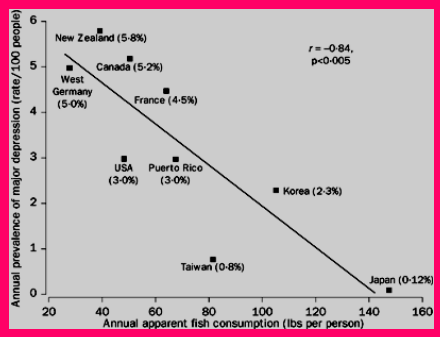
# Fish and (Mental) Health

Malcolm Garland MD
Senior Lecturer in Psychiatry
Royal College of Surgeons in Ireland

The Fresh Fish Master Conference, Genval, 23rd April 2007

*Depression increases as fish consumption decreases*
[Hibbeln, 1998 *Lancet*]




DIETARY FAT

- Saturated
- Polyunsaturated
  - "Essential"
    - Omega-3 (ALA)
      - EPA
      - DHA
    - Omega-6 (LA)
  - "Non-essential"
- Unsaturated

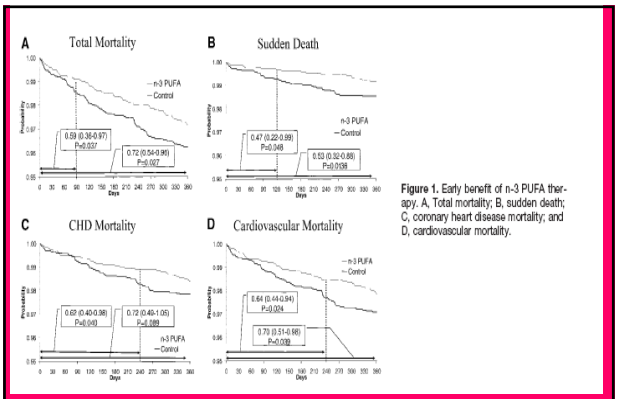
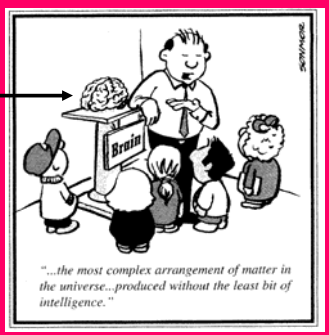


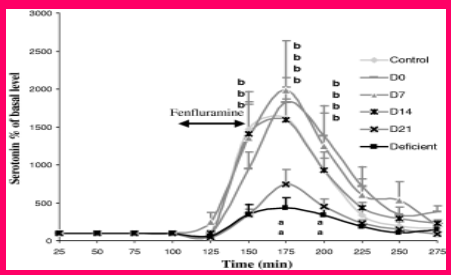

**Figure 1.** Early benefit of n-3 PUFA therapy. A, Total mortality; B, sudden death; C, coronary heart disease mortality; and D, cardiovascular mortality.

Marchiole et al, *Circulation*, April 2002

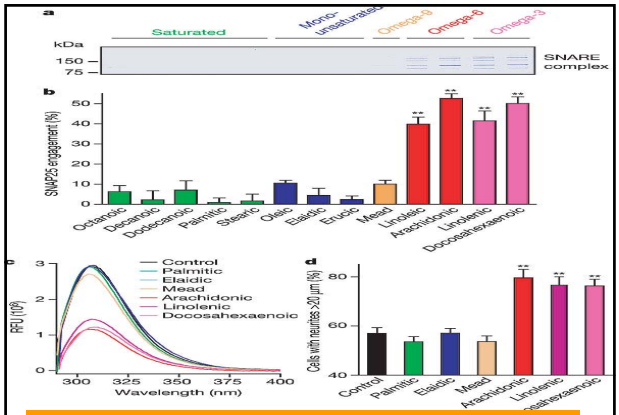
- 60% Fat!
  - 20% EFA!!




Effects on serotonin transmission following Fish Oil supplementation in rats



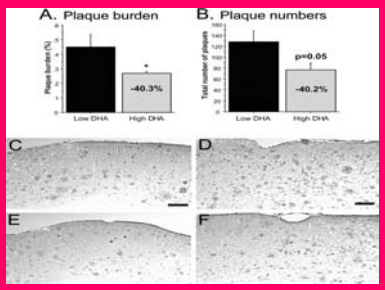

Kodas *et al* (2004)




Ability of LC-PUFAs to stimulate neurite growth *in vitro*

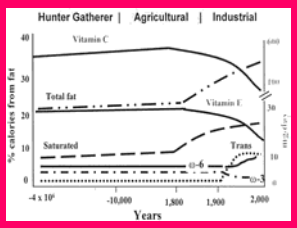
*(Darios and Davletov, Nature, 2006)*

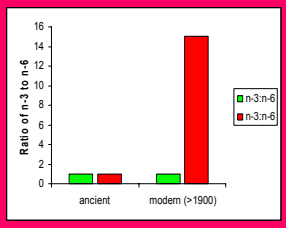
**Figure 2.** DHA lowers plaque burden (mouse).




(Lim *et al* 2005)

How our diet has changed!




Adapted from Simopoulus (2002)

An egg is an egg is an egg is an egg??

| Fatty acid | Alabama | Spanish | Kansas | Average |
|---|---|---|---|---|
| Palmitic | | | | |
| 16:0 | 1.1 | 0.7 | 1.0 | 0.9 |
| 16:1 | – | 0.1 | 0.3 | 0.2 |
| Total | 19.9 | 19.1 | 20.6 | 19.9 |
| 18:0 | 4.1 | 4.3 | 4.5 | 4.3 |
| 18:1 | 31.1 | 32.4 | 33.8 | 32.1 |
| 18:2 | 24.3 | 23.6 | 23.8 | 24.1 |
| Total | 60.1 | 61.1 | 62.4 | 60.8 |
| Monounsaturated | | | | |
| 16:1n7 | 2.1 | 2.7 | 2.1 | 2.2 |
| 18:1 | 33.5 | 33.0 | 35.0 | 34.2 |
| 20:1n9 | 0.4 | 0.3 | 0.4 | 0.4 |
| 22:1n9 | – | – | 0.1 | – |
| Total | 36.0 | 35.4 | 38.0 | 36.8 |
| n-6 polyunsaturated | | | | |
| 18:2n6 | 19.9 | 20.3 | 20.3 | 20.2 |
| 20:2n6 | – | 0.3 | 0.3 | 0.2 |
| 20:3n6 | 0.5 | 0.4 | 0.6 | 0.4 |
| 20:4n6 | 0.3 | 0.5 | 0.3 | 0.3 |
| 22:4n6 | 0.1 | 0.2 | 0.1 | 0.1 |
| 22:5n6 | 0.3 | 0.4 | 0.2 | – |
| 22:6n6 | 0.1 | 0.3 | 0.3 | – |
| Total | 20.4 | 22.0 | 21.8 | 21.0 |
| n-3 polyunsaturated | | | | |
| 18:3n3 | 0.9 | 0.9 | 0.1 | 0.7 |
| 20:3n3 | 0.5 | – | 0.1 | 0.3 |
| 20:5n3 | 0.3 | – | 0.3 | 0.3 |
| 22:5n3 | 0.3 | 0.3 | 0.3 | 0.3 |
| 22:6n3 | 0.3 | 0.4 | 0.3 | 0.3 |
| Total | 1.7 | 1.6 | 0.9 | 0.9 |
| PUFA n-6 | 21.4 | 23.6 | 22.6 | 22.0 |
| PUFA n-3 | 1.7 | 1.7 | 1.3 | 1.1 |
| n-6/n-3 ratio | 12.6 | 13.9 | 16.8 | 15.5 |

Table 7. Fatty acid levels (mg/g yolk) in chicken egg yolks (Simopoulos, 2002)

Fish Oils in Bipolar Disorder

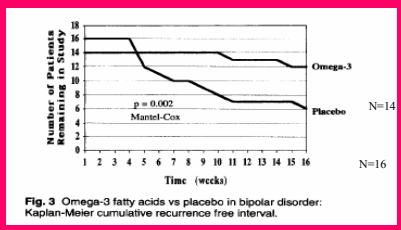
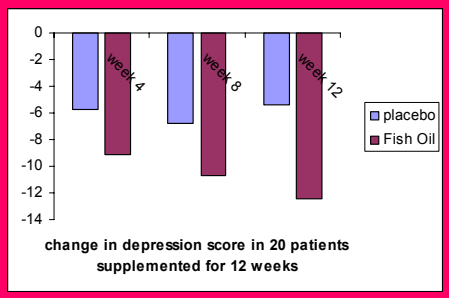



**Fig. 3** Omega-3 fatty acids vs placebo in bipolar disorder: Kaplan-Meier cumulative recurrence free interval.

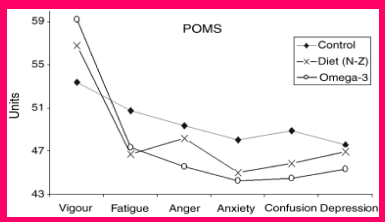
Stoll *et al* (1999)

## Fish Oils in Depression




Nemets *et al* (2002)

## Fish Oils in Normal people (n =33, 70days)




Fontani *et al* (2005)

BRITISH JOURNAL OF PSYCHIATRY (2007), 190, 112–117. doi: 10.1192/bjp.bp.105.019562

**Lipids and essential fatty acids in patients presenting with self-harm†**

MALCOLM R. GARLAND, BRIAN HALLAHAN, MAIREAD McNAMARA, PHILIP A. CARNEY, HELEN GRIMES, JOSEPH R. HIBBELN, ANDREW HARKIN and RONAN M. CONROY

## EFA levels in DSH patients (40) and normal controls controlled for fish intake

| Plasma Fatty Acids (µg/ml) | DSH Cases* | Controls* | p[1] | p[2] |
|---|---|---|---|---|
| Total fatty acids | 243.9 [225.9, 261.9] | 267.2 [247.0, 287.4] | 0.215 | 0.233 |
| Total saturates | 79.5 [73.1, 86.0] | 87.6 [79.5, 95.7] | 0.221 | 0.206 |
| Total monounsaturates | 76.6 [68.9, 84.3] | 74.0 [66.0, 82.0] | 0.422 | **<0.001** |
| Total essential fatty acids | 87.8 [82.3, 93.3] | 105.6 [99.4, 111.7] | **0.002** | **<0.001** |
| Total n-6 fatty acids | 79.5 [74.3, 84.6] | 93.8 [88.2, 99.4] | **0.003** | **0.003** |
| Linoleic acid (18:2n-6) | 59.7 [55.4, 63.9] | 71.4 [67.0, 75.7] | **0.006** | **0.019** |
| Arachidonic acid (20:4n-6) | 14.4 [13.1, 15.6] | 16.1 [14.6, 17.6] | 0.113 | 0.295 |
| Total n-3 fatty acids | 8.3 [7.4, 9.1] | 11.8 [10.3, 13.3] | **<0.001** | **0.011** |
| α-Linolenic acid (18:3n-3) | 1.7 [1.5, 1.9] | 1.9 [1.7, 2.2] | 0.298 | 0.676 |
| Eicosapentaenoic acid (EPA, 20:5n-3) | 1.7 [1.3, 2.1] | 3.2 [2.4, 4.0] | **0.002** | **0.015** |
| Docosahexaenoic acid (DHA, 22:6n-3) | 3.7 [3.2, 4.2] | 5.1 [4.4, 5.8] | **0.003** | **0.016** |

BRITISH JOURNAL OF PSYCHIATRY (2007), 190, 118–122. doi: 10.1192/bjp.bp.106.022707

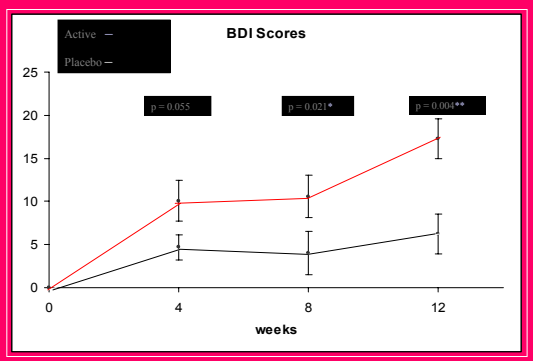
**Omega-3 fatty acid supplementation in patients with recurrent self-harm**

Single-centre double-blind randomised controlled trial†

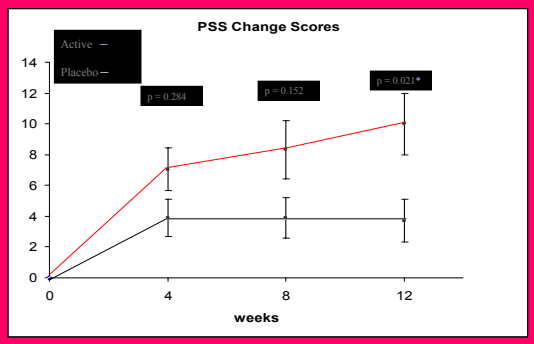
BRIAN HALLAHAN, JOSEPH R. HIBBELN, JOHN M. DAVIS and MALCOLM R. GARLAND

*EPAX 5500 (1.5g EPA, 1.0g DHA)

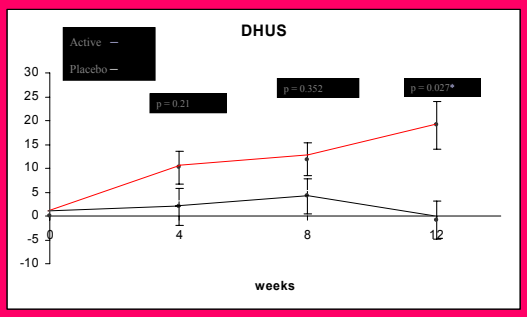
## Improvement in Depression Scores



## “Perceived stress” Change Scores




## “Daily hassles” Scale




## How much Fish: the experts’ view

*Am J Clin Nutr*, 2006

- We need a x4 increase in consumption!
  - 500mg omega-3/day
    =2 portions (oily) fish/week

MERCURY, FISH OILS, AND THE RISK OF MYOCARDIAL INFARCTION

Eliseo Guallar, M.D., Dr.P.H., M. Inmaculada Sanz-Gallardo, M.D., M.P.H., Pieter van't Veer, Ph.D., Peter Bode, Ph.D., Antti Aro, M.D., Ph.D., Jorge Gómez-Aracena, M.D., Ph.D., Jeremy D. Kark, M.D., Ph.D., Rudolph A. Riemersma, Ph.D., José M. Martín-Moreno, M.D., Dr.P.H., and Frans J. Kok, Ph.D., for the Heavy Metals and Myocardial Infarction Study Group*

*Conclusions* The toenail mercury level was directly associated with the risk of myocardial infarction, and the adipose-tissue DHA level was inversely associated with the risk. High mercury content may diminish the cardioprotective effect of fish intake. (N Engl J Med 2002;347:1747-54.)
Copyright © 2002 Massachusetts Medical Society.

And…Monsanto are coming!!!!!!!!!!

“There is a need to develop new solutions for delivering Omega-3 fatty acids in a wider variety of consumer products," said Tony Arnold, president and chief executive officer of The Solae Company. "Our goal is to accelerate the creation of a convenient, affordable and sustainable source of Omega-3 ingredients."