

The Biology of Entrepreneurship

Ahmed Maged Nofal
Warwick Business School
a.nofal.15@mail.wbs.ac.uk

Nicos Nicolaou
Warwick Business School
Nicos.Nicolaou@wbs.ac.uk

SOTA Review No 27: May 2019

What do we know about the role of biology in entrepreneurship? The past decade has unravelled various associations between biological factors, including genetics, hormones, mental conditions and neuroscience, and the tendency of people to engage in entrepreneurial outcomes. Yet, it is unclear how this evidence can be useful for policy-makers and practitioners. In this work, we provide some insights to policy-makers and practitioners from this area of research.

Background

What makes an entrepreneur? The past few years have witnessed a significant increase in research examining the role of biology in entrepreneurship. For instance, evidence shows that the genetic factors explain almost half of the variance in people's tendencies towards entrepreneurship (Nicolaou, Shane, Cherkas & Spector, 2008). Other research suggests that hormones, such as testosterone and cortisol, affect the propensity of people to become entrepreneurs (Nicolaou, Patel & Wolfe, 2018; Wolfe & Patel, 2017b). Further research argues that entrepreneurs have increased activations in the frontopolar cortex of the brain when engaging in exploration tasks (Laureiro-Martinez et al., 2014). Studies also show that mental conditions, including attention-deficit hyperactivity disorder (Wiklund, Yu, Tucker & Marino, 2017), dyslexia (Logan, 2009), depression (Hessels, Rietveld, Thurik & van der Zwan, 2018), bipolar disorder (Johnson, Madole & Freeman, 2018) and obsessive-compulsive personality disorder (Wolfe & Patel, 2017a), influence the propensity of individuals to engage in entrepreneurial outcomes.

Research has outlined a number of mechanisms through which biological factors may influence entrepreneurship (see Table 1) (Nofal, Nicolaou, Symeonidou & Shane, 2018). First, evidence indicates that biological factors may affect individuals' propensity to engage in entrepreneurship through psychological

factors such as openness to experience, sensation seeking, creativity, and extraversion and attitudes such as opportunity recognition – a mechanism called “mediation through psychological factors and attitudes” (Shane & Nicolaou, 2015b; Shane, Nicolaou, Cherkas & Spector, 2010). Second, studies demonstrate that biological factors may interact with environmental factors, such as education, to influence the likelihood of becoming an entrepreneur – a mechanism called “biology-environment interaction” (Nicolaou & Shane, 2009; Quaye, Nicolaou, Shane & Harris, 2012). Third, researchers argue that individuals may have biological tendencies towards selecting certain environments that can in-turn affect their likelihood of becoming entrepreneurs – a mechanism called “biology-environment correlation” (Nofal, Nicolaou & Symeonidou, 2017). Fourth, different biological factors can jointly interact to influence entrepreneurship – a mechanism called “interactions between biological strands” (Nofal, Nicolaou, Symeonidou & Shane, 2018).

Table 1: Mechanisms linking Biology to Entrepreneurship

Authors	Methodology	Mechanism	Key findings
(Shane & Nicolaou, 2015b)	Twin Study	Mediation through psychological factors and attitudes	Genetics can influence entrepreneurship through creativity
(White, Thornhill & Hampson, 2006)	Experimental Design	Mediation through psychological factors and attitudes	Testosterone can influence entrepreneurship through risk-taking
(Zhang & Ilies, 2010)	Twin Study	Biology-environment interaction	Genetics can interact with family environment to affect entrepreneurship
(Nicolaou & Shane, 2009)	Conceptual work	biology-environment correlation	Biology can influence education which can affect the likelihood of becoming an entrepreneur

Implications

It is important to emphasise that biological influences on entrepreneurship are definitely not deterministic and that anyone can become an entrepreneur. For instance, research shows that environmental factors can moderate the effect of biology on the tendency to engage in entrepreneurship. Evidence suggests that changing social environments and education can moderate the relationship between genetic factors and the tendency to become an entrepreneur (Quaye et al., 2012; Zhang, Ilies & Arvey, 2009).

Moreover, evidence suggests that identifying the biological covariance between skills, traits, attitudes and entrepreneurial outcomes can present useful implications. For instance, because evidence shows that biological factors contribute to the covariance between creativity and entrepreneurship more than they contribute to the covariance between sensation-seeking and entrepreneurship, targeting people’s sensation seeking can be more effective than policies targeting creativity to stimulate entrepreneurship (Nofal et al., 2018; Shane & Nicolaou, 2015b).

Research on mental conditions has also presented important implications to policy-makers and practitioners. For instance, prior work has changed beliefs about the role of mental conditions by showing that they positively influence the likelihood of engaging in entrepreneurship (Shane & Nicolaou, 2015a). For example, extant studies argue that dyslexic people tend to engage in entrepreneurship (Logan, 2009). Other evidence shows that people with Attention-Deficit Hyper Activity Disorder (ADHD) do well in entrepreneurial careers (Lerner, Hunt & Verheul, 2018). Recent studies indicate that Obsessive-Compulsive Personality Disorder (OCPD) is positively associated with the propensity of people to become entrepreneurs (Wolfe & Patel, 2017a). Furthermore, extant literature demonstrates that bipolar disorder plays an important role in entrepreneurship (Johnson et al., 2018). Thus, policy-makers may encourage people with ADHD, dyslexia and bipolar disorder to consider an entrepreneurial career and turn what others may have **wrongly** perceived to be a disadvantage into a great asset.

Summary and Evidence Gaps

The past decade has witnessed an increase in research on the biological foundations of entrepreneurship. Yet, empirical evidence on the role of biology on entrepreneurship is still limited and much more research is needed before we can understand the role that biology plays in it (Nofal et al., 2018). For instance, researchers are urged to further examine the moderating role that some environmental factors, such as education, financial status and public support, can play in the relationship between biology and entrepreneurship (Quaye et al., 2012). Additionally, research linking hormones, such as oxytocin and serotonin, to entrepreneurship is needed (Nofal et al., 2017). In addition, work linking neuroscience to entrepreneurship is encouraged as it has the potential to uncover some explanations with regards to how emotions and cognition relate to entrepreneurship (de Holan, 2013). Finally, research studying the effect of entrepreneurship on individuals' health more generally is needed, given the increasing evidence on the negative effect that entrepreneurship can have on individuals' well-being (Stephan, 2018).

Sources

- de Holan, P. M. 2013. It's All in Your Head: Why We Need Neuroentrepreneurship. *Journal of Management Inquiry*, 23(1): 93-97.
- Hessels, J., Rietveld, N., Thurik, R., & van der Zwan, P. 2018. Depression and entrepreneurial exit. *The Academy of Management Perspectives*.
- Johnson, S. L., Madole, J. W., & Freeman, M. A. 2018. Mania risk and entrepreneurship: Overlapping personality traits. *Academy of Management Perspectives*, 32(2): 207-227.
- Laureiro-Martinez, D., Canessa, N., Brusoni, S., Zollo, M., Hare, T., Alemanno, F., & Cappa, S. F. 2014. Frontopolar cortex and decision-making efficiency: comparing brain activity of experts with different professional background during an exploration-exploitation task. *Frontiers in Human Neuroscience*, 7: 927.
- Lerner, D., Hunt, R., & Verheul, I. 2018. Dueling Banjos: Harmony and Discord between ADHD and Entrepreneurship. *The Academy of Management*

- Perspectives*: amp. 2016.0178.
- Logan, J. 2009. Dyslexic entrepreneurs: the incidence; their coping strategies and their business skills. *Dyslexia*, 15(4): 328-346.
- Nicolaou, N., Patel, P. C., & Wolfe, M. T. 2018. Testosterone and Tendency to Engage in Self-Employment. *Management Science*.
- Nicolaou, N., & Shane, S. 2009. Can genetic factors influence the likelihood of engaging in entrepreneurial activity? *Journal of Business Venturing*, 24(1): 1-22.
- Nicolaou, N., Shane, S., Cherkas, L., & Spector, T. D. 2008. The influence of sensation seeking in the heritability of entrepreneurship. *Strategic Entrepreneurship Journal*, 2(1): 7-21.
- Nofal, A. M., Nicolaou, N., & Symeonidou, N. 2017. Biology and Entrepreneurship. In G. Ahmetoglu, T. Chamorro-Premuzic, B. Klinger and T. Karcisky (Eds.), *The Wiley Handbook of Entrepreneurship*: Wiley.
- Nofal, A. M., Nicolaou, N., Symeonidou, N., & Shane, S. 2018. Biology and Management: A Review, Critique, and Research Agenda. *Journal of Management*, 44(1): 7-31.
- Quaye, L., Nicolaou, N., Shane, S., & Harris, J. 2012. A Study of Gene-Environment Interactions In Entrepreneurship. *Entrepreneurship Research Journal*, 2(2).
- Shane, S., & Nicolaou, N. 2015a. The Biological Basis of Entrepreneurship. In S. M. Colarelli and R. D. Arvey (Eds.), *The Biological Foundations of Organizational Behavior*: University of Chicago Press.
- Shane, S., & Nicolaou, N. 2015b. Creative personality, opportunity recognition and the tendency to start businesses: A study of their genetic predispositions. *Journal of Business Venturing*, 30(3): 407-419.
- Shane, S., Nicolaou, N., Cherkas, L., & Spector, T. D. 2010. Genetics, the Big Five, and the tendency to be self-employed. *Journal of Applied Psychology*, 95(6): 1154-1162.
- Stephan, U. 2018. Entrepreneurs' Mental Health and Well-Being: A Review and Research Agenda. *Academy of Management Perspectives*, 32(3): 290-322.
- van der Loos, M. J. H. M., Rietveld, C. A., Eklund, N., Koellinger, P. D., Rivadeneira, F., Abecasis, G. R., Ankra-Badu, G. A., Baumeister, S. E., Benjamin, D. J., Biffar, R., Blankenberg, S., Boomsma, D. I., Cesarini, D., Cucca, F., de Geus, E. J. C., Dedoussis, G., Deloukas, P., Dimitriou, M., Eiriksdottir, G., Eriksson, J., Gieger, C., Gudnason, V., Hohne, B., Holle, R., Hottenga, J.-J., Isaacs, A., Jarvelin, M.-R., Johannesson, M., Kaakinen, M., Kahonen, M., Kanoni, S., Laaksonen, M. A., Lahti, J., Launer, L. J., Lehtimaki, T., Lottfelder, M., Magnusson, P. K. E., Naitza, S., Oostra, B. A., Perola, M., Petrovic, K., Quaye, L., Raitakari, O., Ripatti, S., Scheet, P., Schlessinger, D., Schmidt, C. O., Schmidt, H., Schmidt, R., Senft, A., Smith, A. V., Spector, T. D., Surakka, I., Svento, R., Terracciano, A., Tikkanen, E., van Duijn, C. M., Viikari, J., Volzke, H., Wichmann, H.-E., Wild, P. S., Willems, S. M., Willemsen, G., van Rooij, F. J. A., Groenen, P. J. F., Uitterlinden, A. G., Hofman, A., & Thurik, A. R. 2013. The molecular genetic architecture of self-employment. *PLoS One*, 8(4): e60542.
- White, R. E., Thornhill, S., & Hampson, E. 2006. Entrepreneurs and evolutionary biology: The relationship between testosterone and new venture creation. *Organizational Behavior and Human Decision Processes*, 100(1): 21-34.
- Wiklund, J., Yu, W., Tucker, R., & Marino, L. D. 2017. ADHD, impulsivity and entrepreneurship. *Journal of Business Venturing*, 32(6): 627-656.
- Wolfe, M. T., & Patel, P. C. 2017a. Persistent and repetitive: Obsessive-Compulsive Personality Disorder and self-employment. *Journal of Business Venturing Insights*, 8: 125-137.

- Wolfe, M. T., & Patel, P. C. 2017b. Two are better than one: Cortisol as a contingency in the association between epinephrine and self-employment. *Journal of Business Venturing Insights*, 8: 78-86.
- Zhang, Z., & Ilies, R. 2010. Moderating Effects of Earlier Family Environment on Genetic Influences on Entrepreneurship. *Symposium Presentation at the Annual Conference of the Academy of Management*. Montréal, Canada.
- Zhang, Z., Ilies, R., & Arvey, R. D. 2009. Beyond genetic explanations for leadership: The moderating role of the social environment. *Organizational Behavior and Human Decision Processes*, 110(2): 118-128.

About the authors



Ahmed M. Nofal is a Doctoral Researcher at Warwick Business School. Ahmed's research examines the influence of biology on the tendency to engage in entrepreneurship. His most recent work has been published in the *Journal of Management* and the *Wiley Handbook of Entrepreneurship*. He has also received the outstanding published research paper award from Warwick Business School in 2018. He can be contacted at a.nofal.15@mail.wbs.ac.uk



Nicos Nicolaou is a Professor of Entrepreneurship and the Head of the Entrepreneurship and Innovation Group at Warwick Business School. He has received both research and teaching awards including the 2013 INFORMS Technology Management Best Paper Award for the best paper published in an entire year in *Management Science* or *Organization Science*, two of the leading journals in the field, the Principal's Award for the best teaching scores at Imperial College London and teaching awards at the University of Warwick. He can be contacted at Nicos.Nicolaou@wbs.ac.uk

Other SOTA Reviews are available on the ERC web site www.enterpriseresearch.ac.uk. The views expressed in this review represent those of the authors and are not necessarily those of the ERC or its funders.

