min then 5°C/min to 235°C. The most recent analyses were performed by capillary gas chromatography on a BP20 column (S.G.E.), with a temperature programme of 200°C for 5 min then 3°C/min to 230°C, held for 30 min. The capillary column allowed the more accurate determination of long-chain polyunsaturated fatty acids in the n–3 family, precursors to DHA. Phospholipids were also prepared from the plasma [10] and fatty acids analysed in the same manner as for the whole plasma. Data were calculated as g/100 g of total fatty acids recovered, and the statistical significance of differences between affected and non-affected family members was analysed by the Mann–Whitney test (Table 1).

To conclude, despite the statistical problems associated with small populations, there is a consistent pattern of low DHA levels in affected members of this family over a 7-year period.

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Polyunsaturated fatty acid metabolism in miniature poodles with an inherited retinal degeneration

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Retinitis pigmentosa (RP), a hereditary disease of the retina characterized by progressive night blindness and tunnel vision, has been the subject of many studies, but its aetiology is still unknown. We have been particularly interested in investigating the abnormal plasma lipid levels found in many types of RP [1, 2] as it is known that certain lipids are required for optimal retinal function. In particular, the retina has a high concentration of docosahexaenoic acid (DHA) (C22:6n-3) [3] and animals deprived of this fatty acid or its precursors in the n–3 family have decreased visual function [4–6].

In two types of RP, X-linked and autosomal dominant, we found significantly decreased levels of DHA in affected...
persons compared with their unaffected relatives [1, 7]. This finding has been confirmed in these types of RP [8]. Low levels of DHA have also been reported in a large kindred with Usher syndrome (RP with congenital deafness) [9].

There are a number of animal models for RP, of varying similarity to the human disease. It has been reported recently in America that miniature poodles with inherited progressive rod–cone degeneration (PRCD) (a disease which bears some resemblance to human RP) have low levels of DHA compared with unaffected animals of the same breed [10, 11].

To determine whether this is also true for miniature poodles raised in Britain, we obtained permission from the owners of 36 miniature poodles to study their dogs. PRCD–affected dogs were identified by retinal fundus examination and in some cases, by electroretinography; 18 affected and 18 non-affected animals were chosen for further study. To control for dietary differences among kennels, all the owners were asked to feed their animals the same proprietary feed (Pedigree Chum) for 1 week. Blood samples were taken in the morning from overnight-starved animals, and plasma was prepared and stored at -20°C until analysis. Lipids were extracted using chloroform–methanol and fatty acids were methylated as previously described [7]. The fatty acid methyl esters were analysed by capillary gas chromatography (S.G.E. BP20 column, using temperature programme steps: 200°C for 5 min then 3°C/min to 230°C, held for 30 min) on a Shimadzu GC-9A instrument. Levels of each fatty acid analysed were calculated as g/100 g of the total fatty acids. Data for affected and unaffected animals, when compared using the Mann–Whitney test (Table 1).

These results are at variance with the studies of Anderson et al. [11], who found a significant decrease in the 22:6/16:0 ratio in affected dogs compared with unaffected animals. The differences between the two studies could be due to different mutations in the two strains in America and Britain or could indicate that there is some complex interplay between fatty acid metabolism and plasma fatty acid levels, perhaps with the interposition of some other modulating influences, such that the same basic defect is expressed differently in the two strains. Nevertheless, our study confirms that of Anderson et al. [11] in that we also have found an apparent difference in fatty acid levels between affected and unaffected animals, indicating a possible defect in lipid metabolism in this disease.

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Table 1. Comparison of plasma fatty acid levels in PRCD-affected and unaffected miniature poodles

<table>
<thead>
<tr>
<th>Fatty acid</th>
<th>Comparison</th>
</tr>
</thead>
<tbody>
<tr>
<td>n-6 family</td>
<td>18:2.n-6</td>
</tr>
<tr>
<td>18:3.n-6</td>
<td>PRCD &gt; unaffected, ( P &lt; 0.005 )</td>
</tr>
<tr>
<td>20:3.n-6</td>
<td>NS</td>
</tr>
<tr>
<td>20:4.n-6</td>
<td>NS</td>
</tr>
<tr>
<td>n-3 family</td>
<td>18:3.n-3</td>
</tr>
<tr>
<td>20:5.n-3</td>
<td>NS</td>
</tr>
<tr>
<td>22:5.n-3</td>
<td>NS</td>
</tr>
<tr>
<td>22:6.n-3</td>
<td>NS</td>
</tr>
<tr>
<td>22:6:16:0</td>
<td>PRCD &gt; unaffected, ( P &lt; 0.025 )</td>
</tr>
</tbody>
</table>


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The fatty acid composition of phospholipids from the eyes of the northern deepwater prawn, Pandalus borealis

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Abbreviations used: EPA, eicosapentaenoic acid (20:5, n-3); DHA, docosahexaenoic acid (22:6, n-3); PE, phosphatidylethanolamine; PS, phosphatidylserine; PUFA, polyunsaturated fatty acids; PC, phosphatidylcholine; PL, phosphatidyl ethanolamine; RP, retinitis pigmentosa; PRCD, progressive retinal degeneration; PC, phosphatidylcholine; PI, phosphatidylinositol.

The biological roles of eicosapentaenoic acid (EPA; 20:5, n-3) and docosahexaenoic acid (DHA; 22:6, n-3) have attracted much interest in recent years. The cardiovascular and anti-inflammatory effects of EPA are now relatively well understood [1, 2] but the role(s) of DHA is unclear. Neural tissues from a wide range of vertebrate species are rich in DHA and detailed analyses of phosphoglycerides from bovine and frog retina [3, 4] and from trout retina and brain [5] have shown docosahexaenoic molecu-