Medical uses of EPA

Omega-3s already in use as active pharmaceutical ingredients

Many of these required in high doses (grammes per day)

Requires concentrated or purified forms for compliance

Manufacturing issues related to specifications

Change in Median Placebo-Adjusted TG Levels From Baseline to Study End: Patient Statin Use at Baseline

- With Statin
  - EPA 4g/day: -65%
  - EPA 2g/day: -41%
- No Statin
  - EPA 4g/day: -26%
  - EPA 2g/day: -16%
- All Patients
  - EPA 4g/day: -33%
  - EPA 2g/day: -20%
Supply shortfall

Additional quality constraints for pharmaceutical uses:

- Fatty acid composition
- Trans-fat content – Zero (Japan)
- Oxidation, metals, PCBs, etc

Shortfall 460,000 tonne?
Short-term risk: Annual variation

Peruvian Anchovy Catch

El Niño

Pacific Decadal Oscillation?
Peru slashes anchovy quota by 68%; fish meal prices forecasted to soar

Peru slashed its commercial fishing quota as warmer water temperatures and controversial practices deplete stocks of anchovy in one of the world’s richest fisheries. The government cut its quota for this summer’s anchovy season by 68% to 810,000 tons, the smallest allowance in 25 years.

Anchovy is rarely eaten fresh, but is instead dried, ground up and exported as a protein-rich feed for livestock and farmed fish.

The stricter quota will allow just enough anchovy to swim into spawning season, reproduce, and keep the size of the fishery more or less stable, according to a report by the government marine institute, IMARPE.

“Technically we should have said the quota is zero. That’s how bleak the panorama is,” Production Minister Gladys Trevino told reporters this week in Lima.

The anchovy population has shrunk 41% since last summer and is 28% smaller than the average of the past 12 years, IMARPE says.
Early February.....
Current EPA (or omega-3) drugs are all derived from fish oil (mainly anchoveta), and there’s a supply issue.

There are, of course, other types of fish.

More costly, smaller supply volumes, may not be as suitable for production of high-purity EPA drugs due to fatty acid profile.

But marine fish do not make omega-3s, they get them from their diet.

Algae are the primary producers of omega-3s.
### Commercial Sources of Omega-3s

<table>
<thead>
<tr>
<th></th>
<th>DHA</th>
<th>EPA</th>
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<tbody>
<tr>
<td><strong>Fish</strong></td>
<td>✔</td>
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<tr>
<td>(Secondary Source)</td>
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<tr>
<td><strong>Algae</strong></td>
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<tr>
<td>(Primary Source)</td>
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<tr>
<td><strong>GM Plants</strong></td>
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</tbody>
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Important factors for medical use

Product Purity (ability to meet specification)
Consistency of Product Composition

Security of supply
  Secondary sites

Traceability of supply
  Manufacture under cGMP

Heterotrophic fermentation of algae

Stable process with low variation
Simple composition for processing

Equipment already available for rapid scaling to commercial quantities in multiple locations

Controlled growth conditions with traceability of ingredients right from fermentation
The production process

Fermentation → Extraction → Esterification → Concentration → Purification

Biomass → Lipid → Ethyl esters → Concentrate → >96.5% EPA

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Confidential
Since high concentration EPA has always been the aim with the EICONZ™ range, our choice of organism has been guided by its ability to produce EPA that can readily be purified.

Also needs the ability to grow heterotrophically.

Diatoms in particular can be grown on organic carbon whilst producing EPA with little in the way of other long chain polyunsaturated fatty acids, especially those that interfere with concentration and purification.
Type of organism dictates fermentation method

When producing EPA at a high enough level, and producing low enough quantities of ‘contaminating’ fatty acids these types of organisms grow slowly.

Traditional batch or fed-batch fermentations lead to build-up of undesirable molecules.
Continuous fermentation

CO2 Evolution
pH
Cell Density
Dissolved Oxygen
Strain Development, Process Development and Small Scale Production performed in New Zealand

Downstream Processing developed both in NZ and overseas with well established partnerships.
Scale up to multiple thousands of litres successfully conducted at contract sites overseas, sites for full-scale manufacture identified and first production runs underway.
The EICONZ™ range

High Concentration EPA from controlled algal fermentation

**Control**
Photonz’ proprietary phycopharming technology uses highly controlled heterotrophic fermentation to produce EPA directly from the primary source, algae. Photonz’ EICONZ™ EPA is:
- Pure EPA
- Sustainable, vegetarian source
- No environmental contaminants
- Simple impurity profile
- Rapidly scalable
- Fully traceable
- Non-GMO

For more detailed information on Photonz, the phycopharming platform or the range of EICONZ™ EPA products please contact our CEO, James Campbell at jcampbell@photonzcorp.com

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