Treatment with tyrosine, a neurotransmitter precursor, reduces environmental stress in humans

Acutely stressful situations can disrupt behavior and deplete brain norepinephrine and dopamine, catecholaminergic neurotransmitters. In animals, administration of tyrosine, a food constituent and precursor of the catecholamines, reduces these behavioral and neurochemical deficits. Using a double-blind, placebo-controlled crossover design we investigated whether tyrosine (100 mg/kg) would protect humans from some of the adverse consequences of a 4.5 hour exposure to cold and hypoxia. Tyrosine significantly decreased symptoms, adverse moods, and performance impairments in subjects who exhibited average or greater responses to these environmental conditions. These results suggest that tyrosine should be evaluated in a variety of acutely stressful situations. Banderet LE, Lieberman HR. *Brain Res Bull* 1989 Apr;22(4):759-62

Dietary tyrosine as an aid to stress resistance among troops

In past conflicts battle stress casualties have caused a serious exit of troops from the frontlines. Recent research has linked stress-caused impairments of performance with depletion of brain stores of the neurotransmitter norepinephrine (NE), which functions in neural tracts responding to stress. The amino acid tyrosine (TYR) is the dietary precursor for NE, and supplementation with TYR has been demonstrated in the laboratory to alleviate declines in both neural NE and performance during stress. Thus, TYR supplementation might help to prevent and treat stress. Salter CA. *Mil Med.* 1989 Mar;154(3):144-6.

The effects of tyrosine on cognitive performance during extended wakefulness

Tyrosine, a large neutral amino acid found in dietary proteins, has received recent attention as a potential treatment for stress. The behavioral effects of tyrosine were examined during an episode of continuous nighttime work involving one night’s sleep loss. Subjects performed nine iterations of a battery of performance tasks and mood scales for approximately 13 h, beginning at 1930 and ending at 0820. They remained awake throughout the day on which the experiment began and were awake for more than 24 h by the end of testing. Six hours after the experiment began, one-half of the subjects received 150 mg.kg-1 tyrosine in a split dose while the other half received cornstarch placebo in a double-blind procedure. Tyrosine administration was associated with a significant amelioration of the usual performance decline on a psychomotor task and a significant reduction in lapse probability on a high-event-rate vigilance task. The improvements lasted on the order of 3 h. The results of this study also suggest that tyrosine is a relatively benign treatment at this dose. After further testing with other doses and timing of administration, tyrosine may prove useful in counteracting performance decrements during episodes of sustained work coupled with sleep loss. Neri DF, Wiegmann D, Stanny RR, Shappell SA, McCardie A, McKay DL. *Aviat Space Environ Med* 1995 Apr;66(4):313-9

Tyrosine improves cognitive performance and reduces blood pressure in cadets after one week of a combat training course

The effects of the amino acid tyrosine on cognitive task performance were studied on a group of 21 cadets during a demanding military combat training course. In addition, the effects on mood, blood pressure and the noradrenaline metabolite MHPG were determined. Ten subjects received five daily doses of a protein-rich drink containing 2 g tyrosine, and 11 subjects received a carbohydrate rich drink with the same amount of calories (255 kcal). Assessments were made both immediately prior to the combat course and on the 6th day of the course. The group supplied with the tyrosine-rich drink performed better on a memory and a tracking task than the group supplied with the carbohydrate-rich drink. In addition, the supplementation of tyrosine decreased systolic blood pressure. No effects on mood were found. These findings suggest that supplementation with tyrosine may, under operational circumstances characterized by psychosocial and physical stress, reduce the effects of stress and fatigue on cognitive task performance. Deijen JB, Wiëntjes CJ, Vullings HS, Cloin PA, Langefeld JJ. *Brain Res Bull* 1999 Jan 15;48(2):203-9
Tyrosine improves working memory in a multitasking environment

Previous studies indicate that tyrosine may prove useful in promoting improved performance in situations in which performance is compromised by stress. To extend the generality of previous tyrosine findings, the present study examined the effects of tyrosine ingestion on performance during both a Multiple Task and a Simple Task battery. The multiple task battery was designed to measure working memory, arithmetic skills, and visual and auditory monitoring simultaneously, whereas the simple task battery measured only working memory and visual monitoring. Ten men and 10 women subjects underwent these batteries 1 h after ingesting 150 mg/kg of L-tyrosine or placebo. Administration of tyrosine significantly enhanced accuracy and decreased frequency of list retrieval on the working memory task during the multiple task battery compared with placebo. However, tyrosine induced no significant changes in performance on the arithmetic, visual, or auditory tasks during the Multiple Task, or modified any performance measures during the Simple Task battery. Blood levels of ACTH and cortisol were not, but heart rate and blood pressure were significantly increased during the performance tasks. The present results indicate that tyrosine may sustain working memory when competing requirements to perform other tasks simultaneously degrade performance, and that supplemental tyrosine may be appropriate for maintaining performance when mild to severe decrements are anticipated. Thomas JR, Lockwood PA, Singh A, Deuster PA. Pharmacol Biochem Behav 1999 Nov;64(3):495-500

Tyrosine administration prevents hypoxia-induced decrements in learning and memory

Exposure to hypobaric hypoxia rapidly produces decrements in learning and memory. Tyrosine, a neurotransmitter precursor, has beneficial behavioral effects when administered to animals and humans exposed to various acute stressors. To determine whether tyrosine would protect rats from the adverse effects of hypobaric hypoxia on spatial reference and working memory, it was administered to 27 male Fischer 344 rats tested in the Morris water maze. Rats were tested starting at 2 and 6 h of an 8 h exposure to a simulated altitude of 5950 m (19,500 ft) or sea level. Tyrosine or placebo was administered 1/2 h prior to each testing session (400 mg/kg, IP). Altitude exposure significantly increased working memory escape latency; treatment with tyrosine reversed this decrement. There was no effect of altitude or tyrosine on reference memory. There were also no treatment-related differences in performance when animals were tested the next day at sea level. The beneficial effects of tyrosine on working memory performance may be due to a direct effect of tyrosine on memory, alleviation of a hypoxia-induced retardation of learning, or to other central or peripheral effects of this dietary catecholamine precursor. Shukitt-Hale B, Stillman MJ, Lieberman HR. Physiol Behav 1996 Apr-May;59(4-5):867-71

Tyrosine reverses a cold-induced working memory deficit in humans

Acute exposure to cold stress has been shown to impair short-term, or working, memory, which may be related to reduction in, or disruption of, sustained release of brain catecholamines. Administering a supplemental dose of the catecholamine precursor tyrosine may alleviate cold stress-induced memory impairments by preventing cold-induced deficits in brain catecholamine levels. The present experiment determined whether administration of tyrosine would prevent a cold-induced working memory deficit, using a computer-based delayed matching-to-sample (DMTS) memory task. Eight male volunteers performed the DMTS task for 30 min at an ambient temperature of either 4 degrees C (cold) or 22 degrees C following a 30-min preexposure period and 2 h after ingesting 150 mg/kg of L-tyrosine or placebo. Subjects demonstrated a decline in matching accuracy on the DMTS task as delay interval increased, such that matching accuracy following a 16-s delay between sample and comparison stimuli was lower than that following a delay of 2 or 8 s. Consistent with previous research, and relative to 22 degrees C exposure sessions, matching accuracy during 4 degrees C exposure sessions was reduced significantly following placebo administration, which is attributed to the effect of cold exposure on short-term, or working, memory. Administration of tyrosine significantly improved matching accuracy at the longest delay interval most affected by cold exposure, such that matching accuracy in the cold following tyrosine was at the same level as matching accuracy following placebo or tyrosine administration at 22 degrees C. Tyrosine administered prior to 22 degrees C exposure had no effect on DMTS performance. Shurtleff D, Thomas JR, Schrot J, Kowalski K, Harford R. Pharmacol Biochem Behav 1994 Apr;47(4):935-41
L-tyrosine cures, immediate and long term, dopamine-dependent depressions. Clinical and polygraphic studies

Twelve patients with polysommographic and clinical signs of dopamine-dependent depression (DDD) received, after a short-lasting trial with the dopamine agonist Piribedil, a treatment with oral-tyrosine (3,200 mg/day). On the very first day of treatment a return to mood, as judged by clinical impression and MADRS scores was observed. Sleep recordings performed on nights following days 1, 2, 7 and 8 of treatment showed an immediate improvement of those sleep parameters differentiating the more clearly DDD from other types of depression. More than 50 patients have now been treated successfully for periods ranging from a few months to almost 2 years. This treatment is ineffective in other types of depression. Mouret J, Lemoine P, Minuit MP, Robelin N. C R Acad Sci III 1988;306(3):93-8