Special issue: recognizing the lifetime scientific contributions of Athina Markou

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Published online: 18 April 2017
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Athina Markou, who passed away far too young in May 2016, dedicated her entire scientific life to psychopharmacology. This Special Issue has been assembled to commemorate the immense impact that her work has had on the field and to highlight her legacy. Indeed, with more than 200 articles in peer-reviewed journals including *Nature*, *Nature Neuroscience* and *PNAS* not to mention as recounted by Trevor Robbins in his generous obituary in this special issue (Robbins 2017), the 34 articles in *Psychopharmacology*, Athina has played a major role in the development of the field over the past three decades. In addition, Athina was a stalwart member of the European Behavioural Pharmacology Society, this journal's society partner.

The special issue is bookended on one side by a personal and comprehensive review by George Koob, Athina's PhD mentor, of Athina's most renowned work—her contribution to understanding motivational dysregulation in addiction using experimental models (Koob 2017). Indeed, among her most important findings was the observation that nicotine withdrawal induces anhedonic effects in rats similar to other major drugs of abuse (Epping-Jordan et al. 1998). This enabled her to have a model for assessing novel strategies for developing anti-addictive agents including mGlu and GABA_B receptor ligands (Cryan et al. 2003; Kenny and Markou 2004). In this regard, Winsky and Brady (2017) describe how Athina created collaborative networks to develop novel treatments for

nicotine abuse and mental disorders. Moreover, reviewing the field and Athina's contribution Anton Beshpalov and colleagues focus on mGlu1 receptor as a drug target for treatment of substance use disorder (Dravolina et al. 2017) whereas Jane Acri details the journey that mGlu2 ligands have come on as therapeutic targets for substance abuse (Acri et al. 2016). On the other hand, Christian Chiamulera highlights the state of the art for mGlu5 ligands as treatments for nicotine dependence (Chiamulera et al. 2016). With regard to GABA_B receptors, McDonald and colleagues present new research on a novel GABA_B receptor positive allosteric modulator for nicotine dependence (Li et al. 2017) whereas Jacobson and colleagues highlight interactions between GABA_B receptors and 5-HT system (Jacobson et al. 2017). The special issue is also focused on other novel targets for drug dependence; among those highlighted are neuropeptides (Bruijnzeel et al. 2017), Toll-like receptors (Crews et al. 2017), 5-HT_{2C} receptors (Palacios et al. 2017), opioid receptors (Norman and D'Souza 2017), glycine site ligands (Yohn et al. 2017) and alpha7 receptors (Higa et al. 2017).

Athina Markou's influence has spread beyond that of substance use disorders often focusing on other diseases with shared neurobiological mechanisms. Moreover, her focus on the principles underlying the validity of animal models of psychiatric disease has been very important, guiding their appropriate use when translating basic research findings into efforts to develop new therapeutics (Geyer and Markou 1995; Cryan et al. 2002; Barnes et al. 2014; Pergadia et al. 2014). In the special issue, this is exemplified by the papers from Baldo on feeding mechanisms (Selleck and Baldo 2017), O'Dell on diabetes (Pipkin et al. 2017), Belin on impulsivity (Rotge et al. 2017) and Dalley and colleagues on perseveration (Zhukovsky et al. 2017). The overlap between stress and reward pathways has been one of the key themes emerging from Athina's research (Der-Avakian et al. 2014) and there is a fitting review on this

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relationship (Slattery and Cryan 2017) as well as articles on the failure of CRF1 receptor antagonists in drug development efforts to date (Spierling and Zorrilla 2017). Liu and colleagues present new data on the role of isolation stress on impulsivity-related behaviours (Liu et al. 2017) whereas Semanova and colleagues focus on impact of another early-life stress protocol interacting with adolescent exposure to ethanol (Boutros et al. 2017). Der-Avakian focuses on adult social defeat stress and its functional consequences on behaviour and neurochemistry (Der-Avakian et al. 2017).

Athina always had her eye focus on clinical translation of her rodent findings and it is thus fitting that there are two human psychopharmacology papers focused on overlapping neurobiology of both hallucinogens and schizophrenia with drug dependence (Alexander et al. 2017; Liechti et al. 2017).

We would like to thank all of the authors for their rapid and very enthusiastic response to the call for articles and hope that the Special Issue offers a glimpse into the legacy that Dr. Markou has had on the field and will continue through her trainees, collaborators and friends. We would also like to extend our sympathies to Professor Mark Geyer and to all Athina's family and friends at this difficult time.

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