ANSC/NUTR 618 Lipids & Lipid Metabolism Long-chain PUFA and Health

I. Classes of prostaglandins

A. PGE_1 and $PGF_1\alpha$

1. From 20:3n-6

2. Little biological activity

 $B.\ PGE_2$ and $PGF_2\alpha$

1. From 20:4n-6

2. Very high biological activity

 $C.\ PGE_3$ and $PGF_3\alpha$

1. From 20:5n-3

2. Less biological activity than PGE_2 and $PGF_2\alpha$

| Precursor | E series | F series |
|---|--|--------------------|
| 9 8 7 6 5 4 3 COOH 10 11 12 13 14 15 17 18 19 | 0 9 8,,7 6 4 3 2 COOH 10 11 12 13 16 17 18 19 OH | HO 99 8 11 12 HO |
| Dihomo- γ -linolenic acid (all- cis -8,11,14 $_{C_{20:3}}$) | E , | F _{1a} |
| 9 8 7 6 5 3 COOH 10 11 12 13 14 15 16 17 18 19 20 Arachidonic acid (all - cis - 5, 8, 11, 14 C _{20:4}) | 0 9 10 11 12 13 14 16 17 18 19 19 10 10 10 10 10 11 10 10 10 10 | HO 9 8 11 11 12 HO |
| 9 8 7 6 5 3 COOH 10 11 12 13 14 15 16 17 18 19 20 Eicosapentaenoic acid (EPA) all-cis-5,8,11,14,17 _{C20:5} | O 9 8 COOH 10 14 16 17 18 19 20 HO OH E3 | HO 11 11 12 HO |

II. Classes of leukotrienes

- A. Leukotriene 3 series
 - 1. From 20:3n-6
 - 2. Little biological activity
- B. Leukotriene 4 series
 - 1. From 20:4n-6
 - 2. e.g., 5-hydroxyeicosatetraenoic acid (5-HETE), leukotriene B₄, and the slow-reacting substances of anaphylaxis, LTC₄ and LTD₄
 - 3. Very high biological activity
- C. Leukotriene 5 series
 - 1. From 20:5n-3
 - 2. e.g., leukotriene B₅
 - 2. Less biological activity than 4 series leukotrienes

Slow reacting substances of anaphylaxis LTC₄

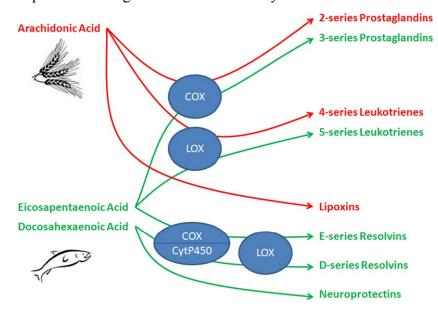
SRS A LTD₄

SRS LTE₄

III. n-3 Fatty acids in critical care

- A. Pro-inflammatory lipid mediators
 - 1. Prostaglandins (via COX) and leukotrienes (via LOX) from 20:4n-6
 - 2. Lipid mediators from EPA and DHA
 - a. Exhibit less inflammatory properties
 - b. Resolvins and protectins are generated from n-3 fatty acids

Arachidonic acid, EPA, and DHA share common enzyme systems. The are metabolized by cyclooxygenase (COX) to the 2 or 3 series of prostaglandins. Via the lipoxygense (LOX) they are metabolized to leukotrienes. EPA and DHA are converted to resolvins E and D by cytochrome P450 or COX followed by LOX. Neuroprotectins are synthesized from DHA.



B. Resolvins

- 1. Produced by COX pathway in the presence of aspirin.
 - a. Produced in vascular endothelial cells
 - b. Acetylated COX introduces a hydroperoxy group into EPA and DHA.

- 2. Reduce cellular inflammation by inhibiting production and transportation of inflammatory cells and chemicals to the sites of inflammation.
- 3. Resolvins may be causative in reducing the incidence of respiratory in newborns and neonates.

Resolvins are compounds produced by cells of the human body from EPA and DHA. They are produced by the COX pathway especially in the presence of aspirin. The figure at right is resolving D₂, derived from DHA.

C. (Neuro)protectins

- 1. Produced by COX pathway in the presence of aspirin.
 - a. Produced in brain and other tissues from DHA (not EPA or AA)
 - b. Acetylated COX introduces a hydroperoxy group into EPA and DHA.
- 2. Like resolvins, protectins reduce cellular inflammation by inhibiting production and transportation of inflammatory cells and chemicals to the sites of inflammation.

inflammation. They reduce neutrophil invasion into inflammation sites. They also reduce synthesis of proinflammatory cytokines. Resolvins also recruit monocytes. Protectins have similar effects.

Resolvins the course of

