Intestinal microbiota perturbation induces depressive-like behavior associated with brain biochemical and functional alterations

F. Guida[1], F. Turco[2], M. Iannotta[1], A. Furiano[1], F. Napolitano[3], I. Palumbo[2], L. Luongo[1], A. Usiello[3], R. Cuomo[2], S. Maione[1], V. de Novellis[1]

[1]Dept. of Experimental Medicine, Section of Pharmacology L. Donatelli, Second University of Naples, 80138 Naples, Italy
[2]Dept. of Clinical Medicine and Surgery, Federico II University of Naples, Via S. Pansini, 5, 80131, Naples, Italy
[3]Behavioural Neuroscience Laboratory, CEINGE - Biotecnologie Avanzate, Via Comunale Margherita 482, 80145 Naples, Italy

The gut-brain axis has been indicated as major substrate of pathophysiological mechanisms in chronic inflammatory bowel disorders and psychiatric comorbidities. In particular, intestinal microbiota may play a role in communication between these two systems (Collins et al., 2013). However, such communication is not fully understood and probably involves multiple mechanisms. Therefore, in the present study we examined the behavior, as well as, the brain biochemical and functional alterations in an antibiotic-induced dysbiosis animal model. Young male mice received a mixture of nonabsorbable antimicrobials (ampicilline, streptomicin and clyndamicin), which has been associated to the bacterial composition alteration (Lamouse´-Smith et al, 2011) for 2 weeks. Afterwards, animals were treated with probiotic (lactobacillus, 10^9 cells) or vehicle up to 7 days. Biochemical evaluations indicated that dysbiosis induced an overall gut inflammatory condition, associated with a depressive-like behavior and a reduced social interaction. Altered behavior was accompanied by changes in hyppocampal BDNF/TrkB expression levels as well as in neurons firing activity. Moreover, phenotypic changes of supraspinal glia and microglia cells in brain areas involved in depression-like behaviour were observed. We found that probiotic treatment counteracted the gut inflammation and restored the behavioural phenotype as compared with vehicle-treated animals. Moreover, probiotic treatment normalized the biochemical and functional changes occurring in the brain of dysbiotic mice. These data suggest that intestinal dysbiosis might contribute to psychiatric disorders in patients with bowel disorders.

Lamouse´-Smith, Alice Tzeng, Michael N. Starnbach (2011) Plosone
Collins SM, Kassam Z, Bercik P (2013) Curr Opin Microbiol