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Research Article

Delonix Regia Linn Extract As A Antidepressant Anxiolytic Property

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ABSTRACT:
Delonix regia Linn, commonly known as Royal Poinciana or Flamboyant, is a well-known ornamental tree with a rich history of medicinal use in various traditional systems of medicine. Recent research has shed light on its potential pharmacological properties, particularly its effects on mood disorders such as depression and anxiety. This review aims to provide a comprehensive overview of the scientific evidence supporting the antidepressant and anxiolytic properties of Delonix regia Linn extract. Studies investigating the effects of Delonix regia Linn extract on depression and anxiety-related behaviours in preclinical and clinical settings were included. The findings suggest that Delonix regia Linn extract possesses promising antidepressant and anxiolytic properties, as evidenced by its ability to modulate neurotransmitter systems, attenuate oxidative stress, and regulate neuroinflammation. Furthermore, several bioactive compounds present in Delonix regia Linn extract, such as flavonoids, alkaloids, and phenolic compounds, have been implicated in its therapeutic effects on mood disorders. However, further research is warranted to elucidate the underlying mechanisms of action, optimize dosage regimens, and evaluate its safety profile in human subjects. Overall, Delonix regia Linn extract holds potential as a natural alternative for the management of depression and anxiety, offering new avenues for drug discovery and development in psychopharmacology.

Keywords: Delonix regia Linn, Royal Poinciana, Flamboyant, antidepressant, anxiolytic, mood disorders, phytochemicals, neuropharmacology, oxidative stress, neuroinflammation.

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INTRODUCTION:

Anxiety and depressive disorders are common psychiatric conditions. More than 20 % of the adult population suffers from these conditions at some time during their life [1]. There is abundant evidence for abnormalities of the dopamine, acetylcholine,

norepinephrine (NE) and serotonin (5HT) neurotransmitter systems in depression and anxiety disorders [2, 3]. Moreover, anxiety and depressive disorders may share the common pathophysiology of deficient serotonin neurotransmission, thus supporting the efficacy of selective serotonin reuptake inhibitors (SSRIs) in the treatment of depression and panic disorder [4].

However, due to the therapeutic lag and limited efficacy of drugs currently used in managing mixed depressive anxiety disorder, there is dire need for newer, better-tolerated and more efficacious drug. The search for novel pharmacotherapy from medicinal plants for psychiatric illnesses has progressed significantly in the past decade [5]. This is reflected in the large number of herbal medicines whose psychotherapeutic potential has been assessed in a variety of animal models. These studies have provided useful information for the development of new pharmacotherapies from medicinal plants for use in clinical psychiatry [6].

Despite the availability of pharmacological treatments, many patients experience inadequate relief of symptoms, intolerable side effects, or resistance to existing medications. Therefore, there is a growing interest in exploring natural compounds with potential antidepressant and anxiolytic properties as alternative or adjunctive therapies.

Delonix regia Linn, a member of the Fabaceae family, has garnered attention due to its diverse pharmacological activities, including antioxidant, anti-inflammatory, analgesic, and neuroprotective effects. Traditionally, various parts of the Delonix regia tree, including leaves, flowers, seeds, and bark, have been used in folk medicine to alleviate various ailments. In recent years, scientific research has focused on elucidating the therapeutic potential of Delonix regia Linn extract in mood disorders, particularly depression and anxiety. This review aims to provide a comprehensive overview of the current evidence supporting its antidepressant and anxiolytic properties, highlighting underlying mechanisms of action and potential therapeutic applications [7, 8].

Delonix regia Linn, commonly known as Royal Poinciana or Flamboyant, is a majestic flowering tree native to Madagascar but widely cultivated in tropical and subtropical regions around the world for its ornamental beauty. Beyond its aesthetic appeal, Delonix regia has a rich history of traditional medicinal use, with various parts of the plant being employed in folk remedies for numerous ailments. In recent years, scientific interest in Delonix regia has surged, driven by growing evidence of its pharmacological properties and potential therapeutic benefits [9]. The plant is characterized by its vibrant red-orange flowers and fern-like leaves, making it a striking addition to landscapes and gardens. However, it is not merely its visual allure that has garnered attention; rather, it is the bioactive compounds found within Delonix regia that have sparked scientific curiosity. Phytochemical analyses have revealed the presence of flavonoids, alkaloids, phenolic compounds, and other secondary metabolites in different parts of the plant, each with its own unique pharmacological properties [10].

Potential health benefits of Delonix regia extract, focusing particularly on its antioxidant, anti-inflammatory, analgesic, and neuroprotective properties. Studies have demonstrated its ability to scavenge free radicals, reduce inflammation, alleviate pain, and protect against neurodegenerative diseases. Moreover, emerging evidence suggests that Delonix regia extract may exert modulatory effects on neurotransmitter systems, offering promise for the management of mood disorders such as depression and anxiety [11].

Given the limited efficacy and adverse effects associated with current pharmacological treatments for depression and anxiety, there is growing interest in exploring natural alternatives such as Delonix regia extract. However, despite the accumulating evidence from preclinical studies, there remains a need for further research to elucidate the underlying mechanisms of action, optimize dosage regimens, and evaluate the safety and efficacy of Delonix regia extract in clinical research [12].

Therefore, this review aims to provide a comprehensive overview of the antidepressant and anxiolytic properties of Delonix regia Linn extract, synthesizing existing literature and highlighting potential avenues for future research. By consolidating the current evidence, this review seeks to contribute to our understanding of Delonix regia as a potential natural remedy for mood disorders, offering new possibilities for drug discovery and development in the field of psychopharmacology.

Figure 1. Delonix regia [9].

Table No. 1 Overall information of Delonix regia [10].

Scientific name	Delonix regia
Family name	Fabaceae
Common names	Flamboyant, phoenix flower, flame of the forest, flame tree, royal poinciana
Height	30-40 feet tall
Blooming Time	June to July
Uses	Delonix regia is an excellent flowering tree for gardens, parks, along streets, and large front yards where it is winter hardy. Mature trees provide plenty of shade.
Environmental Impact	Positive
Maintenance	Low
Best season for growth	Winters

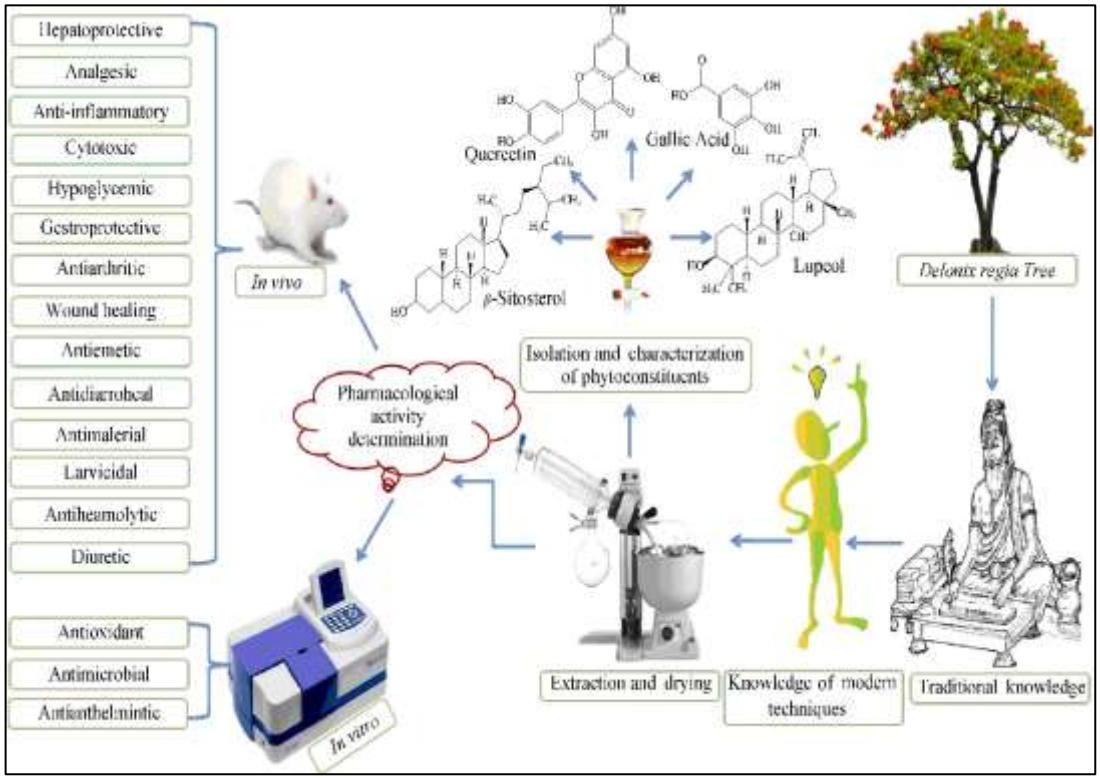

Figure 2. Pharmacological Uses of Delonix regia [11].

❖ **ANTIDEPRESSANT PROPERTIES:**

Preclinical studies investigating the antidepressant effects of Delonix regia Linn extract have demonstrated promising results. For example, animal models of depression, such as the forced swim test (FST) and the tail suspension test (TST), have shown that administration of Delonix regia Linn extract attenuates immobility time, a behavioural parameter indicative of despair-like behaviour. Moreover, Delonix regia Linn extract has been shown to increase levels of monoamine neurotransmitters, including serotonin (5-HT), dopamine (DA), and norepinephrine (NE), in key brain regions implicated in the pathophysiology of depression, such as the hippocampus and prefrontal cortex. These neurochemical changes are consistent with the mechanisms of action of conventional antidepressant drugs, which primarily target monoaminergic systems. Additionally, Delonix regia Linn extract exhibits antioxidant properties, scavenging free radicals and reducing oxidative stress markers, which have been implicated in the pathogenesis of depression. Furthermore, studies have highlighted the role of neuroinflammation in depression, and Delonix regia Linn extract has been shown to suppress pro-inflammatory cytokines and modulate microglial activation, thereby exerting anti-inflammatory effects in the brain. Collectively, these findings suggest that Delonix regia Linn extract may ameliorate depressive symptoms through multiple neurochemical and neuroprotective mechanisms [13, 14, 15, 16].

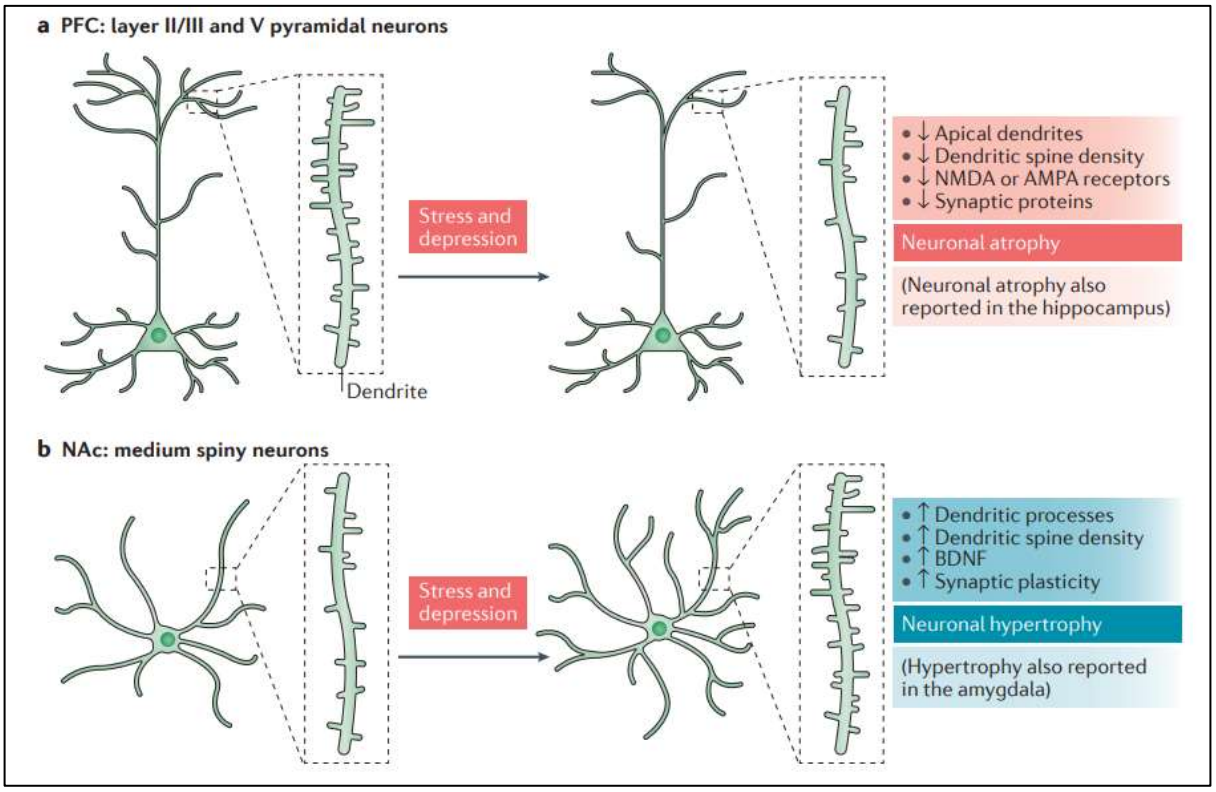

Figure 3. Neurobiology of depression [17].

1. Forced swimming test

Forced swimming test (FST) is a 2 day procedure in which mice swim under conditions where escape is not possible. A total of 60 mice were used. On the first day, mice were forced to swim for 15 min in a 50 cm tall, 30 cm diameter cylinder filled to 25 cm with 24–26 °C water. They initially struggled to escape from water, but later they adopted a posture of immobility in which they only made the movements necessary to keep their head above water. After the 15 min forced swim session, mice were removed from the water and wiped with towels until dry. The cylinder was emptied and cleaned between tests. 24 h later, mice were re-tested for 5 min in the same conditions after 1 min of acclimatisation, and immobility was increased if the animals showed a depressive-like behaviour. Immobility was defi ned as the time spent by mouse making only movements necessary to keep their head above water; swimming was defi ned as making active swimming movements to the centre of the cylinder; climbing if they were making forceful thrashing movements with their forelimbs against the walls of the cylinder. The time mice spent in each of these behaviours was measured by a trained observer who remained unaware of the treatments [18, 19].

✓ **Elucidation of mechanism of antidepressant-like effect in the FST**

▪ **Serotonergic system involvement**

To assess the involvement of the serotonergic system in the antidepressant-like eff ect of MC, mice were pre-treated with cyproheptadine (3 mg/kg, i.p., a 5-HT 2 receptor antagonist) or metergoline (non-selective 5-HT 2 receptor antagonist) and were used at doses effective in blocking the in vivo eff ects induced by 5-HT receptor agonists in mice [20].

▪ **Noradrenergic system involvement**

The possible involvement of the noradrenergic system in the antidepressant-like eff ect of MC, animals were pre-treated with prazosin (62.5 µg/kg, i.p., an α1 -adrenoceptor antagonist), yohimbine (1 mg/kg, i.p., an α2 -adrenoceptor antagonist) [21].

▪ **Dopaminergic system involvement**

To test the possible involvement of the dopaminergic system in the antidepressant-like eff ect of MC, animals were pre-treated with sulpiride (50 mg/kg, i.p., a dopamine D 2 receptor antagonist) [21].

2. Tail suspension test

Tail suspension test (TST) is based on the observation that a mouse suspended by the tail alternates between periods of immobility and agitation. A total of 40 mice were used. Mice were moved from the colony room to the testing area in their home cages and allowed to adapt to the new environment for at least 1 h before testing. They were then suspended individually on a paper adhesive tape, 35 cm above the table top. The tape was placed approximately 1 cm from the tip of the tail. Animals were suspended for 6 min, and the duration of immobility was measured by a trained observer who remained unaware of the treatments. Mice were considered immobile only when they hung passively and completely motionless. Approximately 10 % of mice climbed their tails during these tests, and these mice were excluded from data analysis [22, 23].

❖ **ANXIOLYTIC PROPERTIES:**

In addition to its antidepressant effects, Delonix regia Linn extract has shown promise as an anxiolytic agent in preclinical models of anxiety. Anxiety-related

behaviours, such as elevated plus maze (EPM) and open field test (OFT), have been used to evaluate the anxiolytic potential of Delonix regia Linn extract. Administration of Delonix regia Linn extract has been associated with increased time spent in open arms of the EPM and central zone of the OFT, indicative of reduced anxiety-like behaviour. These behavioural effects are accompanied by alterations in neurotransmitter systems, including modulation of gamma-aminobutyric acid (GABA) ergic and glutamatergic transmission, which play critical roles in the regulation of anxiety. Moreover, Delonix regia Linn extract has been shown to mitigate oxidative stress and neuroinflammation in brain regions implicated in anxiety disorders, such as the amygdala and hippocampus. By targeting these neurochemical pathways, Delonix regia Linn extract may exert anxiolytic effects and alleviate symptoms of anxiety disorders [24, 25].

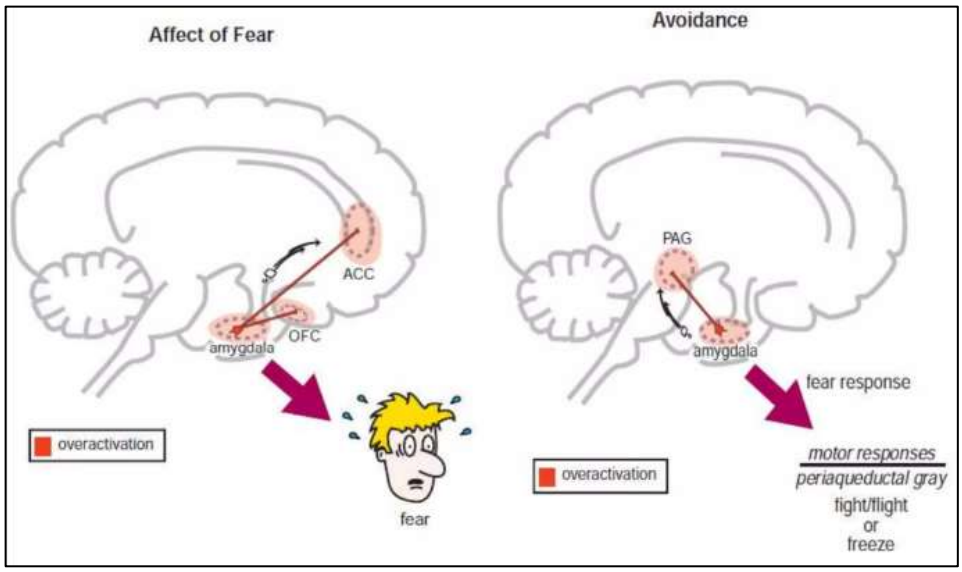

Figure 4. Neurobiology of Anxiety [26, 27].

1. Elevated plus maze test

The apparatus consisted of 2 opposite open arms (50 × 10 cm) and 2 enclosed arms (50 × 10 × 40 cm) extended from a common central platform (10 × 10 cm). A total of 60 animals were used. Upon completion of oral administrations made in the colony room, animals were moved to the plus maze laboratory to facilitate adaptation to novel surroundings for 20 min. Then, mice were placed individually onto the centre of the apparatus facing an open arm, and the time spent on and entries onto each arm were noted for 5 min by a trained observer who remained unaware of the treatments. The maze was carefully cleaned up with 10 % ethanol solution using tissue paper and dried after each trial to remove any residue or odour. An arm entry was recorded when all 4 paws of the mouse were in the arm. The number of open and closed-arm entries and the time spent in open arms were recorded. An increase in the mean time spent in open arms depicts anxiolytic-like effect [28, 29].

2. Open field test

The open field is usually an enclosed space, which may be square, rectangular, or circular in shape with surrounding walls that prevent the animal from escaping. One of the walls is clear Plexiglas, so mice could be visible in the apparatus. Commonly, the field is marked with a grid and square crossings. The centre of the field is marked with a different colour to differentiate from the other squares. The measures of the number of squares crossed can be obtained manually or with an automated camera-based computer tracking system fixed to the ceiling [30, 31].

✓ **Elucidation of mechanism of Anxiolytic Properties**

- **GABAergic transmission involvement**

Drugs targeting GABAergic transmission have been widely employed for anxiety therapy. As discussed before, specific GABA subunits are involved in the anxiolytic effects of drugs and are held responsible for mediating such effects on pre-clinical studies. Additionally, specific GABA subunits lacking animals, either GABAA or GABAB subunits, are less prone to develop anxiety-like behaviours. This information hence provides us with a rationale for the development of selective drugs, opening avenues for further studies on the role of the diverse subtypes of GABA receptors in the physiopathology of anxiety [32].

- **Glutaminergic system involvement**

The glutaminergic system is thought to play a major role in the pathogenesis of anxiety and fear conditioning. Treatments that improve the excitability of output neurones in the basolateral amygdala improve aversive conditioning. Alternatively, treatments that decrease the excitability of these neurones produce anxiolytic effects. Decrease in excitatory output in the amygdala can be achieved by decreasing the excitatory glutaminergic transmission. Blocking the basal glutamate excitation generated by ionotropic receptors could elicit a significant anxiolytic effect. Indeed, the administration of antagonists of the NMDA and non-NMDA type receptors into the basolateral amygdala has been shown to reduce anxiety in animal models. The anxiolytic benzodiazepines increase GABA neurotransmission and

induce a decrease in excitatory output of the amygdala. There appears to be a balance between GABA receptor mediated inhibition and glutamate receptor mediated excitation that regulates behavioural and physiological responses associated with anxiety [33].

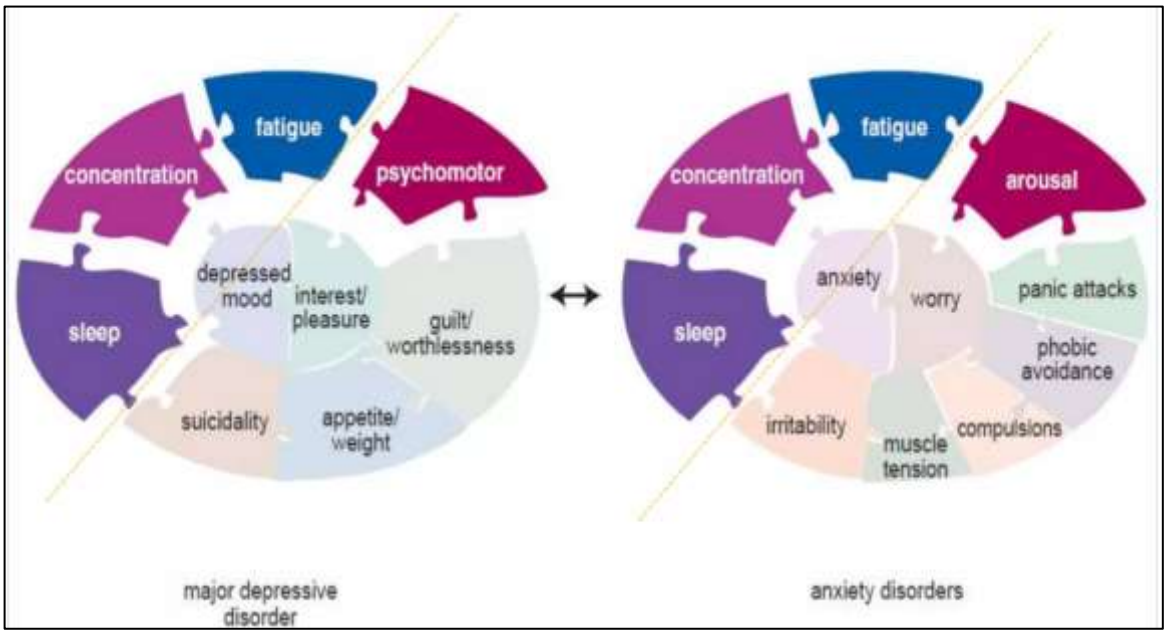

Figure 5. Overlap of Anxiety & Depression [34].

CONCLUSION:

In conclusion, Delonix regia Linn extract possesses promising antidepressant and anxiolytic properties, as supported by preclinical evidence from animal studies. These effects are mediated through modulation of neurotransmitter systems, attenuation of oxidative stress, and regulation of neuroinflammation in key brain regions implicated in mood disorders. Furthermore, the presence of bioactive compounds, such as flavonoids, alkaloids, and phenolic compounds, likely contributes to the therapeutic effects of Delonix regia Linn extract. However, further research is needed to elucidate the underlying mechanisms of action, optimize dosage regimens, and evaluate its safety and efficacy in human subjects. Delonix regia Linn extract holds promise as a natural alternative for the management of depression and anxiety, offering new opportunities for drug discovery and development in psychopharmacology.

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