



The 8th International Symposium of Fish Endocrinology is honored to recognize the Lifetime Achievement of Dr Jack FALCÓN



Main research areas

Jack Falcón is one of the most prestigious world experts in the study of fish pineal gland and melatonin, the hormonal time-keeping messenger. More broadly, Jack's career has focused **on the impact of photoperiod and temperature on the control of daily and annual physiological and behavioural rhythms in fish**. More particularly he has studied:

1. the impact of photoperiod and temperature on the production of melatonin, in the retina and the pineal gland

- ⊗ One of Jack's most important discoveries was to show that the fish pineal gland contains an intrinsic circadian clock that is synchronized by light and temperature and generates rhythms of melatonin synthesis. His researches bring support to define the fish pineal gland as a "photo-thermo-neuroendocrine" organ
- ⊗ He demonstrated that this circadian clock is located in the pinealocyte, which possess the essential components of a circadian system: it is a photoreceptor that mediates effects of light and temperature (input), it possess a endogenous circadian clock and it possess the capacity to produce and release a synchronizing signal, melatonin (output).
- ⊗ The duration of the daily illumination dictates the duration of the night-secretion of melatonin, while temperature controls in ectotherms the amplitude of this rhythm, in a highly species-dependent manner. Jack significantly contributed to the knowledge of function and evolution of AANATs, as a key enzyme in the melatonin synthesis pathway.
- ⊗ The mechanism underlying temperature sensitivity in ectotherms such as fish is a renewed subject of great interest for Jack

2. the impact of melatonin on the regulation of neuroendocrine functions.

Melatonin allows the body to synchronize its rhythmic activities to the daily and seasonal cycles. In the brain, it targets particularly the hypothalamus (which is at a crossroads of nervous and endocrine regulations) and the pituitary gland.

- ⊗ Jack's investigations on the melatonin receptors (characterization & localization), together with those reporting the impact of melatonin on the production of pituitary hormones (*e.g.*, prolactin & growth hormone) have underlined the role light and temperature play, *via* melatonin, in the control of neuroendocrine regulations of physiological functions including growth, osmoregulation and immunity.

Fish models



Impact of Activities

Jack's work contributes to the understanding of the processes that allow fish to cope with their environment, by integrating the photoperiodic and thermoperiodic signals to regulate the daily and annual variations of fish metabolism, physiology and behaviour.

Jack's results have strong impact as visualized by the abundant academic, national and international press releases, web articles, radio and television.

The transmission of basic knowledge on adaptation and biological timers directly to the aquaculture industry offers the exciting possibility to guide the development of ethically acceptable strategies in the quest to improve both yield and efficiency.

In the context of the global climatic change, it is of the utmost importance to evaluate how changing temperatures will impact on fish strategies to cope with their environment. A precise knowledge on how temperature affects metabolism, physiology and behaviour (including their temporal organization) is a prerequisite to provide molecular and biological markers, and predictive scenarios on the response of individuals, populations and ecosystems to rapid global changes. Such tools are of crucial importance for the decision makers at the political, societal and economical levels.



What time is it, Dr Falcon ?...!!!

Major significant publications

Jack Falcón is the author of more than 151 publications in scientific journals, books and conference proceedings, including 117 peer reviewed publications in international journals, with a h-index of 32.

- Nisembaum LG, Besseau L, Paulin CH, Charpantier A, Martin P, Magnanou E, Fuentès M, Delgado MJ, Falcón J. In the heat of the night: Thermo-TRPV channels in the Salmonid pineal photoreceptors and modulation of melatonin secretion. *Endocrinology*. 2015, 156(12):4629-38.
- Paulin C-H, Cazamea-Catalan D, Zilberman-Peled B, Herrera-Perez P, Sauzet S, Gothilf Y, Muñoz-Cueto J.A, Falcon J, Besseau L. Sub-functionalization of arylalkylamine-N-acetyltransferases in the sea bass *Dicentrarchus labrax*: Two ones for one two. *J Pineal Res*. 2015, 59: 354–364.
- Falcón J, Coon SL, Besseau L, Cazaméa-Catalan D, Fuentès M, Magnanou E, Paulin CH, Boeuf G, Sauzet S, Jørgensen EH, Mazan S, Wolf YI, Koonin EV, Steinbach PJ, Hyodo S, Klein DC. Drastic neofunctionalization associated with evolution of the timezyme AANAT 500 Mya. *Proc Natl Acad Sci USA*. 2014, 111(1):314-9.
- Herrera-Pérez P, Del Carmen Rendón M, Besseau L, Sauzet S, Falcón J, Muñoz-Cueto JA. Melatonin receptors in the brain of the European sea bass: An in situ hybridization and autoradiographic study. *J Comp Neurol*. 2010, 1;518(17):3495-511.
- Falcón J, Besseau L, Sauzet S, Boeuf G. Melatonin effects on the hypothalamo-pituitary axis in fish. *Trends Endocrinol Metab*. 2007, 18(2):81-8.
- Vuilleumier R, Besseau L, Boeuf G, Piparelli A, Gothilf Y, Gehring WG, Klein DC, Falcón J. Starting the zebrafish pineal circadian clock with a single photic transition. *Endocrinology*. 2006, 147(5):2273-9
- Gaildrat P, Becq F, Falcón J. First cloning and functional characterization of a melatonin receptor in fish brain: a novel one? *J Pineal Res*. 2002, 32(2):74-84.
- Falcón J. Cellular circadian clocks in the pineal. *Prog Neurobiol*. 1999, 58(2):121-62
- Bolliet V, Bégay V, Taragnat C, Ravault JP, Collin JP, Falcón J. Photoreceptor cells of the pike pineal organ as cellular circadian oscillators. *Eur J Neurosci*. 1997, 9(4):643-53.
- Falcón J, Bolliet V, Ravault JP, Chesneau D, Ali MA, Collin JP. Rhythmic secretion of melatonin by the superfused pike pineal organ: thermo and photoperiod interaction. *Neuroendocrinology*. 1994, 60(5):535-43.
- Bolliet V, Bégay V, Ravault JP, Ali MA, Collin JP, Falcón J Multiple circadian oscillators in the photosensitive pike pineal gland: a study using organ and cell culture. *J Pineal Res*. 1994, 16(2):77-84.