



# Factors in the Economic Success of Omega-3 in North America: Implications for Other Functional Ingredients

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# Long Chain Omega's: Strategies for Product Development and Commercial Success

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- **Milestones/History**
- **Market size and growth**
- **Key issues**
- **Commercial Drivers for success**
- **Future view**



# Milestones and Historical Perspective

- 1780: Fish oil (CLO) taken for arthritis relief
- 1935: Prostaglandins (PG) discovered
- 1970: Eicosanoid, leucotriene, prostaglandin metabolism elucidated
- 1971: Prostaglandins recognized as causing bad inflammatory health effects
- 1971: Dyerberg & Bang showed diet high in LC lipids reduced heart disease
- 1982: Nobel prize awarded for PG discovery and role in human health
- 1985-1990: Benefits of LCP shown for the developing embryo and infants
- Late 1980's: Growing scientific data on benefits of LCP for CVD
- Late 1980's-early 1990's: supplements of LCP launched for CVD and general health
- Early-Mid 1990's: Large ingredient companies enter fish oil business and specialty refining commences. Investments made in research and marketing
- Early 2000's: Explosion in science papers on LCP, NGO recommendations and governments permit fortification, some RDA's developed



# Long Chain Omega-3's The Event(s)

## “What it Meant”

1971: Dyerberg & Bang showed diet high in LC lipids reduced heart disease

1985-1990: Benefits of LCP shown for the developing embryo and infants

Late 1980's: Growing scientific data on benefits of LCP for CVD, and other diseases

Late 1980's-early 1990's: Many supplements with LCP launched for CVD and general health

Early-Mid 1990's: Large companies enter LCP business specialty refining, investments in research and marketing

Early 2000's: Explosion in LCP science, NGO recs. and governments now permit fortification

You need to eat whale blubber every day!

Confirms the benefits of LCP but LCP difficult to refine, formulate, expensive

Many Gov's see LCP as drugs requiring expensive clinical data

Supplement Co's make many varied claims and products seen by consumers as 'Snake Oil', and too good to be true. Key health professionals skeptical/non supportive.

New food forms developed. Gov's not convinced of health benefits, no RDA's, few recs. Health professionals more positive

Food forms variable quality, food companies with little interest, commercial potential unclear. DS sector strong growth.

H Professionals supportive, wide media, H Claims limited, food fortification still difficult, expensive.







“... and every day you should eat something from each of the five basic food groups: fried fish, boiled fish, stewed fish, baked fish and raw fish!”



# Omega-3's Today: The Grades

Measurement	Parameter	Score
Science	Quantity/quality	B+
Government Recommendations	US, Global, RDA's etc.	C+
Health/label Claims	Available, friendly	B-
NGO Support	Number, relevance of group	B
Consumer Awareness	USA, global	B
Product Forms available DS Funct. Food	Provide, no taste issues, stable, easy to use	A B-
Product Quality	Raw material ingredients	B+
Raw material supply	Availability FO, future sources	A





# Omega-3's: Large & Growing Science Base

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- 16,000 published papers
- Meta analyses show health benefits in many areas
- Excellent rationale based on the science and the human inflammatory response
- Brain and eye function with a well documented need for DHA (EPA?)
- IOM Reviews
- AHRQ Reports 3/2004 confirm the science
- Very long history of use
- Gene signaling by omega-3's the new frontier for research



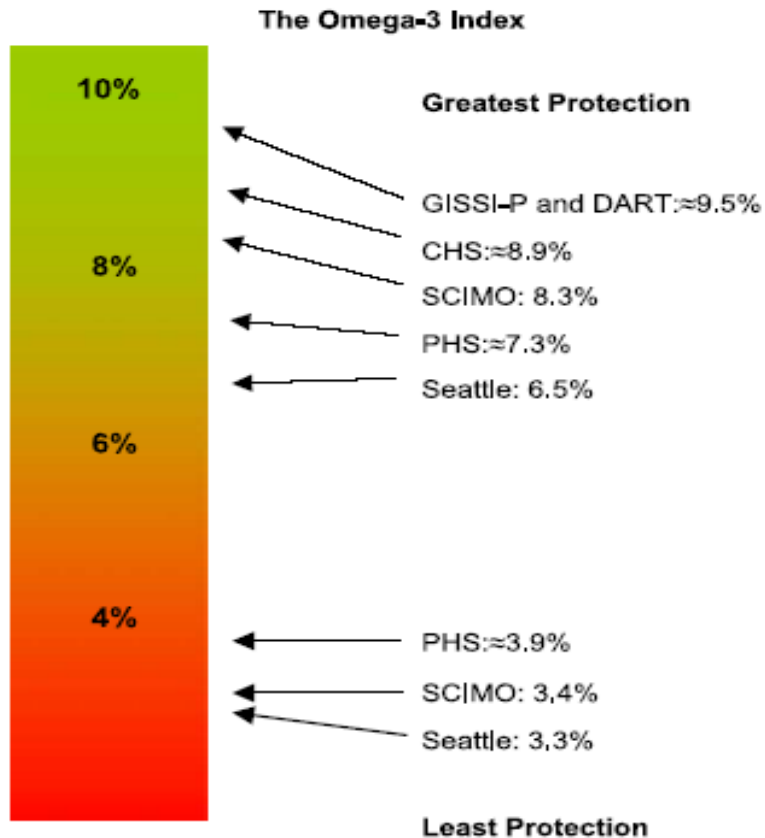
# Clinical Conditions with Possible Involvement of Omega-3 EPA/DHA

- **Coronary heart disease**
- Hypertriglyceridemia
- Hypertension
- Atherosclerosis
- Thrombosis
- Vasospasm
- **Mental/visual development**
- Depression
- Cognitive
- Rheumatoid Arthritis
- Allergic asthma
- Inflammatory diseases (e.g. GI tract)
- Premature birth
- Cancer





# The Omega-3 Index



Omega-3 index of >8% associated with lowest risk of CHD, whereas an Index of <4% is associated with the highest risk



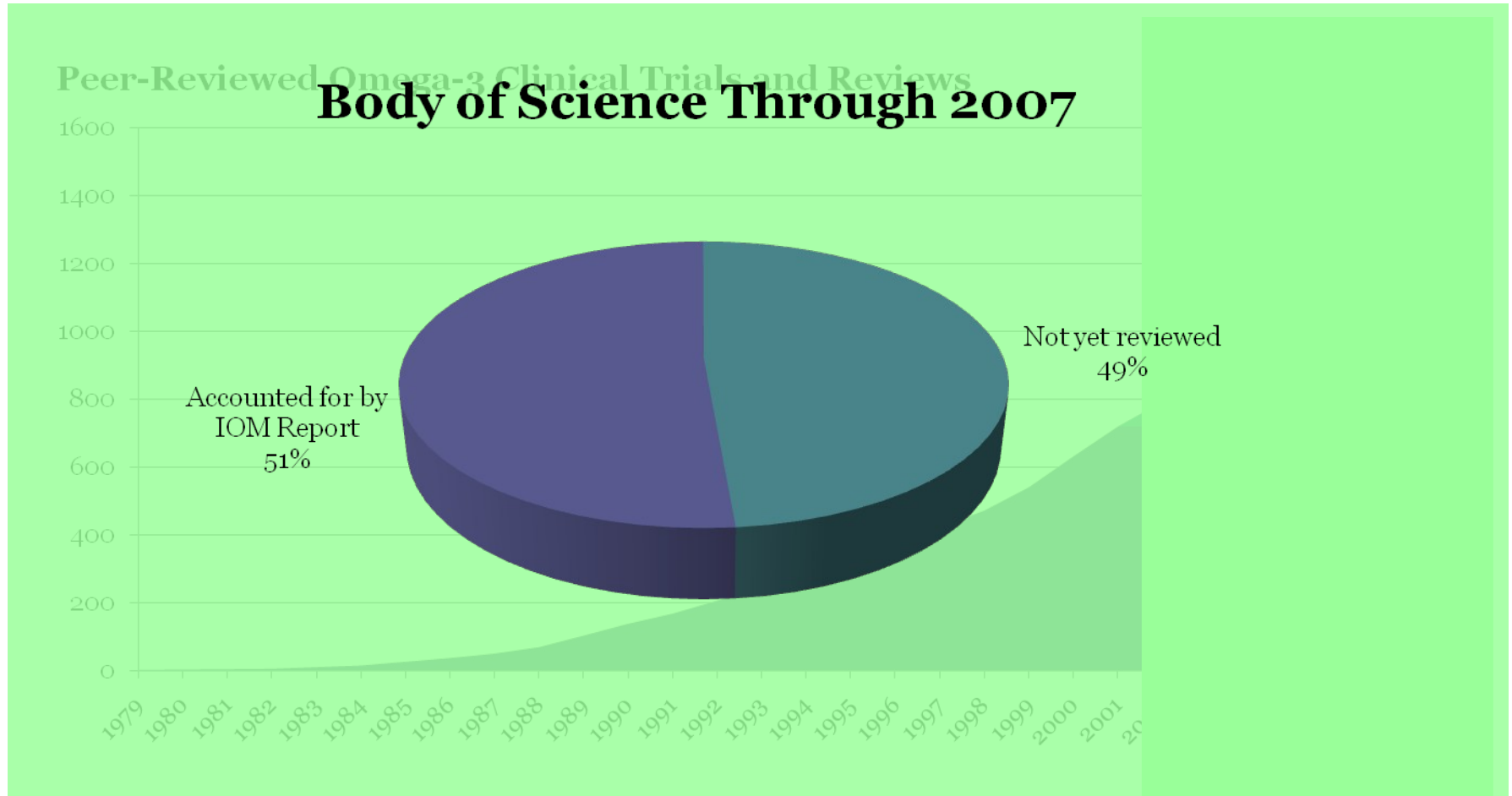
# DHA Essential for Fetus and Newborn

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- Human milk contains DHA
- DHA passes through placenta and is accreted in brain and eye
- Intellectual performance, psychomotor development and visual function are better in breast-fed babies
- DHA supplementation improves development of formula-fed infants



# A significant part of the body of science for omega-3s has never been accounted for



# Omega-3 LC-PUFA Science

## Target concentration

LC PUFA EPA  
LC PUFA DHA  
LC PUFA EPA

LC PUFA DHA  
LC PUFA DHA

LC PUFA EPA  
LC PUFA DHA

LC PUFA EPA  
LC PUFA EPA/DHA

## Target indication

Heart health  
Infant/toddler brain/vision  
Enteral Nutrition

Elderly Cognition  
Depression/mood  
suicide, child behaviour

Joint health  
Elderly, dementias  
ALZ

Skin, allergy, GI  
Elderly AMD, diabetes

## Scientific evidence

Unequivocal  
Very strong  
Excellent science

Strong  
Considerable science

Sound rationale, varied results  
Science building

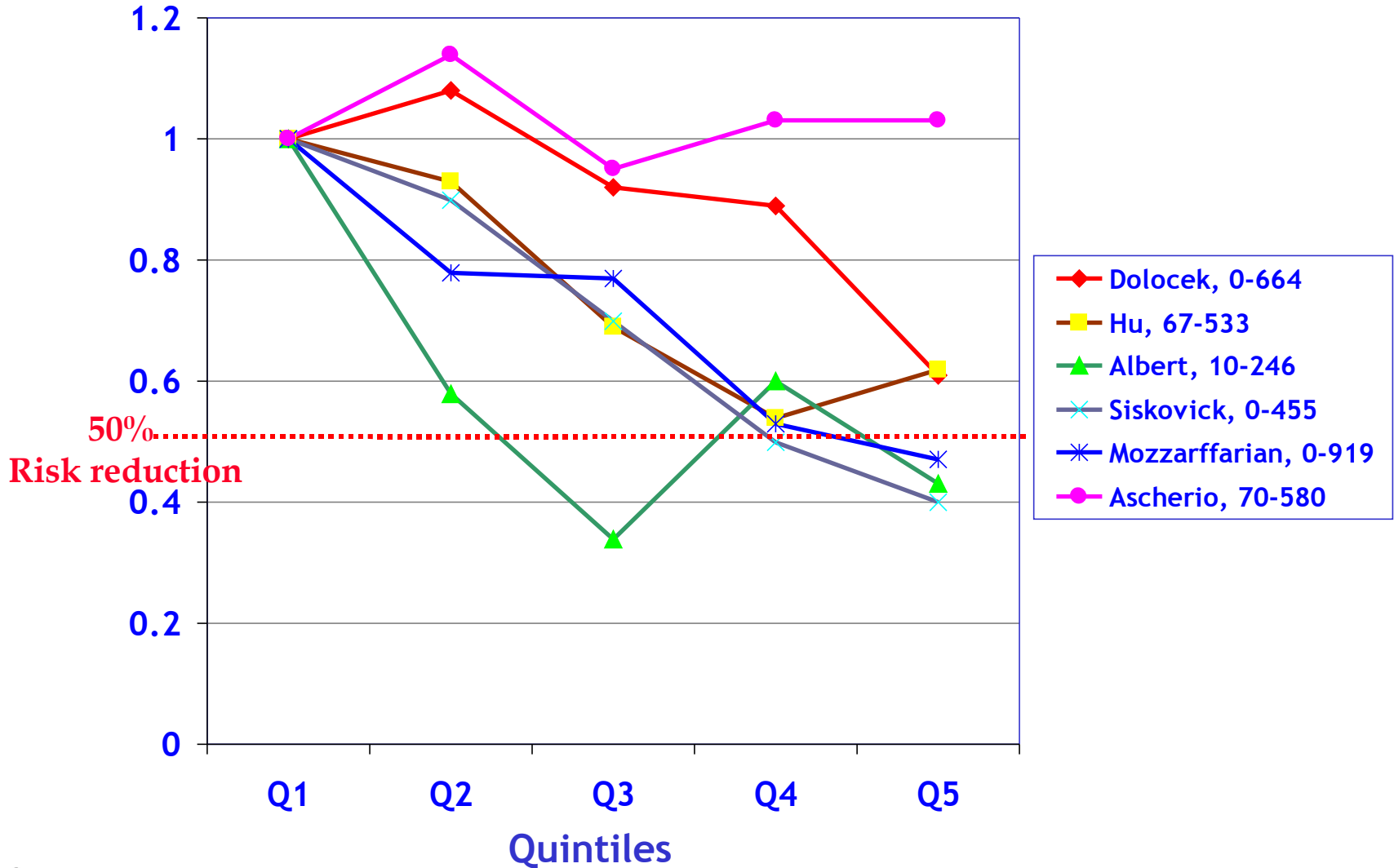
Emerging science  
Emerging science

## Gov Rec's.

Yes  
Yes

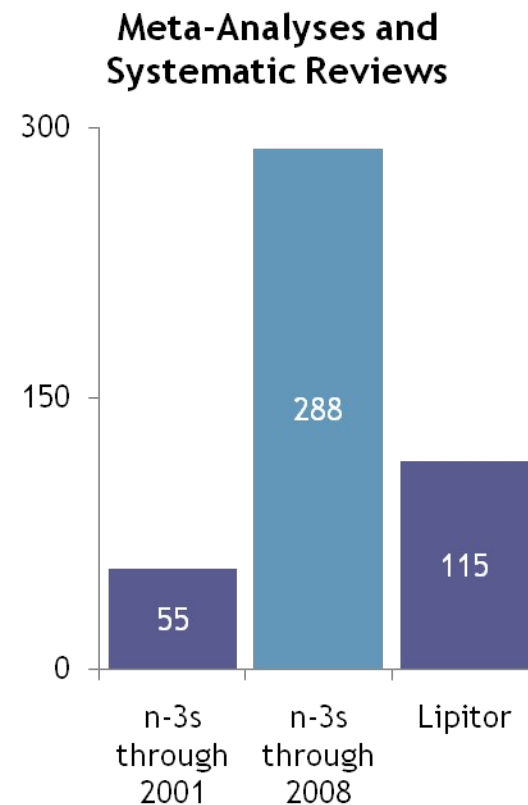
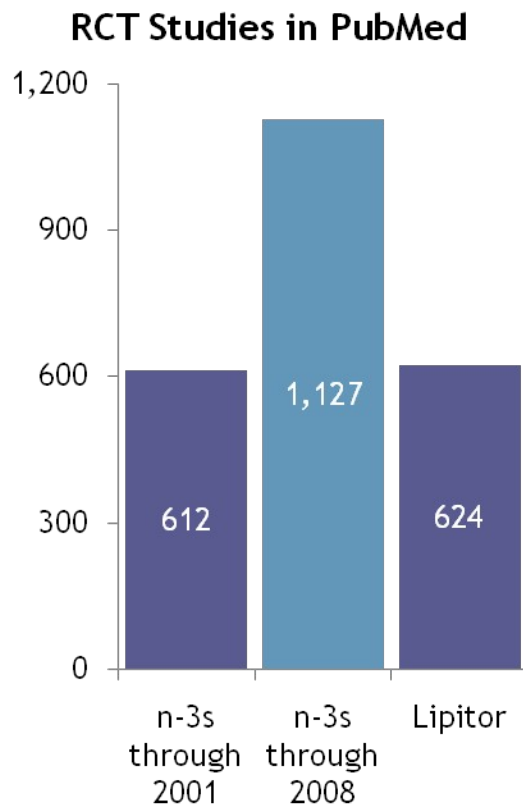
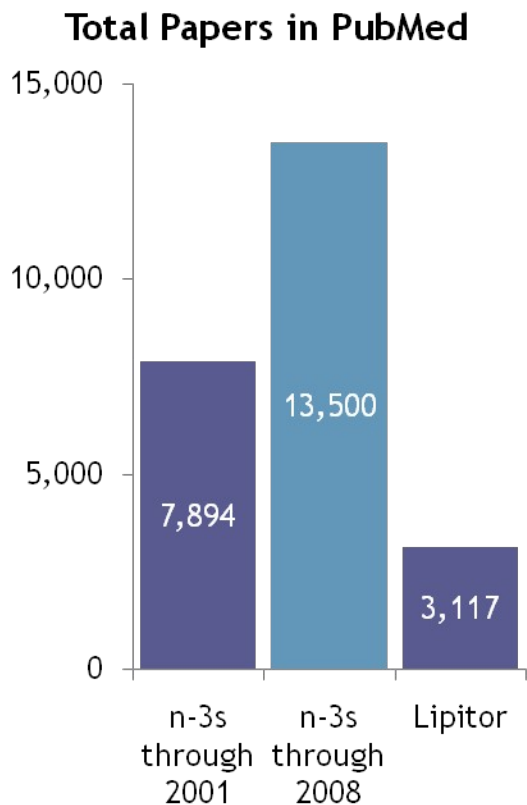


# Relative Risk Odds for Six LC Omega-3 Trials at Varying Dietary Intakes EPA/DHA per day.



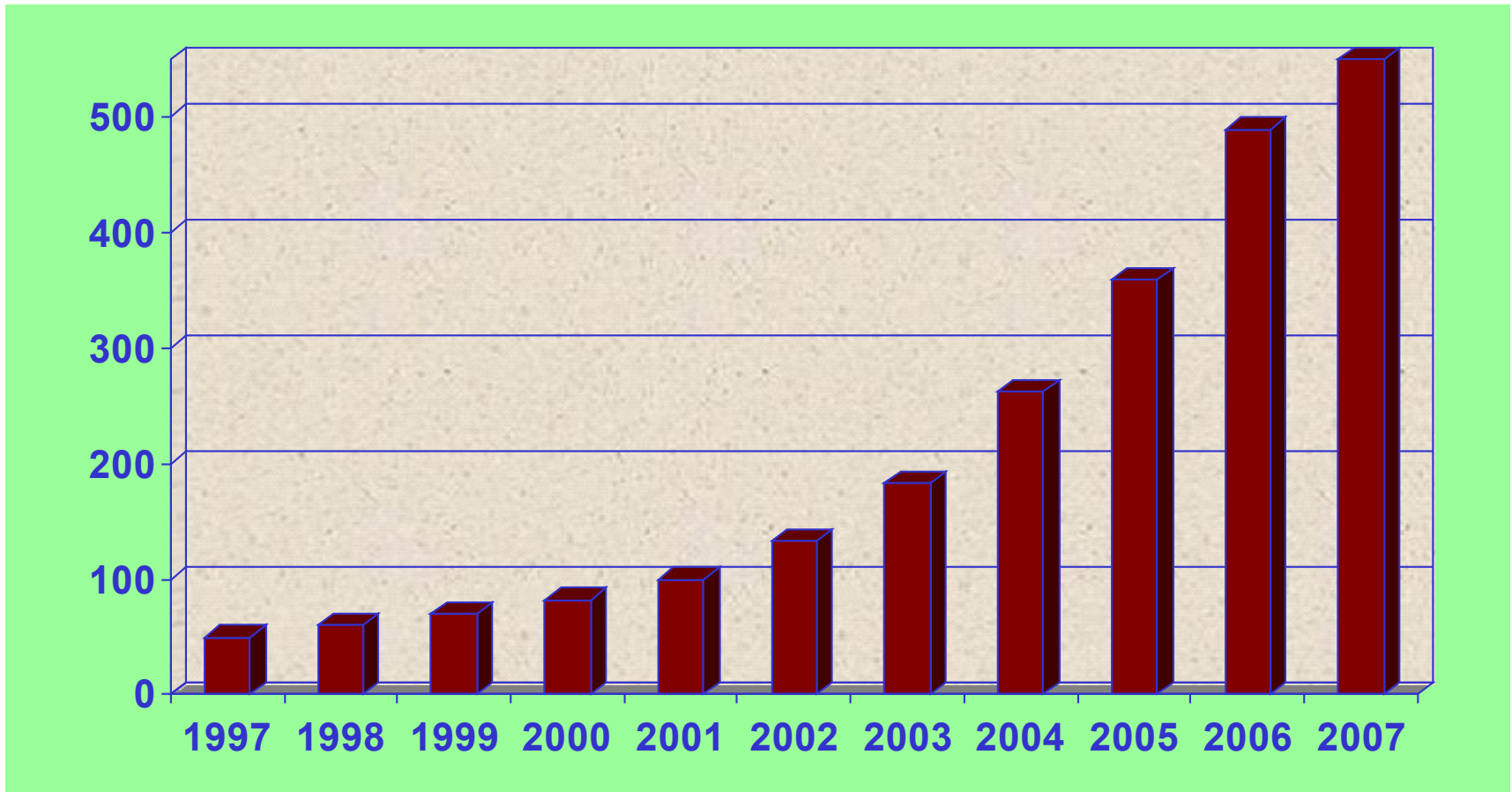


# Published Papers on Omega-3 PUFA's



# US Fish Oil Sales Retail 1997-2007

(\$ millions)



## 2007 Top Supplements by Sales

2007 rank	Supplement Product	2006	2007	07g	2007 rank	Supplement Product	2006	2007	07g
1	MultiVitamins	4,322	4,492	3.9%	21	Other specialty	177	198	11.8%
2	Sports Powders/Formulas	2,009	2,165	7.8%	22	Digestive Enzymes	181	196	8.3%
3	Weight-Loss Meal Supplements	2,067	2,154	4.2%	23	Mangosteen Juice	147	191	29.9%
4	Calcium	1,007	1,056	4.9%	24	Sports Pills	132	144	9.0%
5	B Vitamins	998	1,042	4.4%	25	green tea	144	139	-3.4%
6	Vitamin C	864	884	2.3%	26	garlic	150	137	-8.7%
7	Glucosamine/Chondroitin	803	831	3.5%	27	echinacea	125	126	0.6%
8	Homeopathics	710	781	9.9%	28	saw palmetto	129	125	-3.1%
9	Other vitamins	602	663	10.2%	29	Chromium	115	108	-5.8%
10	Fish/Animal Oils	486	627	29.0%	30	ginkgo biloba	102	107	4.4%
11	CoQ10	381	413	8.3%	31	MSM	104	105	0.5%
12	Vitamin E	409	391	-4.3%	32	SAMe	101	102	1.1%
13	Probiotics	301	366	21.3%	33	Goji Juice	65	98	50.4%
14	Vitamin A/Beta Carotene	290	315	8.6%	34	ginseng	96	95	-0.5%
15	Meal Medical/Wt Gain	295	308	4.3%	35	Bee Products	92	95	3.2%
16	Noni Juice	256	277	8.4%	36	Melatonin	81	93	14.1%
17	Magnesium	240	271	13.1%	37	milk thistle	91	93	1.9%
18	Iron	237	253	6.8%	38	psyllium	84	87	3.0%
19	Plant Oils	223	253	13.6%	39	5 HTP	79	83	5.8%
20	Sports Drinks (for core sports)	202	227	12.5%	40	Potassium	74	78	4.3%



# Key Issues/Success Drivers for Omega-3's

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- Government recommendations (RDA's,
- Health Claims- few available, US and UK
- TG not recognized as major CVD factor
- Health professional support
- Consumer awareness/confusion (EPA, and ALA, good fats, plant oils vs fish oils)
- Too many health benefits, confuses consumers
- Quality of raw materials: safety, supply
- Taste/stability (RM and food forms)
- Food companies slow to fortify
- Safety (unfounded)



# Omega-3 / DHA & EPA Recommendations

- Institute of Medicine (IOM) - US (2002/2005)
- Dietary Guidelines for Americans (USDA Food Guide Pyramid) (2005)
- PeriLip Consensus Conference - EU (2005)
- American Heart Association (2002/2006/2007)
- Food Standards Agency - UK (2004)
- Child Health Foundation (2001)
- International Society for the Study of Fats and Lipids (ISSFAL) (1999)
- World Health Organization (1994/2003)
- British Nutrition Foundation (1992/2000)

**FDA issued a qualified health claim for Omega-3 fatty acids (2004)**

- “Supportive but not conclusive research shows that consumption of EPA and DHA omega-3 fatty acids may reduce the risk of coronary heart disease.”

**IOM Macronutrient Report (2005)**

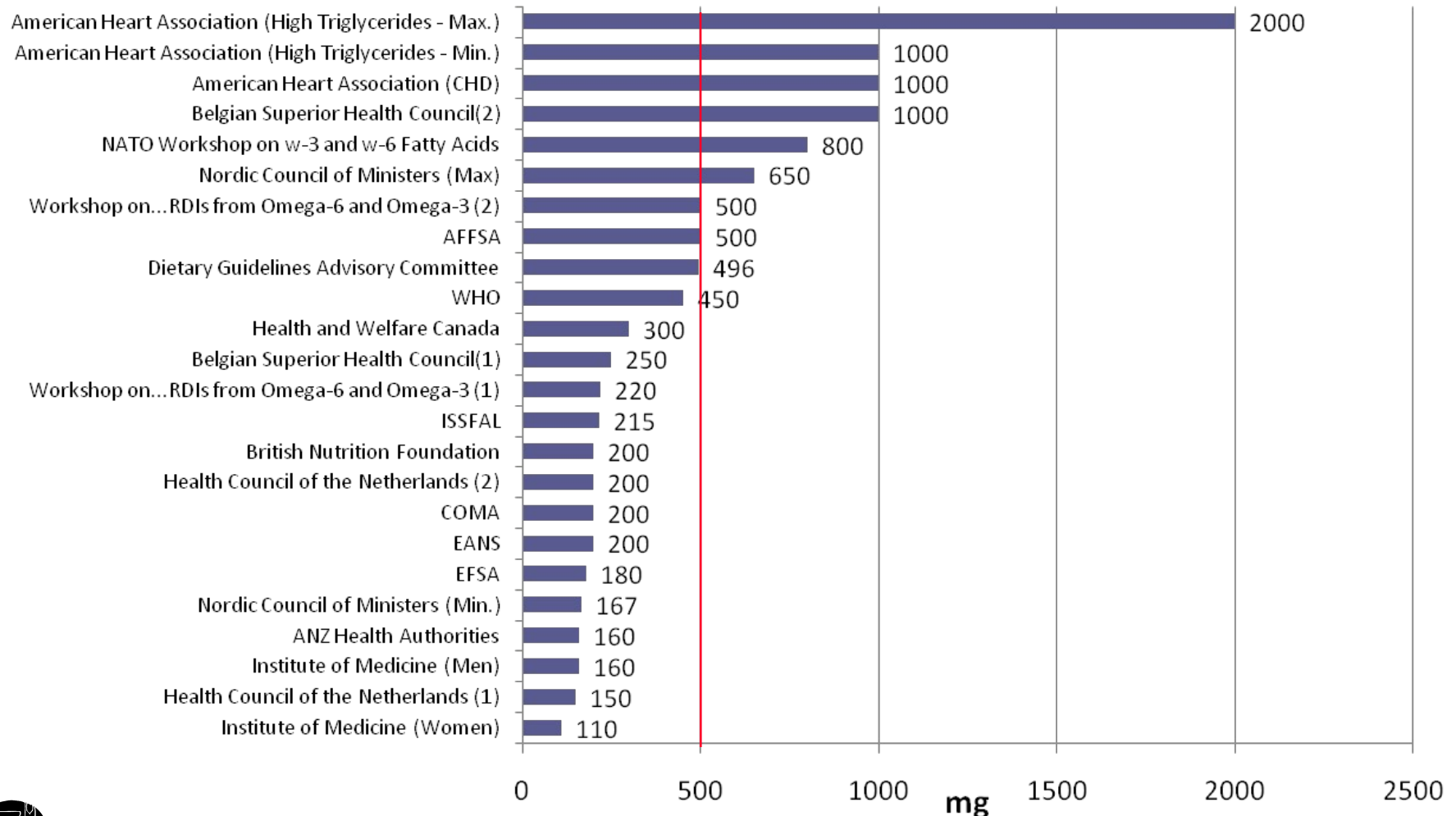
- AI (calculated) for DHA and/or EPA 160 mg for good health
- AMDR advises consumption of 133-267 mg/day DHA (and/or EPA) to reduce risk of cardiovascular disease





# Numerous health bodies have set intake recommendations

## Daily EPA/DHA Intake Recommendations from Global Health Bodies



# Current Global Adult Intakes versus Recommendations of Long-Chain Omega-3s

## Recommendations:

### LC n-3

ADA (2007)

ISSFAL (2004)

WHO/FAO (2003)

France (2001)

UK (2003)

Netherlands (2006)

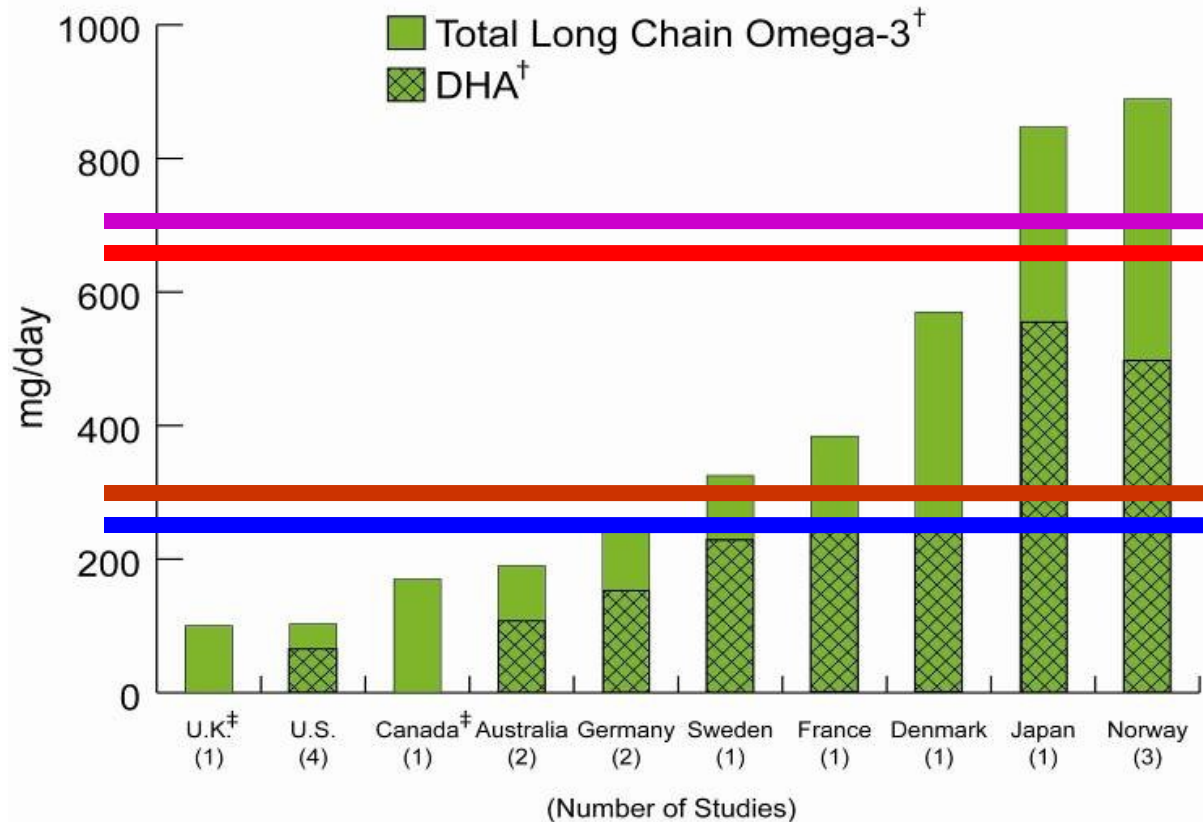
Canada (2005)

Australia (2005)

### DHA alone

France (2001)

## Intake:



† weighted means

‡ DHA data not available



# Commercial Drivers for Future Success: NGO's

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- American Heart Association
- American Dietetic Association
- ISSFAL
- ESPGAN, PeriLip
- Pediatric Organizations
- Cardiology Associations
- Nutrition Groups



# Commercial Drivers for Future Success: Science

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- Continued science data
  - CVD
  - Infant
  - Vision
  - Joints
  - Alzheimers/cognitive
  - Asthma/allergy
  - Diabetes



# Commercial Drivers for Future Success: Consumer Awareness

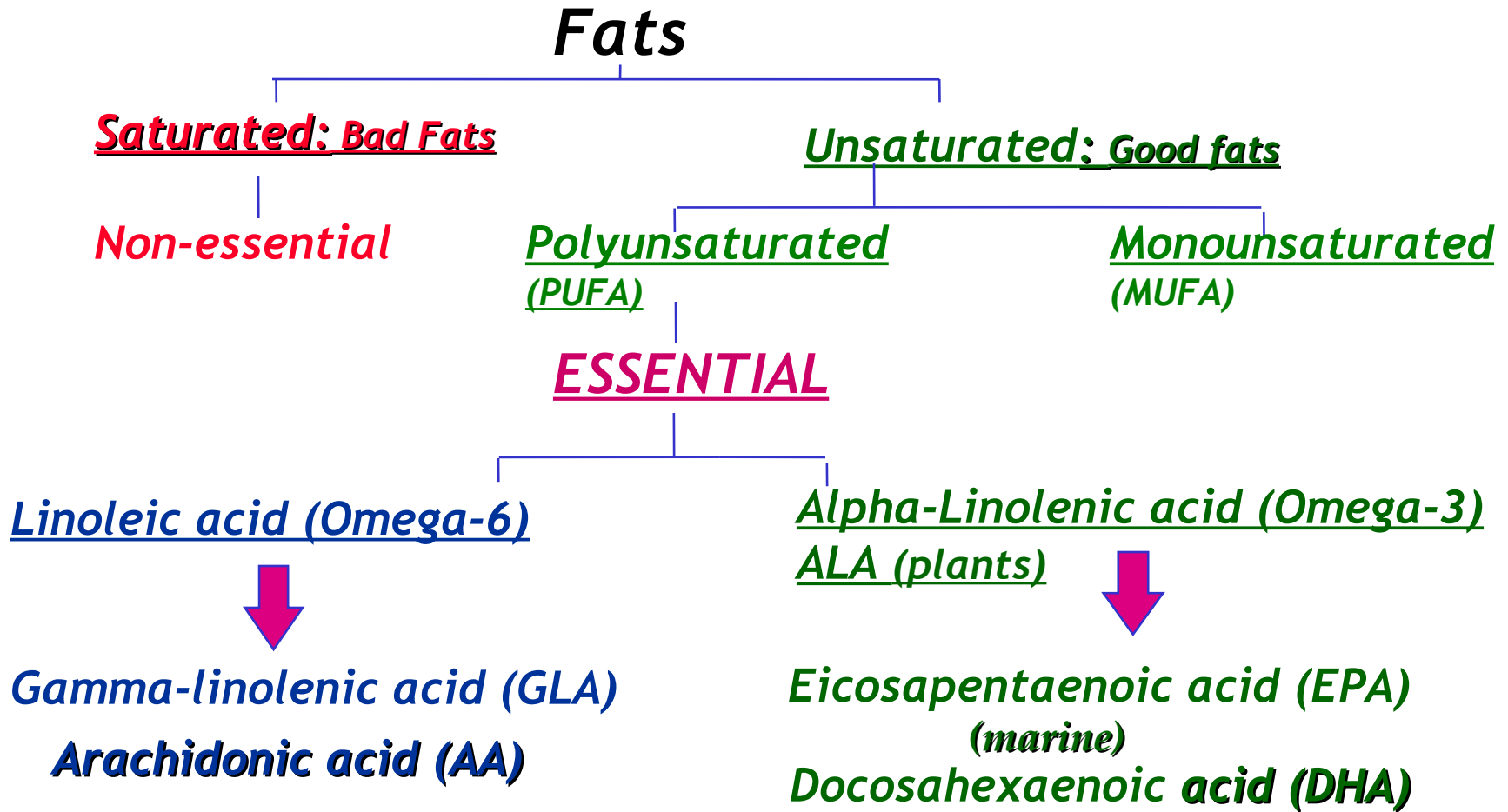
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- Globally very high awareness, critical mass reached
- Consumer use of supplements, now 8% US population take on a daily basis
- Interest in fortified foods high
- Consumer confusion on types of Omega's, terms used, varied health benefits. Fish oil vs Flax oil, ALA:EPA:DHA



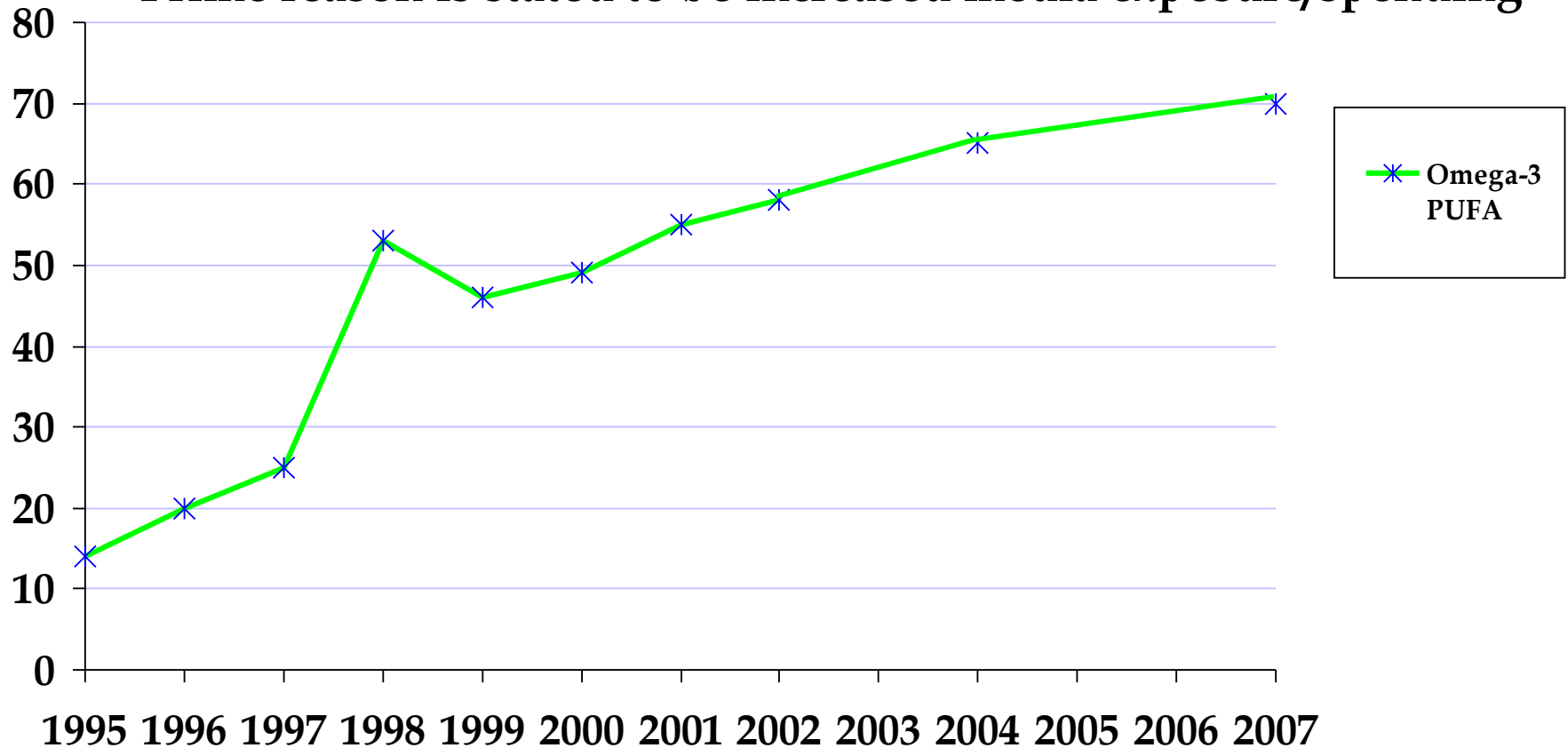


# Classification of Fats... Very Complex!!

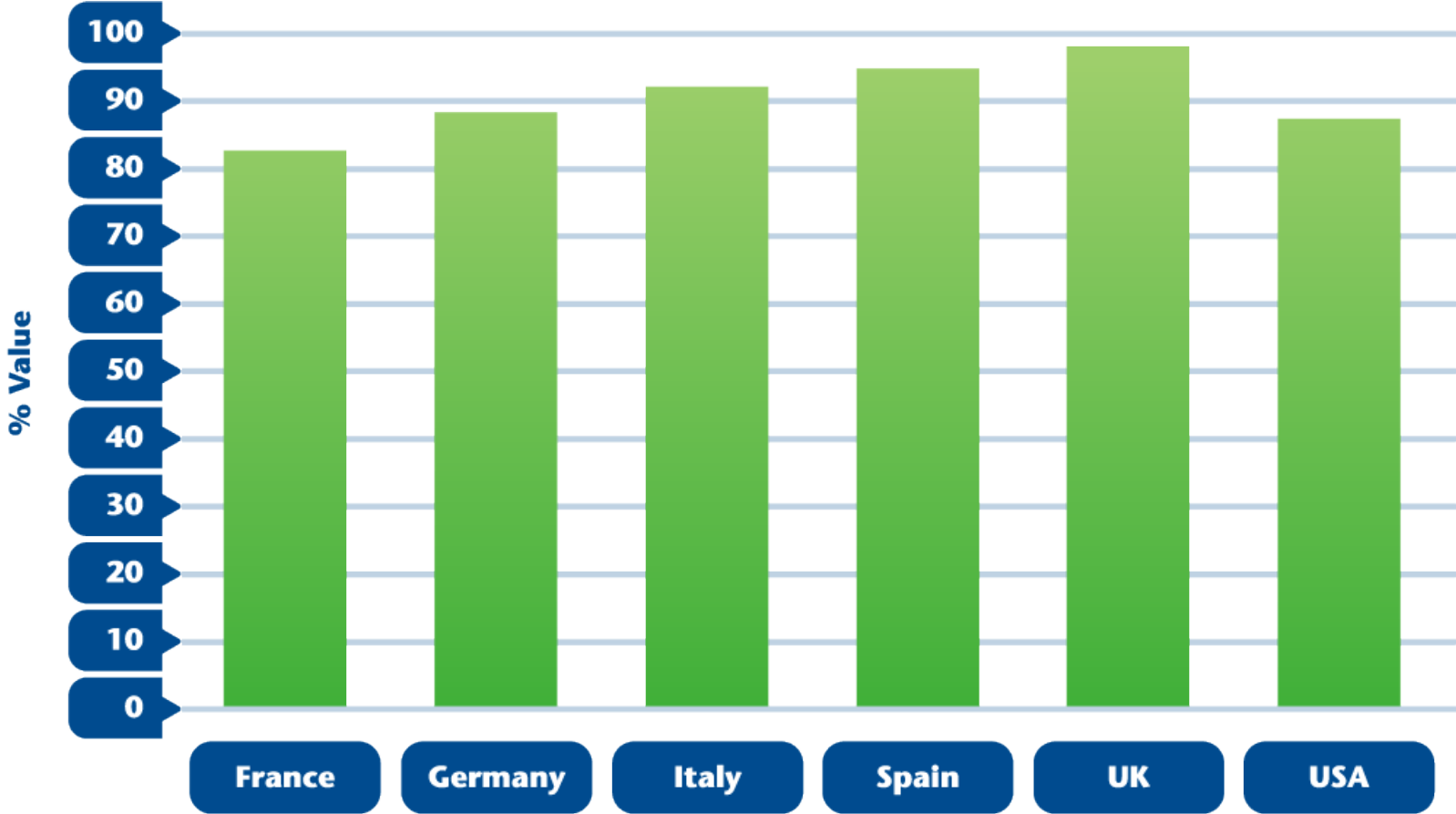


# Awareness Among Users USA

Prime reason is stated to be increased media exposure/spending



# Consumer Awareness of term Omega-3



# Recent paper highlights flax oil superior to fish oil as a source of n-3' s

## Actual results:

- Low levels of fish oil intake led to higher serum levels of long-chain n-3's than high intakes of flaxseed oil
- Fish oil led to higher serum levels of DHA, flaxseed oil did not
- The increase in serum long-chain n-3 levels was uniform for fish oils, but increases from flax oil were much more variable

**NUTRA**  
ingredients.com | europe

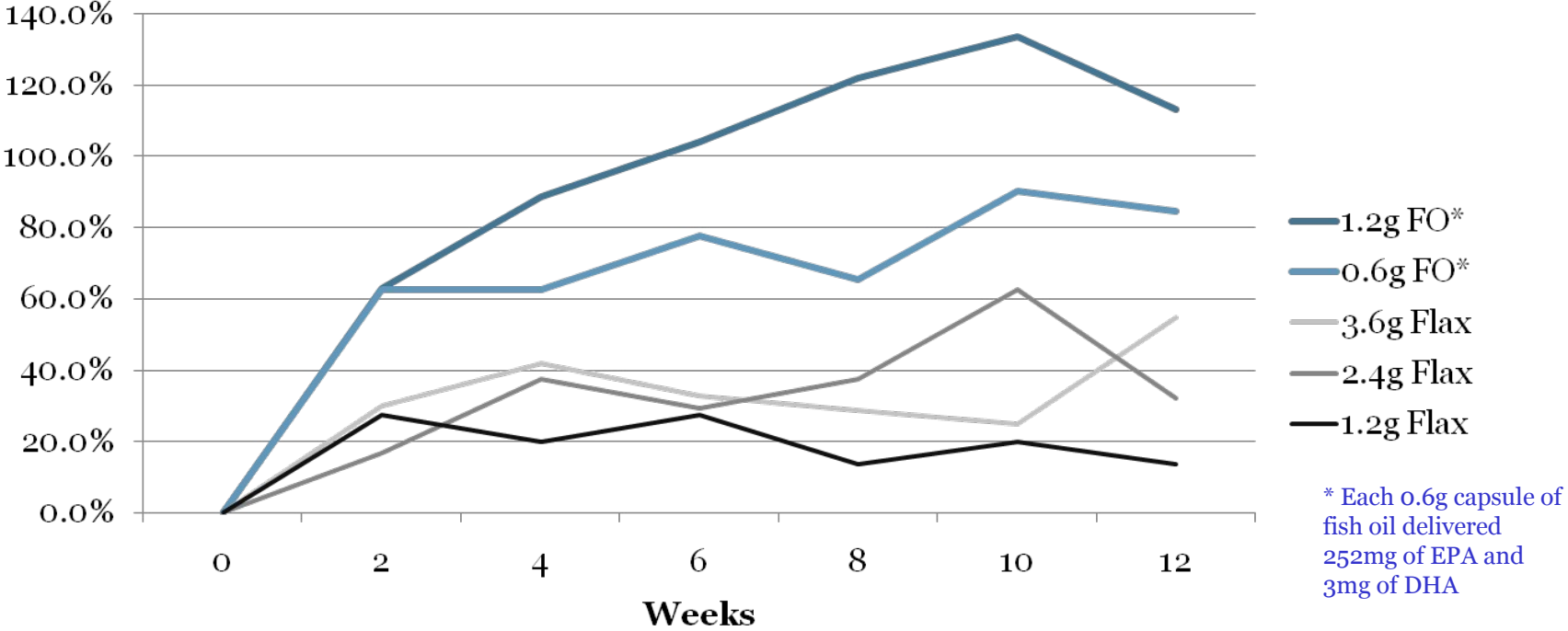
Breaking News on Supplements &  
Nutrition - Europe  
Dietary ALA sufficient to raise  
omega-3 levels, says study



# Low levels of fish oil intake led to higher levels of LCn-3s than high intakes of flaxseed oil

## Increase in Mean Serum EPA Levels

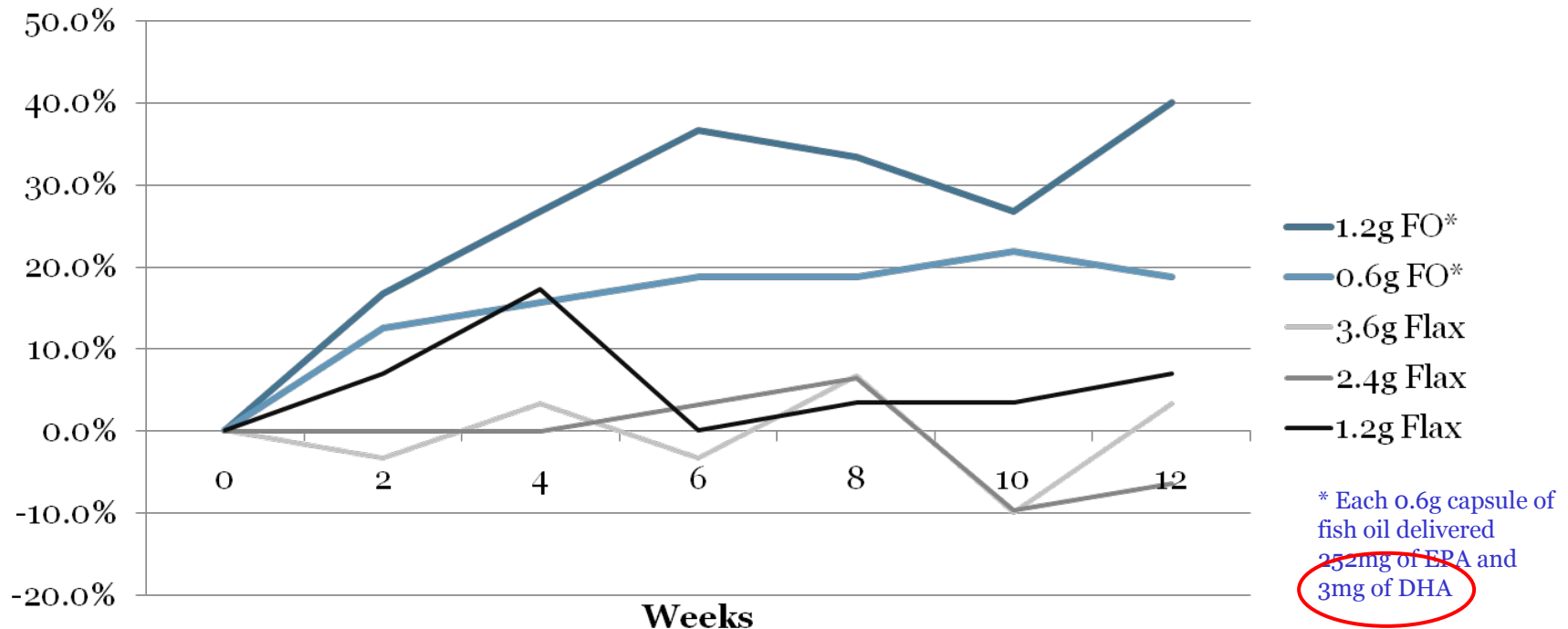
*Expressed as a % of baseline value*



# Fish oil led to higher serum levels of DHA, flaxseed oil did not

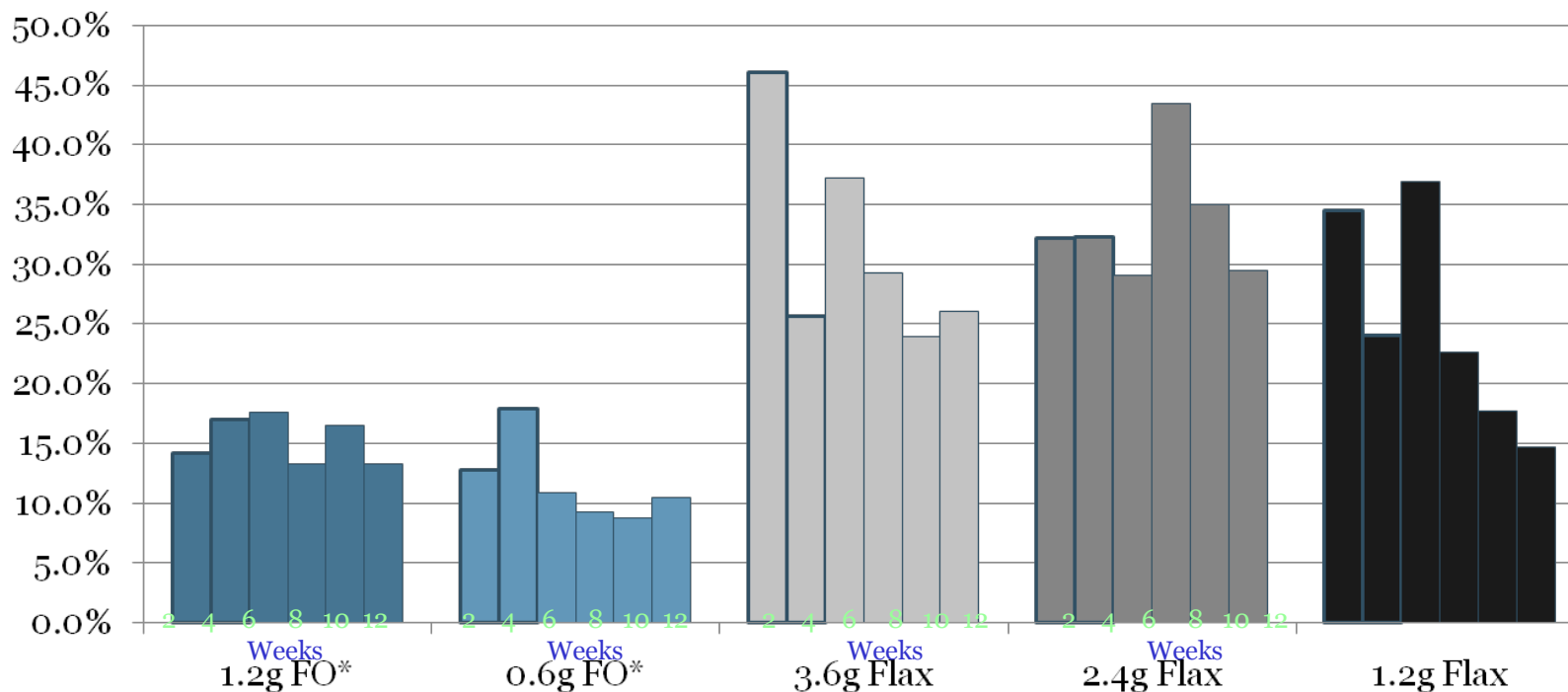
## Increase in Mean Serum DHA Levels

*Expressed as a % of baseline value*



# The increase in serum LCn-3 levels was uniform for fish oils, but from flax oil were much more variable

## Standard Deviation of Serum EPA Levels *Expressed as a % of mean values*



\* Each 0.6g capsule of fish oil delivered 252mg of EPA and 3mg of DHA



# Commercial Drivers for Future Success: Quality/Quantity

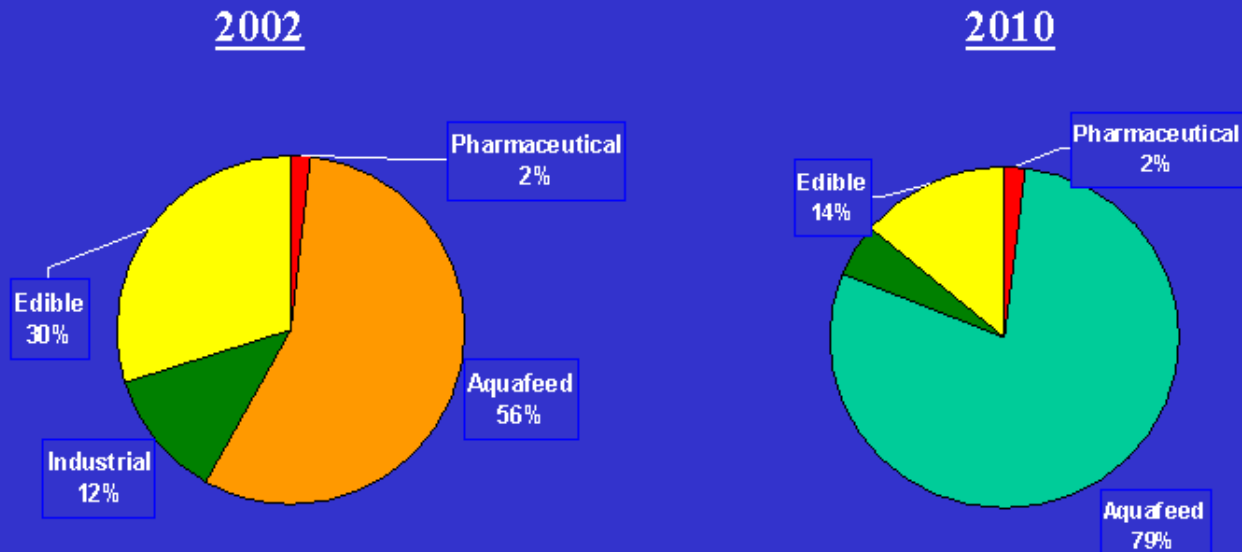
- Monographs (GOED)
  - EU and US monographs, specify amounts omega-3's, heavy metals, dioxins, oxidized molecules
- GOED Activities
  - Trade support, science support (Purdue Univ.), science writers support, consumer media support. Legislation; recommendations, claims, legislation
- Fish Stock sustainability.
  - Really a non issue but perceived by media/consumers to be a problem due to declining stocks of fresh fish.
  - Fish oils **do not** come from the main fish stocks.
  - Around 100,000,000 tons fish caught per year of which 90% of industrial fish catch goes to aquaculture, so still plenty of supply for human use. Fish oil is a by product of fish meal production.





# Fish Stocks: Fish Oil Use 2002-2010

## SUMMARY OF FISH OIL USE FOR THE PERIOD 2002 AND 2010

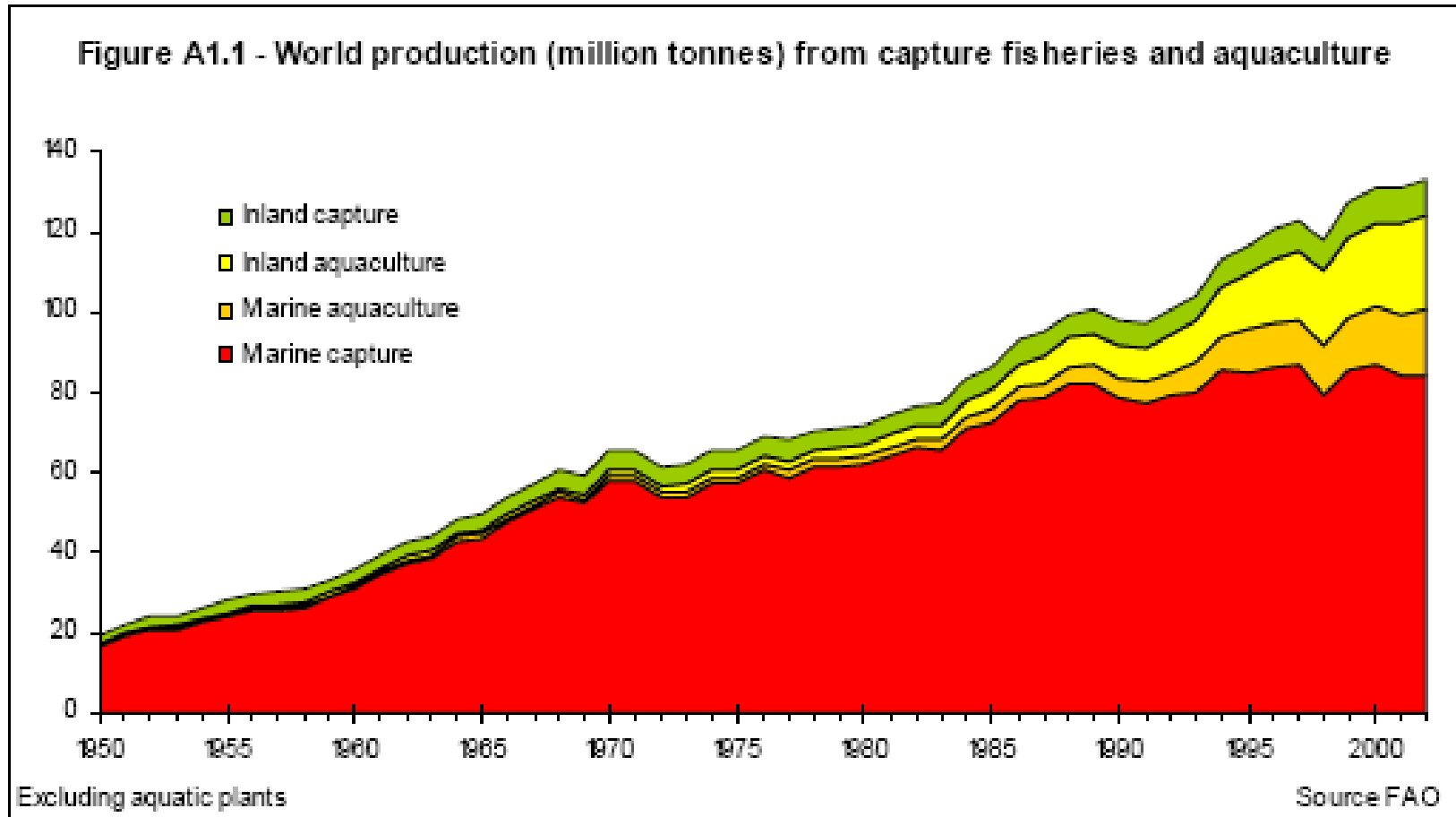


September 2002

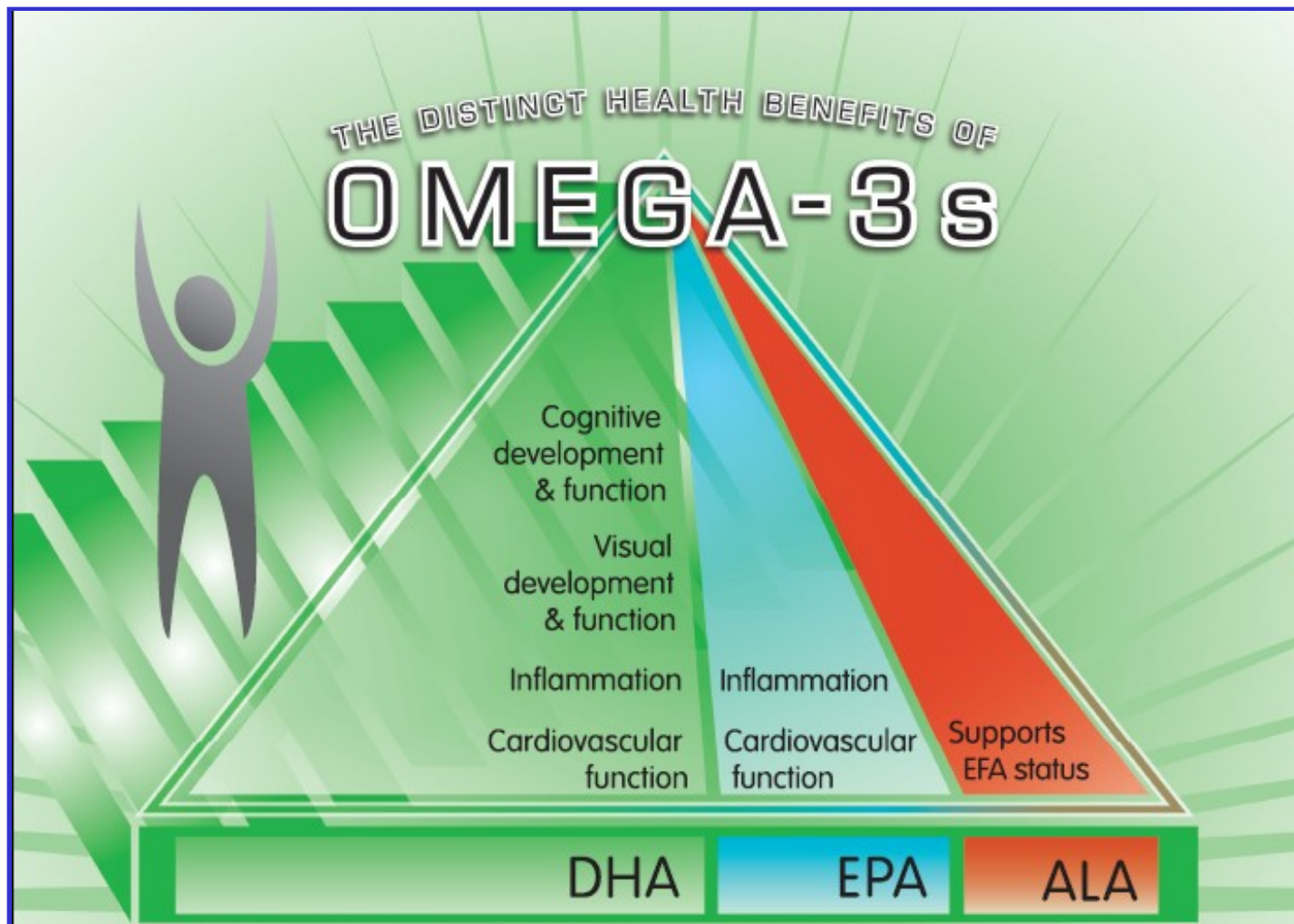


# World Fishery Catch 1950-2000

(FAO)



# The Many Distinct Benefits of Omega-3s



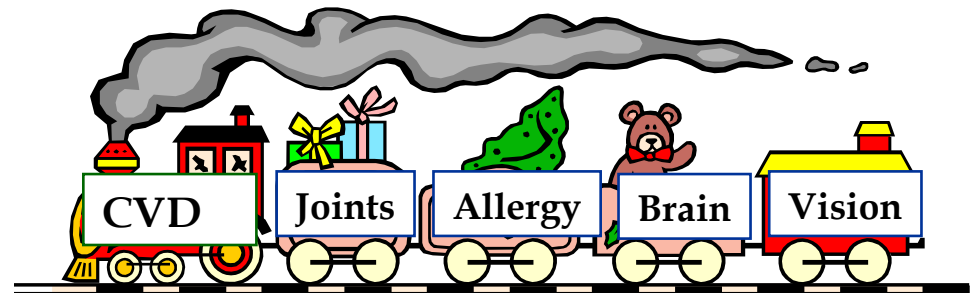
# Positioning of Omega 3 Fatty Acids

Fatty acid	Category	Target group	Health target
EPA	Enteral clinical nutrition	Patients	Immune system
	Dietary supplement	Population	Joints (rheumatoid arthritis)
DHA	Infant nutrition	Infants	Brain + eye development
	Maternal nutrition	Pregnant mother	Brain + eye development
	Maternal nutrition	Lactating mother	Brain + eye development
	Dietary supplement	Population	Brain function (cognition, behavior, mood)
	Dietary supplement	Population	Eye (macula degeneration, dyslexia, dark adaptation)
EPA/DHA	Mainstream food	Population	Heart



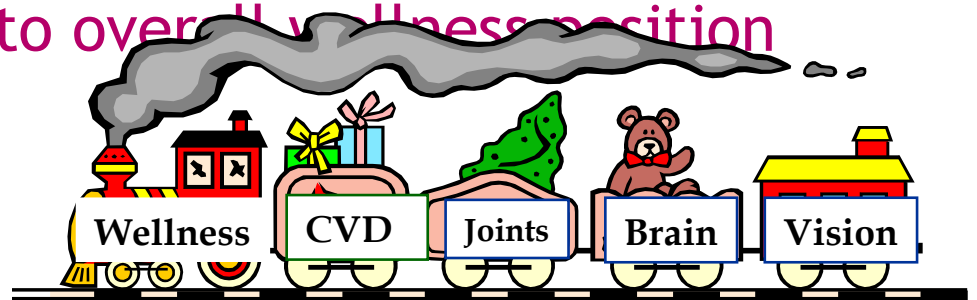
# Marketing Dietary Supplements: Then and Now

- Initially refined oils primarily for CVD (18/12)
- Highly refined oil now shifting to Concentrates
- Life stage marketing, primarily adults/seniors
- Varied ratios EPA:DHA
- Specialty marine oils (salmon, tuna, krill) niche markets.
- CVD engine and many niche products created
- DHA for cognitive benefits
- EPA benefits for infants and ALZ

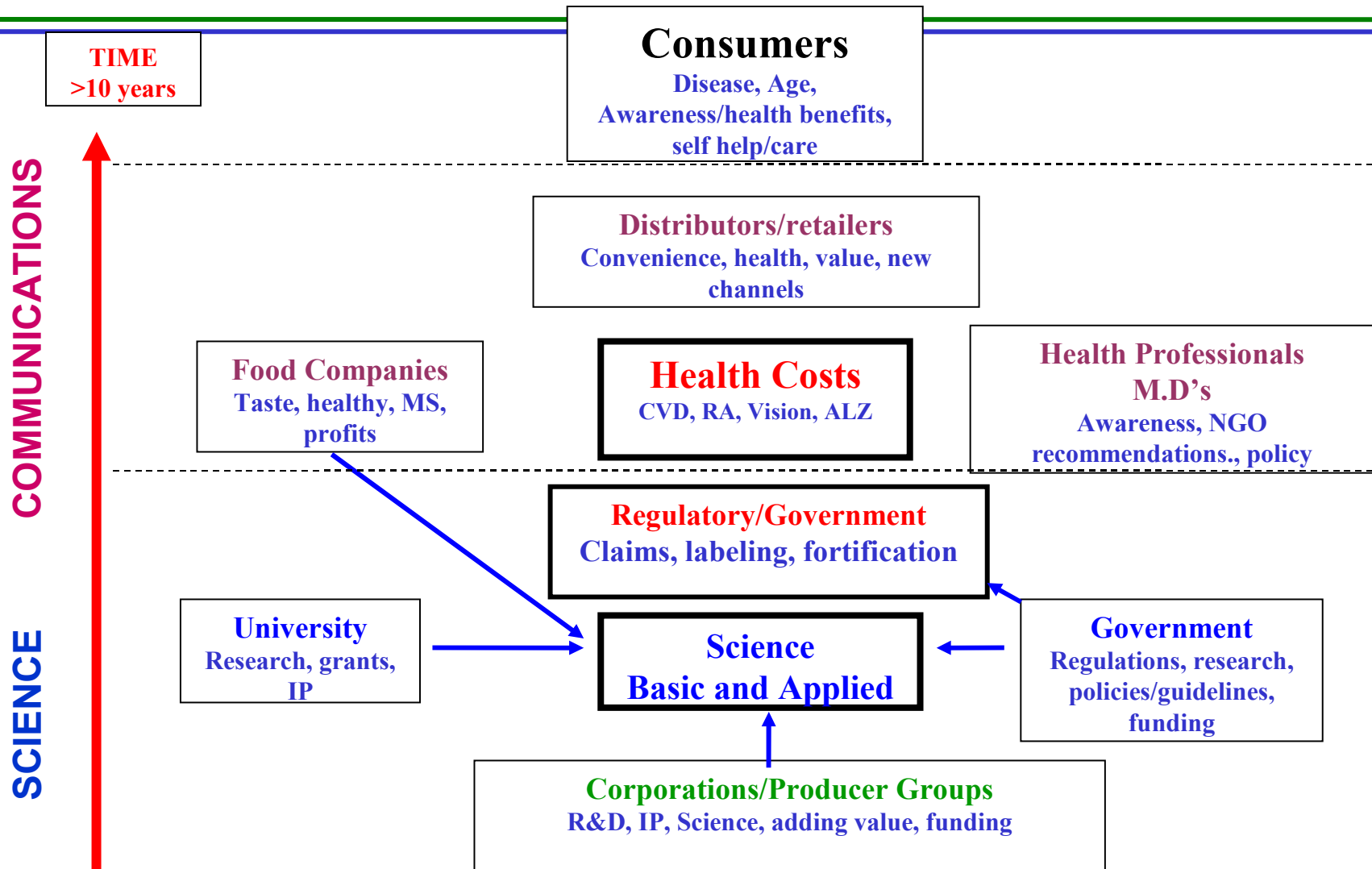


# Functional Foods: Then and Now

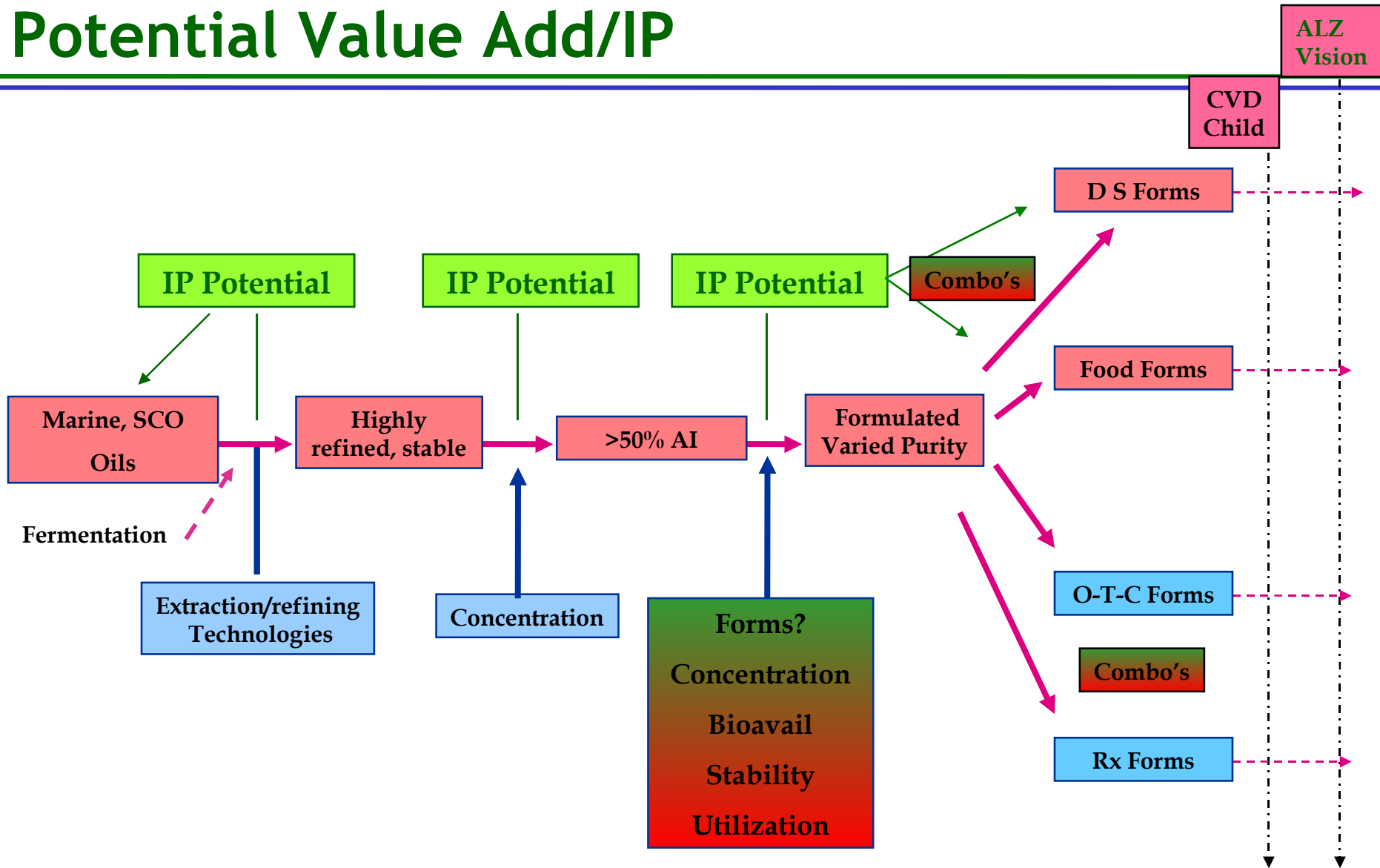
- “Good” quality oils promoted where ever we could find interest; spreads, breads, bars, surimi. Sometimes omega-3 added to help a “failing” product.
- Excellent quality oils in virtually any food, without taste compromise. Longer shelf life and stability still needs work
- Smaller innovative companies looking for advantage (niche opportunities)
- Major companies now aggressively looking to push bottom line revenues with big SKU’s
- Need to move from CVD to overall wellness position rather than niche areas.



# Success Factors & Key Inter-relationships



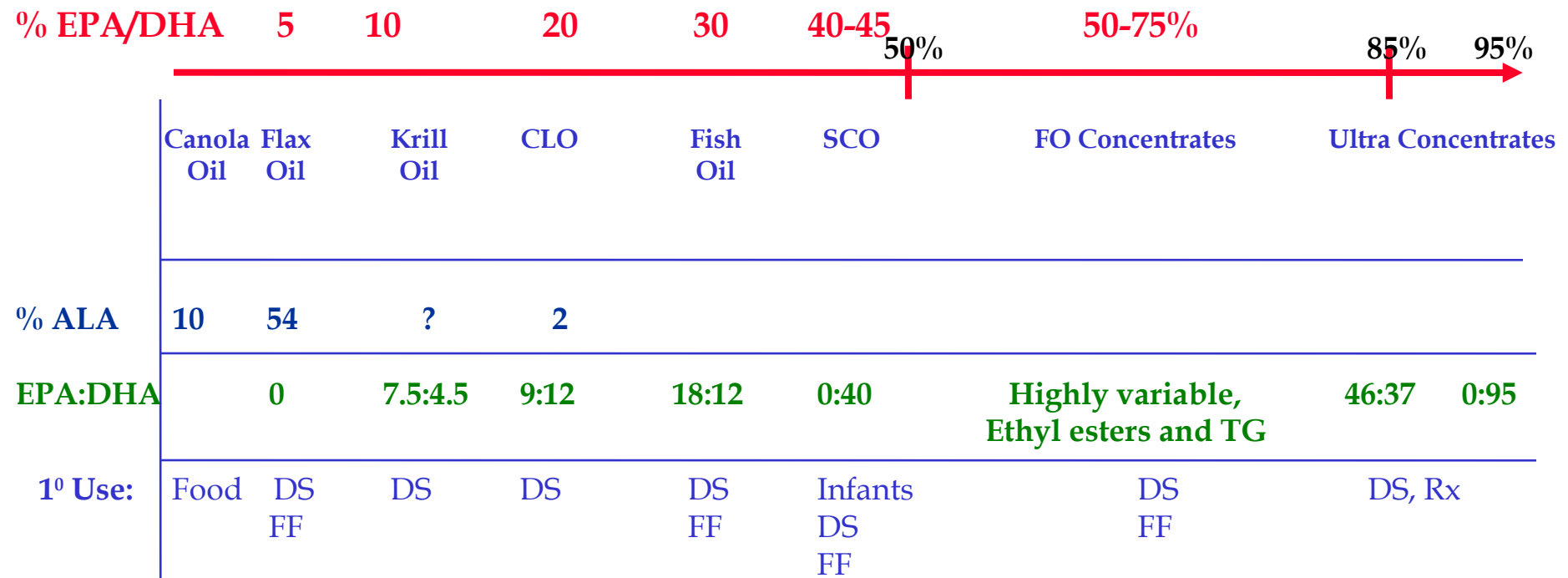
# Product Development pathway & Potential Value Add/IP





# From Fishes to Drugs....and beyond

Increasing Concentration LC Omega-3's



New Frontier 10-20% EPA  
GMO

30-40% EPA



# Success Stories, Product Launches with Omega-3's (Mintel data)

	<u>2004</u>	<u>2005</u>	<u>2006</u>	<u>2007</u>
Total New	120	NA	250	NA
Total EU		291		723
Total USA		315		541
Types	Baby Food Bakery Meats		Dairy Yoghurt Spreads Beverages Snacks Juices	

Conclusion: moving from niche to mainstream.



# Mintel Consumer Study 2007 Summary

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- Awareness reached globally
- Confusion regarding ALA, EPA, DHA and the need for message consistency
- 30% persons buying food specifically buy food with omega-3's
- US functional food market estimated at \$600-700 million in 2007.
- DS market at \$489 million (NBJ),
- 8% of US population taking DS daily
- Market growth dependent on honest claims
- Market depends on regulation and validation through research
- Competing food additives such as antioxidants, probiotics, carotenoids, etc

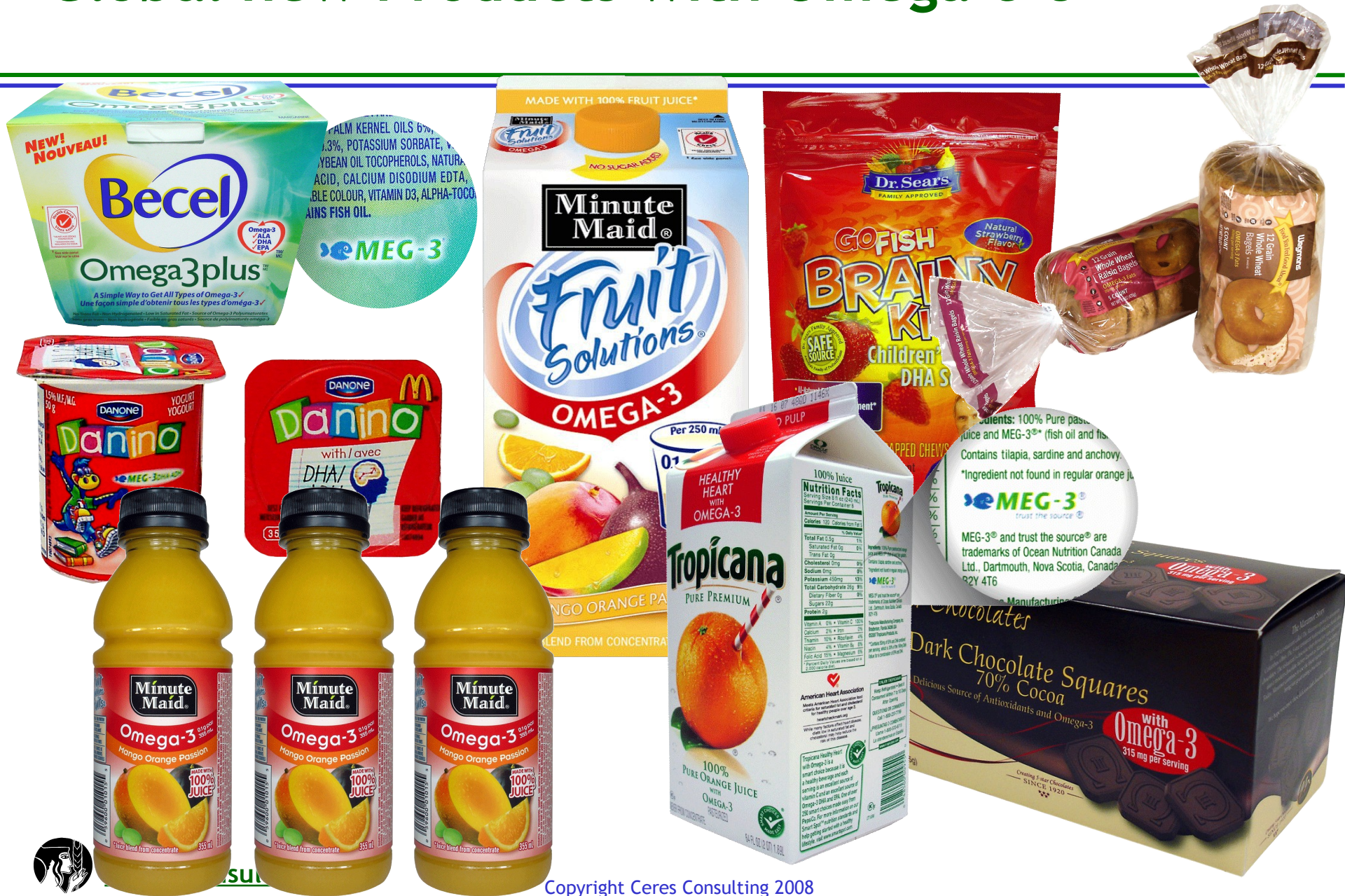




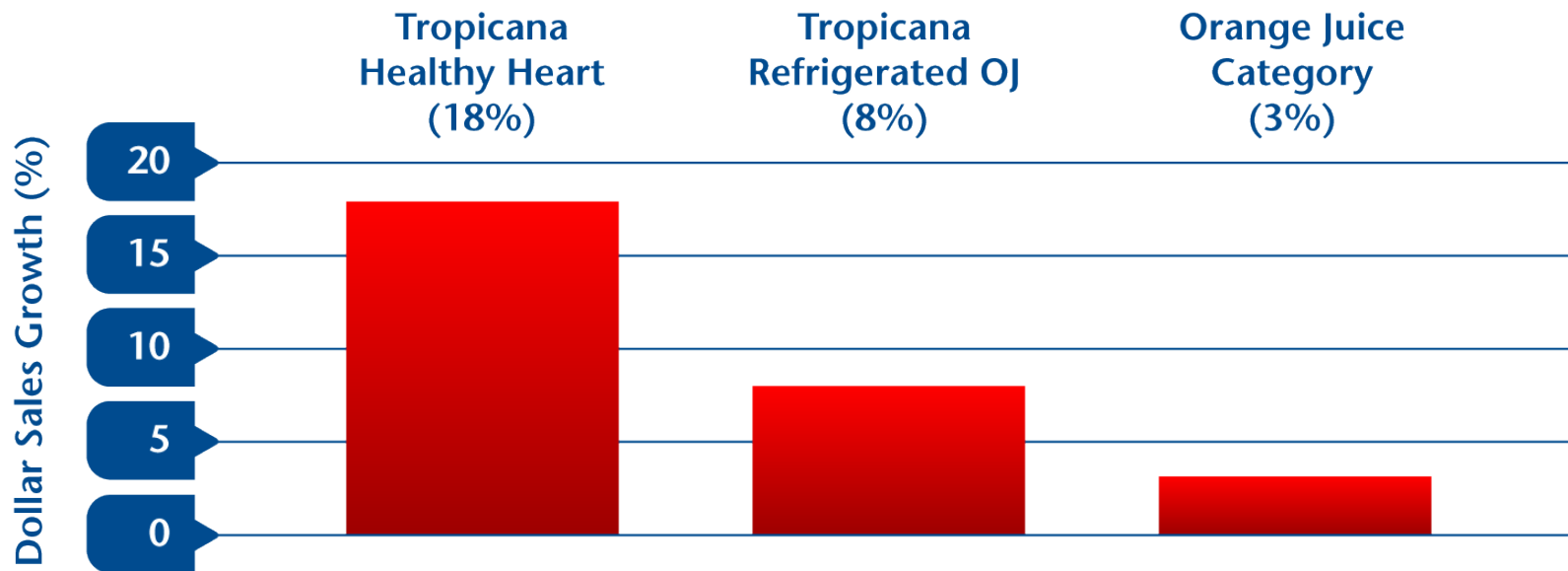




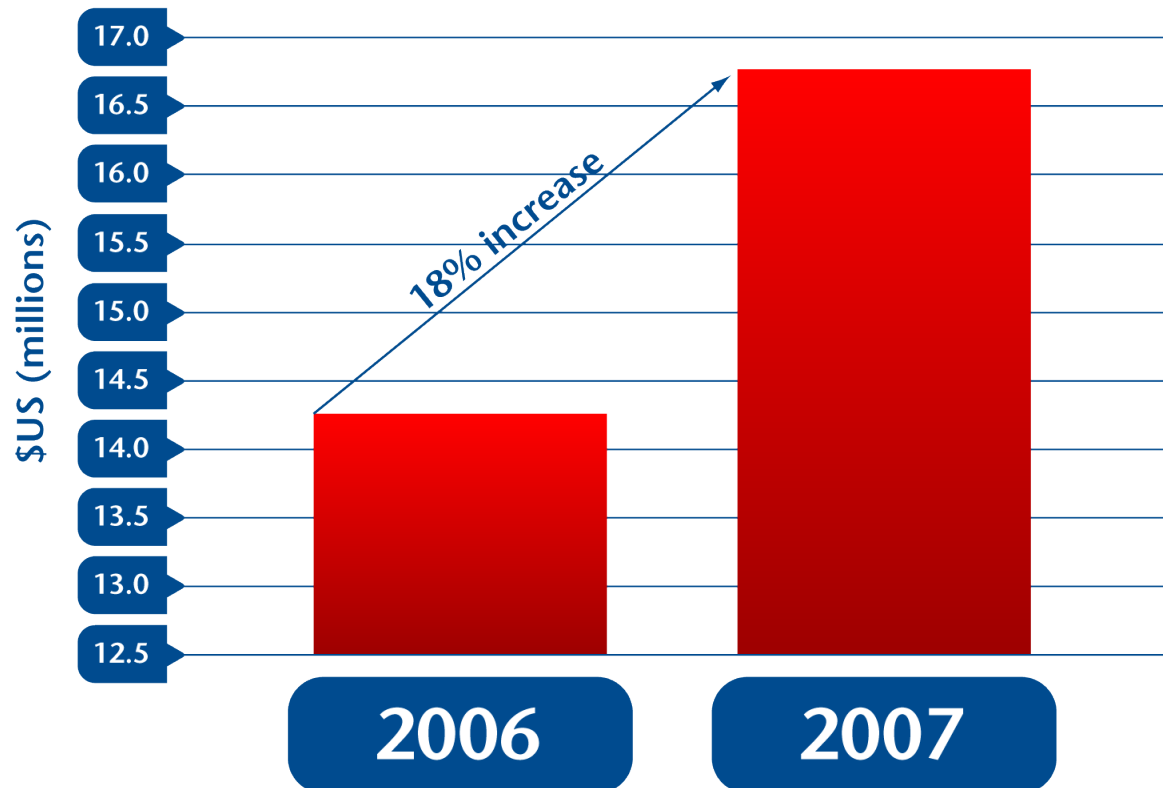
# Global new Products with Omega-3's



# Dollar Sales Growth (2006-'07): Tropicana (USA) Healthy Heart Orange Juice



# Sales of Tropicana Healthy Heart Orange Juice



While Tropicana Healthy Heart sales increased by 18%, sales of Tropicana refrigerated orange juice actually decreased by 8% and the whole orange juice category increased by only 3%



# Market Segmentation....Too Much?

Segment	CVD	Brain	Joints	Vision
Seniors	X	Cognitive ALZ	X	AMD X
Adult Female	X	Depression	X	
Male	X	Suicide	X	
Children		Learning, IQ ADHD ADD		X
Infants		Development IQ		X





# Future View

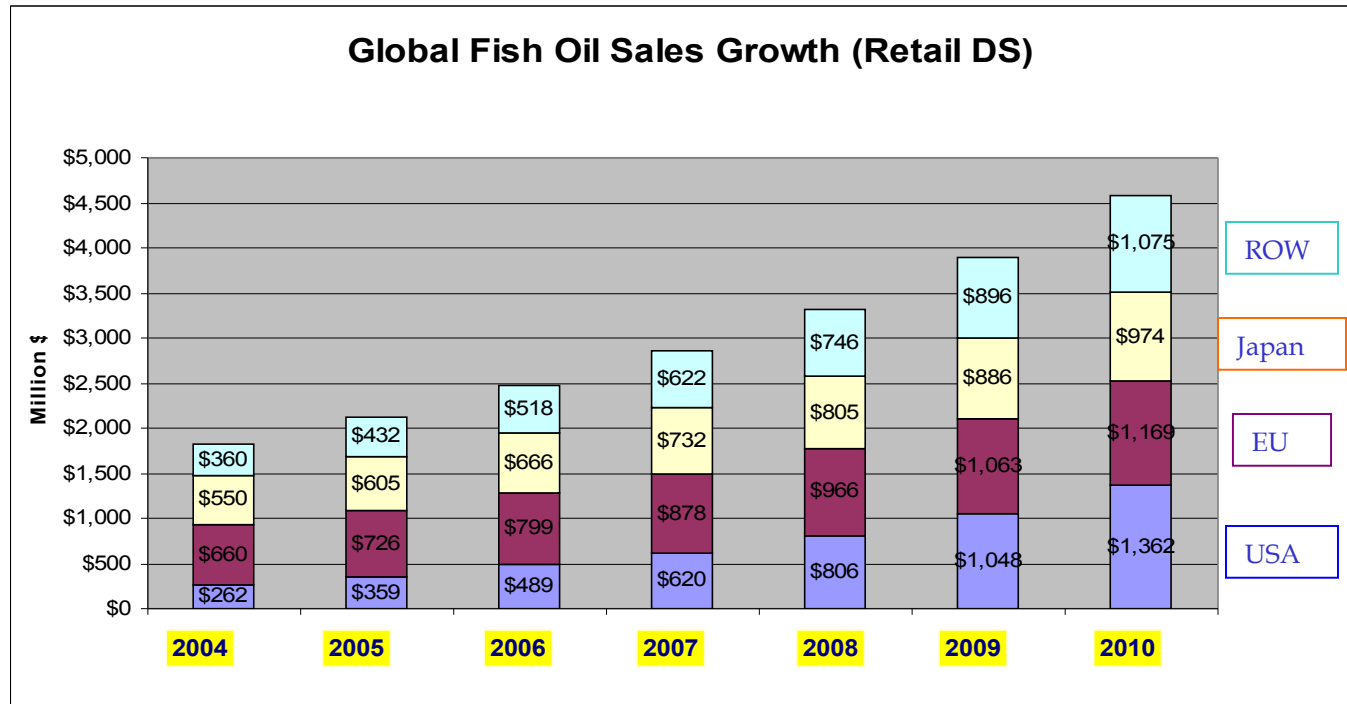
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- **Sources;**
  - Marine; (Sources?, krill)
  - Fermentation; (Martek, Lonza, Others)
  - Plant; (Syngentia, Bayer, Dow, BASF)
- **Technology;** Forms development, clear beverages, extruded cereals, better stability. These are **not** forgiving lipids. Need hand holding and support to food companies.
- **Consolidation;** RM producers and technology providers or marketers?
- **New Science:** Gene signaling, diabetes, bones, cancer, as delivery molecules
- **Regulatory:** RDI's, health claims, will be there just time



# Market Forecast for Fish Oil Sales by Region (\$MM)

(Retail supplements)



GROWTH	2003	CAGR	2004	2005	2006	2007	2008	2009	2010
Region									
USA	\$183	30%	\$262	\$359	\$489	\$620	\$806	\$1,048	\$1,362
EU	\$600	10%	\$660	\$726	\$799	\$878	\$966	\$1,063	\$1,169
Japan	\$500	10%	\$550	\$605	\$666	\$732	\$805	\$886	\$974
Rest of World	\$300	20%	\$360	\$432	\$518	\$622	\$746	\$896	\$1,075
TOTAL	\$1,583	18%	\$1,832	\$2,122	\$2,472	\$2,853	\$3,324	\$3,892	\$4,581



# Market Forecast Functional Foods

- Anybody's guess:
- Frost and Sullivan EU analysis, ingredient market growing at 24% and estimated \$1.6 billion in 2014
- Packaged Facts 2007, US market FF \$2 billion, growing to \$7billion by 2011

If we believe the global EPA/DHA ingredient market is \$700 million today (excluding infant foods), this is now a larger market than many vitamin markets for human use, and it is really only just starting to become mainstream for functional foods.



# Thank You.....Questions?

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