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C. Athena Aktipis, Ph.D.

Evolutionary Biology

University of California, San Francisco

Born in 1981 in Chicago, Illinois
Studied Ecology and Evolutionary Biology at the University of Arizona and Psychology at the University of Pennsylvania

FOCUS

PROJECT

Social Dilemmas and Evolutionary Tradeoffs in Cancer

During my time at the Wissenschaftskolleg, I plan to continue my research on applying evolutionary theory and principles of social dilemmas to the problem of cell motility, invasion, and metastasis. I plan to deepen this approach by accounting for the cancer equivalents of niche construction dynamics (including angiogenic signaling, macrophage recruitment, modification of the extracellular matrix, or production of immune factors). I also would like to further explore some of the implications of our model of the stem cell theory, including the possibility that groups of cells may be acting as "protomulticellular" units, with non-stem cells promoting the fitness of stem cells directly or indirectly through niche construction dynamics.
I intend to continue my work on life history tradeoffs in cancer (e.g., between fertility and cancer susceptibility) addressing questions such as:
- Does the profile of hormone-negative cancer reflect evolutionary life history tradeoffs?
- How do early life stress and social support influence life history trajectories and subsequent cancer risk?
- Do reproductive hormones such as testosterone and estrogen influence both fertility and cancer susceptibility?
- What is the role of ovulation (frequency, intensity, and hormonal profile) in influencing cancer susceptibility, especially for female reproductive cancers?
- Are placental mammals more susceptible to cancer because they have reproductive tissues that are receptive to growths?

Recommended Reading

Aktipis, C. A. and R. Nesse (2013). "Evolutionary foundations for cancer biology." Evolutionary Applications 6, 1: 144-159.
Aktipis, C. A., C. C. Maley, and J. W. Pepper (2012). "Dispersal evolution in neoplasms: The role of disregulated metabolism in the evolution of cell motility." Cancer Prevention Research 5, 2: 266-275.
Aktipis, C. A. (2011). "Is cooperation viable in mobile organisms? Simple Walk Away strategy favors the evolution of cooperation in groups." Evolution and Human Behavior 32, 4: 263-276.

TUESDAY COLLOQUIUM, 18.03.2014

Sharing, sociality and the evolution of multicellularity

The Maasai of East Africa have a system of resource sharing called "osotua," in which individuals ask partners for help when they are in need and give what they are able to if asked. Literally translated, osotua means umbilical cord, according osotua the metaphorical status of the life-giving relationship between mother and child. The osotua system of the Maasai is one example of a broader class of systems of resource transfer based on need. In need-based transfer systems like osotua, partners have a reciprocal obligation to help one another, but their gifts do not follow the logic of account keeping. Individuals do not expect repayment, there is no debt and the flows of goods and services can be largely one-way.

In this talk I will argue that need-based transfer systems like osotua have been neglected in the study of human cooperation. However, increasing evidence suggests that need-based transfers have played and continue to play an important role in resource sharing systems. I will report results from several computational models of need-based transfer systems, present data on human sharing from participants in the laboratory, and provide a brief review of the literature on need-based sharing systems across human societies. I will also discuss the problem of cheating in the evolution and maintenance of cooperation and how cheating manifests and is suppressed in need-based transfer systems.

Finally, I will discuss the extent to which need-based transfer systems may be evolutionarily ancient, dating back to the origins of multicellularity. In a cluster of cells, a gradient emerges because of the limits of resource diffusion to the cells on the interior. In order to make the transition from solitary unicellular life to massively social multicellular life, resources must be transferred from high to low resource sites. This suggests that need-based transfers may have played an important role in the evolution of both simple and complex forms of multicellularity, from those using simple direct resource transfer (e.g., through cell-cell junctions) to more complex forms of resource distribution (e.g., the mammalian circulatory system).

PUBLICATIONS FROM THE FELLOWS' LIBRARY

Aktipis, C. Athena (2017)

Cooperation and cheating as innovation : insights from cellular societies

https://kxp.k10plus.de/DB=9.663/PPNSET?PPN=104086660 3

Aktipis, C. Athena (2017)

Correlated disasters and need-based transfers : the limits of risk pooling systems in simulated ecologies

https://kxp.k10plus.de/DB=9.663/PPNSET?PPN=1040866093

Aktipis, C. Athena (2016)

Cooperation in an uncertain world : for the Maasai of East Africa, need-based transfers outperform account-keeping in volatile environments

https://kxp.k10plus.de/DB=9.663/PPNSET?PPN=1040864376

Aktipis, C. Athena (Washington, DC,2015)

Opinion : control vs. eradication ; applying infectious disease treatment strategies to cancer

https://kxp.k10plus.de/DB=9.663/PPNSET?PPN=1726277852

Aktipis, C. Athena (2015)

Inclusive fitness effects can select for cancer suppression into old age

https://kxp.k10plus.de/DB=9.663/PPNSET?PPN=1041112521

Aktipis, C. Athena (2015)

Cancer across the tree of life : cooperation and cheating in multicellularity

https://kxp.k10plus.de/DB=9.663/PPNSET?PPN=1041108044

Aktipis, C. Athena (2015)

Principles of cooperation across systems : from human sharing to multicellularity and cancer

https://kxp.k10plus.de/DB=9.663/PPNSET?PPN=1040865127

Aktipis, C. Athena (2015)

Cancer susceptibility and reproductive trade-offs : a model of the evolution of cancer defences

https://kxp.k10plus.de/DB=9.663/PPNSET?PPN=1040705332

Aktipis, C. Athena (Amsterdam [u.a.],2014)

Need-based transfers on a network : a model of risk-pooling in ecologically volatile environments

https://kxp.k10plus.de/DB=9.663/PPNSET?PPN=1726118266

Aktipis, C. Athena (2014)

Resistance is mobile : the accelerating evolution of mobile genetic elements encoding resistance

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