Summary and Conclusion
Plants that have a history of use in medicine constitute an obvious starting point in the research for new therapeutically active, drugs. It is only by infusing the ancient wisdom and modern science the world class product can be created because new product can not compete with products that have only traditional and impractical observation as the knowledge base. The knowledge to be integrated in to the traditional products has to emerge from modern science especially modern biology and chemistry.

The results arrived and inference drawn Conclusively validate the Anti-inflammatory, Hepatoprotective and Antioxidant effect of *Glycyrrhiza glabra* are presented as follows.

❖ The reduction in the swelling of the injected paw as well as the secondary lesions in the adjuvant induced arthritis by the *G. glabra* extract was found, It may be inferred that the extract is effective and showed positive antiarthritic effect.

❖ The enhanced collagen level in tissue of group (II) animals restored to near normalcy in treatment with aqueous root extract of *G. glabra*.

❖ FCA induced changes in hematological parameters (WBC, RBC, PCV, ESR and Hb) reflects antigen induced inflammation. The increased WBC count and in arthritis induced rats were effectively reduced by the plant extract (*G. glabra*). Decreased RBC count, Hb and PCV level in Group II arthritis induced were significantly increased and restored normacly, on treatment with *G. glabra* extract.

❖ The Restoration of the biochemical indices (Protein, Urea, Uric acid, and Creatinine) in both liver and serum by the *G. glabra* extract was considered to be safe and produced no harmful effects towards liver function. The results
ascertained on biochemical constituents conclusively validate safety and can be used as remedy thereby improving appetite, which is considered as a positive in chronic inflammatory disease such as R.A.

❖ It was interesting to note that the increased levels of cell-wall muco polysaccharides due to the release of lysosomal enzymes using arthritic condition was very effectively reduced by the *G. glabra* root extract, which indicates that the drug may exert its antiarthritic effect through lysosomal membrane stabilization.

❖ The enhanced levels of serum marker enzymes (ALP, ACP, AST, LDH and CAT-D.) in arthritic condition was significantly reduced when treated with the *G. globra* root extract which further confirms its effectiveness in liver function.

❖ The altered various levels of liver enzymes (ALP, ACP,AST LDH) by the drug and there by restoring the enzyme levels to near normal, exemplifies its protective role in inflammatory conditions such as R.A. *G. glabra* treatment seems to preserve the integrity of liver membrane.

❖ The characteristic enhanced lipid peroxidation has been compromised and counter balanced by the drug. The root extract of *G. glabra* could be inferred that the drug exerts its pharmacological and therapeutic effect against adjuvant induced arthritis by suppressing the increased level of lipid peroxidation.

❖ The diminished levels of enzymatic antioxidants (SOD, CAT, POD) were remarkably enhanced and restored to normal condition by the drug which emphasis the antioxidant potential of *G. glabra* against ROS implicated damage.

❖ The reduced non- enzymatic antioxidants levels (GSH, Vit C, TSH, NPSH) in arthritic condition was very effectively and significantly increased on drug treatment, which uncovers the hidden antioxidant principles possessed by *G. glabra*.
Control rats (GroupV) treated with *G. glabra* alone does not show any significant changes when compared with normal, which proves the plant was not toxic.

The results of qualitative analysis of *G. glabra* validates the presence of variety of secondary compounds namely flavonoids, alkaloids, steroids, glycosides etc., which is of commercial of therapeutic value.

The quantification of biochemical constituents of *G. glabra* such as total carbohydrates glucose, starch, reducing sugar was found to be in significant amount, while the protein content and were aminoacid present in lower amount.

The *G. glabra* root contains considerable amount of secondary metabolites (Tannin, steroids and total phenols).

The results further ascertain the medicinal effect indulged by *G. glabra* may be due to the presence of this valuable secondary compounds.

Efficient extraction of Secondary metabolites was performed by accelerated Solvent extraction (ASE), a process that utilizes enhanced solubilization kinetics followed by column chromatography, eluents collected using three different solvents namely Hexane, Benzene & Ethyl acetate.

TLC analysis of *G. glabra* showed a dirty white precipitate, which was identified as flavonoids.

It is clearly inferred that MS+ 2.5 mg/l 2.5 mg/unit Kinetin (++++) Combination of growth hormone showed highest callus rating (95%), which showed healthy callus initiation which can be used as a Protocol for callus initiation in *G. glabra*.
Among the five different combination of growth hormones used for callus initiation, MS + 1.5 mg/- IAA / NAA gave poor callus rate + MS + 2.5 mg/- Kinetin / 2.5 gave moderate callus (++) and Ms + 2.0 mg/IAA / Kinetin gave good callus rate (+++).

Organogenesis (shooting) of *G.glabra* (MS+ 2.5 mg/ IAA + 2.5 mg/Kinetin) callus was noted in the combination of MS +1.5 mg/ BAP. + 1.0 mg/ IAA. The growth rate of the shoot showed a marked increase as the period of incubation prolonged (5 to 7 weeks).

CONCLUSION

Efforts to develop safer and more effective treatments for rheumatoid arthritis (RA) that are based on an improved understanding of the role of inflammatory mediators are being investigated with the development of biologic agents of our therapeutic approach to RA and inflammatory diseases in general has dramatically changed within last few years. Technology-based economic growth has been one of the prime factors in creating the wealth of nation. The most developed countries are characterized by their wealth creation based on pursuing high quality research and translating their innovations into commercial products.

The present study aimed to evaluate the possible, anti-inflammatory, hepatoprotective and antioxidant effect of *G.glabra* extract used widely in Indian indigenous systems of medicine. The results obtained validate that *G.glabra* root extract as potent antiarthritic agent. Thus the ethnobotanical claims of the herb *G.glabra* ascertains, hepatoprotective and anti-oxidant activity.

Our present study demonstrates that antiarthritic effect of *G.glabra* against FCA induction in animal model by multiple mechanism of action thereby proved to be effective against Rheumatoid arthritis.
❖ Among the two doses, **500 mg/kg b.wt** of *G. glabra* showed more efficacy than the lower dose of 250 mg/kg b.wt.

❖ By fusing ancient wisdom and modern science, India can create world class products. Therefore, it has embarked on a fast track programme to discover new drugs by building on traditional medicines, screening diverse plants resource of the country.

❖ Secondary metabolites are synthesized in specialized cells during distinct developmental stages and have high complex structure, making their extraction and purification difficult and cumbersome. The results of the above study conclusively validate the protocols for isolation and purification process for detecting the secondary metabolites. Hence a valiant effort was undertaken to isolate, purify and identify the secondary compound flavonoids, which is of very high therapeutic and commercial value.

❖ The demand for *G. glabra* and its important bioactive constituents is increasing because of its therapeutic value. But due to non-conducive climatic conditions the drug does not grow well in all apro climates. Keeping this in mind, biotechnological approach was adopted for the production of callus medicinally important plant *G. glabra* using various phytohormones.

❖ Present investigations revealed that MS medium containing different combinations and concentrations of phytohormones favours the growth and production of callus derived from stem leaf explants of *G. glabra*. The protocol deduced for the micropropagation of *G. glabra* would also facilitate the rapid propagation of this valuable medicinal plant.
Future recommendations and suggestion

❖ Further detailed work is warranted in characterization and drug development
❖ More clinical trials are recommended in order to establish *G. glabra* as an effective tool to treat rheumatoid arthritis in near future.
❖ Herbal option is the only alternate to treat disease in future hence thus work was undertaken to focus *G. glabra* as an effective curative agent for R.A.