

EICOSAPENTAENOIC ACID IN BACTERIAL ISOLATES AND TIDAL FLAT SEDIMENTS (WADDEN SEA, NORTH SEA, GERMANY)

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Eicosapentaenoic acid (EPA, 20:5 ω 3 fatty acid) in sediments is commonly considered to be of algal origin. It was shown that some bacteria mainly from deep-water and cold habitats produce EPA (Russell and Nichols, 1999; Nichols, 2003). Here, we report the occurrence of EPA in three bacterial isolates from a temperate tidal flat environment and in intertidal sediments up to 5 m depth. The temperature dependency of the fatty acid compositions shows that EPA contributes to the temperature adaptation in a range between 10 and 30°C.

Three strains of bacteria were isolated from sediments of the backbarrier tidal flats of Spiekeroog island (Northern Germany). They are phylogenetically closely related to the species *Shewanella colwelliana*, *Vibrio splendidus* and *Photobacterium lipolyticum*. Major phospholipid types of these bacteria were phosphatidyl ethanolamine (PE), phosphatidyl glycerol (PG) and cardiolipin (CL). PE was the most abundant type accounting for 38%, 60% and 77% of total phospholipids in *Photobacterium* sp. SAMA2, *Shewanella* sp. NB72 and *Vibrio* sp. NB73, respectively. EPA was detected as a side chain in all three phospholipid types. The most abundant EPA-containing phospholipid type was PG (15-30% of all PG molecular species), followed by CL (10-25% of all CL molecular species) and PE (<5% of all PE molecular species). In PG and CL, EPA occurred in combination with saturated and monounsaturated C₁₆ and C₁₈ fatty acid substituents whereas in the case of PE it was only detected in combination with C₁₆ fatty acids.

The individual strains show different modes to maintain cell membrane fluidity by changes in their fatty composition when cultivated at 10, 20 and 30°C. The highest EPA content (14% of total fatty acids) was found in *Photobacterium* sp. at 10°C (Fig. 1) indicating that EPA plays an important role in temperature adaptation when temperatures decrease from 20 to 10°C. In the case of *Vibrio* sp. an elevated proportion of EPA at 10°C is accompanied by the occurrence of *trans* n-16:1 ω 7 fatty acid (10%). In this strain temperature adaptation from 30 to 20°C appears to be achieved by increasing amounts of monounsaturated fatty acids at the expense of saturated analogues. In the *Shewanella* strain, an increase in EPA was

observed between 30 and 20°C accompanied by a moderately higher monounsaturated/saturated fatty acid ratio. Additionally, branched fatty acids (up to 24%) occur as major phospholipid-bound fatty acids.

In surface sediments EPA was a major substituents in phosphatidyl choline, phosphatidyl serine and phosphatidyl inositol, whereas at 11-15 cm depth phosphatidyl glycerol was the major phospholipid type containing EPA. Phospholipid-bound EPA accounted for 15% of the polar lipid fatty acids (Rütters et al., 2002) at the surface and up to 4% between 10 and 20 cm depth. In a 5 m long sediment core the content of phospholipid-bound EPA decreased within the upper meter, but EPA was present throughout the whole core indicting a bacterial origin of this compound.

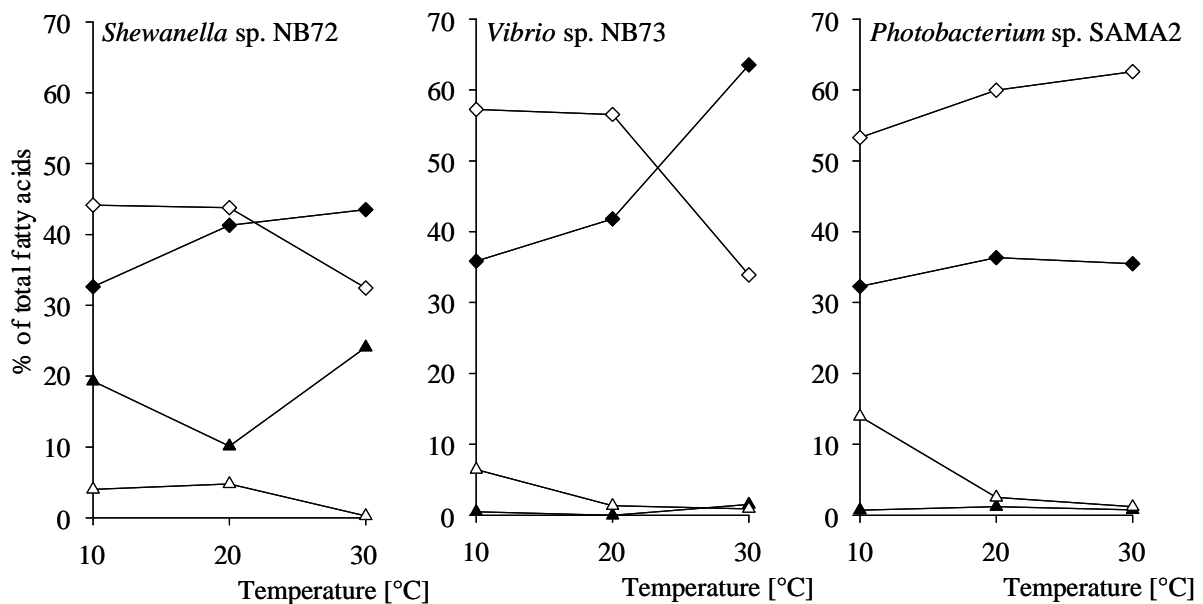


Figure 1. Relative abundance of straight-chain fatty acids (closed diamonds), branched-chain fatty acids (closed triangles), monounsaturated fatty acids (open diamonds) and eicosapentaenoic acid (open triangles) in three bacterial isolates from a temperate tidal flat sediment and in cultures grown at different temperatures (as percentage of total fatty acids).

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