DISCUSSION

Co-relating the clinical experiences of the present research work with the neurobiology of depression:

The researcher was desirous to know about the functioning of the brain of depressed patient. The experiences while working with the patients and the findings of the research motivated her to understand the neurobiological manifestations in depressed patients.

It was practically impossible to study the effects of music on depressed patients in the neuro-biological aspects by the study of E.E.G. patterns or using brain-imaging techniques.

The findings of the present research work which, inspired the researcher to study neurobiology of depression can be given as:

Findings:
1) Intolerance to noise or any kind of sound.
2) Initial lack of interest in listening to music.
3) Lowered intensity of emotions.
4) Lowered ability in expressing responses to music.
5) Intolerance to fast music phrases.
6) Intolerance to high pitch.
7) High probability in evocation of sad memories.

Similar findings were observed by different researchers, which are mentioned as below:

1) S. Noelzen and, Z. Cesarec (1982), studied emotional experience of music by psychiatric patients compared with normal subjects. Psychiatric patients (n=107) and normal subjects (n=100) were exposed to seven newly composed pieces of music orchestrated for a small symphony orchestra. The patients were divided
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into seven subgroups: schizophrenic, depressive and manic psychosis, obsessive, depressive, anxiety and hysterical neurosis. All subjects rated the music on semantic differential scales describing three factors of emotional experience: tension-relaxation, gaiety-gloom and attraction-repulsion. The ratings by patients in the different groups were compared with those by the normal subjects. The most conspicuous findings were the anxiety neurosis patients experienced the music as neutral in tension and gaiety, but repulsive. Hysterics experienced more gaiety and attraction together with varying degrees of tension, obsessives more tension, depressive psychotics more gloom and less attractive while schizophrenics experienced more attraction than other groups.

2) Valerie N Stratton, Annette H. Zalanowski (1989), studied the ability of music and painting to change mood. The moods of depression and positive affect were measured using the Multiple Affect Adjective Check-List (MAACL) before and after subjects were presented with music alone, paintings alone or music paired with paintings. The music and paintings used were chosen to reflect the mood states of depression, positive affect and neutrality. Depressing music paired with either a depressing or pleasant painting increased depression and decreased positive affect, and pleasant music paired with either painting had the opposite effect. Music appears to be dominant in determining the direction of mood change, but music alone does not produce the change.

3) A.L. Bouhuys, G.M. Bloem, T.G. Groothuis (1995), studied the induction of depressed and elated mood by music. Music influenced the perception of facial emotional expressions in healthy subjects. All eight (fear, happiness, anger, sadness, disgust, surprise, rejection and invitation) emotions were reflected in the set of faces and the emotions were consensually judged. Twenty-four healthy subjects judged the faces after listening to depressing or elating music. The faces were subdivided in six ‘ambiguous’ faces (i.e., expressing similar amounts of positive and negative emotions) and six ‘clear’ faces (i.e. faces showing a preponderance of positive or negative emotions). Eleven subjects who showed substantial differences in experienced depression after listening to music were selected for further analysis. It was found that, when feeling more depressed, the
subjects perceived more rejection/sadness in ambiguous faces displaying less intensive emotions and less invitation/happiness in clear faces. In addition, subjects saw more fear in clear faces that express less intensive emotions. Hence results show a depression-related negative bias in the perception of facial displays.

4) V. Stratton, 1991, studied the effects of Music and Cognition on mood. The influence of music and cognitive appraisal on mood was examined by instructing seventy-two subjects to tell a story about a painting with or without background music. The three types of instructions were to tell a happy or sad story or whatever came to mind (neutral). And the music categories were pleasant, depressing and none. With neutral story instructions, the music determined mood change, but the happy and sad story instructions superceded any effect of the music. The sad story instructions were most effective leading to increased depression and decreased positive affect in all three music conditions. The results that mood responses to music are indeterminate and depend on cognitive processes.

The findings of the present study are discussed in the light of the literature review based on the effects of music on stress hormones'.

In the present research, variability was observed in the responses of subjects in the two groups (Study Group and Non-depressed group) and also among the subjects within the same group. How and why depressed patients showed different responses to music as compared to the non-depressed, how music affects brain of a depressed patient, whether music plays a kind of role as that of a stress releaser - these were some of the basic questions raised in the mind of the researcher. Hence beyond the scope of the study, the researcher started reviewing the literature on 'Music and Brain'.

In the Western countries, research has been going on to study the effects of music on brain. The researchers are doing research on why and how music soothes the human
mind. The research on effect of music on stress hormones proves that music lowers level of stress hormones in depressed patients. The effect of music shows frontal laterality ratios moved significantly closer to symmetry. The researchers also have found that the effect of music on stress hormones depends upon the components in the music as well as on the listener.

There are now several studies, mainly within the last five years or so, which have addressed the issue of whether music itself actually changes the amount of release of stress hormones. Most of these have concentrated on measuring levels of Cortisol (a stress hormone) before and after various exposures to music.

5) Some of the research studies on 'effect of music on stress hormones' are mentioned as below:

- Recent studies suggest that effective states are associated with E.E.G. patterns in the frontal region of the brain (Fox, 1991, Rex and Davidson, 1989). Specifically, left frontal asymmetry has been associated with negative effect (withdrawal emotions) or decreased positive affect (Abern and Schwartz, 1985, Davidson Ekman, Saron, Senulis and Friesen 1990).

Chronically depressed adolescent females (N=28) were recruited from an adolescent clinic based on their Beck Depression Inventory (BDI) scores and Diagnostic Interview Schedule (DIS) diagnosis (adolescent receiving medication were excluded). They were randomly assigned to a music group or a control group that was simply asked to relax their minds and their muscles for the same time period that the experimental group listened to music. The music group’s Cortisol values however decreased significantly from pre-session to post-session. In addition, the music group’s frontal laterality ratios moved significantly closer to symmetry during and after the music session. (which indicates increasing tranquillity of the brain.)

- Dr. Escher and coworkers (1993) allowed a group of patients undergoing gastroscopy to select and listen to the type of music they preferred, chosen in consultation with a music therapist. A control group heard no music. The control group showed a large increase in levels of Cortisol, and also ACTH, in their
blood. In contrast, the music group exhibited a significantly lower level of release of these hormones.

In a similar approach, in the case of a surgery, MilukKolasa et al (1994) observed that music greatly reduced the duration of the Cortisol response to stress.

Both studies indicate that stress hormone levels can be reduced by exposure to music in a medical treatment setting. But it is also found that there is no simple relationship between music and stress hormones. It is not only a matter of the type of music played, but also the cognitive and other mental activities that the individual brings to the situation.

- Mśckel and several coworkers (1994) at the Free University of Berlin examined the effects of three types of music on several physiological measures. They employed a Waltz by Johann Strauss because it had a regular rhythm. To contrast with this, a composition by the more contemporary composer W. H. Henze was used; the authors note that its rhythm was markedly irregular. The third piece was by Pt. Ravi Shankar, selected for its meditative nature without strong rhythmic characteristics. Levels of Cortisol and also Noradrenaline were reduced by one type of music - the Pt. Ravi Shankar's music piece. Of course, the types of music differed in many ways in addition to rhythm, so the particular aspect of music that was responsible is unknown. Still hormonal control by music seems clear.

- While these findings all seem to agree that music lowers levels of stress hormones, this is not a universal finding. For example, Brownley et al (1995) investigated how music affects Cortisol in trained and untrained runners under three conditions - 'sedative', 'fast' and 'no music'. Following high intensity exercise, the authors observed increased levels of Cortisol for fast music, compared to sedative and no music in the untrained runners only. So music can actually increase stress hormones. Other studies also show that music can increase as well as decrease stress hormones - and this does not have to happen under conditions of high activity or athletic exercise.

- In one such study by S.D. VanderArk and D. Ely (1992), college students in music and in biology were exposed to two selections from Holst's. The former music
selection was rated as peaceful and the later as very lively. Hormones were altered by the music, but the effect was not so much due to the type of music (relaxing vs. energizing) as to the field of study of the subjects. The biology students exhibited a decrease in Cortisol, similar to that, which might be expected from other studies of the effects of music. In contrast, the music students had significant increases in Cortisol. When later interviewed, music students indicated that they were actively engaged in mental analysis of the music, some even “playing” their instruments mentally.

In S.D. VanderArk and D Ely (1993), obtained similar findings in a follow-up study in which unpleasant, even tragic, music was played to the two groups.

6) Researchers (Juan Lopez, March 2000) have determined that patients suffering from depression often have depleted levels of one or more of the brain’s neurotransmitters, altering the level of contact between nerve cells. Two neurotransmitters have been strongly linked to depression, Noradrenaline and Serotonin.

The role of Norepinephrine depletion in depression has been suggested by the often low levels of norepinephrine metabolites (or by-products) in urine and cerebrospinal fluid of depressed patients. Norepinephrine circuit originates in the brain stem and projects system - an area that plays a significant role in regulating emotions. Norepinephrine depletion in depressed patients is believed to be most closely associated with several specific symptoms including lack of energy and interest and loss of motivation, addressing these symptoms of depression is an important treatment goal for many patients.

Thus the observations and findings of the present study can be co-related with the depletion of the Norepinephrine in depressed patient. In the present research, the depressed patients showed gradual increase in the interest towards music. Whether this is because of the effect of music on secretion of Norepinephrine is not ascertained but can be studied through experimentation.
Thus the effects of music on the major biological determinants of depression can be understood in detail and those insights will open a way in the application of music as a therapy on depression.