in GCT were largest with the largest number of nuclei, whereas those in conventional or osteoblastic osteosarcoma were smallest with the smallest number of nuclei. The osteoclast-like giant cells in chondroblastoma appeared to be larger than those in osteoblastoma. TRAP activity was stronger in the larger cells in GCT and chondroblastoma than in the smaller cells in osteoblastoma and osteosarcoma. Our data therefore support Dr. Metze's attractive idea that GCT and chondroblastoma cells have stronger TRAP activity than osteoblastoma and osteosarcoma cells because the former have larger multinucleated cells than the latter, to some extent. Unfortunately, however, we did not quantitate the correlation between cell size and TRAP activity, while Dr. Metze's data cover only one example of each of two atypical tumours. The carbonic anhydrase II (CA II) immunohistochemistry is the only histochemical distinction between the two populations justified so far.

We now refer to the second point. The materials examined were fixed in neutral buffered formalin for 4–6 h, undecalcified, dehydrated through graded ethanols and embedded in 55–60° C paraffin. For histochemistry, we believe that extreme conditions such as decalcification or paraffin embedding at extremely high temperature or low temperature should be explained in the text. We omitted the details simply because the routine histology for clinical pathology does not include these extreme conditions. To date, most of the immunohistochemical studies of CA have been carried out using routinely processed, paraffin-embedded materials. Though Carnoy's fixative provides optimal immunostaining, aldehyde fixatives also provide good retention of affinity for anti-CA antibody (Hennigar et al. 1983; Kuwahara et al. 1983). Moreover, we employed the highly sensitive ABC technique (Hsu et al. 1981) to demonstrate immunoreactivity for CA II. Therefore, our materials and histochemistry can be considered to be suitable for the demonstration of CA immunoreactivity. More importantly, the present immunohistochemistry using routine histological preparations has clearly distinguished the osteoclast-like giant cells in GCT and chondroblastoma from those in osteoblastoma and osteosarcoma: the former, like osteoclasts, are positive for CA II, whereas the latter are negative.

In summary, we do not feel that Dr. Metze's comments are justified. They vitiate neither our experimental results nor the conclusions which we have obtained.

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