Amino acid requirements and metabolism in fish larvae and post-larvae

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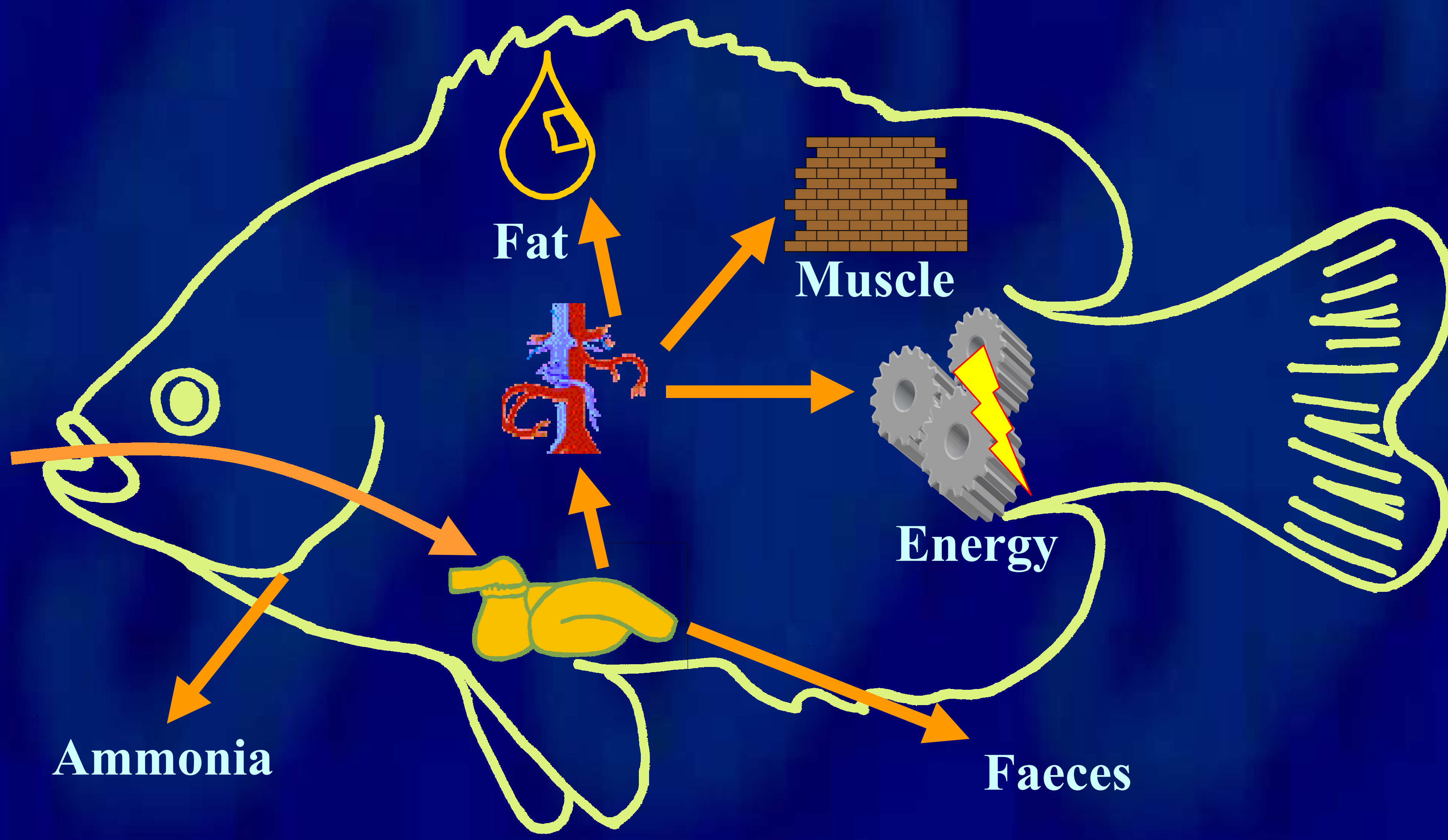
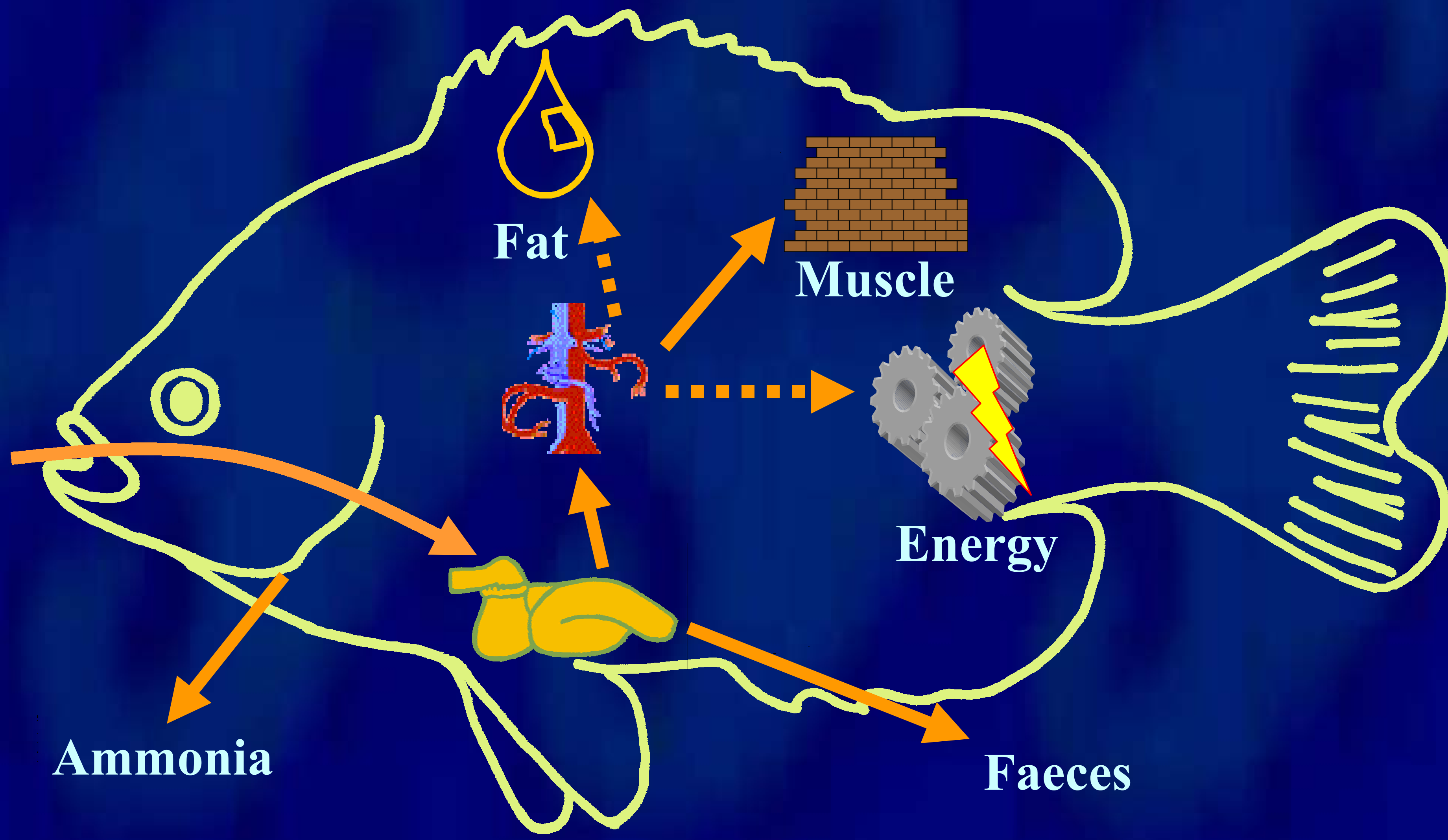
• Juvenile and adult fish have a higher protein requirement and a lower adaptability of amino acid metabolism than mammals.

•Fish larvae seem to have even less control of their AA metabolism leading to higher catabolic losses of AA, and thereby to higher AA requirements.

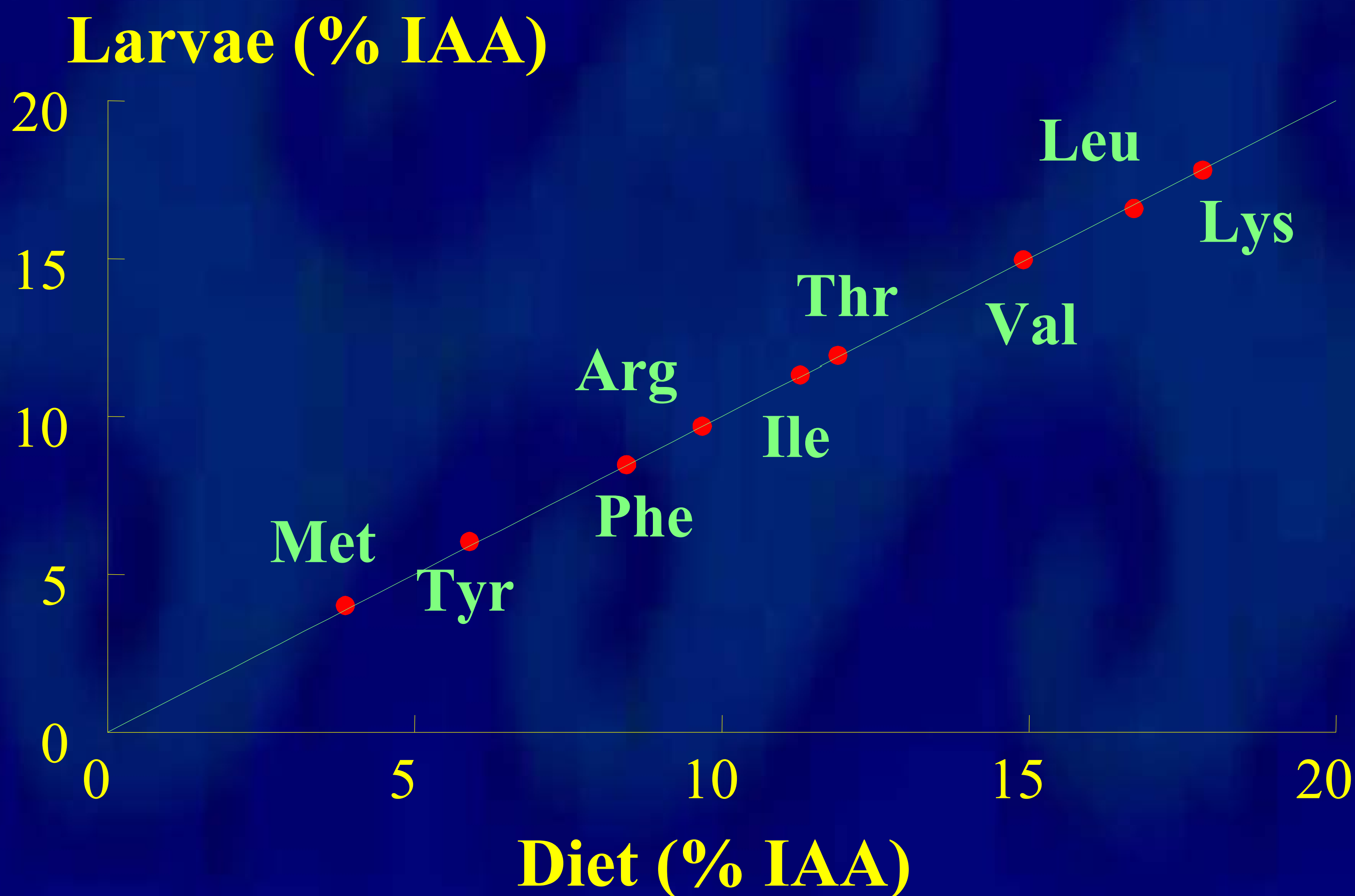
•Fish are probably more sensitive to diets poor in protein or with an imbalanced AA profile.

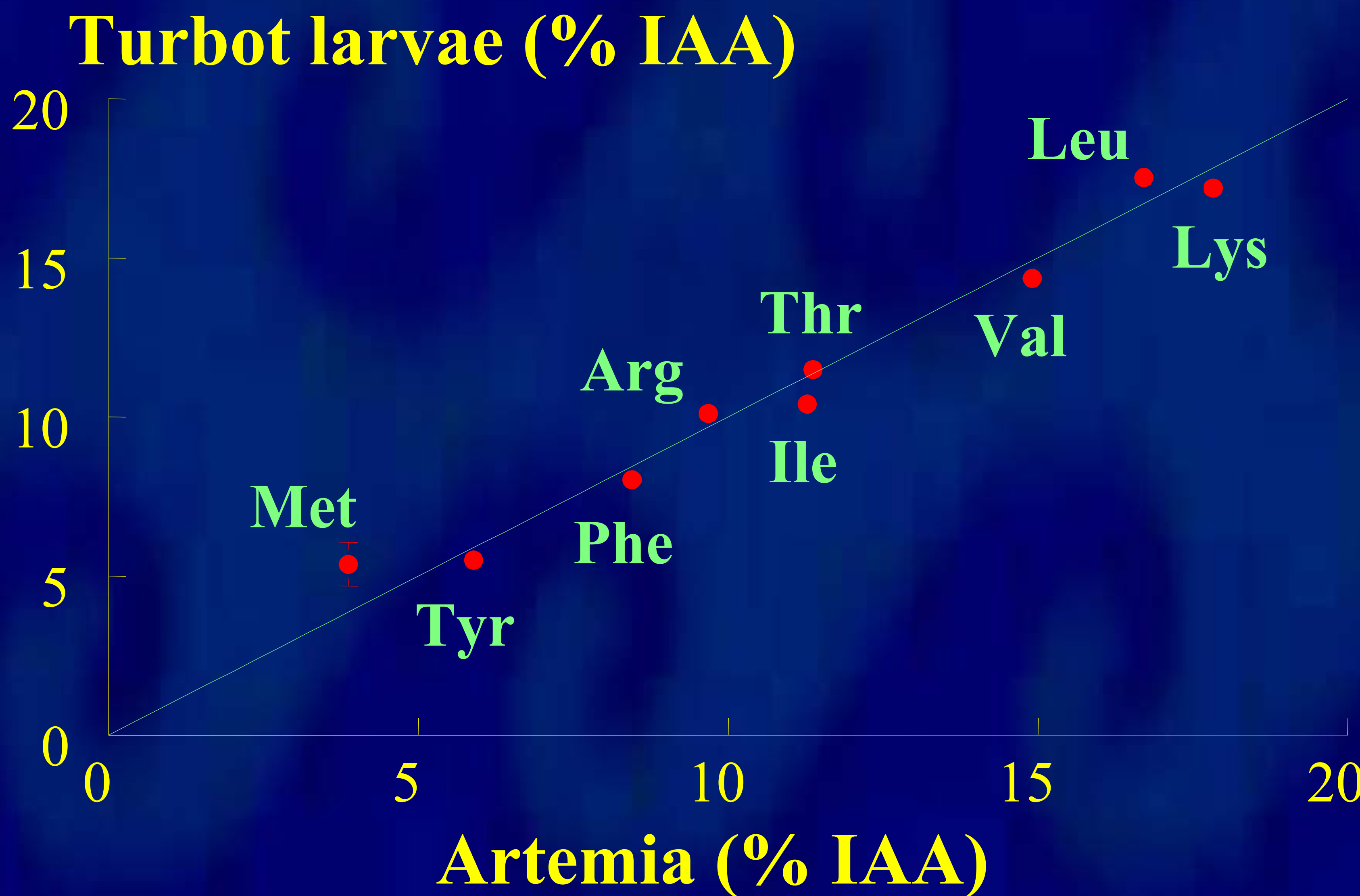

Fat
Muscle
Energy
Ammonia
Faeces

Balanced AA profile



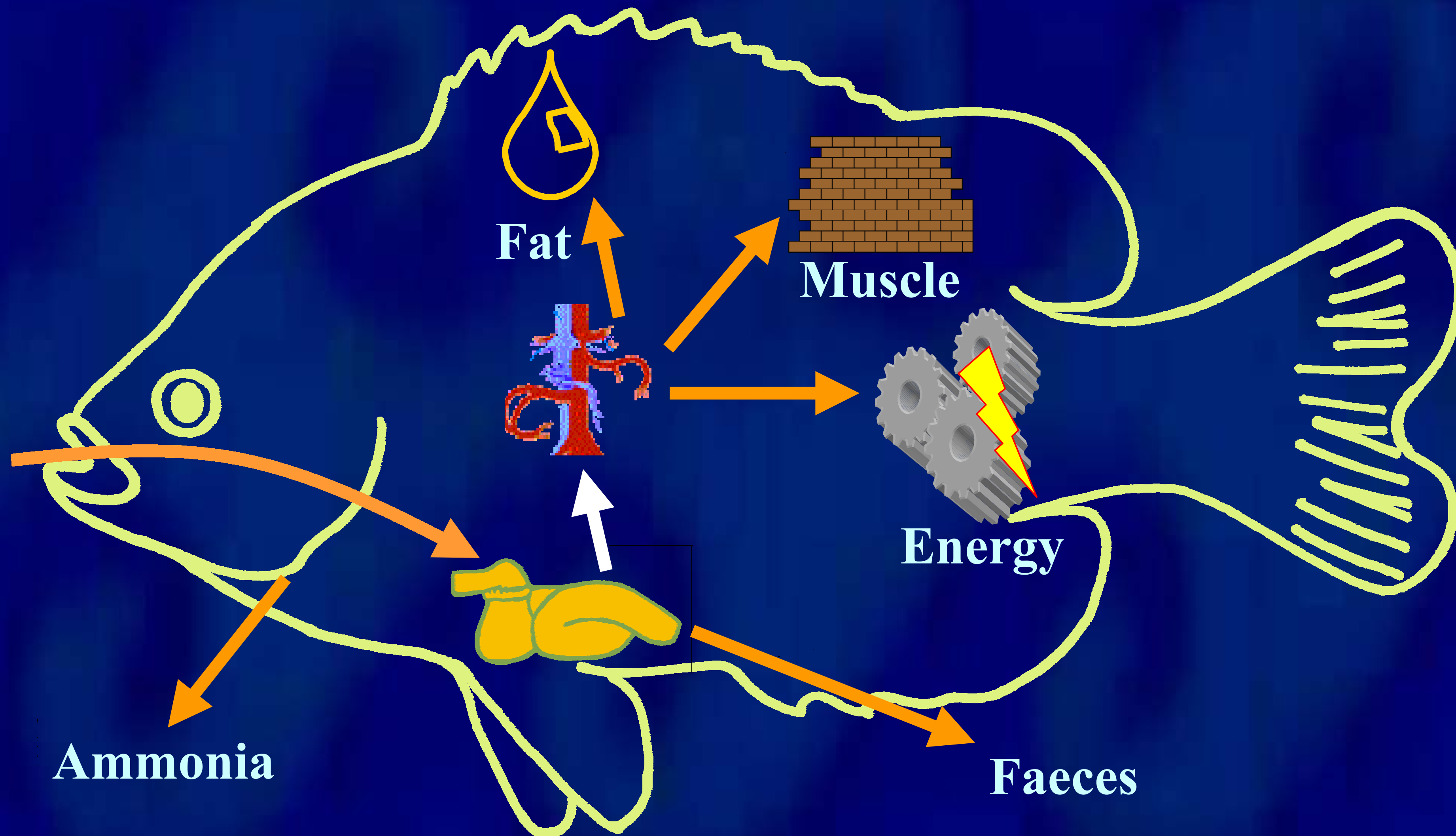
Ideal dietary AA profile





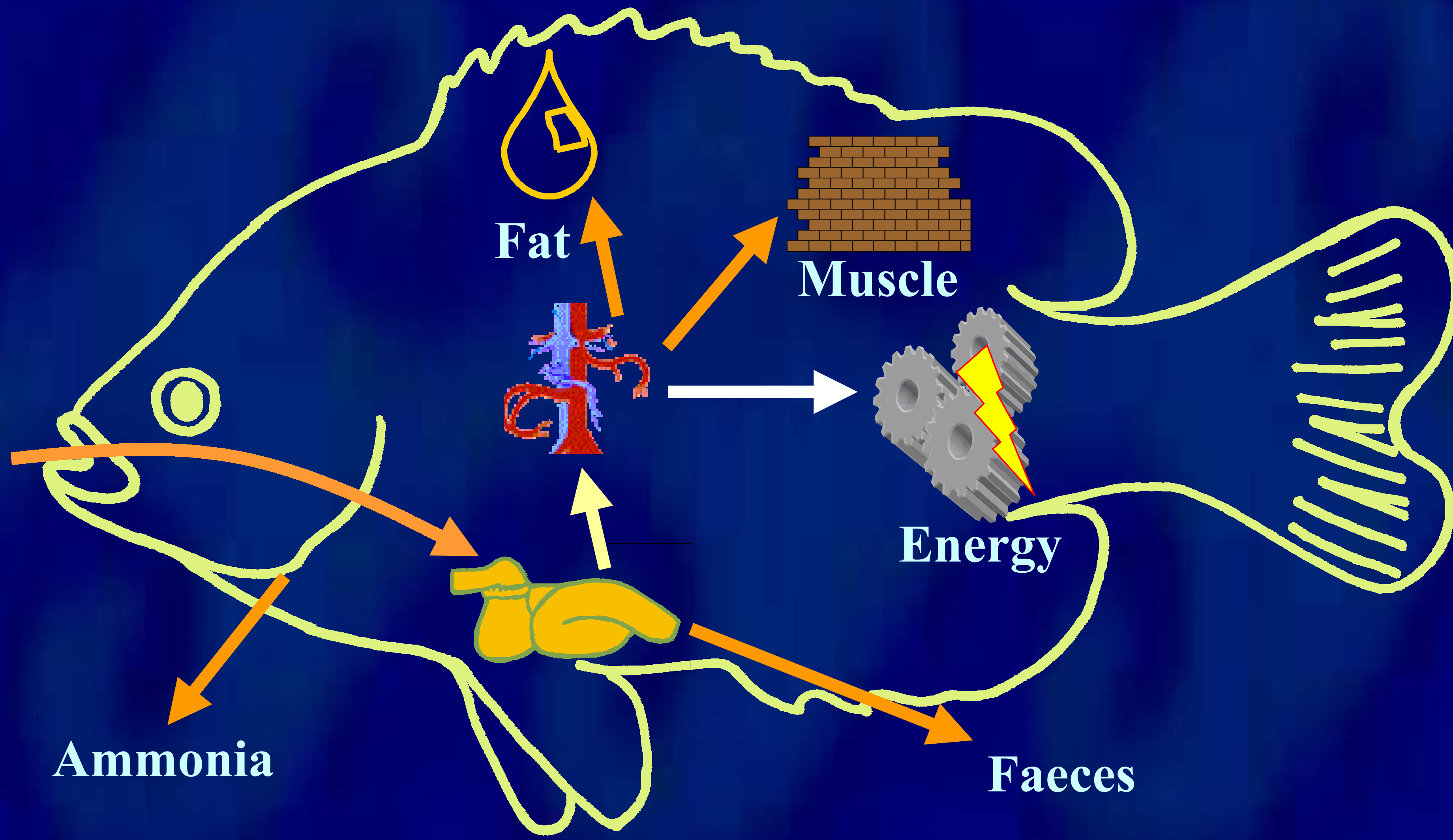
Turbot larvae (% IAA)
20
15
10
5
0
Leu
Lys
Val
Thr
Arg
Ile
Met
Phe
Tyr
0
5
10
15
20
Artemia (% IAA)


Fat
Muscle
Energy
Ammonia
Faeces

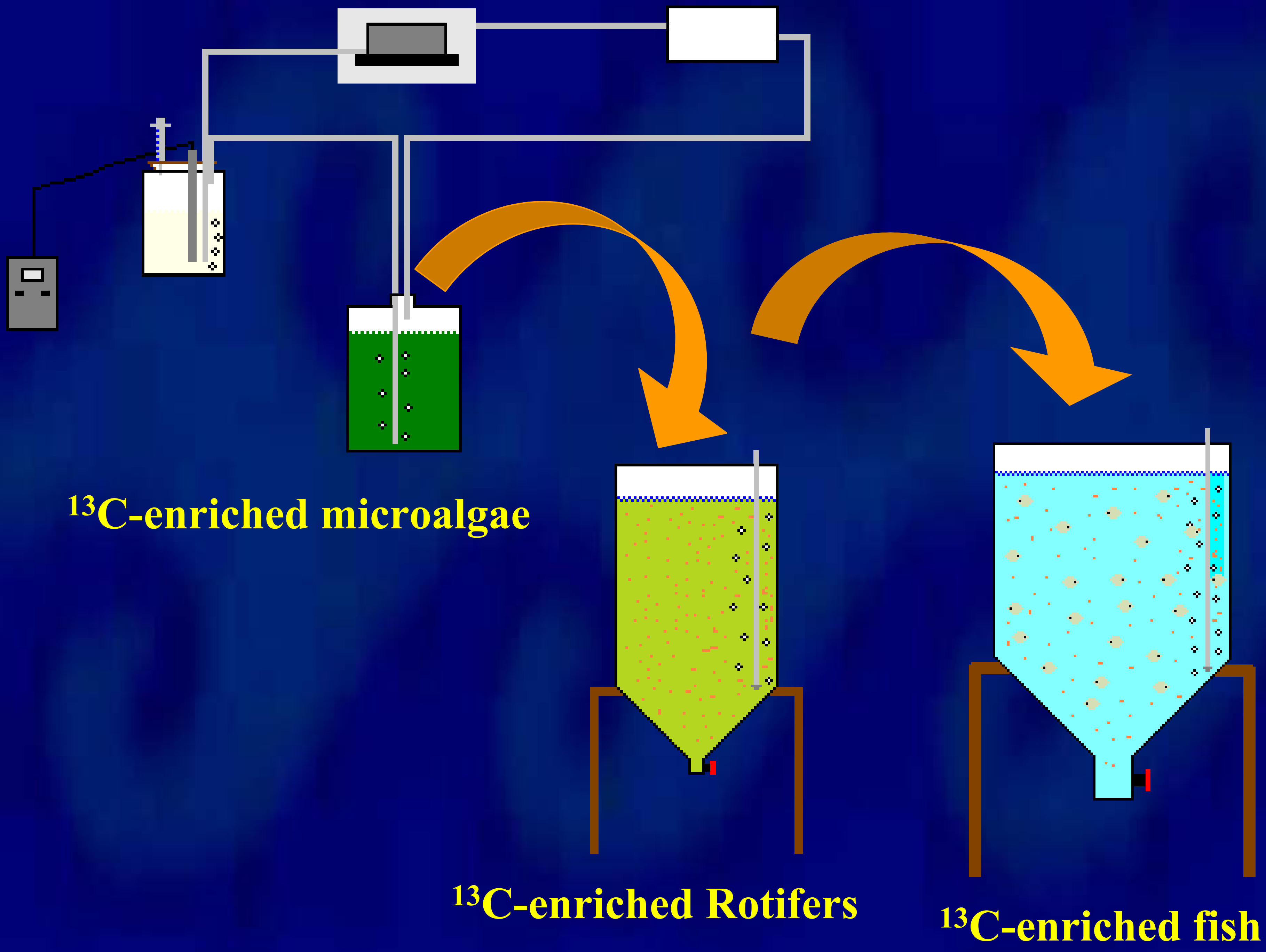


- **Differential absorption of individual AA?**

- **Selective catabolism of individual AA?**

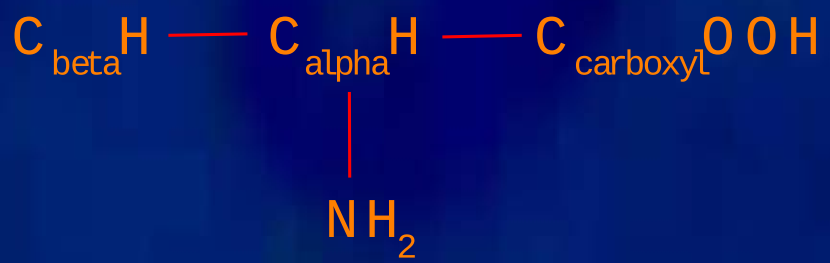


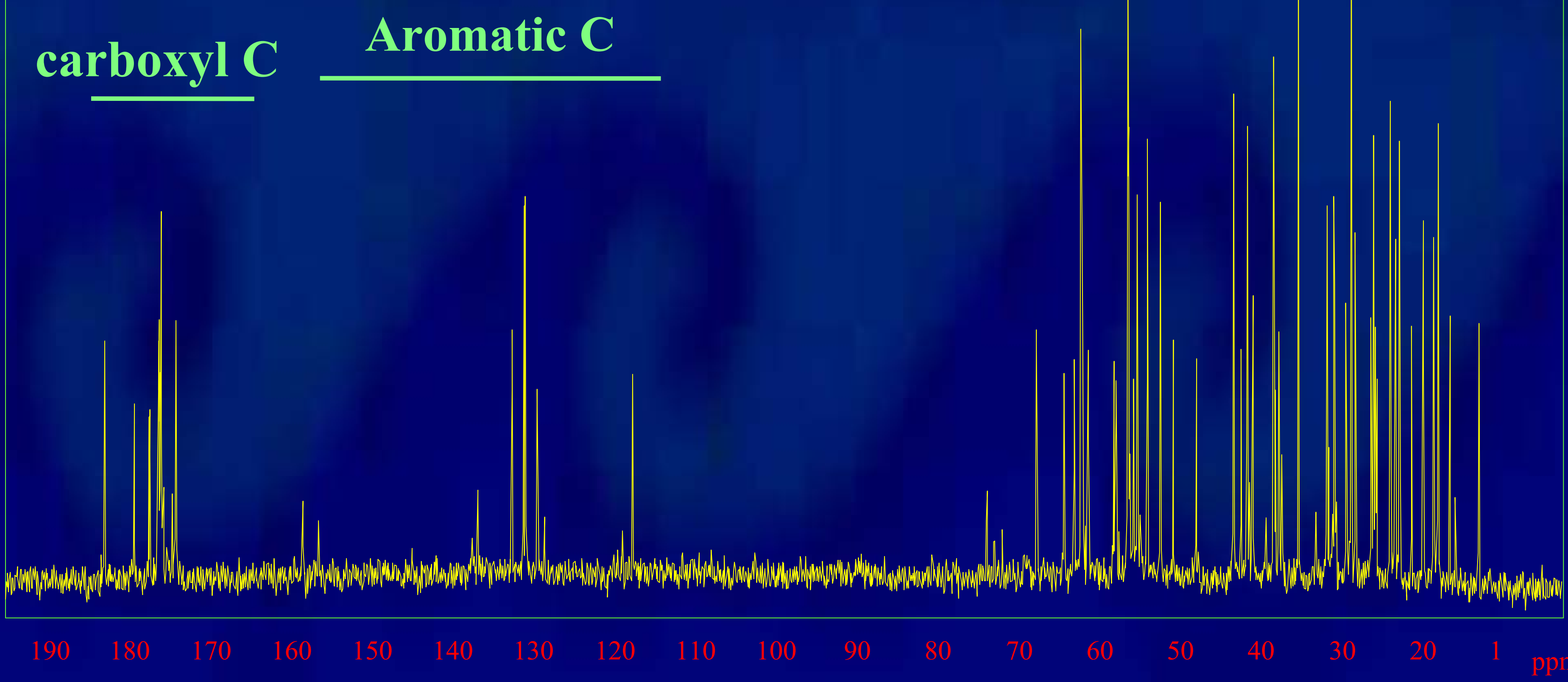
- **Differential absorption of individual AA?**



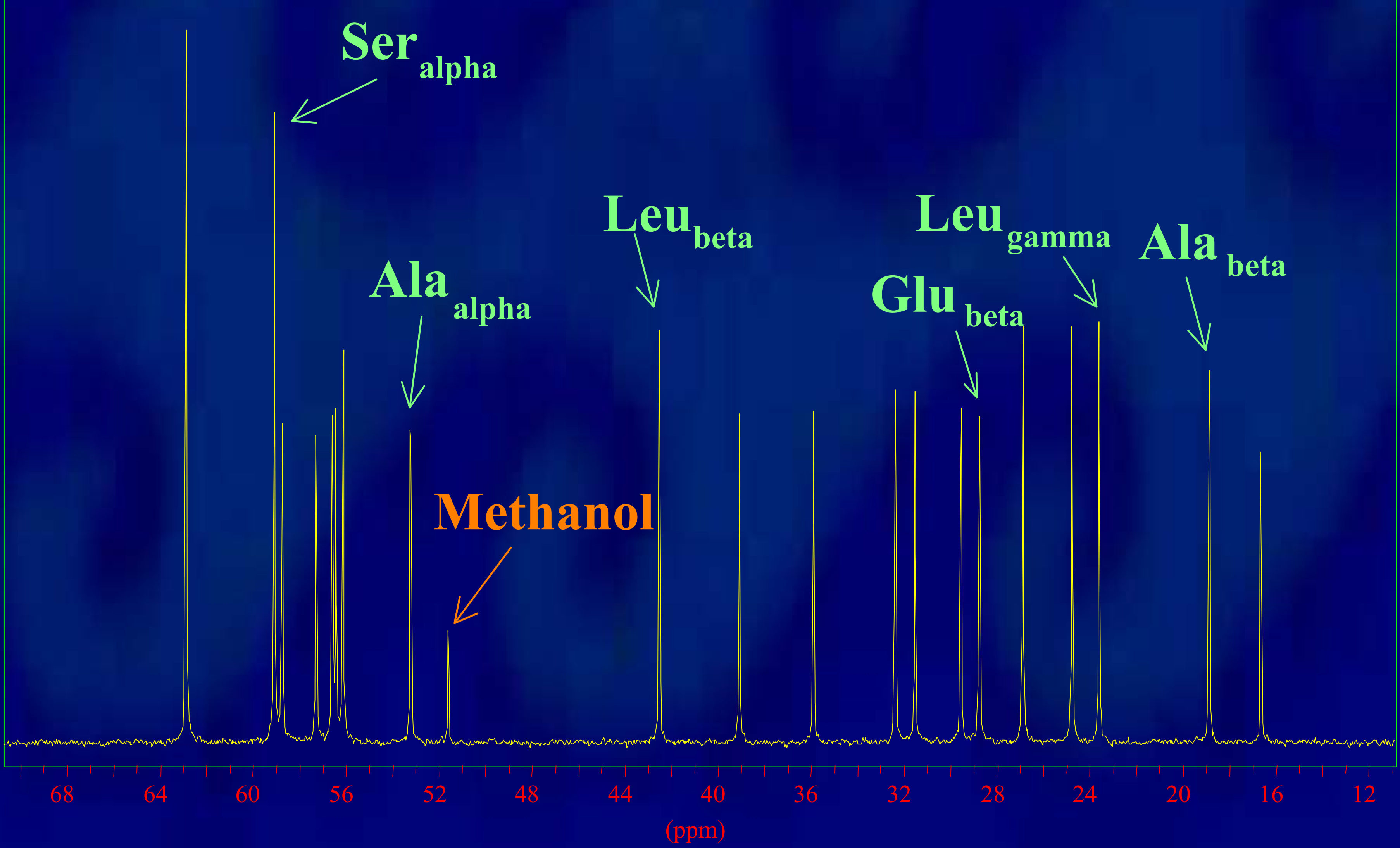
^{13}C-enriched microalgae
^{13}C-enriched Rotifers
^{13}C-enriched fish

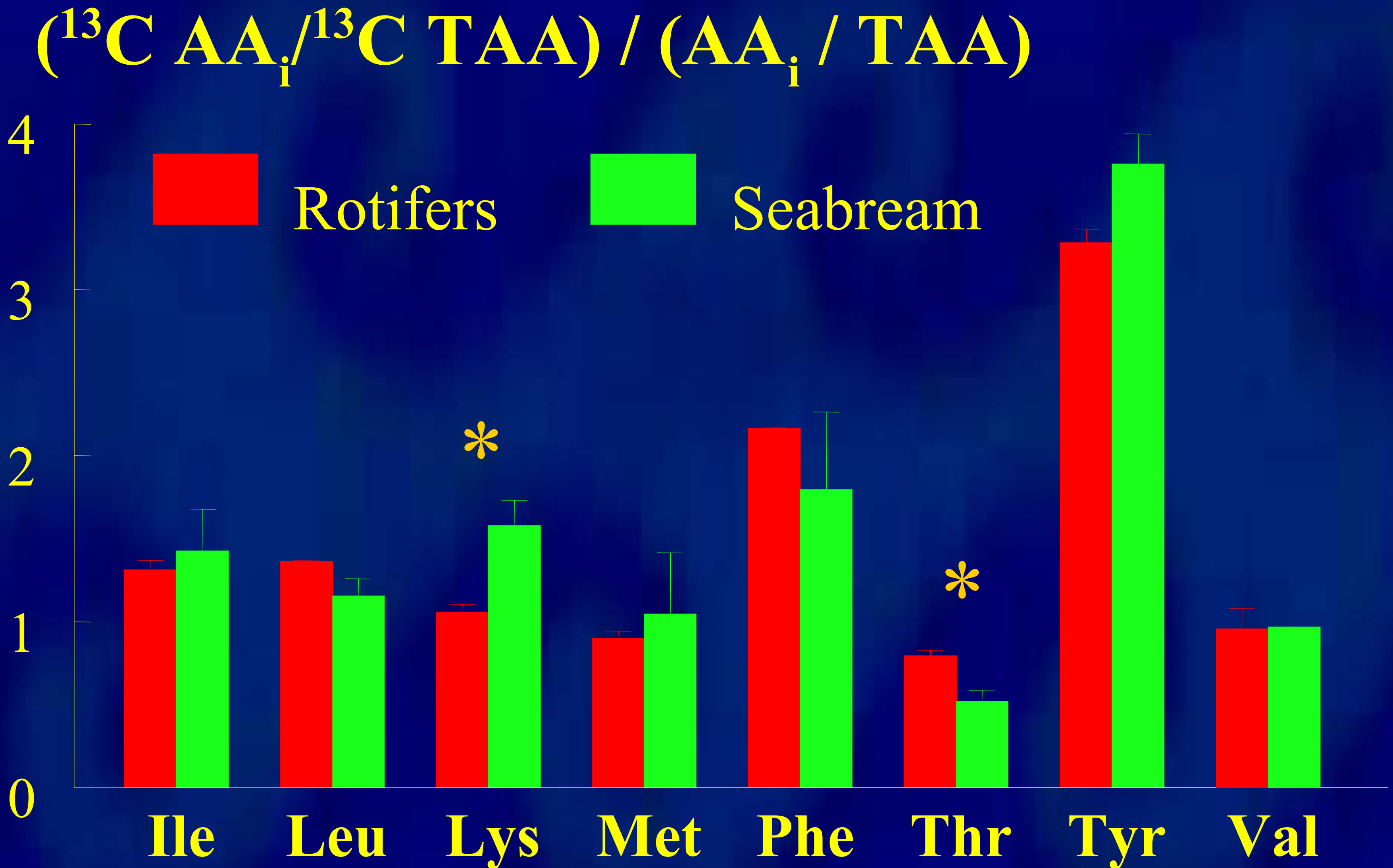
^{13}C-NMR Spectroscopy





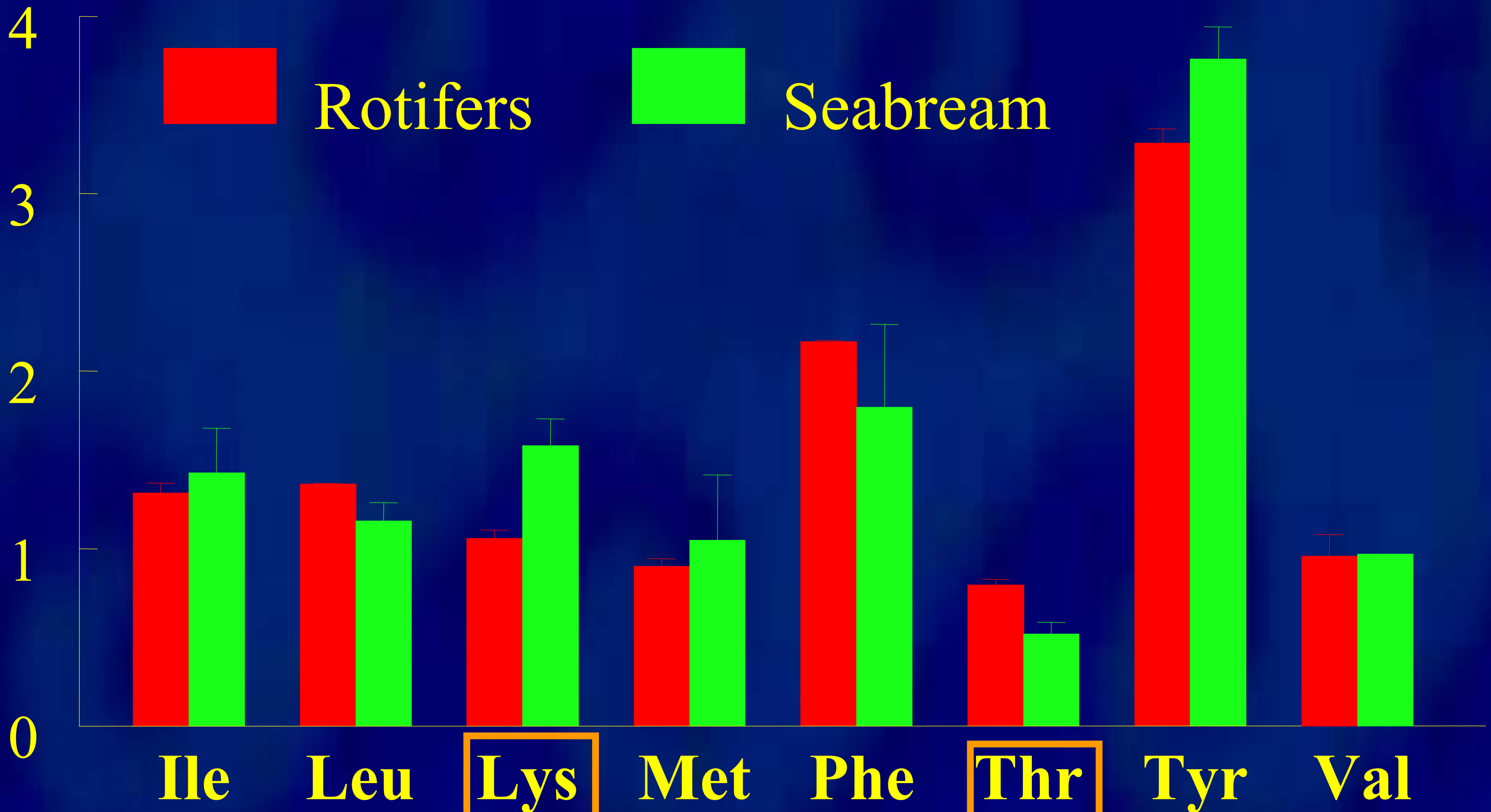
^{13}C-NMR Spectroscopy



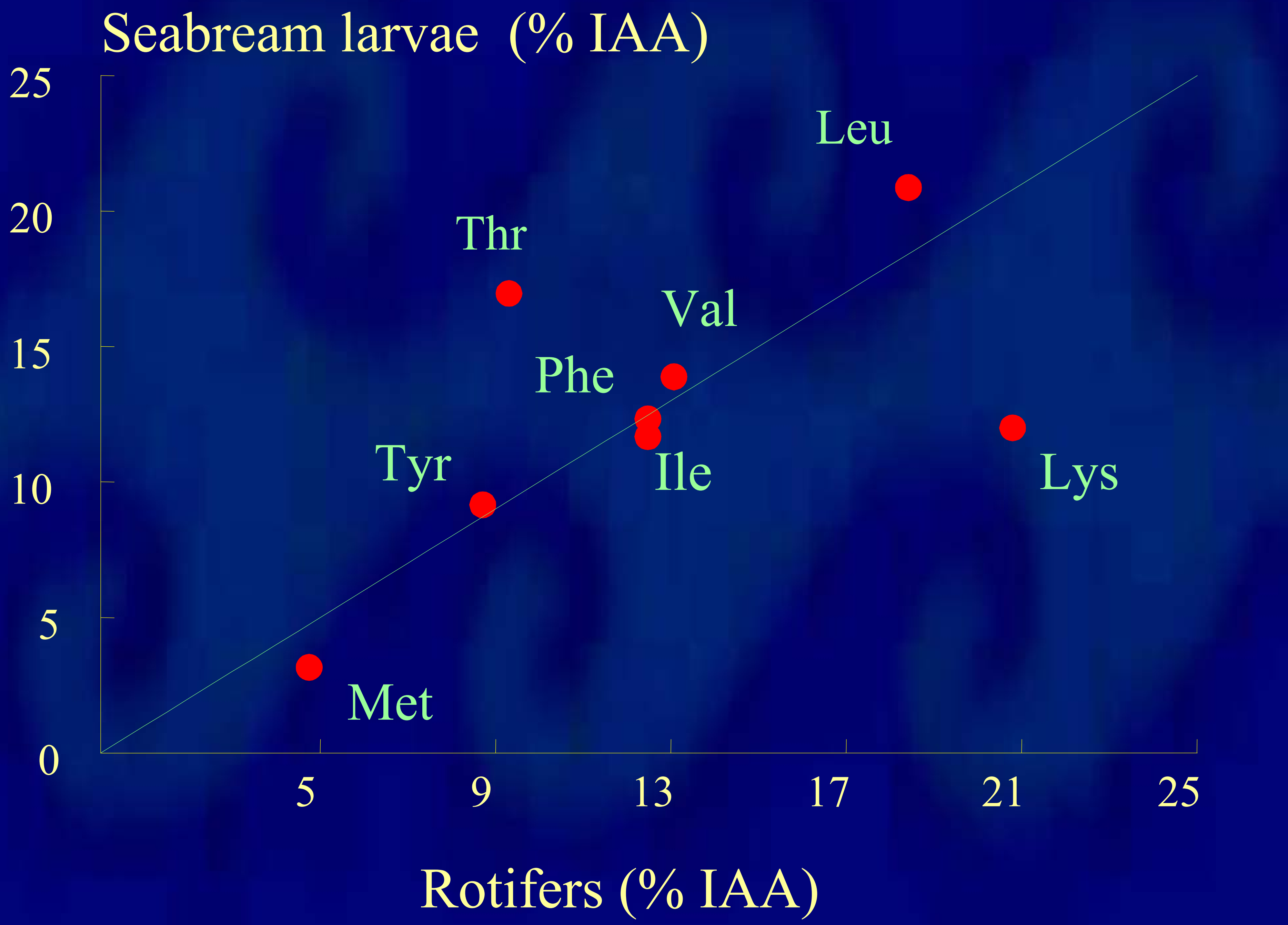


$(^{13}C\ AA_i / ^{13}C\ TAA) / (AA_i / TAA)$
4
3
2
1
0
Rotifers
Seabream
*
*
Ile
Leu
Lys
Met
Phe
Thr
Tyr
Val

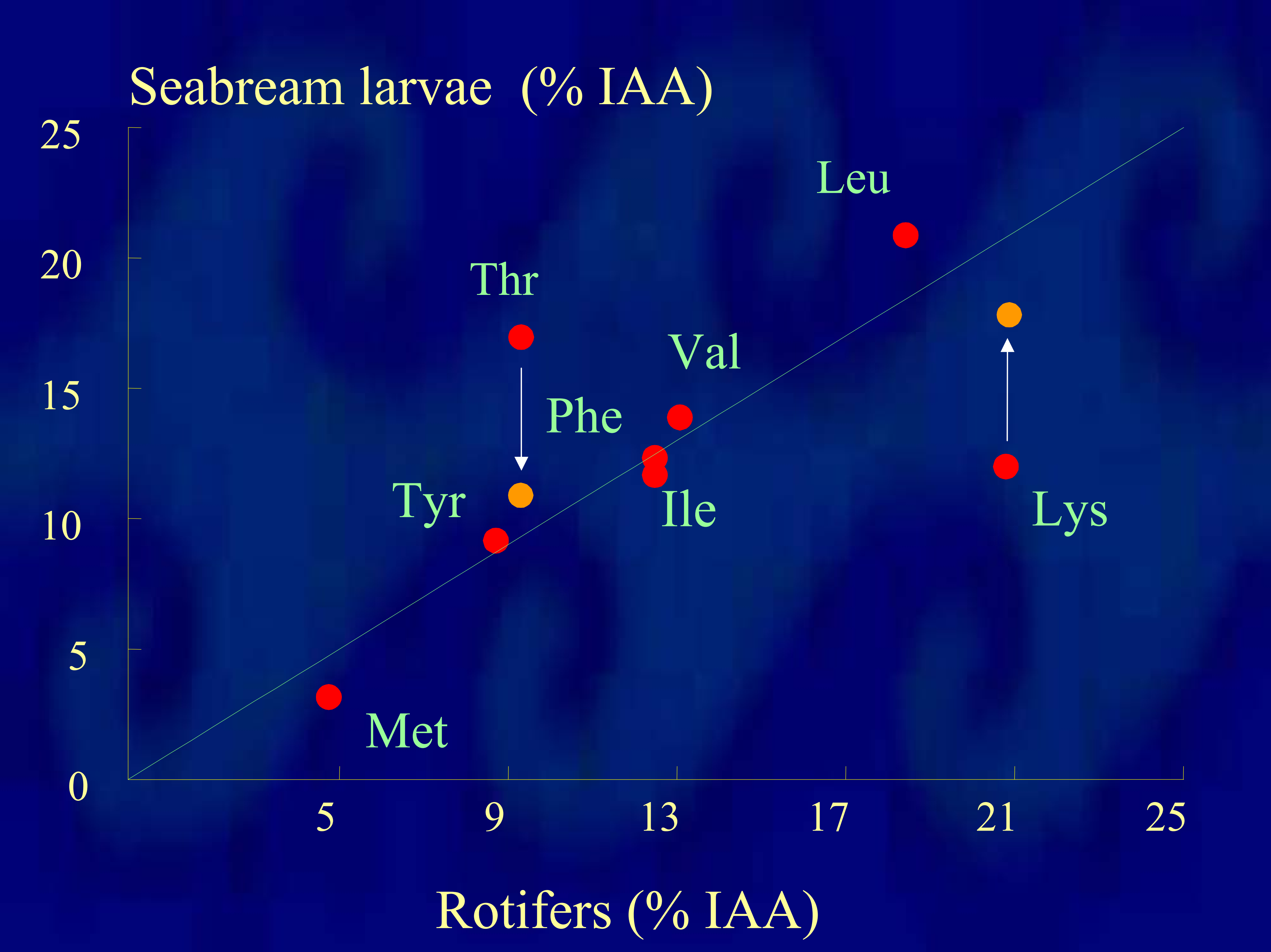
$(^{13}C\ AA_i / ^{13}C\ TAA) / (AA_i / TAA)$



Bioavailability 1.49 0.65



Seabream larvae (% IAA)
25
20
15
10
5
0
Leu
Thr
Val
Phe
Ile
Tyr
Lys
Met
5
9
13
17
21
25
Rotifers (% IAA)


Seabream larvae (% IAA)
25
20
15
10
5
0
Leu
Thr
Val
Phe
Tyr
Ile
Lys
Met
5
9
13
17
21
25
Rotifers (% IAA)

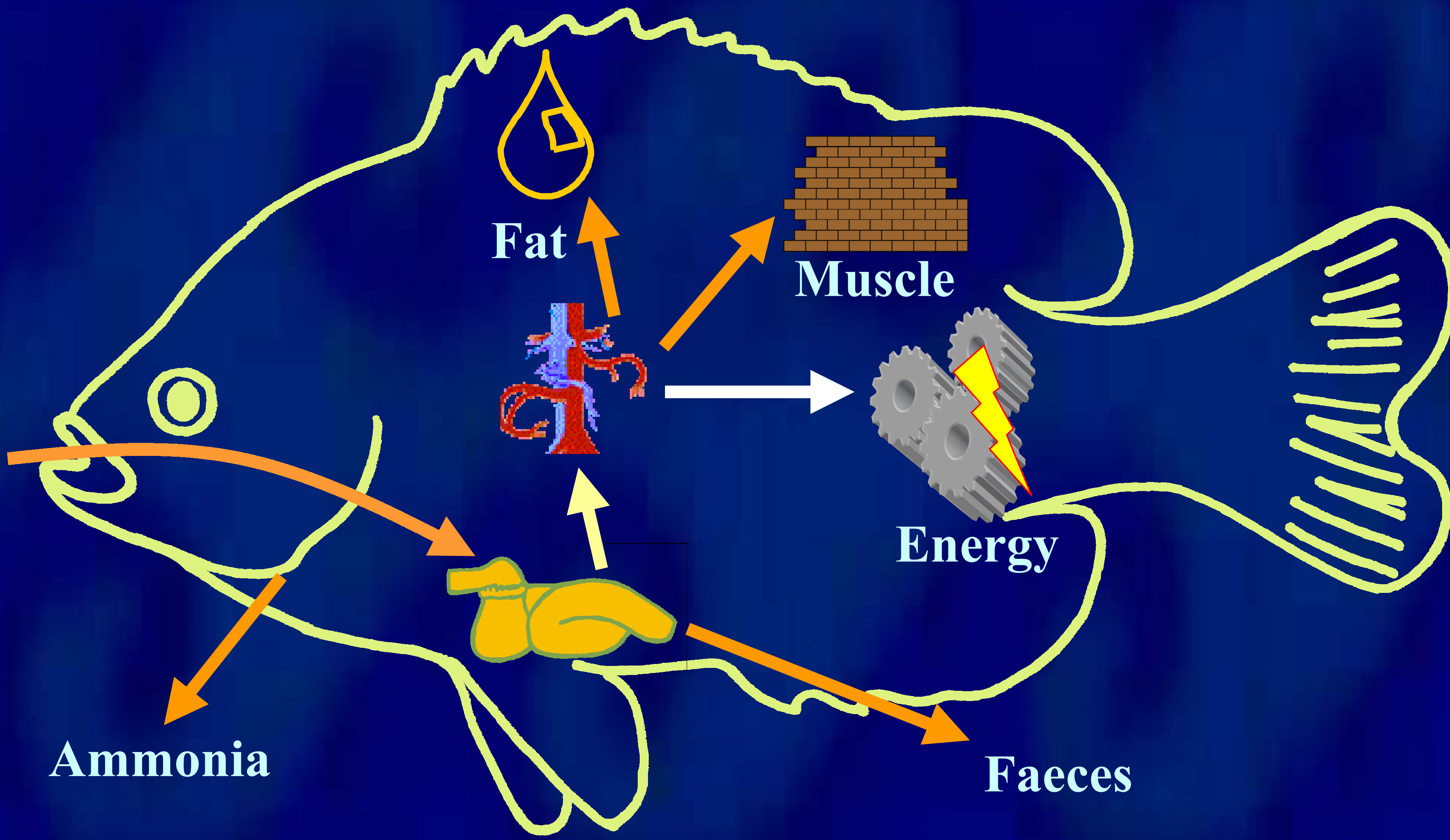
There are differences in the biovailability of individual AA

different absorption efficiencies

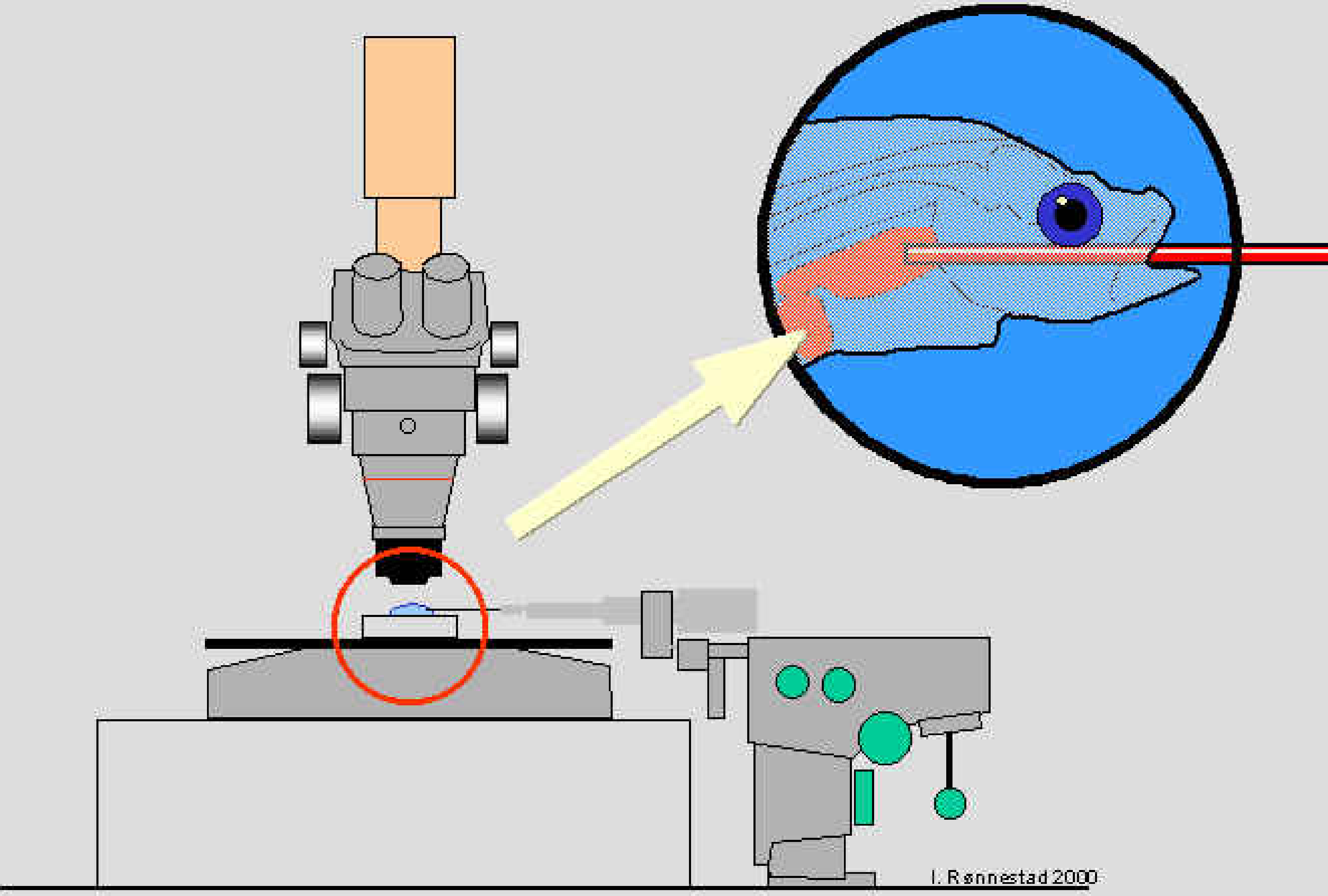
and/or

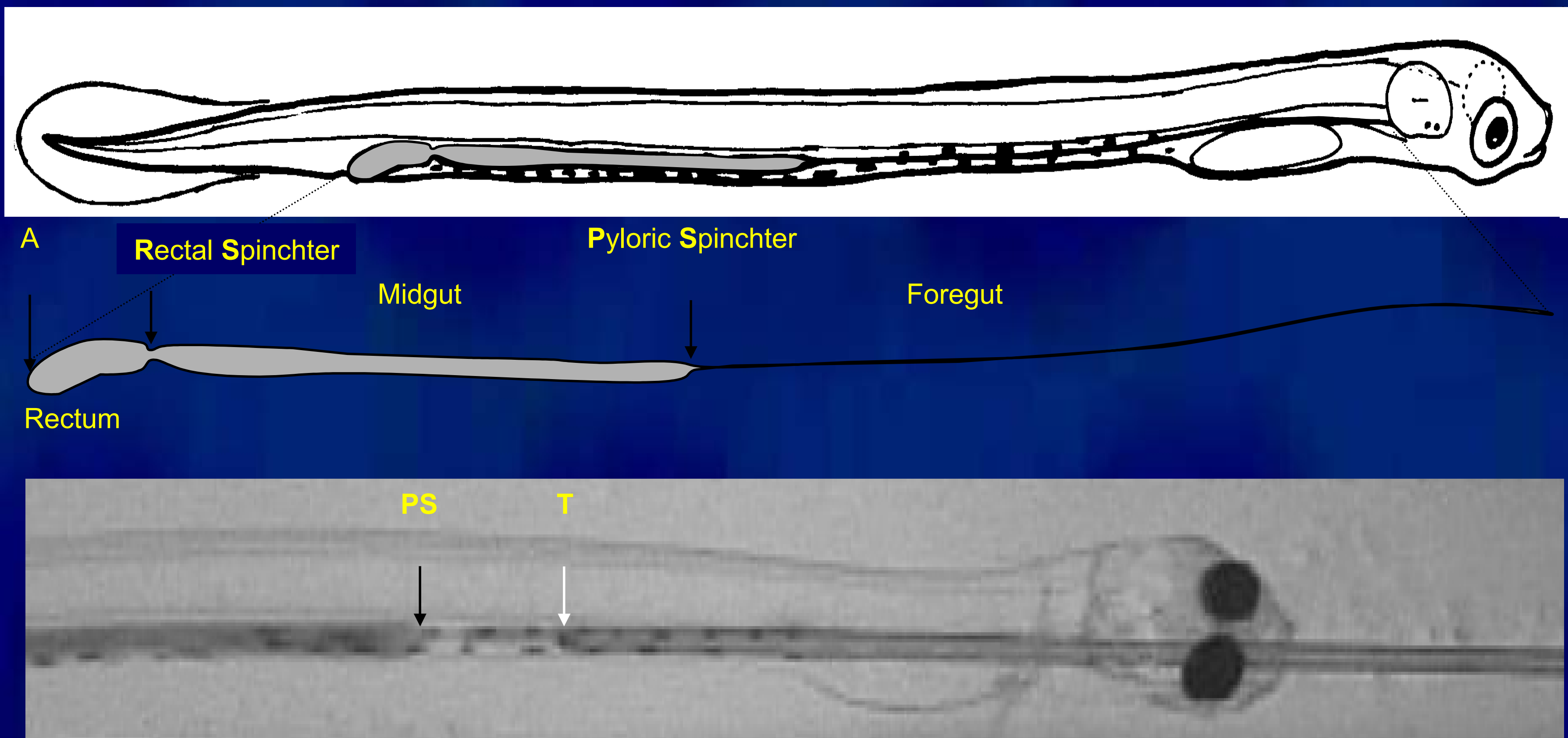
selective catabolism of individual AA

- **Selective catabolism of individual AA?**



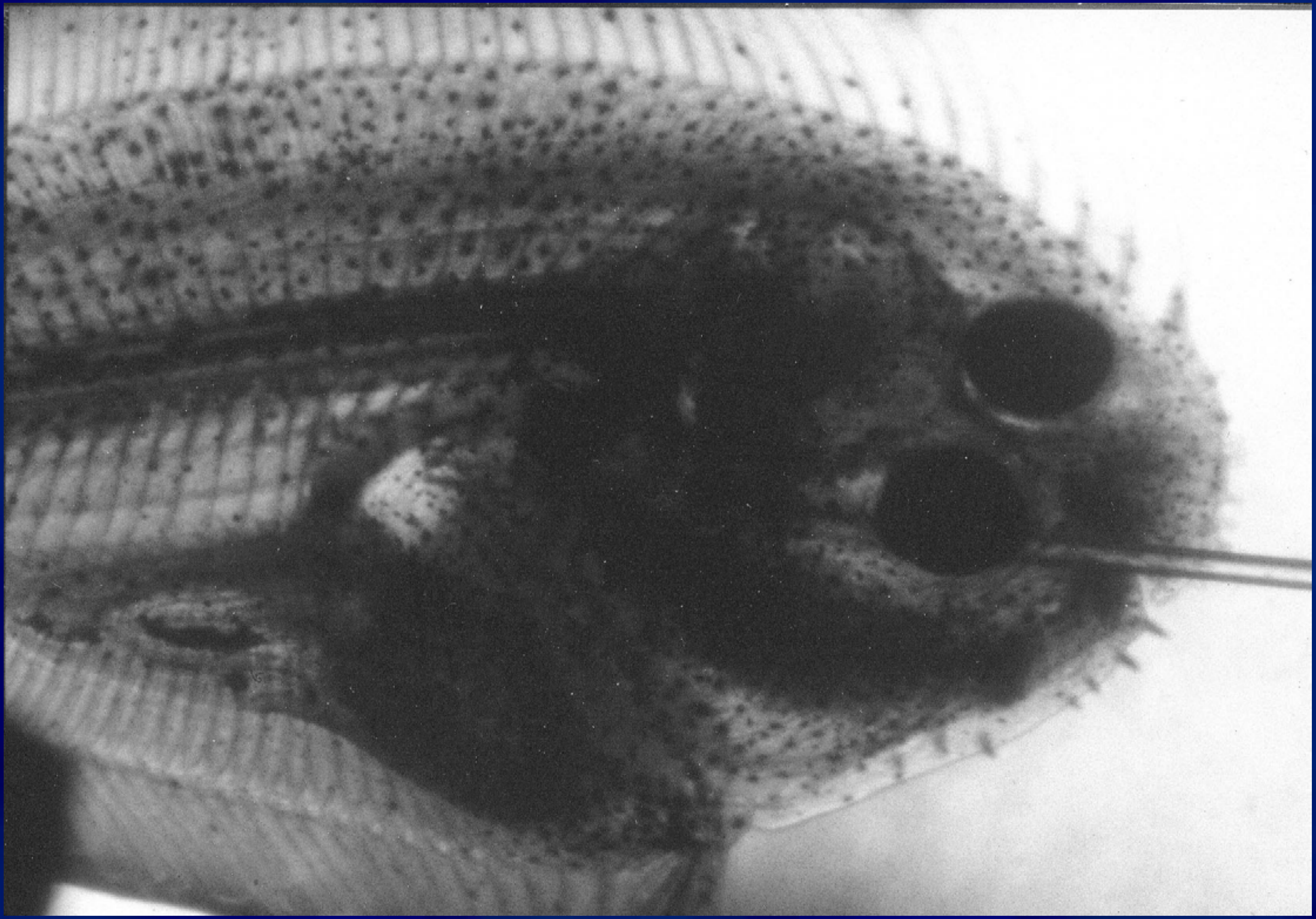
- **Differential absorption of individual AA?**


I. Rønnestad 2000

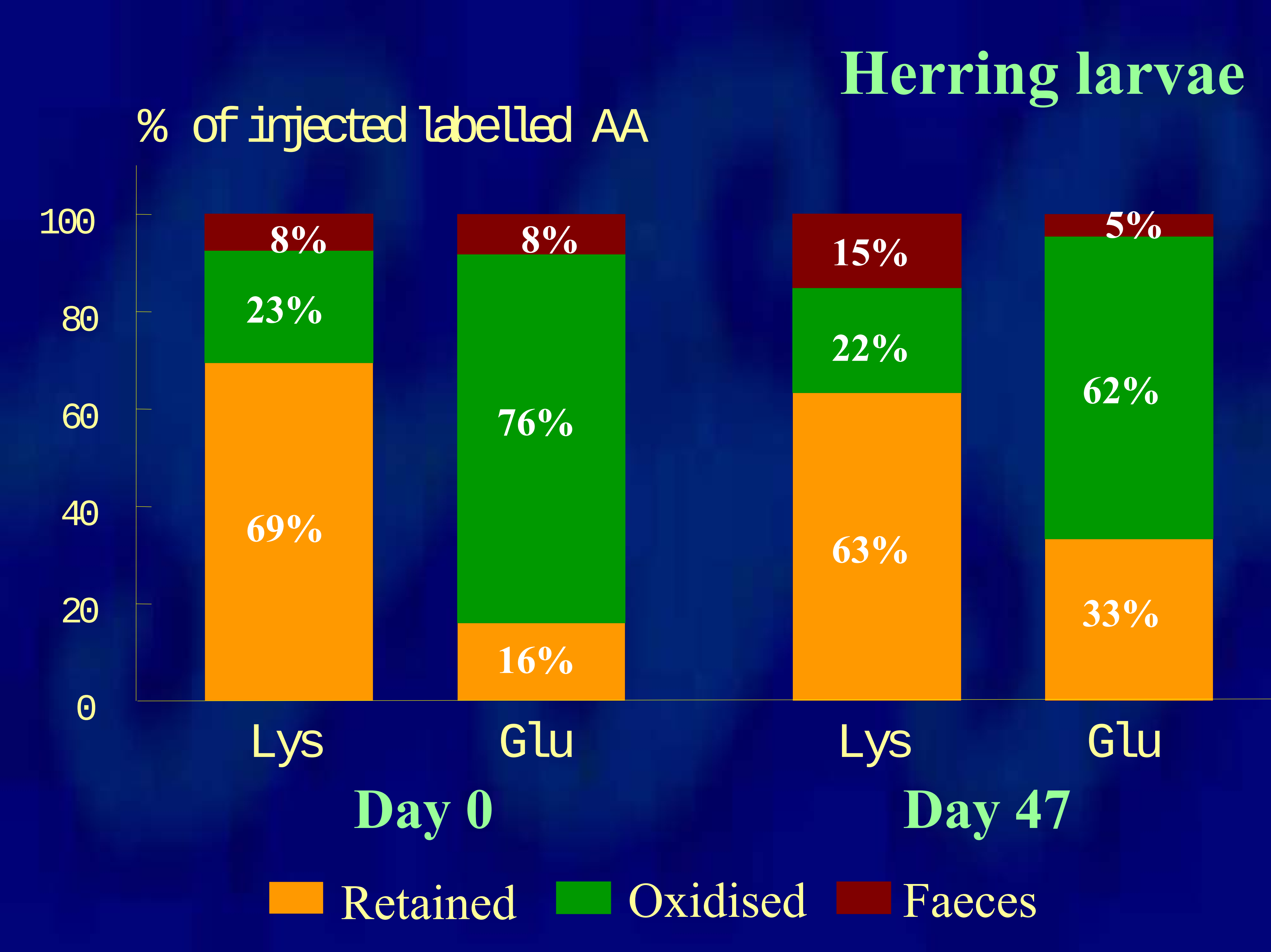


First-feeding herring larvae

I. Rønnestad 2000

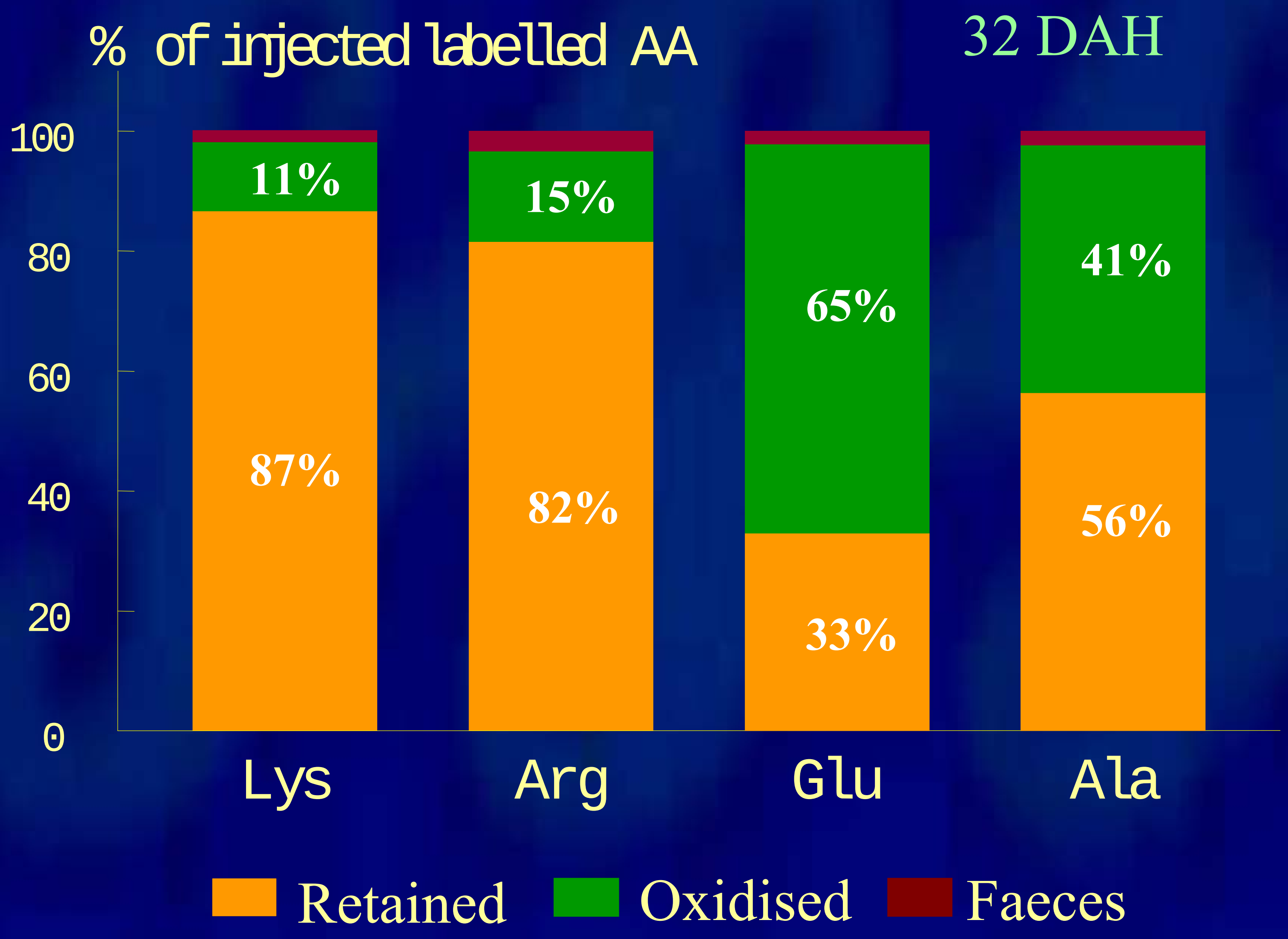


Senegal sole post-larvae 30 DAH



Herring larvae
% of injected labelled AA
100
80
60
40
20
0
8%
23%
69%
8%
76%
16%
15%
22%
63%
5%
62%
33%
Lys
Glu
Lys
Glu
Day 0
Day 47
Retained
Oxidised
Faeces

Sole post-larvae



Conclusions

- Fish larvae and post-larvae use DAA preferentially to IAA for energy production.
- Fish larvae may have a better capacity of regulating AA catabolism than thought before.
- Individual amino acids have different bioavailabilities in fish larvae and post-larvae