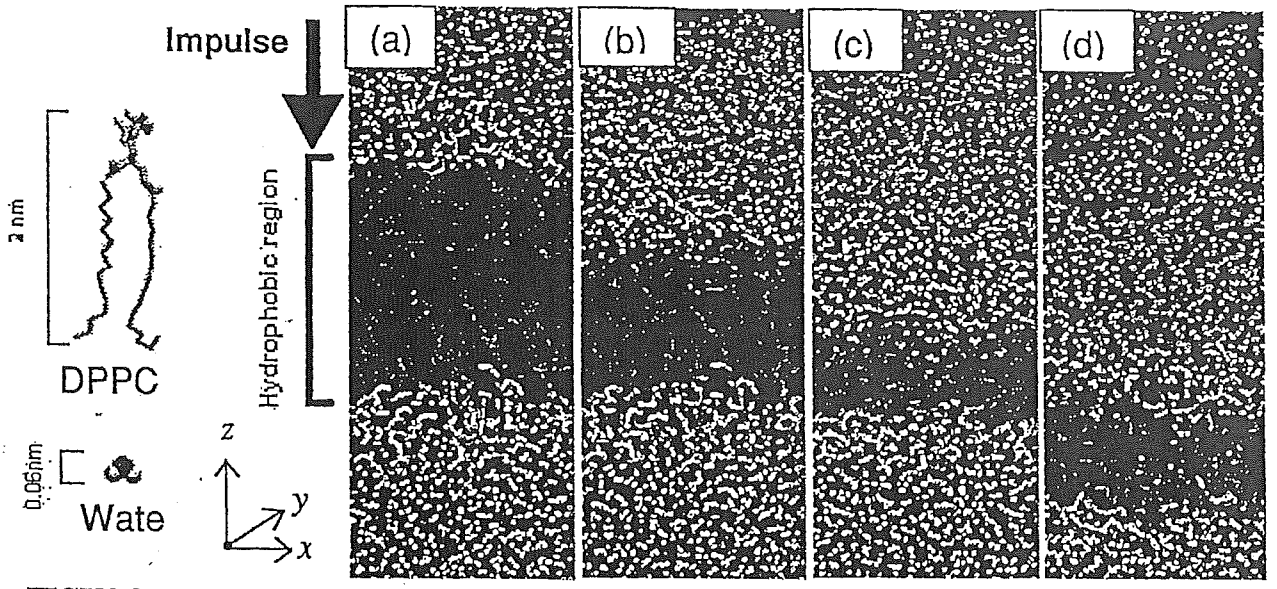


**FIGURE 1.** Structural change in the DPPC bilayer with an impulse of 0.7mPa s /lipid : The impulse is applied downwards to a part of the upper water layer. (a) Stable state, (b) 0.15ps, the upper water layer moves downwards, (c) 0.30 ps, the lower monolayer moves, (d) 0.45ps, the bilayer moves. All figures were made with the VMD molecular visualization programme[7]

**TABLE 1. Uptake of water molecules into the lipid bilayer and its structure change due to a single shock wave impulse.**

| Impulse (mPa s) | $N_W$ | $S_{CD}$ | $V_C$ |
|---|---|---|---|
| 0 | 1 | 0.14 | 1 |
| 4.8 | 3 | 0.076 | 2 |
| 9.6 | 11 | 0.066 | 7 |
| 14.4 | 18 | 0.061 | 16 |

$N_W$ : number of water molecules delivered into the bilayer normalized with the number of water molecule in the hydrophobic region of bilayer in the stable state, $S_{CD}$ : averaged order parameter, $V_C$ : lateral mass center velocity of DPPC lipids normalized with the velocity in the stable state.

## CONCLUSION

We conducted MD simulations to elucidate the mechanism of the interaction of a shock wave impulse with a lipid bilayer. After exposure to the impulse, a structural change of the bilayer and subsequent increase in the fluidity of each molecule was induced. These changes in the bilayer may be an important factor in the use of shock waves to produce transient membrane permeability.

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