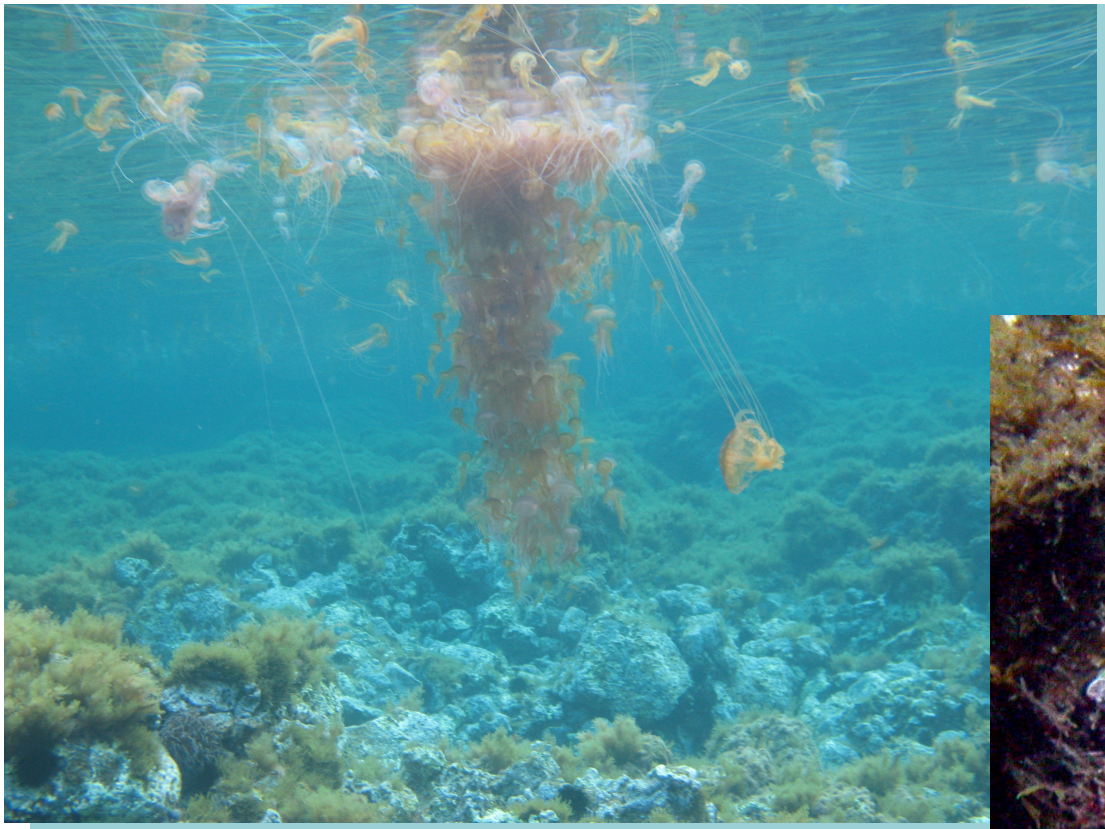
DO WE KNOW ENOUGH?

(to give answers and suggest appropriate countermeasures)

Stefano Piraino
University of Salento



UNIVERSITÀ DEL SALENTO

Third Jellyfish Bloom Symposium
Mar del Plata, 14 July 2010

Reverse development: a boosting mechanism for jellyfish blooms

Stefano Piraino, Gerhard Jarms
Ferdinando Boero

2009

NATIONAL GEOGRAPHIC

SEARCH

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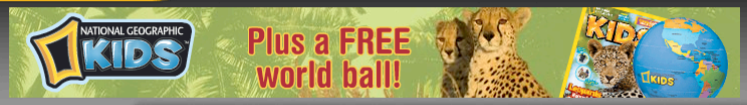

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Thursday, June 17, 2010

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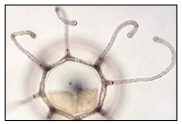
"Immortal" Jellyfish Swarm World's Oceans

Ker Than
for National Geographic News
January 29, 2009

A potentially "immortal" jellyfish species that can age backward—the Benjamin Button of the deep—is silently invading the world's oceans, swarm by swarm, a recent study says.

Like the Brad Pitt movie character, the immortal jellyfish transforms from an adult back into a baby, but with an added bonus: Unlike Benjamin Button, the jellyfish can do it over and over again—though apparently only as an emergency measure.



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About as wide as a human pinky nail when fully grown, the immortal jellyfish (scientific name: *Turritopsis dohrnii*) was discovered in the Mediterranean Sea in 1883. But its unique ability was not discovered until the 1990s.

How the Jellyfish Becomes "Immortal"

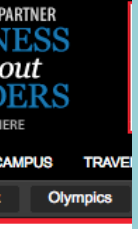
Turritopsis typically reproduces the old-fashioned way, by the meeting of free-floating sperm and eggs. And most of the time they die the old-fashioned way too.

But when starvation, physical damage, or other crises arise, "instead of sure death, *[Turritopsis]* transforms all of its existing cells into a younger state," said study author Maria Pia Miglietta, a researcher at Pennsylvania State University.

The jellyfish turns itself into a bloblike cyst, which then develops into a polyp colony,

2010

MACLEANS.CA



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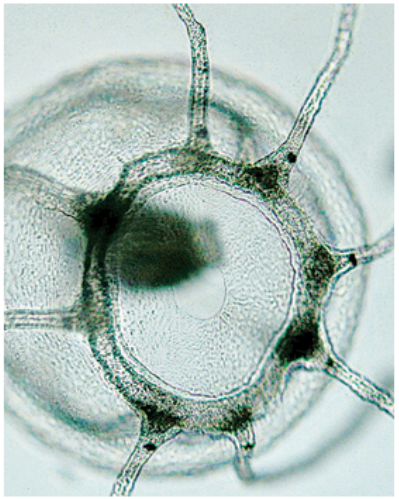
Never say die

Nearly immortal jellyfish could help unlock health secrets

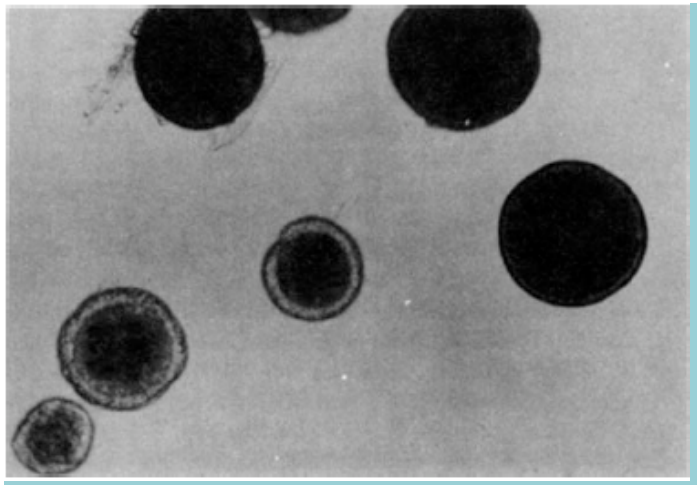
by Tom Henheffer on Thursday, April 29, 2010 12:20pm - 2 Comments



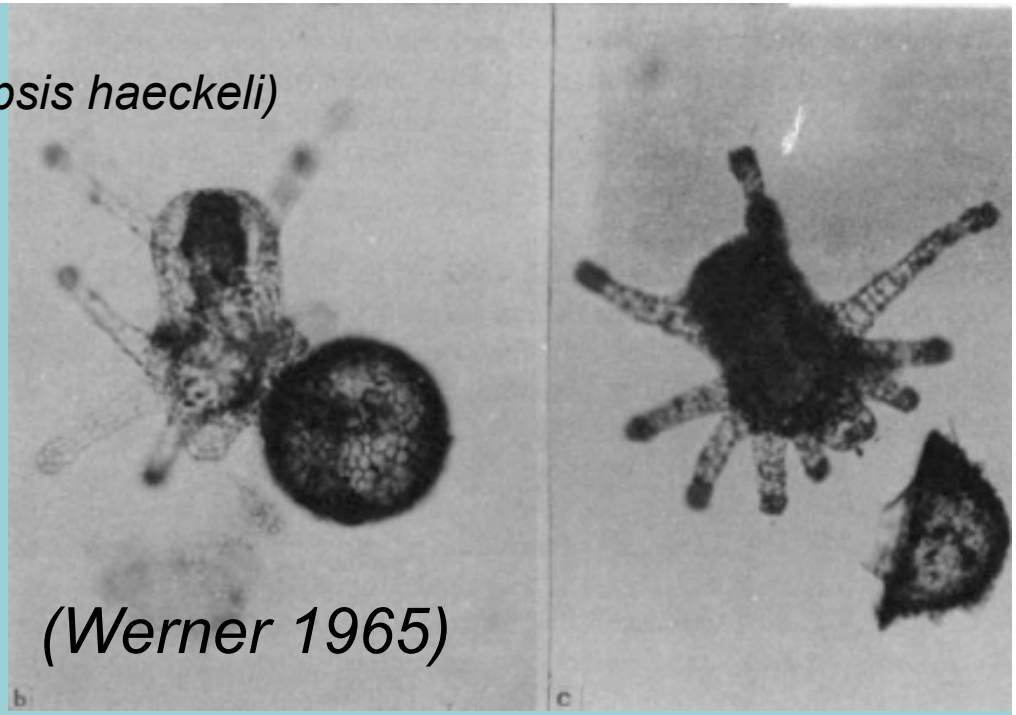
Barcroft Media

Scientists are finding that the world's oceans are being infested with a specific species of jellyfish—one that can potentially live forever. "We're facing a worldwide silent invasion," says Maria Pia Miglietta, a biology researcher at Pennsylvania State University. What makes this particular creature—the *Turritopsis dohrnii*—so special is its ability to change from its adult state (the tentacle-trailing dome we all know and avoid) back into tiny polyps, restarting what would normally only be a life cycle of a few months and allowing it to create more colonies, and thousands more jellyfish. "It's like a butterfly," says Miglietta, "but instead of dying it turns back into a caterpillar."

The process is called transdifferentiation—that's when specialized cells change from one type into another. It occurs elsewhere in nature, mostly in partial organ regeneration, but scientists don't know of any other animals that use it the same way as this particular jellyfish. And learning how the *Turritopsis* "switches on genes that rejuvenate their cells" may result in major breakthroughs in reversing the cellular degeneration that causes diseases like Alzheimer's and Parkinson's, says Stefano Piraino, a professor of biology and environmental science at Italy's University of Salento. It could also lead to greater insight into the world's most deadly illness: "I don't want to say that we will find a solution for cancer," says Piraino. "But it could contribute to the understanding of how cancer occurs."



(*Margelopsis haeckeli*)



(Werner 1965)

Resting eggs, cysts

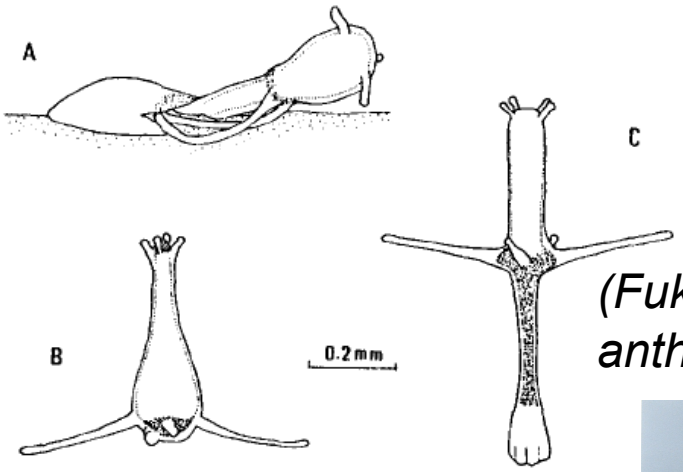
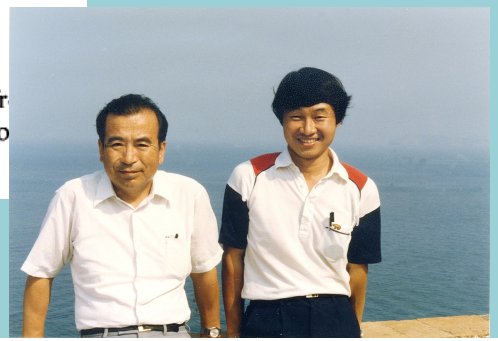


Fig. 2. F. anthoformis. A, polypoid actinula creeping fr
cyst. B, polypoid actinula 1 day old. C, attached young po
3 days old. (After a sketch by M. Yoshimoto.)

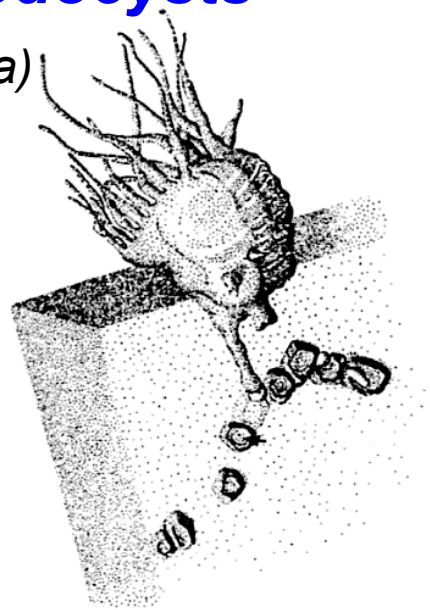
(*Fukaurahydra anthoformis*)

(*Yamada & Kubota, 1991*)



podocysts

(*Cyanea capillata*)



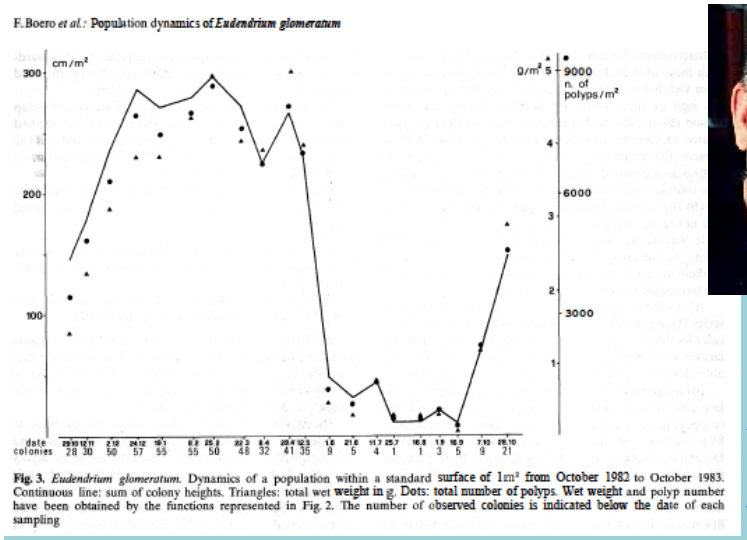
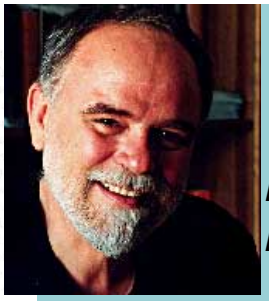

F. Boero *et al.*: Population dynamics of *Eudendrium glomeratum*

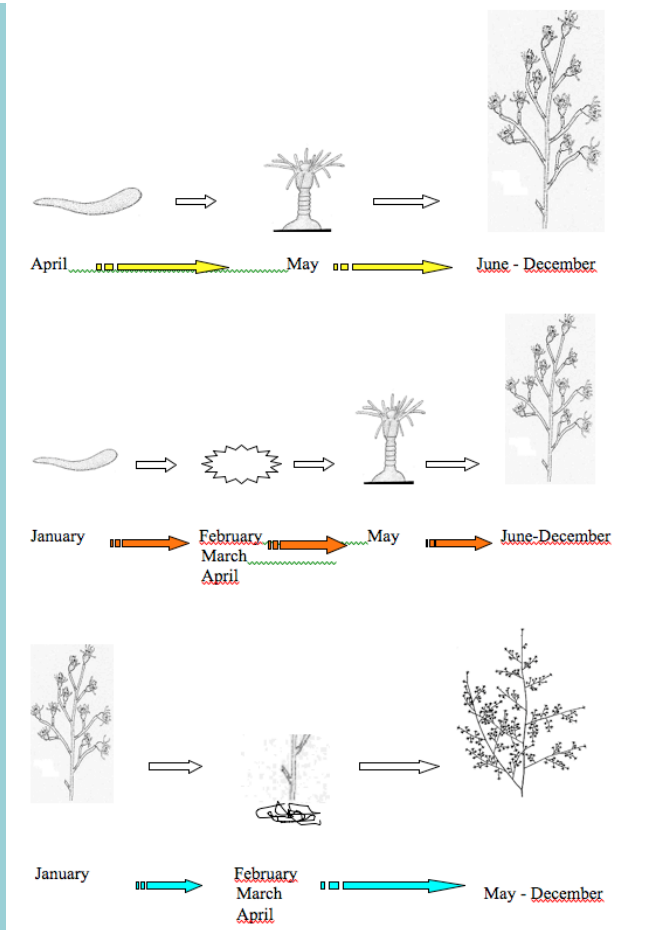
Fig. 3. *Eudendrium glomeratum*. Dynamics of a population within a standard surface of 1m² from October 1982 to October 1983. Continuous line: sum of colony heights. Triangles: total wet weight in g. Dots: total number of polyps. Wet weight and polyp number have been obtained by the functions represented in Fig. 2. The number of observed colonies is indicated below the date of each sampling

Eudendrium glomeratum
Boero et al 1987



Nando Boero

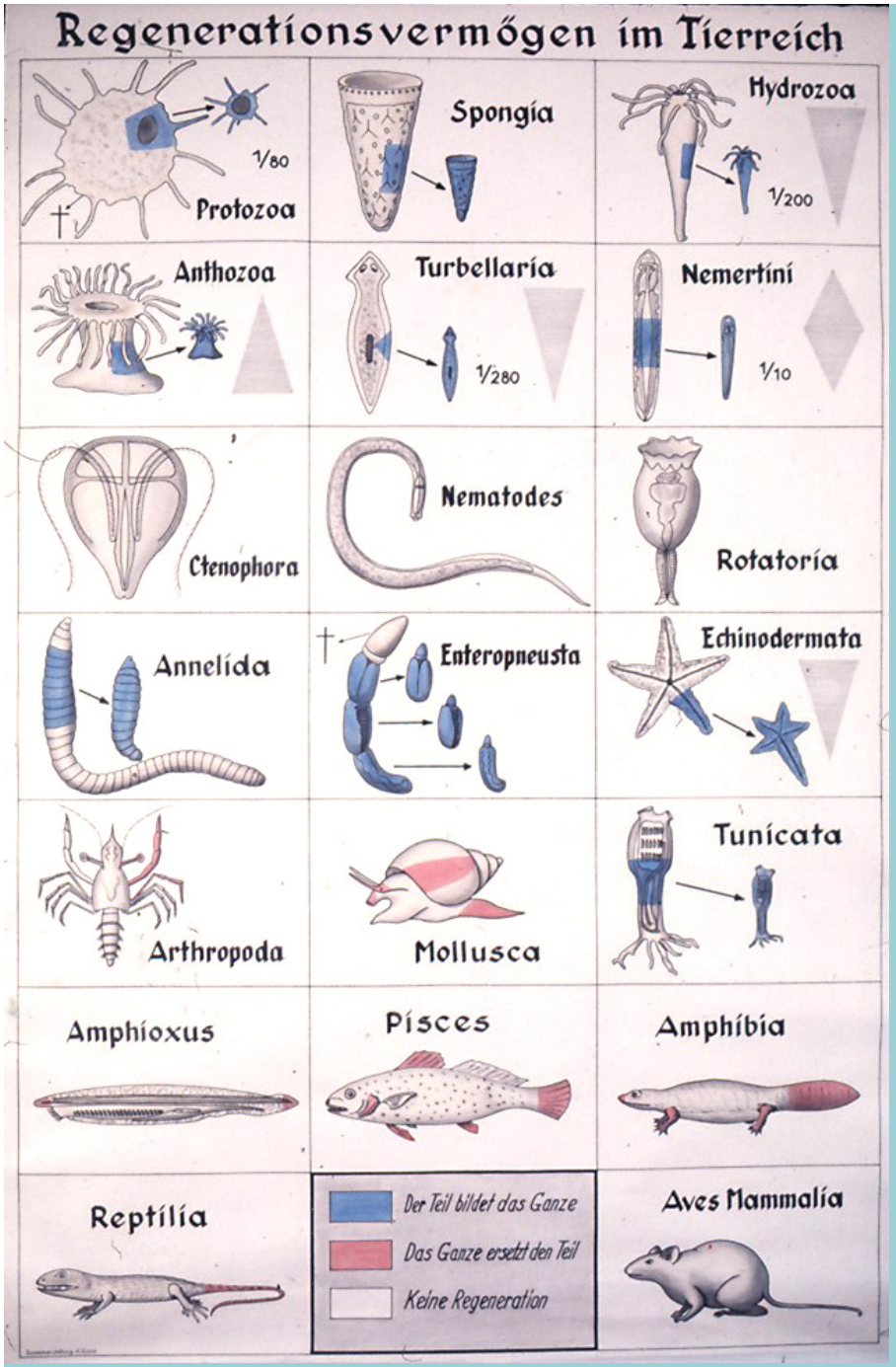
Resting hydrorhizae

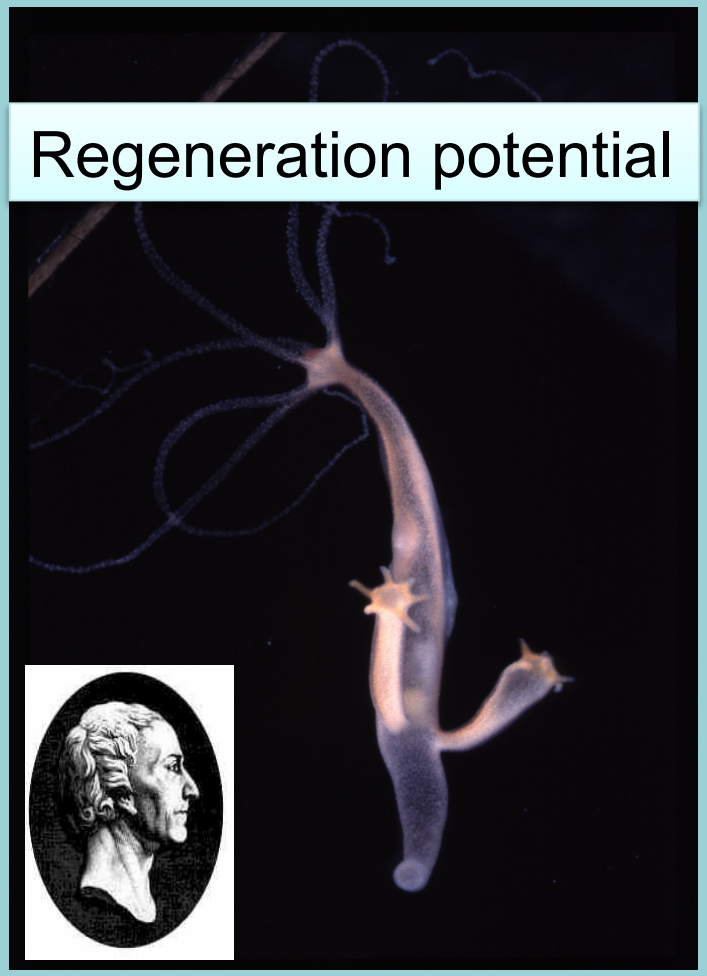


Resting planulae

Eudendrium carneum

Cesar Megina
Universidad Sevilla

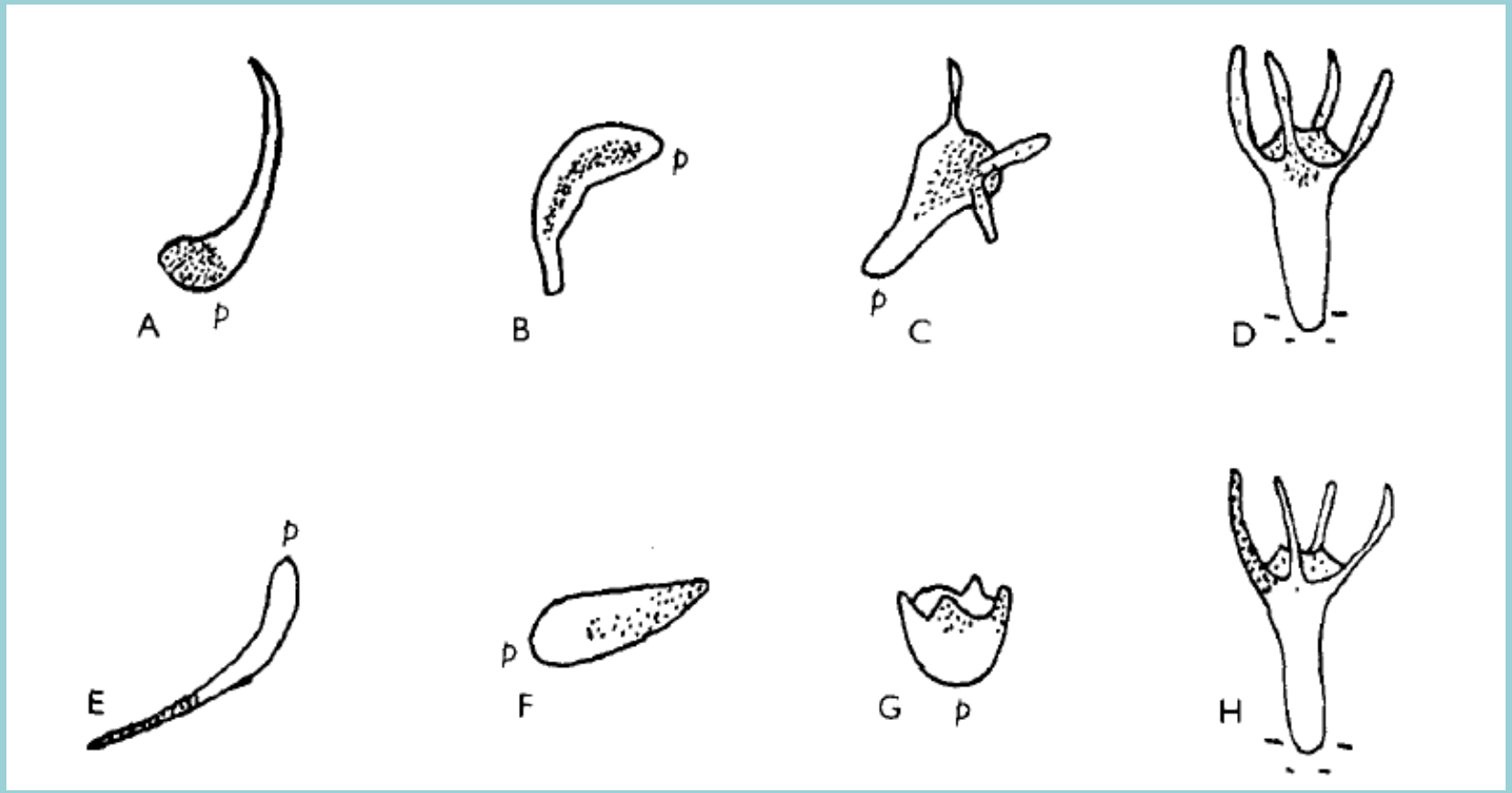




Abraham Trembley 1710-1784

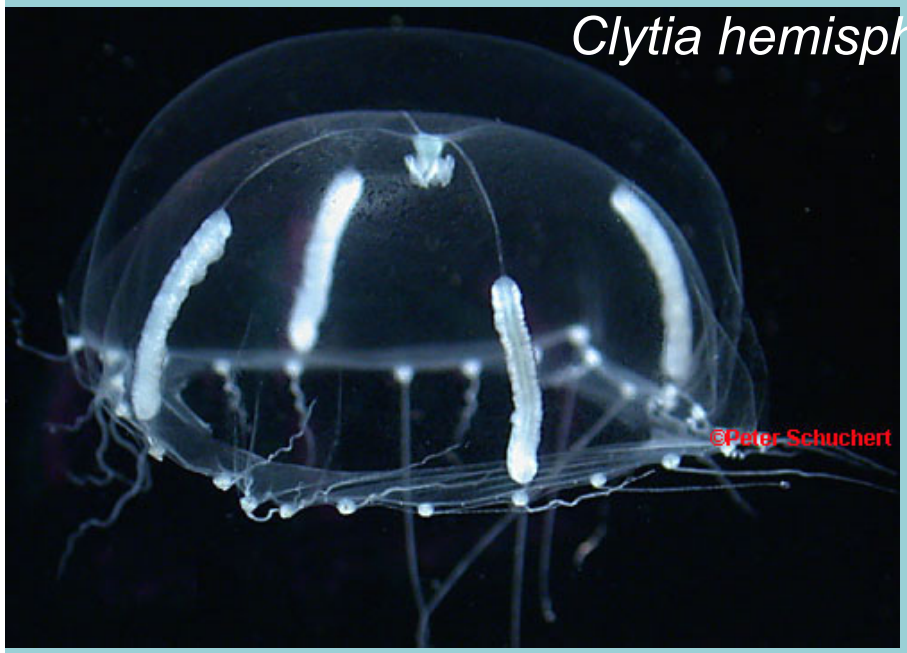
The whole
from a piece

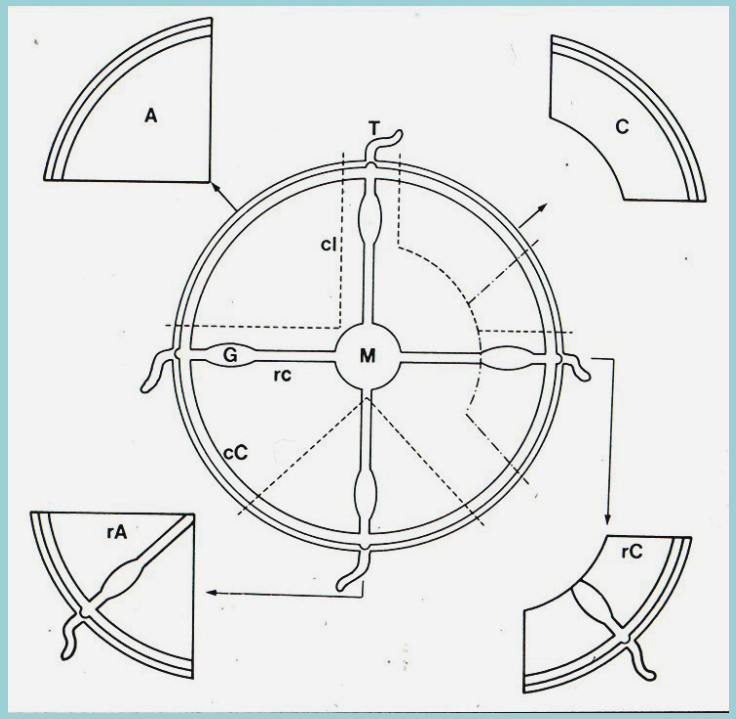
Pseudoplanulae
(Hérouard 1909)



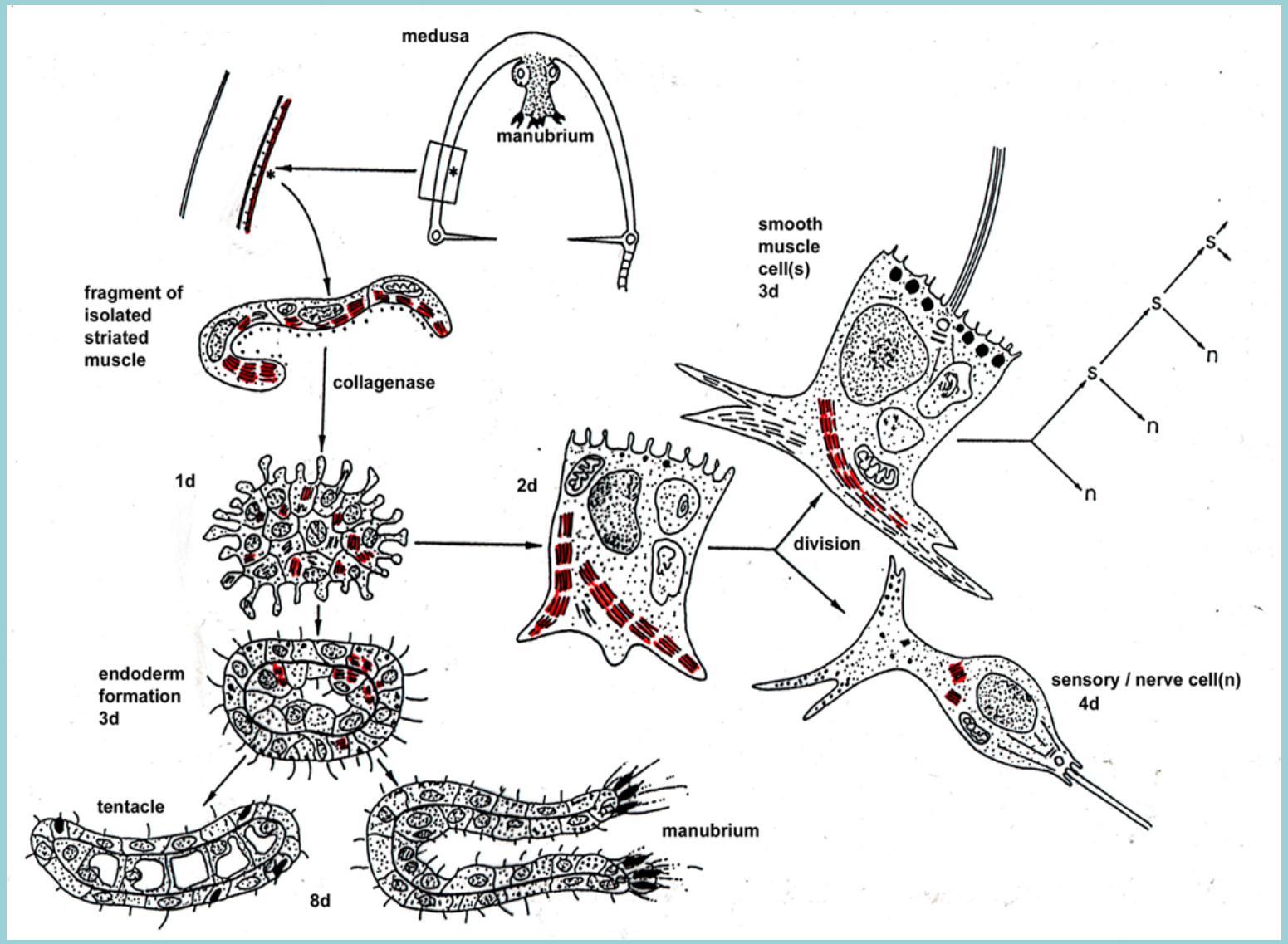
(Lesh-Laurie & Corriel 1973)

Clytia hemisphaerica





Transdifferentiation in *Podocoryne carnea*

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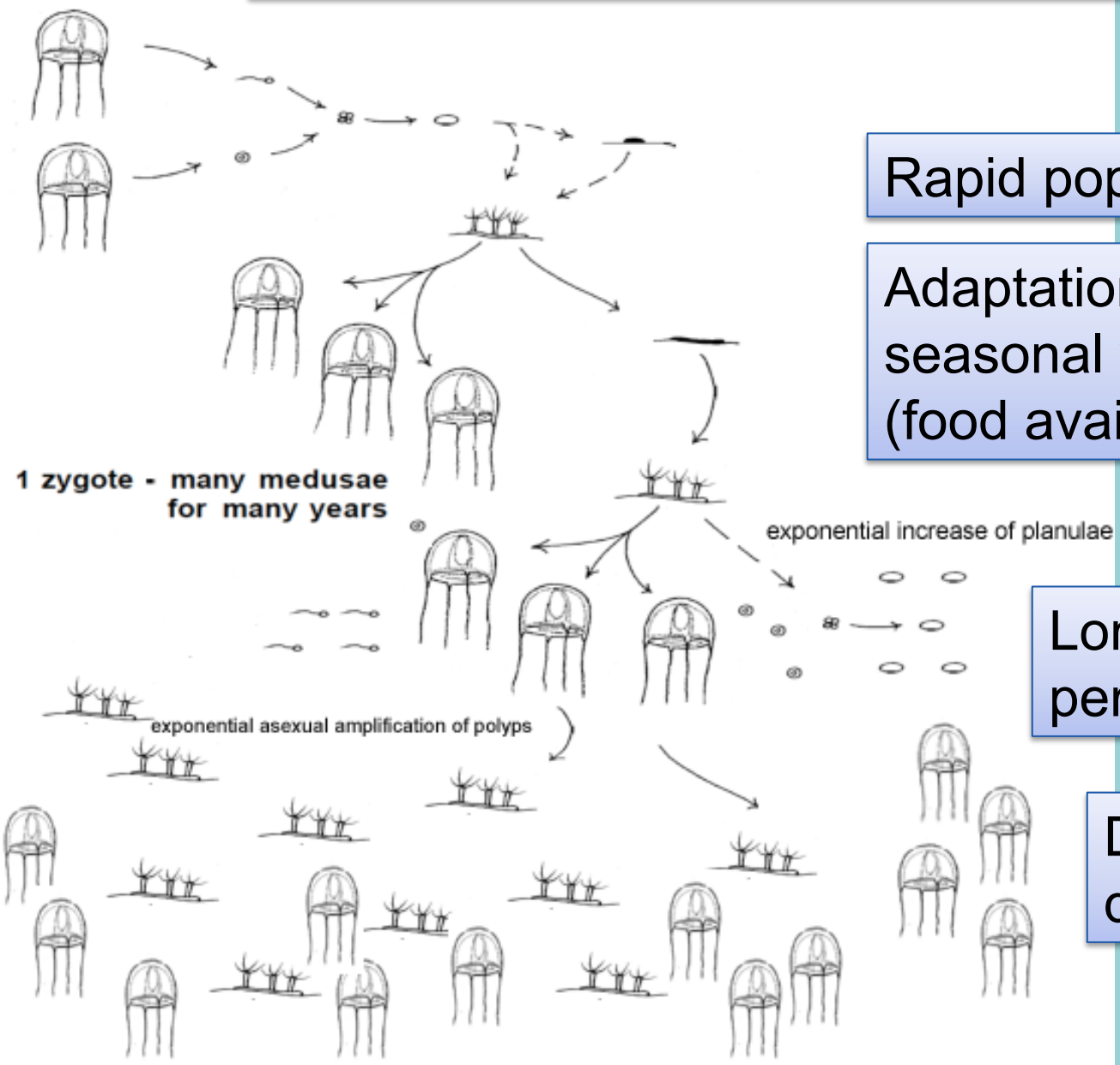
Reverse development: ecological meaning



Rapid population growth

Adaptation to seasonal variability (food availability, T)

Long-term persistence

Dispersal (wide distribution)

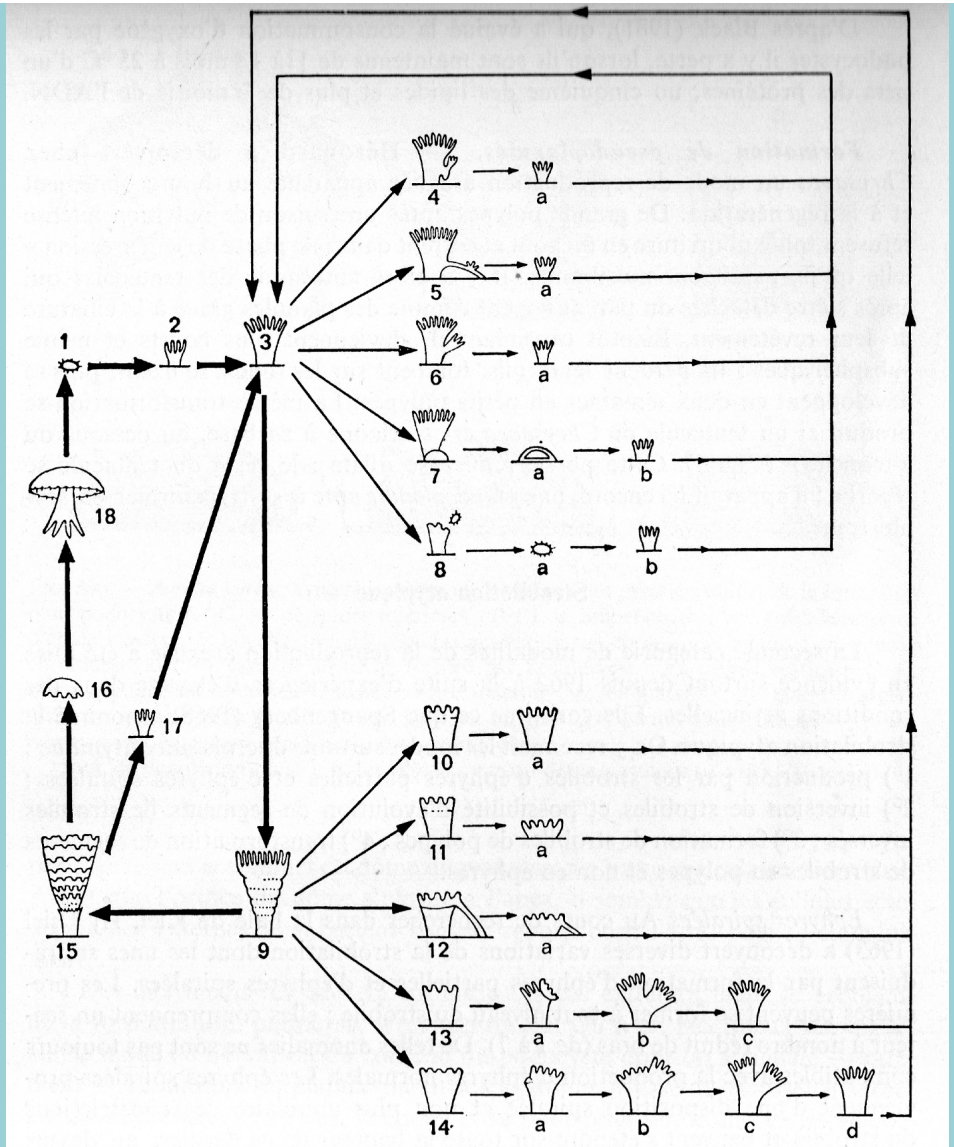


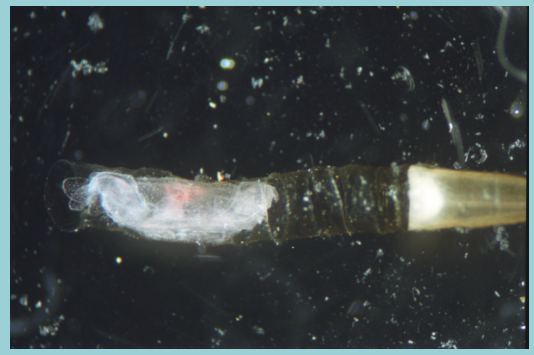
FIG. 307. — Schéma résumant les diverses possibilités de développement d'*Aurelia aurita*. Le cycle « typique » occupe la partie gauche : *1*, (planule) ; *2*, (polype jeune) ; *3*, (polype adulte) ; *9*, (strobile jeune) ; *15*, (strobile âgé) ; *16-17*, séparation des éphyrules et de la souche ; *18*, (méduse). A droite et en haut, possibilités de reproduction asexuée : 3-4-3 : bourgeonnement direct ; 3-5-3, bourgeonnement indirect ; 3-6-3, bourgeons type *Hydra* ; 3-7-3, formation de podocystes ; 3-8-3, formation de pseudoplanules. En bas et à droite, modalités du développement atypique. 9-10-3 : fusion éphyrule-souche en un polype ; 9-11-3 : transformation d'une ébauche d'éphyrule en polype fixé ; 9-12-3, réversion d'une éphyrule en polype après fixation par un stolon. 9-13-3 ; 9-14-3 : deux modalités de formation de polypes doubles (d'après HJ. THIEL).

"Abnormal" strobilation

Chrysaora hysoscella (Hadzi 1909)

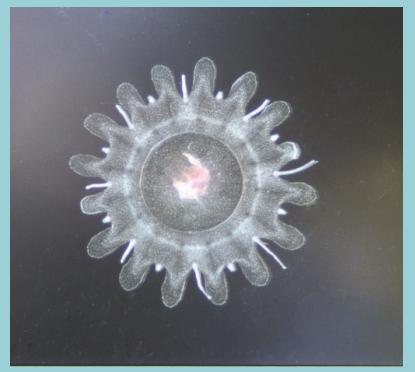
Rhizostoma pulmo (Paspaleff 1938)

Aurelia sp. (Thiel 1963)



Nausithoe sorbei

Reverse metamorphosis



Gerhard Jarms

华大基因
BGI

Coming soon:

Full genome sequencing of *Turritopsis dohrnii*

Beijing Genomics Institute
Shenzhen, China

The 1000 plant and animal reference genomes project (100 Million US $)

http://www.genomics.cn

The DNA Network

NOT ONLY NEGATIVE EFFECTS!

Antioxidants

Jellyfish extracts in vitro anti-proliferative effects on cancer cells

Resources for

- Nutraceuticals
- Pharmaceuticals
- Feed products (aquaculture, farming)
- Food

Cotylorhiza tuberculata, Rhizostoma pulmo, Rhopilema nomadica,

Approaches

- Understanding of patterns and processes at global scales may require large, integrative efforts to gather multiple and diverse contributions about regional and local cases.

- Unweighed metanalyses may lead to high-publicity answers, but non generalizable and therefore, useless for coastal management

Mudtrails are also visible in this amazing satellite image, depicting vessels anchored off the Chinese coast, and holding their double nets against the current…

van Houten and Pauly (Nature, 2007)

ESTABLISHED NETWORK

Vol. 356: 299–310, 2008
doi: 10.3354/meps07368

MARINE ECOLOGY PROGRESS SERIES
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Published March 18

AS WE SEE IT*

Gelatinous plankton: irregularities rule the world (sometimes)

F. Boero[1,**,***], J. Bouillon[1], C. Gravili[1], M. P. Miglietta[2], T. Parsons[3], S. Piraino[1,***]

[1]DiSTeBA, CoNISMa, Stazione di Biologia Marina, Università del Salento, 73100 Lecce, Italy
[2]Smithsonian Tropical Research Institute, Naos Marine Laboratory, PO Box 0843-03092 Balboa, Panama
[3]Institute of Ocean Sciences, Sidney, British Columbia V8L 4B2, Canada

Objectives: Causes, countermeasures, and uses of jellyfish blooms

I) **Joint Mediterranean jellyfish database**

- Ecology, distribution patterns, life histories traits (trophic niche, food web interactions, predatory impact assessment)
- Population connectivity (genetic/oceanographic network)

II) **Predictions for fishery management**

III) **New methodology for automated monitoring** (underwater and surface recording technologies)

IV) **Early warning system** for mass episodes (regional numerical modeling)

V) **Exploitation, biotechnological processes** (food, bioactive molecules, aquaculture feeds)

V) **Education, information, tourism management, planning for summer health services**

Consortium

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- **University of Salento**

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- **Centro Polimeros Biomedicos, Cooperativa Ensino Superior, Caparica**

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