Chapter-I

Introduction

L. K. Ravindranath* et.al. shows that the organophosphorous heterocyclic compounds chemistry received much attention of chemists in past two decades due to their wide range of applications in the field of agriculture, medicine and industry. Some organophosphorus compounds have been described in the literature as inhibitors of bacterial, herbicides, insecticides, pesticides, antifungal agents, anti-HIV, anti-cancer, antiviral and anti-inflammatory. An important group of this class is 1, 3, 2-benzodioxaphospholes which have been used in many reactions and synthesis of new organic compounds. 1,3,4-Oxadiazole system belongs to the group of heterocycles that exhibit antibacterial, anticonvulsant, anticancer activities and are used to fight infections involving AIDS. For instance, 2-amino-1, 3, 4-Oxadiazoles act as muscle relaxants and show antimitotic activity. Analgesic, anti-inflammatory, anticonvulsive, diuretic and antiemetic properties are exhibited by 5-aryl-2-hydroxymethyl-1, 3, Oxadiazole derivatives. 2- hydroxyphenyl-1, 3, 4-Oxadiazole acts as a hypnotic and as a sedative. 1, 3, 4-Oxadiazoles containing phosphorous ester moiety exhibit insecticidal and pesticidal property.[1]

Mohamed S. Mostafa* et.al. shows that the chemistry of pyrazolone and its derivatives is particularly interesting because of their potential application in medicinal chemistry as herbicidal, fungicidal, bactericidal, anti-inflammatory, antipyretic, antiviral, blood pressure lowering and SARS-corona virus 3C-like protease inhibitors agents. Thiazole ring system and its derivatives are core structure in synthetic compounds displaying broad spectrum of biological actives. Penicillin and thiamine (Vitamin B1) structure containing sulphur and nitrogen in five member ring system which is similar to thiazole and its derivatives. Thiazolyl Schiff bases have been reported to exhibit antibacterial activity and antitumor activity against human cancer cell lines. Indole derivatives are useful in antibacterial activity, antifungal activity, antitumor, antioxidant, and antiviral potency. Microwave assisted organic synthesis has become increasingly popular in recent years to improve the yields and shorten reaction time in a variety of reactions. Encouraged by the above observations, herein we report the synthesis of some new 3-methyl-1-[(5-substituted-1H-indol-2-yl)carbonyl]-4-4-{(4- (substituted thiazo-2-yl) iminoethyl)
phenyl] hydrazono}-2-pyrazolin-5-one derivatives and evaluation of their antimicrobial activity. [2]

S. S. Shah et.al. explains that the Chalcones are an important class of compounds which are good intermediates for the synthesis of various heterocyclic compounds like flavones, flavanones, flavanols, aurones, isoxazolines, anthocynins, pyrazolines, pyrimidines, quinoxalines, benzalcoumaranes. The biological and industrial applications of chalcones are also found significant. Due to the presence of chromophor –CO-CH=CH- and other auxochromes, chalcones are colour compounds. These compounds exhibit high reactivity due to α: β-unsaturated unsaturation present in the compounds. Chalcone is also known as 1, 3-disubstituted-2-propene-1-ones. Kostanekci and Tambor gave them the name “Chalcones.” Chalcones are characterized by their possession of a structure in which two aromatic ring I and II are linked by an aliphatic three-carbon chain. The chalcones have been found to be useful in providing structure of natural products like cynamaclurin, sakuranetin, ploretin, hemlocktanin, homoriodictyo, etc. Keeping in view of biological importance of this group and their close relationship to flavones, flavanones, flavanols and dihidroflavonals, chalcones have been investigated since long time. It has been of great interest in their study as intermediates for substances of therapeutic importance. Schraufstatter and Deutsch and Calcinari reported antibacterial properties of some chalcones, and have concluded that the bacteriostatic activity is due to their unsaturation. [3]

Lokhande* et.al. explains that the cobalt has many applications in chemicals, pharmaceuticals and medical field. Cobalt is used in the preparation of alloyssuch as Superalloys, for parts in gas turbine aircraft engines, Corrosion- and wear-resistant alloys, High speed steels, Cemented carbides and diamond tools. It is used as drying agent in paints, varnishes, and inks. Catalysts for the petroleum and chemical industries. It is used in radiotherapy, biomedical implant and medical tests. It is used as a radiolabel for vitamin B-12 uptake. It is used in Sterilization of medical supplies, medical wast, radiation treatment of food, radiography and Dentistry. Hence owing to the significance of cobalt, its determination from associated elements by extractive spectrophotometry has been of considerable importance. A wide variety of chelating agents have been reported for the spectrophotometric determination of cobalt. However these methods suffer from limitations such as critical pH low stability of complex, requirement of surfactants or other agents,
requirement of heating, and interference from some ions, inconvenient extractant etc. A method, far superior in sensitivity and selectivity to these reported in the literature is developed for the extractive spectrophotometric determination of cobalt with with 1, 2-propanedione, 1, 2–propanedione – 1 – phenyl – 1 - (2 – hydroxyl – 5 – bromo - benzilidineazine)-2-oxime [PDPHBBAO] A close literature survey indicates that PDPHBBAO has so far not been employed for either co-ordination or analytical studies. The developed method is highly sensitive, selective, simple, rapid, accurate, and has been satisfactorily applied for the determination of cobalt in the synthetic mixtures, pharmaceutical samples, and alloys. The proposed method is free from many limitations. [4]

Krishnakumar* et.al. shows that the Several synthetic metal complexes which mimic the behavior of complicated bimolecules are known and at present the study of such compounds are receiving much attention. One such example is curcuminoids, the active chemical component present in traditional Indian plant *curcuma longa* (turmeric). They are 1, 3-diketones in which the diketo function is directly attached to olefinic groups. Here all efforts were made to synthesize heterocyclic analogues of such β-dicarbonyl compounds and their metal complexes. Very few literatures were available with the use of heterocyclic aldehydes for the synthesis of curcumin related compounds. Pharmacological significance of hetero rings was the reason behind selecting different heterocyclic aldehydes like imidazole-2-carboxaldehyde, pyrrole-2-carboxaldehyde and thio phene-2-carboxaldehyde as one of the reactant to condense with benzoyl acetone. Transition metals like Cu (II), Ni (II) were used as metals for present work. The reaction proceeded via condensation of heterocyclic aldehydes with benzoyl acetone through boric anhydride mediated esterification. These compounds were subjected to anti microbial tests against the test organisms; bacterial cultures *Staphylococcus aureus, Bacillus subtilis, Escherichia coli* and *pseudomonas aeruginosa* and fungal cultures *Candida albicans, Aspergillus Niger* respectively. [5]

R. Rajavel* et.al. explains that Schiff base ligands have been studied extensively due to synthetic flexibilities, selectivity as well as sensitivity towards the transition metal ions. The architectural beauty of these coordination complexes arises due to the interesting ligand systems containing different donor sites in heterocyclic rings. In the last decades, Schiff base have received much great interest, mainly because of their wide application in the field of synthesis and catalysis.
Similarly heterocyclic ligands containing nitrogen atoms are drawing a great deal of attention in Coordination chemistry and homogeneous Catalysis. Two or more potential donor centre of amino heterocycles plays an important role in the study of comparative reactivity of ambideterminate ligand systems. Furthermore, transition metal complexes containing pyrimidine ligands are commonly found in biological studies and play important roles in processes, such as catalysis of drug interaction with biomolecules. A timid number of Schiff base ligand and metal complexes are of substantial sake and attention because of their biological activity including anti-tumor, antibacterial, fungicidal and anti-carcinogenic properties. Several complexes coordinated through the Schiff base ONNO donors have been studied as oxygen carrier and they are useful models for bioinorganic processes. The cobalt (II) and manganese (II) complexes with tetradentate Schiff base which coordinate through N2O2 donor atoms have been extensively studies as oxygen carriers and also as catalysts for water-splitting systems. In this paper, we report the recent research on template reaction of 2-Hydroxy acetophenone, with 4-chloro-2, 6-diaminopyrimidine in the presence of copper (II), nickel (II), manganese (II), cobalt (II) and oxovanadium (IV) ions a result of (2+1+1) Schiff base condensation complexes. The obtained new mononuclear complexes were characterized by some physico-chemical techniques and some biological applications

Doddappa Pralhad Anekal* et.al. explains that the indole and its derivatives occupied a unique place in the chemistry of nitrogen heterocyclic compounds because of their varied biodynamic properties. Most of the Indole derivatives are biologically active chemicals present in microorganisms, plants and animals representing an important class of therapeutic agent in medicinal chemistry. Some indole derivatives are found to exhibit antibacterial, antifungal, antiviral, antimalarial and anti-HIV activities. Furthermore, 1, 3, 5-triazines are amongst the oldest known organic molecules; originally they were called the symmetric triazines usually abbreviated as S- or Syn-triazines. Some of the substituted 1, 3, 5-s-triazine have reported to possess diverse biological activities. A wide range of 1, 3, 5-triazines exhibit selective herbicidal properties, Simazine and atrazines are the organic compounds containing s-triazine skeleton are most important herbicides. Baker triazines are inhibitors of dihydrofolate reductase and some have shown activity against leukemia. Currently Baker antifol (BAF) triazine is undergoing clinical trials as a drug in cancer chemotherapy. In addition, the interest in 1, 3, 4-
oxadiazole / thiadiazoles are increased due to the high bioavailability of their derivatives. Literature survey evidenced that some substituted bridged substituted 1, 3, 4-oxadiazolo / thiadiazolo [3, 2-a]-s-triazines are excellent bioavailable compounds with incorporation of various pharmacophores as antibacterial, antifungal and fungicidal. [7]

S. Narasimhan* et.al. shows that a remarkable effort has been devoted by organic chemists over the past 20 years to the Design, synthesis, characterization and application of diverse chiral Schiff bases reagents are becoming increasingly important in the pharmaceutical, plastic and dye industries generally the chiral compounds has two enantiomers which elicit different properties and responses. Thus the literature survey reveals that some pharmacophores are indeed essential to impact desired therapeutic effect in the molecules. The significant pharmacophores like halogen, Phenolic –NH₂,-COOH,-CH=N-,-C₆H₅ and chiral centre in the molecules could exhibit broad spectrum activities. Some of the bioactive chiral compounds already reported ,one of the potential chiral Compound was the hydroxyazole bioisosteres of glutamic acid , also some Compounds like Novel bicyclic acidic amino acids, both the compounds are the biologically important based on the nature of compounds ,and recently our group found some chiral compound, which is the Schiff bases of Salicylaldehyde and Amino acid derivatives already reported to possess potential pharmacological activities and biological activities. some of the bi and tridentate amino alcohol ligands as Schiff bases were already reported.A number of chiral compounds like (+) tartaric acid ,(+)-ephedrine,(+)-nicotine,(+)-cinchonine are very good chiral molecules, and much of the work in this area has been an attempt to mimic the action of enzymes. Already the antibacterial studies on mononuclear complexes of chiral Schiff’s base have been reported In the present study synthesize of chiral ligands by treating L-Valinol or L-Phenylalaninol salts with 2-amino-3,5-dibromo benzaldehyde to form schiff base and it has complexed with metal acetate like Copper and Nickel to form the tridentate chiral Schiff base metal complexes. The structures of the synthesized compounds were confirmed by FT-IR, \(^{1}\)HNMR, \(^{13}\)CNMR, UV-Vis and Mass spectral analysis. The newly synthesized complexes have been screened for their antibacterial effects against the number of gram positive and gram negative bacteria. [8]

Kokila A. Parmar* et.al. explains that an antibacterial diseases are very common all over the world. Currently used antimicrobial agents are not effective
due to the resistance developed by the microbes. And therefore, it is an ongoing effort to synthesize new antimicrobial agents. Triazine has been used to form many types of functional groups other than amines and heterocycles and used as protecting groups in natural product synthesis. Thus, they are reactive groups, which are adaptable to different synthetic transformations. Triazine derivatives have attracted considerable pharmaceutical interest due to their antitumor, anticonvulsant and antileukemic activities and cytotoxic effects antimicrobial activity. [9]

Rangappan Rajavel et.al. the metal complexes with Schiff bases as ligand have been playing an important role in the development of coordination chemistry as a whole. Schiff bases have therefore provided a foundation stone for the building of contemporary coordination chemistry and find extensive applications in different fields. Schiff bases are derived from aromatic carbonyl compounds and have been widely studied in connection with metalloprotein models and asymmetric catalysis, due to versatility of their steric and electronic properties. Metal ions can enhance a reaction with Schiff base ligand by stabilization of a transition state or product by appropriate coordination. Schiff base and their biologically active complexes have been often used as chelating ligands in the coordination chemistry of transition metal, radiopharmaceuticals for cancer targeting, agrochemicals, models systems for biological macromolecules, catalysts and as dioxygen carrier. They also found useful in catalysis, in medicine as antibiotics and anti-inflammatory agents and in the industry as anticorrosion. In recent years much effort has been put in synthesis and characterization of mono and binuclear transition metal complexes. Schiff base ligands that are able to form binuclear transition metal complexes are useful to study the relation between structures and magnetic exchange interactions, and to mimics bimetallic biosites in various proteins and enzymes. Glyoxal and its related compounds have been extensively used as biologically active complexing agents and analytical reagents. It is employed as a selective diketones to obtain binuclear complexes of desired cavity size and significant reactivity. In this regard, there is much current interest in designing dinucleating ligands and their transition metal complexes. [10]

Anantha Lakshmi* et.al. explains the high affinity for the chelation of the Schiff bases towards the transition metal ions is utilized in preparing their solid complexes. Schiff base metal complexes have been useful to design and develop some models for biological systems. Transition metal complexes which usually
contain nitrogen, sulphur / oxygen as ligand atoms are becoming increasingly important because these Schiff base can bind with different metal centers involving various coordination sites and allow successful synthesis of metallic complexes with interesting stereochemistry. Heterocyclic compounds are widely distributed in the nature and essential to many biochemicals, analytical and industrial processes. Compounds containing these heterocycles have important properties in the field of material science and biological systems. Various heterocycles especially 2-aminothiazoles are a remarkably versatile group of compounds that have found recent applications in the drug development and production of dyes. Thiazole derivatives play important role in many biochemical reactions. The molecular systems having chelating molecular designing and incorporating thiazole ring have been examined in the field of mycology for the development of metal based drugs. In several decades, efforts have been made to design and development of these drugs with thiazole based molecular devices. The basic characteristics of these metal based drugs for their drug activity is their penetration power through pathogenic cell membrane and their affinity for the genetic material (DNA and RNA) of the pathogens. Schiff base from 2-hydroxy-1-naphthaldehyde have often been used as chelating ligand in the field of coordination chemistry.\textsuperscript{[11]}

Elisabeth Bouwman et.al. reported that the chemistry of pyrazolone and its derivatives has attracted special interest due to their potential applications in medicinal chemistry as antimicrobial and therapeutic agents. Azo compounds based on pyrazolone play a central role as chelating agents for a large number of metal ions. They form a stable six membered ring after complexation with the metal ions and can be used as analytical reagents. In continuation to the earlier works. We report herein on the synthesis of 3-methyl-1-phenyl-/p- [N-(pyrimidin-2-yl) sulfamoyl] phenylazo]-2-pyrazolin- 5-ones (L). The dissociation and the stability constants of Mn\textsuperscript{2+}, Co\textsuperscript{2+}, Ni\textsuperscript{2+}, Cu\textsuperscript{2+}, La\textsuperscript{3+}, Hf\textsuperscript{3+}, UO\textsuperscript{2+}, and Zr\textsuperscript{4+} complexes with L were determined potentiometrically at different temperatures. Furthermore, the corresponding thermodynamics parameters of dissociation and complexation are derived and discussed.\textsuperscript{[12]}

bE. E. el-katori et.al. explains that the metal complexes of the Schiff bases have occupied a central role in the development of coordination chemistry. Many attempts have been made to evaluate different factors affecting the stability of the metal chelates along with their stability constants. In the present study the stability
constants of the mixed ligand complexes of Co (II), Ni (II), Cu (II) and Zn (II) with N-(2-hydroxybenzylidene)-2,3-dimethylaniline (X) as primary ligand and N-(2-hydroxy-1-naphthylidene)-4-nitroaniline (Y) as secondary ligand in 75:25 (v/v) 1,4-dioxane-water medium at 27±0.5 °C have been reported by employing pH-metric titration technique. Under identical conditions the stability constants of binary metal complexes of N-(2-hydroxy-1-naphthylidene)-4-nitroaniline (Y) have also been investigated.\textsuperscript{[13]}

A. K. Mapari* et.al. shows that the acetylacetone is the simplest β-diketone, prepared by the Claisen condensation between ethyl acetate and acetone (Finar, 1973). B-diketones react with metal ions to form the (O, O') chelates of the type [M (β – dik)\textsubscript{n}], soluble in organic solvents, and used as analytical reagents (Yukio et.al., 1981). The complexes are useful for comparative studies of metal ions, and as starting materials in the preparation of organometallic compounds and as catalysts for organic synthesis (Calvin, 1950; Mark, 1954; Bernal and Rierger, 1963; Chung-Ling, 1969; Mehrotra et.al., 1978). To paucity of information on their characteristics, this paper reports some potentiometric studies on nickel (II) and Cu (II) acetylacetonate complexes.\textsuperscript{[14]}

H. N. Aliyu et.al. shows the references indicates that the metal ligand stability constants and proton ligand stability constants of Cu(II)-salicylic acid complex have been studied. The Narwade et.al have investigated the stability constant of lanthanide ions with some substituted sulphinic acid spectrometrically. The proton-ligand stability constants of o-hydroxy acetophenoxime and its substituted derivatives have been reported Ingle &Khanilkar.Formation constants of bivalent metal ion complexes with 3-amino5-methyl isoxazole Schiff bases have been studied. The formation constant of the complexes of substituted pyrazoles with some lanthanide metal ions. There has been considerable interest in the study of binary ternary and quaternary complexes by pH – metric method. The study of formation constants of metal-methionine and metal-methionine NTA (Nitrilotriacetic acid) (binary and mixed) Complexes have been investigated by Praveen P.Singh etal. The study of Kinetic parameter and formation constants of (Mn- antibiotics cefoperazone) complexes Vis-a-vis Kinetics of electrode reaction has been investigated by Farid Khan & Rakhi Agrawal. The mixed ligand complexes of transition metals are comparatively less studied than inner transition elements.
Ternary complexes of Ni (II) with glycine and glycinamide as primary ligands and imidazole, histidine and L-histidine as secondary ligands have been investigated by Nair and Neelkanta, Nair et al. The ternary complexes of Ni (II) and Cu (II) with Nicotinic acid as primary ligand and imidazole, benzimidazole, histamine and L-histidine as secondary ligands have been studied potentiometrically. The study of stability constants of Mn (II), Co (II), Ni (II), Cu (II) and Zn (II) with nitrilotriacetic acid (NTA) and iminodiacetic acid (IMDA) as primary ligands and pyridoxine hydrochloride (PHC) and ethambutol hydrochloride (EHC) as secondary ligands was reported by Patil et al. [15]

L.P.Shinde et al. explains that the transition metal ion chelate complexes are exploited by industry in the large-scale purification of amino acids and in the synthesis of wide range of drugs and drug precursors containing an amino carboxylic acid moiety. Chiral ligand exchange chromatography, which utilizes stereoselective binding to an immobilized chiral ligand (selector), is commonly used in industry for the separation of racemic mixtures of amino acids and their derivatives. Newer technologies for scalable continuous separation of chiral racemates present the selector either directly in solution or on the surfaces of stable micelles. These industrial applications are often best carried out at temperatures far from ambient or physiological conditions. Efficient design and optimization of these technologies therefore requires knowledge of chemical equilibria within the system and its dependence on temperature. Complexes as the term is usually used in inorganic chemistry, include compounds composed of a metal atom or ion and one or more ligands (atoms, ions, or molecules) that formally donate electrons to the metal. Complexes are the compounds containing coordinate bonds between electron pairs donors as the ligand and electron pairs acceptors as the metal atoms or ions. The number of electron pairs donated to the metal is known as its coordination number and thereby many complexes exist which exhibit coordination number of two, four or six. In order for a pair of electrons to be donated from ligand to a metal ion. There must be an empty orbital on the metal ion to accept the pair of electrons. In a complex a central atom or ion is coordinated by one or more molecules or ions (ligands) which act as Lewis bases, forming coordinate bonds with the central atom or ion; the latter acts as a Lewis acid. Atoms in the ligands that are directly bonded to the central atom or ions with donor atoms. In chemical language, it is known as acid base coordination complex or coordination compound or complexes. [16]
Abdulbaset A. Zaida et al. shows that the Schiff’s bases derived from aromatic amines and aromatic aldehydes have a wide variety of applications in many fields, e.g., biological, inorganic and analytical chemistry. Application of many new analytical devices requires the presence of organic reagents as essential compounds of the measuring system. They are used in optical and electrochemical sensors, as well as in various chromatographic methods, to enable detection of enhance selectivity and sensitivity. Among the organic reagents actually used, Schiff bases possess excellent characteristics, structural similarities with natural biological substances, relatively simple preparation procedures and the synthetic flexibility that enables design of suitable structural properties. Schiff bases are widely applicable in analytical determination, using reactions of Condensation of primary amines and carbonyl compounds in which the azomethine bond is formed \[17\].

Amit Rai et al. shows that the compounds containing an azomethine group (-C=N-) are known as Schiff bases. They are usually formed by condensation of a primary amine with a carbonyl compounds according to the following equation: \[ R-NH_2 + R-COH \rightarrow R-N=CH-R + H_2O \] Where \( R \) may be an aliphatic or aromatic group. Schiff bases of aromatic aldehydes having effective conjugated systems are more stable. Corrosion problems have received a considerable amount of attention because of their economic and safety consequences. The use of inhibitors is one of most practical methods for protection against corrosion. Corrosion commonly occurs at metal surfaces in the presence of oxygen and moisture, involving two electrochemical reactions, oxidation takes place at anodic site and reduction occurs at cathodic site, in acidic medium hydrogen evolution reaction predominates and corrosion inhibitors reduce or prevent these reactions \[18\].

Mohammed Qasim Mohammed et al. hydrazones, possessing an azomethine –NHN=CH- proton, constitute an important class of compounds for new drug development. Therefore, many researchers have synthesized these compounds as target structures and evaluated their biological activities. Hydrazones are synthesized by heating the appropriate substituted hydrazine /hydrazides with aldehydes and ketones in solvents like ethanol, methanol, butanol, glacial acetic acid, ethanol-glacial acetic acid. These are well known intermediates for the preparation of oxadiazolines, azetidinones, thiazolidinones and many other derivatives. Hydrazones exhibit a wide range of pharmacological activities like Anti-cancer, Anti-malarial and Anti-tubercular etc. A large number of substituted
pyrazole derivatives are prepared and tested for variety of biological activities like Anti HIV, Antiviral, Ant parasitic etc. Schiff base of 4-amonoantipyrine have a variety of applications in biological, clinical, analytical and pharmacological areas. Studies of a new kind of chemotherapeutic Schiff bases are now attracting the attention of biochemists. Earlier work reported that some drugs showed increased activity. Deoxyribonucleic acid (DNA) is the primary target molecule for most anticancer and antiviral therapies according to cell biologists.\textsuperscript{[19]}

Akash R. Patel\textsuperscript{*1} et.al. explains that the microwave assisted synthesis has become an important technique for the rapid organic synthesis. The major advantage of this method includes decreasing in reaction time and increasing in yield. The synthesis and characterization of Schiff bases were very important due to their potential biological applications. It is well known that several Schiff bases have anti-inflammatory, anti-fungal, antibacterial and anti-HIV activity. Studies on Schiff bases derived from 3-amino-5-methyl isoxazole and substituted, salicylaldehyde have been reported earlier by conventional method. In the present investigation, we report here the microwave assisted rapid organic synthesis of Isoxazole Schiff bases derived from of 3-amino-5-methyl isoxazole with various substituted salicylaldehyde.\textsuperscript{[20]}

N. J. P. Subhashini\textsuperscript{a} and Shivraja* et.al. shows that the Schiff base compounds are the condensation product of an amine and a ketone / aldehyde. Recent publications showed increased attention to these compounds as corrosion inhibitors especially in acidic environments for various metals like steel, aluminium and copper. The greatest advantage of many Schiff base compounds is that they can be conveniently and easily synthesized from relatively cheap materials. The inhibition of steel corrosion by acids has been previously studied by various researchers using different organic compounds. These compounds in general are adsorbed on the metal surface blocking the active corrosion sites. Several Schiff bases have been investigated as corrosion inhibitors for various metals and alloys in acidic media. Schiff bases are characterized by the – N=CH– (imine) group which is important in elucidating the mechanism of transamination and racemisation reactions in biological systems. Due to the great flexibility and diverse structural aspects, a wide range of Schiff bases have been synthesized and their complexation behavior studied \textsuperscript{[21]}. 

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Dardir M. M. * et.al. explains that the complexes of transition metals have been used in solution as biomimetic catalysts for oxygen atom transfer, and as catalysts for enantioselective epoxidation, aziridinations, mediating organic redox Reactions and other oxidative processes. Vanadium is a physiologically important trace element that is found in both anionic and cationic forms with oxidation states ranging from -1 to +5. Vanadyl (IV) complexes are very interesting as model compounds for the clarification of several biochemical processes. The physico-chemical properties of vanadyl (IV) complexes have been used to treat both insulin-dependent type-1 and non-insulin-dependent type-2, the vanadyl (IV) complexes proposed on the basis of the results of diabetic model animals by using a concept of equivalent transformation, which proven to be effective in changing the chemical property of a complex. The Vanadyl and the micromineral derived from Vanadium, has been shown effective in helping to increase Insulin sensitivity. The main advantages of increased Insulin sensitivity are that it could promote less fat storage as well as that it may act as an Amino Acid magnet to cells. Several pharmaceutical agents have been used in diabetes treatment but many problems occurred such as side effect, hypoglycemia and weight gain, therefore new drug are needed, the vanadyl complexes have been proposed to function as potent insulin-mimetic and antidiabetic agents.[12]

A.A. Ahmed et.al. shows that the Schiff bases and their complexes have been widely studied because of their industrial and biological applications Some Schiff bases were tested for fungicidal activity, which is related to their chemical structure. Schiff base compounds containing an amine group (–RC=N–) are usually formed by the condensation of a primary amine with an active carbonyl. The cross linking agents can also be derived from metal complexes with O–N– or –S ligands. For example, an intracoordination salt such as salicylates or anthranilates and aliphatic or aromatic amines can form strong five- or sixmembered chelate rings which are able to produce metal containing cross linking agents with the required properties. Synthesis of oxovanadium (IV) complexes of Schiff bases derived by the condensation of 2- aminobenzaldehyde with various diamines (1, 2- diaminoethane, 1, 2-diaminopropane, 1, 3-diaminopropane) were characterized by elemental analysis, spectral data and electrochemical studies. The complexes of Co (II), Ni (II), and Cu (II) ions with the Schiff bases derived from the condensation of salicylaldehyde and aminophenol or 2- aminobenzoic acid were synthesized and
characterized by different techniques, in particular, elemental analysis and molar conductance measurements as well as IR and electronic spectroscopy. The aim of the present study was to prepare, characterize and determine the Antimicrobial activity of Schiff base complexes derived from thiocarbohydrazide and 2-amino-4-ethyl-5-hydroxy benzaldehyde.\textsuperscript{[23]}

Y.K. Gupta\textsuperscript{1} et.al. shows that in the recent years, there has been enhanced interest in the synthesis and characterization of transition metal complexes containing Schiff bases as ligands due to their importance as catalysts in many reactions. The reactivity of carbonyl functions of 1,3-diketones and metal 1,3-diketonates towards amino compounds has been utilised in the synthesis of a large number of multidentate and macrocyclic ligands. These ligand systems have evoked considerable interest because of their utility as model compounds in bioinorganic studies. Most of the reported studies are based on 1, 3-diketones in which the diketo function is directly linked to alkyl/aryl groups. Very few reports exist on Schiff bases of 1, 3-diketones in which the diketo group is linked to alkenyl function. Such unsaturated 1, 3-diketones constitute the major physiologically active principle (known generally as curcuminoids) of the traditional Indian medicinal plant turmeric (Curcuma longa, Linn, Zingiberacea family) and several other related spices. Curcuminoids, their synthetic analogues and their metal complexes are known to exhibit anticancer, antioxidant and anti-inflammatory activities. In this paper we report the synthesis and characterization of Schiff bases of the unsaturated 1, 3-diketone; 1, 7-diphenyl-1, 6-heptadiene-3, 5-dione (dicinnamoylmethane) and their metal complexes.\textsuperscript{[24]}

K. Krishnankutty\textsuperscript{1} et.al. explains that during the past two decades, considerable attention has been paid to the chemistry of the metal complexes of Schiff bases containing nitrogen and other donors. This may be attributed to their stability, biological activity and potential applications in many fields such as oxidation catalysis, electrochemistry etc. Herein we report the synthesis of a novel Schiff base ligand (H$_2$L) and it’s Cu (II), Co (II) and Mn (II) complexes. Their spectral properties and electrochemical behavior were investigated. Complexes Elemental analyses indicate that the complexes of H$_2$L with Cu (II), Co (II) and Mn (II) can be formulated as M·L. The disappearance of the OH band of the free ligand in the IR of the metal complexes indicates that the OH group is deprotonated and
coordinated to the metal ion as $-\text{O}^-$. On the other hand, the C=N stretching mode is shifted to a lower frequency by about 29 cm$^{-1}$, compared to the free ligand. These IR results indicate that the ligand is coordinated to Cu (II), Co (II), and Mn (II) via both N and O. The new IR bands appearing at 420 ~ 430 cm$^{-1}$ and 541 ~ 560 cm$^{-1}$ are assigned to $\nu$ (M-O) and $\nu$ (M-N) vibrations, respectively. In addition, no new bands at 1610 ~ 1550 cm$^{-1}$ and 1420 ~ 1300 cm$^{-1}$ are observed, indicating that the complexes do not contain CH$_3$COO$^-$ anions, which is in accordance with the elemental analysis results for the complexes. According to the aforementioned data, we propose for the complexes prepared the structure. It is suggested that the complexes are square planar or nearly square planar, coordinated according to the common stereochemistry of this kind of compounds.$^{[25]}$

Mandava$^a$ V. Basaveswara Rao$^b$ et.al. shows that the treatment of bacterial infections remains a challenging therapeutic problem because of emerging infectious diseases and the increasing number of multidrug-resistant microbial pathogens. Therefore, there is an urgent need for development of new antibacterial agents with divergent and unique structure and with a mechanism of action possibly different from that of existing antimicrobial agents. A variety of fused pyridines have been studied for a long time in the field of the chemistry of heterocyclic compounds and play a significant role in bioactive molecules. In recent years many number of articles have been reported on the synthesis and reactivity of various furo[3, 2-c]pyridines. The furo[3,2-c]pyridine derivatives are emerging as a useful pharmacophore in several therapeutic areas such as, as protease kinase inhibitor, antipsychotic activity, antihypertension, diuretic property, treatment of skin diseases and in treating depression and cerebral ischemia. Encouraged by these interesting biological activities associated with furo[3,2-c]pyridine, we report here in the synthesis, spectroscopic identification and antibacterial activity of amide analogues (6a-6k) derived from 4- aminofuro[3,2-c]pyridine 5 in a few high yielding steps from commercially available 2-Furaldehyde (Scheme 1). The synthesized targets were screened for their antibacterial activity against Escheria.Coli, Pseudomonas.aeruginosa, Staphylococcus.aureus and Streptococcus.pyogenes, while using Chloramphenicol, as the standard drug.$^{[26]}$
Bavantula Rajitha* et.al. shows that in recent times, multicomponent reactions (MCRs) have attracted the researchers worldwide, because of their superior synthetic strategy over conventional organic reactions in the preparation of complex molecules with high efficiency and atom economy in minimum time from the readily available substrates in a single synthetic operation. Literature survey revealed that the thiazole and their synthetic analogs were found to possess various biological and therapeutic properties such as antimicrobial, anti-pseudomonal, antiallergic, antihypertensive, anti-inflammatory, anti-HIV, antiviral, antitubercular, antifilarial, urokinase inhibitors, and fibrinogen receptor antagonists with antithrombotic activities. On the other hand pyrazole derivatives were also possess antimicrobial, antioxidant, anti-inflammatory, cytotoxic, antitumor, antimarial, estrogen receptor-α-selective agonists. Because of the pharmacological importance of these moieties, several methods have been reported for the synthesis of thiazolyl pyrazole derivatives such as under conventional heating and ultrasound irradiation methods. Many of these reported methods suffer from one or several drawbacks such as low yield, long reaction time, multistep process and harsh reaction conditions. To overcome the above limitations, and for continuation of our studies toward the synthesis of biologically potent heterocyclic compounds. Herein, we are reporting the highly efficient protocol for the synthesis of thiazolyl pyrazole derivatives under conventional heating via multicomponent approach in ethanol using catalytic amount of acetic acid in good yields.\textsuperscript{[27]}

Rajeev Johari* et.al. explains that the Schiff bases, products of the reaction of primary amines and carbonyl compounds, are involved in many metabolic processes. Numerous products of further fragmentation and cross linking are responsible for the color, flavor, and taste of foods and drinks. Salicyliden- and 2-hydroxynaphthylideneamines have been the subject of particular interest because some of their complexes are found in nature and biological activities have been recorded for the synthesized ones. Pyrimidine is the parent heterocycles of a very important group of compounds that have been extensively studied due to their occurrence in living systems. Pyrimidine is reported to have a broad spectrum of biological activities. Some are endowed with antitumor, antiviral, anti-inflammatory, antipyretic, antimicrobial, and antifungal properties. Considerable attention has been given to the metal (II) complexes of polydentate Schiff base ligands of the N-aminopyrimidine type, due to their structural richness and electrochemical properties
as well as their potential as a model for a number of important biological systems. This paper describes the synthesis of a new Schiff base ligand containing a ring of pyrimidine and its metal complexes. Spectral and magnetic studies were used to characterize the structure of the complexes. IR, $^1$H-NMR, $^{13}$C-NMR, and mass spectra were obtained to determine the structure of the ligand (HL). All of the synthesized compounds were evaluated for their antimicrobial activities against gram-positive and gram-negative bacteria and fungi using the microdilution procedure.\[28\]

Mehmet G"ulcan\textsuperscript{1} et.al. shows that the drug resistance has become a growing problem in the treatment of infectious diseases caused by bacteria and fungi. The serious medical problem of bacterial and fungal resistance and the rapid rate at which it develops has led to increasing levels of resistance to classical antibiotics, and the discovery and development of effective antibacterial and antifungal drugs with novel mechanisms of action have thus become urgent tasks for infectious disease research programs. Coumarins present a variety of bioactivities, including anticoagulant, estrogenic, dermal photosensitizing, antimicrobial, vasodilator, molluscicidal, antihelmintic, sedative and hypnotic, analgesic and hypothermic actions. In addition, coumarins have been shown to inhibit 2-N-methyl-N-nitrosourea, aflatoxin B1 and 7, 12-dimethylbenz (a) anthracene-induced mammary carcinogenesis in rats. More recently, coumarin derivatives had been evaluated in the treatment of human immunodeficiency virus, due to their ability to inhibit human immunodeficiency virus. Since the late 1980s, a number of \textit{in vitro} and \textit{in vivo} studies have investigated the possible use of coumarins in the treatment of cancer. Coumarin derivatives exhibit not only excellent biological and medical activities, but also have the superior thermal stability and outstanding optical properties, including extended spectral responses, high quantum yields, and superior photostability. Optical applications of these compounds, such as laser dyes, nonlinear optical chromophore, fluorescent whiteners, fluorescent probes, polymer science, optical recording and solar energy collectors, have been widely investigated. More importantly, coumarin dyes are used as blue, green and red dopants in organic light-emitting diodes (OLEDs). Based on the structure of coumarin where there exists delocalization of $\pi$-electrons (resonance effect), the potential for this molecule to be used as chemical inhibitor can be established. 3-Aminocoumarin derivatives have been found to also possess a wide range of
biological activities, including CNS depressant, antibacterial, antiallergic and insect-growth regulatory effects. Medicinal metal complexes have become an interesting research area since the discovery of cisplatin. Since then, many complexes have been synthesized and tested on a number of biological systems. Copper complexes are known to have a broad spectrum of biological action. The preparation of 3-aminocoumarin and its use as a ligand for the formation of Cr (III), Ni (II), and Cu (II) complexes is presented in this study. The chemical structures of the newly synthesized complexes were confirmed. The microbial activities of all synthesized compounds and their in vitro antioxidant activities were also investigated.\textsuperscript{[29]}

Ahmed A. Al-Amiery\textsuperscript{1} et.al. shows that in the recent years, there has been enhanced interest in the synthesis and characterization of transition metal complexes containing Schiff bases as ligands due to their importance as catalysts in many reactions. The reactivity of carbonyl functions of 1,3-diketones and metal 1,3-diketonates towards amino compounds has been utilised in the synthesis of a large number of multidentate and macrocyclic ligands. These ligand systems have evoked considerable interest because of their utility as model compounds in bioinorganic studies. Most of the reported studies are based on 1, 3-diketones in which the diketo function is directly linked to alkyl/aryl groups. Very few reports exist on Schiff bases of 1, 3-diketones in which the diketo group is linked to alkenyl function. Such unsaturated 1, 3-diketones constitute the major physiologically active principle (known generally as curcuminoids) of the traditional Indian medicinal plant turmeric (Curcuma longa, Linn, Zingiberacea family) and several other related spices. Curcuminoids, their synthetic analogues and their metal complexes are known to exhibit anticancer, antioxidant and anti-inflammatory activities. In this paper we report the synthesis and characterization of Schiff bases of the unsaturated 1, 3-diketone; 1, 7-diphenyl-1, 6-heptadiene-3, 5-dione (dicinnamoylmethane) and their metal complexes.\textsuperscript{[30]}

K. Krishnankutty\textsuperscript{1} et.al. explains that the dimercaptosuccinic acid is the organosulphur compound with the formula HO\textsubscript{2}CCH\textsubscript{2}CH(SH)CH(SH)CO\textsubscript{2}H. This colorless solid contains two carboxylic acid and two thiol groups, the latter being responsible for its mildly unpleasant odour. It occurs in two diastereomers, meso and the chiral \textit{dl} forms. The meso isomer is used as a chelating agent. Meso 2, 3-dimercaptosuccinic acid binds to "soft" heavy metals such as Hg\textsuperscript{2+} and Pb\textsuperscript{2+}, was mobilizing these ions for excretion. It binds to metal cations through the thiol
groups, which ionize upon complexation. Dimercaptosuccinic acid is indicated for the treatment of lead poisoning in children with blood level measured above 45 μg/dL. The use of dimercaptosuccinic acid is not approved for prophylactic/prevention of lead poisoning in anticipation of exposure in known lead contaminated environments. Its elimination half-life is 2.5-3.5 h. DMSA can cross the blood-brain barrier of mice, but not that of humans, limiting its use in extracting heavy metals from parts of the body other than the central nervous system. Hippuric acid is a carboxylic acid found in the urine of horses and other herbivores. The determination of hippuric acid in urine is important to determine the risk due to the exposition to toluene. The toluene is metabolised mostly in benzoic Acid and subsequently combined with glycine is eliminated by urine as hippuric acid. An enzyme-linked immunosorbent assay (ELISA) for hippuric acid (HA) was developed using polyclonal anti-HA antibodies. The ELISA system was considered to be useful in the biological monitoring of toluene exposure, and to be more advantageous than time-consuming HPLC, especially when measuring a large number of samples. Patients with non-ketotic hyperglycinaemia excreted significantly more benzoate in the form of hippurate than patients with urea cycle disorders. The plasma concentration of glycine decreased following benzoate treatment only in the patients with non-ketotic hyperglycinaemia.[31]

Nisha Agrawal* et.al. shows that the chemistry of lanthanones has been extensively reviewed. During last 15 years, the lanthanone (III) complexes have been extensively used for medical diagnostic methods like MRI (magnetic resonance imaging). Complexes of lanthanones in solid state were studied for their photo chemical and thermal properties. Lanthanones have been employed as aids to the separation, preparation and purification of molecular cells in immunoassay in histochemistry. Complexes of lanthanones with nitrogen donor ligands of weak basicity are well known. Europium complexes with 1, 10-phenanthroline were studied for their formation, bonding characteristics and important photochemical properties. Amino acids are well known chelating agents, their importance in biological system and in industry has earned attention of chemists for their metal complexes. During past several decades, diamines and their derivatives are studied for important applications as stable complexes in fields like biotechnology, environmental science and biochemistry, etc. A Solution Study of Complex Formation of Some Diamines In the present study, an attempt has been made to
determine the stability constants of binary complexes of Sm (III), Gd (III), Dy (III) and Yb (III) with some diamines. Various factors influencing the formation and stabilities of binary complexes have been discussed.\[32\]

J.J.Vora* et.al. shows that the literature survey reveals that work has been done on heterocyclic compounds for their antibacterial activities on gram positive and gram negative bacteria also their antifungal activity on different fungi’s. Pyrimidine derivatives have found to posses various biological and antibacterial and antifungal properties. Pyrimidine derivatives are known to shows antitumor, anti-inflammatory, anti malarial, anti diabetic, insecticidal and antimicrobial activities. In a view of analytical applications of pyrimidines, it is interest to know the physiochemical properties such as stability of the complexes with lanthanide metal ions. The lanthanide compounds have remarkable importance in everyday life. More explicitly in the previous decades their use in various organic technical processes led to a rapid growth especially in the field of complexes. In recent years the luminescence properties of rare earth metal complexes with different 1-diketones have been widely studied due to their use in fabrication of polymer light emitting diodes to enable low cost, full color, flat panel display. Considerable research work has been done in the past, on the study of complexes. The studies in metal-ligand complexes in solution of a number of metal ions with carboxylic acids, oximes, phenols etc. would be interesting which throw light on the mode of storage and transport of metal ions in biological kingdom. With the view to understand the bi-inorganic chemistry of metal ions, Banerjee et.al. have synthesised a number of mixed-ligand alkaline earth metal complexes. B-jerrum's dissertation has taken the initiative to develop the field. Metal complexation not only brings the reacting molecules together to give activated complex but also polarised electrons from the ligands towards the metal. The relation between stability and basicity of the ligands is indicated by the formation constant and free energy change value. Bulkier group increases the basicity of ligands as well as stability. The stability of complexes is determined by the nature of central metal atom and ligands. The stability of complexes is influenced by the most important characteristics like degree of oxidation, radius and electronic structure. Irving and Williams had studied the order of stability of metal complexes of transition metal ions by comparing the ionic radius and second ionisation potential of metal ions, as it is valid for most nitrogen and oxygen donor ligands. Narwade et.al. have investigated metal-ligandstability
constants of some lanthanides with some substituted sulphonic acids. Many workers have reported their results on metal-ligand stability constants. Bodkhe et al. have reported the metal-ligand stability constants of some 1-diketones. Tekade et al. investigated stability constants of some substituted pyrazolines, isoxalline and diketone. Shekhon potentiometrically determined proton-ligand stability constants in various aqueous organic mixtures. Prasad studied the stability of same metal complexes of β-diketones. Deosarkar have studied stability constants of Al (III), Cr (III) and Fe (III) metal ion complexes with substituted sulphonic acid. Pund have investigated interaction between La (III) and Nd (III) metal ions and 1-(4-hydroxy-6- methylpyrimidine)-3-substituted thiocarbamide of 0.1 M ionic strength pH metrically. Recently Speciation of binary complexes of Ca (II), Mg (II) and Zn (II) with L-glutamic acid in DMSOwater Mixtures has been studied. The present paper describe the interactions between Th (III), Sm (III), Nd (III) and Pr (III) Metal Ions and 2-Mercapto-4-(4’-Aminophenyl)-6-(2’-Hydroxy-5’-Bromophenyl) Pyrimidine [M₄AHBP] (L₁) and 2-Mercapto-4-(2’-Chlorophenyl)-6-(2’-Hydroxy-5’-Bromophenyl) Pyrimidine [M₂CHBP] (L₂) have been studied at 0.1 M Ionic Strength in 70 % Dioxane-water mixture at (30 ± 0.1) by Bjerrum pH metric method as adopted by Calvin and Wilson.[33]

Sumer D. Thakur* et al. reported that in the preceding papers we have reported on the complex equilibria of 2-carboxyphenylhydrazoacetoacetanilide (2-CPHAAA) (structure I) and 2-carboxy phenylhydrazo para methoxyacetocatetanilide (2-CPH-P-OCH₃-AAA) with proton , some of transition and lanthanide ions in 75% (v/v) dioxane-water and 0.1 M KNO₃. The study revealed that the ligands behave as dianionic tridentate (NOO)-donor. The coordination sites as obtained from infrared were carboxylate oxygen, ketonic oxygen and hydrazo nitrogen. In the present report, the chelating ability of 2-CPHAAA has been measured through the isolation of solid complexes and investigation through elemental analysis, IR, UV-visible, ¹HNMR spectra and TG, - DSC measurements. The thermodynamic parameters were determined and discussed through the separation into their electrostatic (el) and nonelectrostatic or cratic components. The mixed –ligand complexes of Cu (II), Ni (II), Co (II), Fe (III), UO₂ (IV) and Th (VI) were prepared by mixing equimolar amount 2CPHAAA with 2- amino-4- methylpyridine (2-AMP) or 1,10 phenthroline(1,10 – phen) In addition the mixed complexes were investigated in 75% (v/v) dioxane water solvents.[34]
Mostafa M. et.al. explains that the chelating ability of BHPAP ligand has been studied with lanthanide ions using 75% (v/v) dioxane-water and at four different temperatures. The results indicate that the BHPAP ligand is diprotic and behaves as a tetra dentate ligand with lanthanide ions using phenoate oxygen, imino nitrogen, and hydro nitrogen and keto oxygen groups. In the present study, the effect of mole fraction of organic-water mixtures on the proton-ligand, formation constant of BHPAP and its complex with Sm\(^{3+}\) ion was studied. It was concluded that the change of protonation of different mixed aqueous solvents changes the dielectric constants. According to Roracher and Bates, both the electrostatic and non-electrostatic effects were considered to explain the change of these constants in various dioxane-water mixtures. Also, the solvation of the proton by organic solvent has a role on the constants. It is convenient to extend the study to include other solvents rather than dioxane. In order to obtain additional information on the relation between ligand protonation constants and formation constant of Sm\(^{3+}\)-BHPAP chelate with different characteristic solvents, the study is extended to use different organic solvent-water mixtures. Also, the elemental analysis, infrared spectra, electronic spectrum, conductance, TG, DTG and DTA techniques were used to investigate the behavior of the ligand in the solid complexes of Pr\(^{3+}\) and Nd\(^{3+}\)-BHPAP and also to explain their metal-binding characteristics.\[^{[35]}\]

T. Surendiran et.al. shows that the carbazole derivatives are important class of heterocyclic compounds possessing variety of biological activity. Carbazole skeleton bearing natural products fused with heterocyclic ring have drawn significant attention due to excellent pharmacological activities of their analogues. There are numerous evidences illustrating that the fused ring of heterocycles at N\(^{\text{th}}\) position have gained unique importance on pharmacological studies. Recently, the heterocyclic nitrogen ring system have reported been an excellent anti-microbial activities. The pyrazole ring system plays an important role in many biological processes such as therapeutic agents, etc... As these two heterocycles are potent as biologically active compound, in the present study we planned to prepare compounds containing 1, 2, 3, 4-tetrahydrocarbazole and pyrazole structures in one compound. In view of these observation, we report herein the reaction of substituted β-ketoesters with N-(hydrazino acetyl)-1, 2, 3, 4-tetrahydrocarbazole to get N-acetyl-(3-substituted-1H-pyrazole-(4H)-5-on)-yl-1,2,3,4-tetrahydrocarbazole\[^{[36]}\]
Ketan B. Patel et al. explains that some 8-hydroxyquinoline derivative has antibacterial and antifungal activity and it is widely used in creams and ointments for the treatment of skin diseases. Clioquinol is an antifungal drug and antiprotozoal drug. It is neurotoxic in large doses. It is a member of a family of drugs called hydroxyquinolines which inhibit certain enzymes related to DNA replication. The drugs have been found to possess activity against both viral and protozoal infections. 8-Quinolinol (8Q) or its derivatives have been introduced as chelating groups. The chelating properties of the compounds of the 8Q series are related to its biological activity. Clioquinol is an antifungal drug and antiprotozoal drug. It is neurotoxic in large doses. It is a member of a family of drugs called hydroxyquinolines which inhibit certain enzymes related to DNA replication. The drugs have been found to have activity against both viral and protozoal infections. 8-hydroxyquinoline (8Q) and its metalloquinolates have attracted great interest because their high thermal stability and good electroluminescence properties make them important prototypical electron transport and emitting materials for OLED devices. 8-Hydroxyquinoline (8-quinolinol, oxine, 8Q) might be thought to function as a phenol, but of the 7 isomeric hydroxyquinolines only oxine exhibits significant antimicrobial activity, and is the only one to have the capacity to chelate metals. If the hydroxyl group is blocked so that the compound is unable to chelate, as in the methyl ether, the antimicrobial activity is destroyed. The relationship between chelation and activity of oxine has been investigated. Copper 8-quinolinolate (copper oxinate), the copper compound of 8-hydroxyquinoline, is employed as an industrial preservative for a variety of purposes, including the protection of wood and textiles against fungus-caused rotting, and interior paints for food plants. It has 25 times greater antifungal activity than oxine. Mixed-ligand chelates serve as suitable models for valuable information in the elucidation of enzymatic processes of biological relevance.  

Dhanraj T. Masram et al. explains that mostly the inorganic polarographic investigation have been carried out in aqueous media and rare are the reports citing advantages by carrying out such investigations in media other than aqueous. Mixed ligand complexes of transition metals with several amino acids have been studied by many workers. Vast data are available on the stability constants of amino acids complexes in aqueous media. Despite this, little is known about the chemistry of amino acids and metal complexes in nonaqueous media and mixed
solvents. The present communication deals with the studies of binary complexes of Cd (II) with glycine in DMF-water mixture.\textsuperscript{[38]}

O.D. Gupta* et.al. shows that the cadmium plays an important role in biological and chemical processes. It also forms useful amalgams with many metals, which find various applications in diverse fields. Due to the numerous applications and the toxic nature of amalgams and cadmium compounds, there is a need for simple and accurate analytical methods that allow for the rapid determination of cadmium content in samples. Cadmium is one of the most toxic heavy metals on earth. The toxicity of cadmium depends on its occurring forms; the coordination chemistry of cadmium (II) differs from most other transition metals due to its large size and d\textsuperscript{10} configuration. Its interference in biological systems, and its potential as a toxin or as a medicine, has required a better understanding of its coordinative properties. The coordination chemistry of transition metals with ligands from the hydrazide family has been of interest due to different bonding modes shown by these ligands with both electron rich and electron poor metals. Schiff bases play an important role in inorganic chemistry as they easily form stable complexes with most transition metal ions. Hydrazides possessing an azomethine -NHN=CH- Proton constitute an important class of compounds for new drug development. Therefore, many researchers have synthesized these compounds as target structures and evaluated their biological activities. Acidhydrazides have recently been investigated for testing their potentiality as tuberculostats. Hydrazides and their condensation products have displayed diverse range of biological properties such as bactericidal, anti-fungal, anti-convulsant, anti-helmintic, anti-tumor, anti-leprotic, anti-malarial, anti-cancer, anti-depressant, anti-HIV, analgesic-anti-inflammatory, leishmanicidal, vasodilator activities. In this paper, we are reporting the synthesis, characterization and biological activities of Schiff base derived from reactions of cadmium (II) bromide with Acetic acid (3 – chloro - 4- hydroxyl - benzylidene) - hydrazide (A) and Acetic acid (2 – Nitro - benzylidene) - hydrazide. The aim of this work is to synthesize new Schiff bases and their metal complexes and to study their coordination behaviour, spectral and biological activities against various microorganisms.\textsuperscript{[39]}

O. W. Salawu et.al. explains that the thiosemicarbazones and their metal complexes present a wide range of applications that stretch from their use in analytical chemistry, through pharmacology to nuclear medicine. The presence of
amide, imine and thione groups makes them potential polydentate ligands and it is not surprising that numerous thiosemicarbazone complexes have been prepared and characterized. In addition, in the last few years there has been a growing attention towards thiosemicarbazones related to their range of biological properties, specifically as antifungal, antiviral, antibacterial and anticancer agents. In the present work, we have synthesized thiosemicarbazones ligand and its transition metal complexes, characterized and study their antimicrobial activity.\textsuperscript{[40]}

Sugam Shivhare\textsuperscript{1*} et.al. shows that the design and study of metal containing macrocyclic is an interesting field of chemistry. Over the last few years, very active research in macrocyclic chemistry has attracted the interest of inorganic chemists. The chemistry of tetraimino macro cyclic complexes is of considerable interest because of their applications for modeling bioinorganic systems, catalysis and analytical practice. Spontaneous self assembly reactions have been considered as vehicles for reliable and economical preparation of macrocyclic complexes. Hence these reactions hold a fascination for chemists to mimic anabolic reaction without enzymes. Nature prefers macrocyclic derivatives for many fundamental biological functions such as photosynthesis and transport of oxygen in mammalian and other respiratory systems. Macrocyclic ligands form more stable complexes as compared to analogous open chain ligands. \textit{In-situ} one pot template synthesis is the most widely adopted method for preparation of macrocyclic complexes. A number of nitrogen donor macrocyclic derivatives have been used for a long time in analytical, industrial and medical applications. Macrocyclic metal complexes are of great importance due to their resemblances with many natural systems such as porphyrins and cobalamines. Macrocyclic nickel complexes find use in DNA recognition and oxidation while macrocyclic copper complexes find use in DNA binding and cleavage. Macrocyclic metal complexes of lanthanides \textit{e.g.} Gd\textsuperscript{3+} are used as MRI contrast agents. Macrocyclic metal chelating agents (DOTA) are useful for detecting tumor lesions. The chemistry of macrocyclic complexes is also important due to their use as dyes and pigments as well as NMR shift reagents. Some macrocyclic complexes have been found to exhibit potential antibacterial activities. Prompted by these, in the present paper synthesis and characterization of trivalent chromium, manganese and iron macrocyclic complexes derived from 2, 6-diaminopyridine and glyoxal have been discussed.\textsuperscript{[41]}

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D.P. Singh et al. shows that the Schiff base of 4-aminoantipyrine and its complexes have a variety of applications in biological, clinical, analytical and pharmacological areas. Studies of a new kind of chemotherapeutic Schiff bases are now attracting the attention of biochemists. Earlier work reported that some drugs showed increased activity, when administered as metal complexes rather than as organic compounds. Deoxyribonucleic acid (DNA) is the primary target molecule for most anticancer and antiviral therapies according to cell biologists. Investigations on the interaction of DNA with small molecules are important in the design of new types of pharmaceutical molecules. Since the chemical nuclease activity of transition metal complexes was discovered in the 1980s, studying the interaction model and the mechanism of transition metal complexes with DNA, and exploring the application of metal complexes in antineoplastic medication, molecular biology and bioengineering have become hotspots in recent years. Some kind of metal complexes interacted with DNA could induce the breakage of DNA strands by appropriate methods. In the case of cancer genes, after DNA strands are cleaved, the DNA double strands break. The replication ability of cancer gene is destroyed. Copper complex could cleave DNA in the presence of ascorbate or hydroquinone. It was suggested that the reductive capability of reductants had a critical influence on DNA cleavage. The coordinating property of 4-aminoantipyrine ligand has been modified to give a flexible ligand system, formed by condensation with a variety of reagents like aldehydes, ketones thiosemicarbazides and carbazides, etc. Literature search reveals that no work has been done on the condensation process of 4-aminoantipyrine, 3-hydroxy-4-nitrobenzaldehyde and o-phenylenediamine. In this paper we report the synthesis, characterization, redox, antimicrobial and DNA cleavage studies of transition metal complexes containing Schiff base derived from 4-aminoantipyrine, 3-hydroxy-4-nitrobenzaldehyde and o-phenylenediamine.

N Raman et al. explains that the colorants, which include chromophores of dyes usually consisting of C=C, N=N, C=N, and aromatic and heterocyclic rings, containing oxygen, nitrogen or sulfur, have been widely used as dyes owing to their versatility in various fields and high technologies, including textiles, paper, leather, plastics, biological staining, lasers, liquid crystalline displays, ink-jet printers, and in specialized applications, such as food, drug, cosmetic and photochemical productions. Dyes used before the nineteenth century were either of vegetable (i.e., weld, madder, indigo) or animal origin (i.e., cochineal, shellfish) and belonged to
various chemical types, such as flavonoids (yellow), anthraquinones (red) and indigoids (blue and violet). These chemical types of anthraquinoid dyes provide the most important red dyes and lakes used in artistic paintings. Synthetic dyes are extensively used in industry and a vast amount of the dyes produced enter the environment as waste material. The main synthetic dye classes include azo, anthraquinone and triarylmethane dyes which constitute more than half of the dyes used in industrial applications. Azo dyes are widely used in the textile industry and are the largest and most versatile group of synthetic organic dyes, with a tremendous number of industrial applications. Schiff base metal complexes have the ability to reversibly bind oxygen in epoxidation reactions, biological activity, and catalytic activity in hydrogenation of olefins and photochromic properties. Also, Schiff bases can be used in the degradation of organic compounds and in radiopharmaceuticals. In previous studies, the synthesis and characterization of various bidentate compounds and some of their properties were investigated. In this article, because of the importance of azo-azomethine compounds and in continuance of present interest in the syntheses of azo and azomethine compounds, the syntheses, complex formation and characterization using different techniques, in particular the elemental analyses, molar conductivity, infrared and electronic spectroscopy, of 4-[(E)-phenyldiazenyl]-2-[(E)-(phenylimino)methyl]phenol are reported. The ligand was synthesized by the reaction of 2-hydroxy-5-[(E)-phenyldiazenyl] benzaldehyde with aniline in EtOH solution at the boiling point. Its complexing ability with Ni (II), Cu (II) and Co (II) salts was examined. The structure of the metal chelates is proposed.\[43\]

T. K. Chondhekar* et.al. explains that the Tetradentate Schiff bases with \(N_2O_2\) donor atoms are well known to co-ordinate with various metal ions and have attracted a great deal of interest in recent years due to their rich co-ordination chemistry. Schiff bases of ophenylenediamine reported to have variety of applications including biological, clinical and analytical fields. Many symmetrical tetradeinate bis-Schiff bases of 1, 2-diamines with \(o\)-hydroxy aldehyde/ketone have been prepared and studied intensively. However much less attention has been focused on asymmetrical tetradeinate Schiff bases derived from 1, 2-diamines and different aldehydes/ketones. In particular, those derived from aromatic 1, 2 diamines have been under-investigated. It is worthwhile to mention here that asymmetrical Schiff bases of this type are difficult to obtain and not easily isolated\[44\]
Trimbak K. Chondhekar et al. explains that the Schiff base complexes have undergone a phenomenal growth during the recent years because of the versatility offered by these complexes in the field of industries, catalysis and in biological system etc. In this way, the synthesis, structural investigation and reaction of transition metal Schiff bases have received a special attention, because of their biological activities as antitumoral, antifungal and antiviral activities. Thus, Schiff base hydrazones are also interesting from the point of view of pharmacology. Hydrazone derivatives are found to possess antimicrobial, antitubercular, anticonvulsant and antiinflammatory activities. Particularly, the antibacterial and antifungal properties of hydrazones and their complexes with some transition metal ions was studied and reported by Carcelli et al. In addition, complexes of salicylaldehyde benzoylhydrazone were shown to be a potent inhibitor of DNA synthesis and cell growth. This hydrazone also has mild bacteriostatic activity and a range of analogues has been investigated as potential oral ion chelating drugs for genetic disorders such as thalassemia. Following all these observations and as a part of our continuing research on the coordination chemistry of multidentate ligands, we report here the synthesis and structural studies on the complexes of Cu (II), Co (II), Ni (II) and Zn (II) with some hydrazone derivatives containing benzimidazole moiety.[45]

R. K. Mohapatra* et al. shows that the organic and coordination chemistry. Metal complexes of a dithiolene and a diimine have excellent electronic functions due to the intramolecular charge transfer from a ligand to other ligand (LLCT). Our interest is in transition metal complexes of the mixture ligands dicyanodithiolene and some diimine such as substituted and unsubstituted phenanthrolines and bipyridines. Recently we studied synthesis, characterization, photo-physical and photochemical properties of the title complexes M (mnt) (phen), M = Fe (II), Co (II) Ni (II), Cu (II), Zn (II). In the present paper we report brevity their synthesis and spectroscopic characterization. As the staring materials, the metal complexe (M (phen) Cl2) of 1, 10-phenanthroline and two chlorine ions and the disodium cis-1, 2-dicyanoethylene-1, 2-dithiolate, i.e., disodium maleonitriledithiolate (Na2 (mnt)) was respectively synthesized and characterized according to the literature method. The complex M (mnt) (phen) was respectively synthesized by reaction of Na2 (mnt) with corresponding metal complex. [46]
Zheng He Peng* et.al. reported that when a ketone or an aldehyde is condensed with a primary amine, a Schiff base is formed. A Schiff base is a compound containing azomethine group, $R - C == N - \quad (Holm$ et.al., 1966; Hobday and Smith, 1972). It has been known that large number of metal ions on interaction with Schiff bases yield stable chelates. For example, Holm et.al.(1966) reported the synthesis and characterization of some Schiff base copper (II) complexes. In another report, Gupta et.al.(2002) explained the synthesis and characterization of cobalt (II) $N, N'$ - bis (acetylacetone) ethylenediaminato complex from the interaction of cobalt (II) salt and $N, N'$- bis (acetylacetone) ethylenediamine Schiff base ligand. Recently, Xishi et.al.(2003) reported the synthesis and spectroscopic properties of manganese (II), cobalt (II) and copper (II) complexes with novel Schiff base ligand derived from 2, 2' bis (p-methoxyphenylamine) and salicylic aldehyde. Transition metal Schiff base complexes are used in electrochemical reduction of gels from styrene polymers, as catalyst in photopolymerization of printing plates and as dispersing agents in dyeing (Theoder, 1975). The complexes of the following metals Ni (II), Cu (II), Cd (II), Co (II), Mn (II) and Zn (II) with hydroxypyrazole or pyrazplane aldehyde Schiff bases are light stabilizers for plastics and fibres (Avar et.al., 1975). Further more Schiff base complexes of transition metal complexes are used as oxidation inhibitors for lubricating oils, in the manufacture of fluorescent brightner and liquid crystal compositions in optical display devices. In the field of medicine has witnessed an increase in the number of complexes with therapeutic value. [47]

H. N. Aliyu et.al. shows that the coordination complexes are gaining increasing importance in recent years particularly in the design of repository; slow release or long acting drugs in nutrition and in the study of metabolism. The metal ions are also known to accelerate drug action. The interaction of metal ions with nucleic acids and nucleic acid constituents has been actively studied in the recent years. The interaction of metal complexes with DNA has long been the subject of intense investigation in relation to the development of new reagents for biological and medicinal fields. DNA can be cleaved by hydrolytic or oxidative pathways. The hydrolytic process involves cleavage of the phosphodiester bond leading to the formation of fragments that could be relegated by enzymatic process. Among the metal complexes so far investigated, it is well known that transition metal complexes inhibit DNA or RNA polymerase activities and induce strandscission of DNA in presence of $H_2O_2$. Transition metals are essential for the normal functioning of
living organisms. Therefore, it is not surprising that transition metal coordination compounds are of great interest as potential drugs. A general study of the structural and bonding features of the various Schiff base complexes can help better understanding of the complex life processes. The findings of structural studies are interesting in that the Schiff base ligands can control the stereochemistry of the complex and provide us with numerous examples of unusual geometries about the central metal ion. Therefore, they can serve to illustrate the coordination flexibility of these ions. A wide number of papers report the synthesis and characterization of many metal complexes of Schiff bases derived from aromatic aldehydes and substituted anilines. It is well known from the literature that semicarbazide compounds containing the amide moiety have a strong ability to form metal complexes. Acetoacetanilide is continued to attract considerable attention from theoretical standpoints concerning the mode of bonding and its general reactivity as coordinated ligand. Keeping the above facts in mind and in continuation of our earlier work on transition metal complexes with Schiff bases, the present paper describes the synthesis and characterization of Cu (II), Ni (II), Co (II) and Zn (II) complexes with the biologically important semicarbazide Schiff base.

N.Raman et.al. shows that the Schiff bases are an important class of ligands in coordination chemistry and find extensive application in different fields (Eichhom et.al., 1994; Hughes, 1984; Tarafder et.al., 2001). Schiff bases derived from the salicylaldehydes are well known as polydentate ligands coordinating in neutral forms (Sonmez and Sekerci, 2002; Vukadin et.al., 2003). The interaction of these donors’ ligands and metal ions give complexes of different geometries and these complexes are potentially biologically active (Harlal Singh and Varshny, 2006). Thus, in recent years metal complexes of Schiff bases have attracted Synthesis and Characterization of Mixed Ligand Complexes of 8-Hydroxyquinoline and o-hydroxybenzylidene-1-phenyl-2,3-dimethyl-4-amino-3-pyrazolin-5-on with Fe(II), Co(II), Ni(II) and Cu(II) ions considerable attention due to their remarkable antifungal, antibacterial, antitumor and anticancer activity (Chakravarty et.al.2002; Gao and Zheng, 2002; Hanna and Moaead, 2001; Keypour et.al., 2002). In particular, Merck company has successfully developed an antibacterial drug cilastatin using chiral copper (II). Several research papers have been synthesized and characterized on transition metal complexes of Schiff base derived from salicylaldehyde (Chaurasia et.al., 1982). A search through literature reveals that
there is no work has been done on the transition metal complexes of the Schiff base and 8-hydroxyquinoline (Ahn et.al. 2004; Abbas, 2005; Giraudi et.al. 2001; Mitsunobu et.al., 2005; Rai et.al., 2001; Rajib et.al., 2002). Keeping this in view, the present paper describes the results of an investigation on mixed Schiff base complexes. 

Shayma A. Shaker et.al. shows that the pyrazole-5-one and its derivatives are not only biologically active but also find applications in photography and dye industry. 4-acyl-3-methyl-1-phenyl-5-pyrazolone has been used to extract Mn (II). 5-pyrazolones possess various biological activities. In view of ligational behaviour and biological importance of 5-pyrazolones and its derivatives the chelating Schiff base ligand derived from 4-benzoyl-3-methyl-1-phenyl-5-pyrazolone and aniline has been synthesized and characterised. A perusal of the literature revealed that no work has been done on the transition metal complexes of the Schiff base derived from aniline and 4-benzoyl-3-methyl-1-phenyl-5-pyrazolone. The Co (II), Ni (II) and Cu (II) complexes of this ligand using acetates, chlorides and nitrates of the metals were synthesized and characterized. The ligand N-phenyl (methylphenyl-5-pyrazolyl) methylidene] aniline (L) has three donor sites, azomethine nitrogen, the pyrazolone ring oxygen and the pyrazolone ring nitrogen atoms.

S. Sunitha et.al. explains that the Schiff bases and their transition metal complexes have been investigated extensively since these types of molecules are important in chemistry and have many applications. A great deal of work has been reported on the synthesis, structural investigations, various crystallographic features, mesogenic characteristics, structure-redox relationships and catalytic properties of different types of Schiff bases and their complexes with transition and non-transition elements. Malonyldihydrazide and Salicylaldehyde compounds are capable to form complexes with transition metal ions in the form of Schiff bases. The complexes of Ni (II) and Cu (II) have been prepared and characterized by elemental analysis, molar conductance measurements, infrared and electronic spectra. Henri et.al. have synthesized two new Schiff bases derived from 2, 3-diaminopyridine and o-vanillin and their transition metal complexes (Cu, Ni, Fe, and Zn). Rajavel and Krishnan have reported the synthesis and characterization of Oxovanadium (IV) complexes of the Schiff bases derived by the condensation of 2-aminobenzaldehyde with various diamines as 1, 2-diaminoethane, 1, 3-diaminopropane and discussed the spectral data of the complexes. Erdal canpolat et.al. have reported and synthesized a new 5-
bromosalicylidene-p-aminoacetophenoneoxime and its complexes of Cu (II), Ni (II) and Zn (II). Jian-ning Lu et al. have reported synthesis and characterization of transition metal complexes. Nair et al. have also reported synthesis and characterization of transition metal complexes of Cu (II), Ni (II) and Zn (II). The present paper aims to synthesize and characterize the chemical structure of Schiff base complexes derived from Malonyldihydrazide and Salicylaldehyde.

Netra Pal Singh et al. shows that the transition metal complexes with Schiff bases as ligands have been amongst the widely studied coordination compounds in the past few years, since they are found to be important as biochemical, analytical and antimicrobial reagents. The complexes of azo compounds also exhibits bacteriostatic and other biochemical activities. Heterocyclic azo Schiff base and their complexes with transition metal ions are also of importance due to their complexing, catalytic biological properties. Heterocyclic ring containing sulphur, nitrogen and oxygen impart special biological activity to these Schiff bases and their metal complexes. In view of the interesting ligating behavior of such system, we considered it worthwhile to prepare Co (II), Ni (II), Cu (II), Zn (II) and Cd (II) complexes of tridentate ligand derived from 5-(2'-thiazolylazo) salicylaldehyde and p-chloroaniline. The complexes have been characterized by various physicochemical methods.

Jian-ning Liu* et al. shows that the tetradeinate Schiff’s base compounds with a N2O2 donor atom set are well known to coordinate with various metal ions, and this has attracted the interest of many authors. Complexes of Schiff’s base ligands have been studied for their dioxygen uptake and oxidative catalysis. Furthermore, complexes of transition metals (II), which involve derivatives of salicyldhyde and diamine, have received considerable attention. This is because of their potential as catalysts for the insertion of oxygen into an organic substrate. The reaction of tetradeinate Schiff’s base compounds derived from salicylaldehyde and diamine has been the subject of many studies. The present study aimed to investigate the reaction of 2 tetradeinate Schiff’s bases derived from the condensation of 4-(benzeneazo) salicylaldehyde with o-phenylenediamine or ethylenediamine with copper, nickel, zinc, cobalt, and manganese and cadmium ions. The prepared ligands and complexes were characterized by elemental analysis, molar conductivity measurements, and infrared and electronic spectral data. Two ligands and their Ni (II) and Zn (II) complexes were further identified using 1H NMR spectra.
M. MiKuria** et.al. explains that there has been a considerable interest in the coordination chemistry of Schiff-base ligands, because of their feasibleness to make various kinds of metal complexes. This has resulted in a vast number of reports on Schiff-base metal complexes. Especially, salen-type tetradeionate ligands \( \text{H}_2\text{salen} = \text{N}, \text{N}′-\text{bis (salicylidene) ethylenediamine} \) have been known since 1933, their complexes became a standard system in coordination chemistry, and their application as inorganic-organic composite materials was examined. We have been engaged in the chemistry of metal Schiff-base compounds with bridging groups. Among Schiff-base ligands, 1-[(2-hydroxyethyl) amino]-2-(salicylideneamino) ethane (H2base) is a unique ligand, which has a phenolic atom and alcoholic oxygen atom as potential bridging groups. \[54\]

Adedibu C. Tella* et.al. shows that the compounds containing an azomethine group (-CH=N-) are known as Schiff-bases. Schiff bases are generally bi, tri, tetradeionate ligands capable of forming very stable complexes with transition metals. Tetradeionate Schiff bases with a \( \text{N}_2\text{O}_2 \) donor atom set are well known to coordinate with various metal ions and this has attracted many authors. Schiff base complexes have been studied for their dioxygen uptake4 and oxidative catalysis, insertion of oxygen into organic substrate. The complexes of transition metal (II) which involves derivatives of salicyaldehyde and diamine, acetophenone and diamine are the subject of many authors. The present study aimed to investigate the reaction of tetradeionate Schiff base derived from condensation of ethylenediamine with substituted acetophenone (2-hydroxy-4-methoxyacetophenone) with Cobalt, Copper, Nickel and Oxovanadium ions. The prepared ligand and complexes were characterized by elemental analysis, UV-visible and infrared spectroscopies. \[55\]

Sangita Sharma et.al. explains that the co-ordination compounds exhibit different characteristic properties which depend on the metal ion to which they are bound. On the basis of nature of the metal as well as the type of ligand, these metal complexes have extensive applications in various fields of human interest. Chelation or complexation observes more potent antibacterial effect against some microorganisms than the respective drug. Kojic acid is known as insecticide, plant growth regulator and as an antifungal and antimicrobial agent. It is also used as a depigmenting agent (and/or skin whitening agent) as it inhibits melanin synthesis by inhibition of tyrosine’s activity. Amino acids are the building blocks of the protein which are major biomolecules of the cell. The presence of transition metals in
human blood plasma indicates their importance in the mechanism for accumulation, storage and transport of transition metals in living organisms. Synthesis of Co (II), Ni (II) and Zn (II) complexes with thiazole ring containing Schiff base ligands and their antimicrobial activities were tested against eight different microorganisms. Spectral, redox and antimicrobial activity of Schiff base transition metal (II) complexes derived from 4-amino antipyrine and benzyl have been already. Synthesis, characterization and antimicrobial studies of transition metal complexes have been an active field of research. The coordination chemistry of manganese is dominated by stable Mn(II) and Mn(III) centers and a mononuclear Mn^{12} centers has been established at the active site of some enzymes that display superoxide dismutase activity. Many metal complexes possess toxicological and pharmacological properties but the problem is that some lose their activity in vivo upon exposure to proteins and appear to have better affinities than the ligands studied for metal ions, which are deactivated once they are embedded in the proteins. The present paper describes the synthesis, characterization and antimicrobial activity of mixed ligand Mn (II), Co (II), Ni (II), Zn (II) complexes formed with L-proline and kojic acid.\[^{56}\]

Stuart L. James et.al. reported that the solvent-free synthesis of coordination polymers or metal–organic frameworks (MOFs) is of interest for several reasons. For example, it could give insight into the roles of solvent molecules in templating microporous structures, give access to green large scale production processes and even provide more convenient lab-scale preparative methods. There have been several reports recently on the use of mechanochemical methods (grinding) to produce discrete coordination complexes, and three reports of the synthesis of 1-dimensional coordination polymers. However, the coordination polymers obtained previously are not porous, and it has not previously been demonstrated, to our knowledge, that grinding can produce the higher-dimensional connectivity which is generally required to support permanent open porosity. Porous MOFs are of great interest for their sorption properties and potentially for applications. Solvent-free synthesis of porous MOFs would therefore be a significant advance. We describe here our observations of the quantitative and rapid synthesis of a microporous framework which is crystalline and has 3-dimensional connectivity, in particular [Cu (INA)\(_2\)] (INA 5 isonicotinate). The reaction occurs within minutes of grinding together copper acetate and isonicotinic acid, and the material can then simply be
heated to remove the water and acetic acid byproducts to give the empty, crystalline, porous framework in quantitative yield.\[57\]

Richard Eisenberg*, et.al. shows that the research involving the excited-state processes of transition metal diimine complexes has dominated the field of inorganic photochemistry for the past two decades. Growth in this area has been driven by rapid advances in the techniques of studying excited-state transient species and in the theory of photoinduced electron transfer. Further support has come from promising results concerning the use of metal diimine chromophores in applications such as solar energy conversion, supramolecular assemblies, photocatalysis, nonlinear optics, photonic molecular devices, and photoluminescent probes of biological systems. Research continues to focus on transition metal diimine complexes because they often possess long-lived excited states capable of bimolecular energy and electron transfer as well as efficient photoluminescence.

Synthetic strategies are aimed at preparing complexes having a high degree of stability and having excited-state properties that can be controlled by systematic variation in molecular structure. These properties, which classical coordination compounds and organometallic complexes often lack, are crucial to most potential applications. An extensive amount of work has involved the homoleptic Ru (II) tris-diimine complex Ru (bpy)\(_{3}^{2+}\) and its derivatives as well as related complexes of Fe (II) and Os (II). Other d\(^{6}\) octahedral complexes having chelating diimines that have received much attention include Re(I) diimine carbonyl complexes such as the prototypical Re(CO)\(_{3}\)Cl(diimine) system and Rh (III) and Ir (III) bis- and tris-chelating diimine systems. In contrast, relatively little work has been done using Pt (II) metal complexes. Much of the early studies involved complexes such as PtX\(_{4}\) 2-(X halide), Pt (diimine) X\(_{2}\), and Pt (diimine) 2 2+, for which emission was observed only in frozen solvent glasses or in the solid state. Recently, a number of square-planar Pt (II) complexes, most of which contain R, R'-diimine or related pyridyl chelates, have been prepared that display long-lived solution luminescence in ambient conditions. One of the first examples of this group was Pt (2-thienylpyridine), which contains cyclometalated thienylpyridyl chelating ligands.\[58\]

Dejian Huang*,† et.al. shows that the clinical trials and epidemiological studies have established an inverse correlation between the intake of fruits and vegetables and the occurrence of diseases such as inflammation, cardiovascular disease, cancer, and aging-related disorders. Dietary antioxidants, including
polyphenolic compounds, vitamins E and C, and carotenoids, are believed to be the
effective nutrients in the prevention of these oxidative stress related diseases.
Antioxidants have thus become a topic of increasing interest recently. A literature
search revealed that the number of publications on antioxidants and oxidative stress
has nearly quadrupled in the past decade (1684 in 1993; 6510 in 2003). It is of great
interest to the general public, medical and nutritional experts, and health and food
science researchers to know the antioxidant capacity and constituents in the foods
we consume. Due to the complexity of the composition of foods, separating each
antioxidant compound and studying it individually is costly and inefficient,
notwithstanding the possible synergistic interactions among the antioxidant
compounds in a food mixture. Therefore, it is very appealing to researchers to have a
convenient method for the quick quantitation of antioxidant effectiveness in
preventing diseases. However, such methods are yet to be developed. A total
antioxidant capacity assay using one chemical reaction seems to be rather unrealistic
and not easy to come by, yet there are numerous published methods claiming to
measure total antioxidant capacity in vitro. Ironically, the biggest problem is the lack
of a validated assay that can reliably measure the antioxidant capacity of foods and
biological samples. Several reviews have been published, and the opinions vary
considerably. There seems to be no consensus of opinions, most probably due to the
fact that the area of antioxidants is such a complex topic.\cite{59}

George J. P. Britovsek\textsuperscript{*} \textsuperscript{†} et.al. explains that the alkanes are notoriously
difficult to functionalize selectively and are therefore currently underused as a
chemical feedstock. With the advent of large-scale gas to liquid (GTL) processing,
higher alkanes are likely to become available in ever increasing amounts. The future
efficient utilization of this carbon resource will depend on the development of highly
active, selective, and stable catalysts that can convert these unreactive hydrocarbons
into useful intermediates or products. To this end, the activation of a C-H bond at a
transition metal center is generally regarded as the first step toward alkane
functionalization and has therefore received a great deal of attention during the last
20 years.\cite{60}

Alceo Macchioni\textsuperscript{*} \textsuperscript{†} et.al. shows that there has recently been increased
interest in complexes containing “hemilabile” N,O ligands because their hemilability
can facilitate the coordination of a substrate into the coordination sphere of a
transition metal. Furthermore, in the case of neutral N, O ligands, the chelation of
the O arm can stabilize reactive species. Cavell and co-workers demonstrated that Pd compounds containing N; O ligands can be used to isolate a reaction intermediate of the ethene insertion. Our interest in neutral N, O ligands is based on the above-mentioned properties and on two other reasons. First, during the kinetic studies on the migratory insertion of carbon monoxide in compounds trans, cis- M (PMe₃)₂(CO)₂(Me)I (M) Fe (1a) Ru (1b), we realized that two processes can occur very easily: the ionization of the M-I bond and the migration of Me onto a cis Co. Depending on which process occurs first, it is possible to hypothesize two different reaction mechanisms. If both processes take place, two coordination sites are left free for the attack of a bidentate ligand. Reactions with neutral N, O ligands, where the N arm is reasonably considered to be the first to coordinate to the metal, can give interesting information about the stereochemistry of the reaction and the active mechanism. Second, the reaction of neutral N, O ligands affords cationic complexes where all but the CO coordination sites around the metal contain nonequivalent protons. This makes the formed complexes suitable for studying their interionic structures in solution by detecting the interionic contacts in the 1H NOESY spectra.

Xiu R. Bu* et.al. shows that the N,N-Bidentate ligands such as 2,2-bipyridine and 1,10-phenanthroline play a pivotal role in key areas such as photovoltaics, OLEDs, molecular sensors, DNA intercalation, molecular wires, and supramolecular structures (network, helical, box, etc.). The diverse applications stem from the facts that the ligands are capable of chelating various metal ions and the resultant complexes possess a wide range of magnetic, photo physical and electrochemical properties. Thus, the development of synthetic methodologies for N, N-bidentate ligands is of paramount importance in chemistry. N, N-Bidentate ligands with mixed five- and six-membered heterocycles are a desirable class of compounds in the pursuit of structural diversity for property performance. In particular, 1-pyridylimidazo [1, 5-a] pyridines possess a bidentate structural feature with a pyridyl unit directly next to a fused imidazole and have emerged as a new class of ligands.

Jianhui Liua,* et.al. explains that in the nature, many processes convert the solar energy into chemical energy, for instance, the photosynthesis. This process involves with a complicated mechanism: sunlight is captured by chlorophyll arrays, funnels the excited energy to the reaction center, and converts it to chemical
potential in the form of a long-lived charge-separated state up to now; many types of supramolecular systems have been designed and studied as model systems to mimic the natural process of sunlight conversion. Among these, porphyrinoid arrays, dyads, triads and higher order arrays, linked by covalent bonds and non-covalent forms have been extensively studied. Porphyrin is the most widely used chromophore. Other elaborate systems include porphyrins–quinine assemblies, with porphyrin or metalloporphyrins as donor and quinones as acceptors. Polypyridine, on the other hand, especially ruthenium (II) tris-(2, 20-bipyridine), is another kind of important chromophore. It has an absorption maximum in the range of 400–500 nm with increased absorptive cross sections at the wavelength of the porphyrins. Such complementary absorption spectra of porphyrin and ruthenium (II) trisbipyridine provide us with an extended absorption range favorable for the collection of light. In addition, an intramolecular electron transfer from porphyrin to the Rucomplex occurs on the excitation of the porphyrin moiety or Ru moiety. Ruthenium (II) tris-bipyridine derivatives have favourable photophysical and redox properties, which make them ideal candidates for photosensitizer.\[63\]

Raymond Ziessel,* † et.al. shows that the utility of fluorescence for biological and medical analyses stimulates considerable research to improve both the sensitivity and selectivity of appropriate fluorophores. Mapping of both the spatial and temporal distribution of calcium within biological systems is a typical challenge. We and others have previously argued the case that rational modification of known molecules is a field that still retains great promise. Binding of the target analyte to a synthetic fluorophore (sensor) can result in either amplification or quenching of the fluorescence but a common instance is that in which photoinduced electron transfer (PET) quenches the luminescence in the absence of the analyte. Analyte binding may then lead to the “switching on” of the emission by inhibition of PET, either because of a direct interaction of the analyte with redox active centers of the sensor or because the binding induces a conformational change which places these centers remote from the emissive site. Aromatic amines are good reductants and for this reason have been widely used to provide PET quenching by covalent binding to various fluorophores such as acridine, acridinium, anthracene, and phenanthrene.\[64\]

Jesús Castro* † et.al. explains that the chemistry of metal complexes with pyridine-functionalized amide ligands has received a great deal of attention, which is
due, in part, to the fact that such complexes can be made relatively easily. Furthermore, variation of the substituents in these ligands is facile. This latter feature provides the possibility of tailoring the bite angle and degree of steric hindrance present in the ligand, and in addition, it is believed that the presence of bulky substituents on these ligands can stabilize the metal complexes. A particular class of ligands of this type is the pyridine sulfonamide ligands. These ligands are very versatile in terms of their coordination modes; they can act as anionic monodentate systems via the nitrogen pyridine atom.

Chandima Abeywickrama et al. shows that the compound 1, 4, 5, 12-tetraazatriphenylene, also known as 4, 7-phenanthrolino-5, 6:56-pyrazine (ppz) is a member of a small family of documented planar heterocyclic molecules containing three or more nitrogen atoms and four or more condensed rings. Like ppz, many of these are biologically active and also act as bisbidentate or polydentate ligands toward a variety of metal ions. Some of these are natural products; others are synthetic materials. Our earlier work described the use of ppz as a bridging ligand in the fabrication of the first luminescent complexes containing two ruthenium atoms. The degree of electronic communication between metal centers connected by such bridging ligands is an area of interest that has been explored by experimental and computational methods. Also of interest is the use of ppz and analogues in the fabrication of dendrimers and microporous network structures; e.g., the bridging ability of ppz makes it an attractive building block for constructing polynuclear systems where lattice interpenetration is diminished due to the rigidity of the ligand. Grove and co-workers have also reported the X-ray structure of ppz, drawing attention to the importance of δ stacking. Another attribute of ppz and analogues related to their planar structures is an ability to intercalate DNA. Applications as sensitive diagnostic tools and novel chemotherapeutic agents have been examined by our group. The route to ppz in all previous work has been the condensation of 4, 7-phenanthrolino-5, 6-dione with ethylenediamine. However, the diimine resulting from this reaction undergoes a spontaneous disproportionation reaction, producing ppz along with the nonaromatic substance 1, 4, 4a, 12b-tetrahydro-1, 4, 5, 12-tetraazatriphenylene in equal amounts. Thus, the maximum yield of ppz is limited to 50% and no methods have been found for oxidizing to ppz (Scheme 1). We have sought improved synthetic routes to ppz and to ppz derivatives potentially useful in fine-tuning the photochemical and redox properties of metal complexes, DNA-
intercalating properties, and also for the construction of more elaborate structures in which the substituents can serve as a site for structural architecture. Only a few ppz derivatives have been reported in the past, reflecting the observation that the known chemistry of 4, 7-phenanthroline and its derivatives is sparse compared to that of 1, 10-phenanthrolines. Here, we report a more efficient synthesis of ppz and the synthesis of several new ppz derivatives. As noted earlier, Dione 2 has been used as a precursor to 1. Direct oxidation of 4, 7-phenanthroline to 2 is unsuccessful, even though the corresponding 1, 10-phenanthroline is easily oxidized to isomeric 1, 10-phenanthroline-5, 6-Dione. However, electron-rich 4, 7-phenanthrolines such as 5-methoxy-4, 7-phenanthroline can be oxidized to the dione. [66]

Greg A. Slough, * † et.al. shows that the development of high-throughput screening technology for metal catalyst development continues to be a very active area of research. Methods as diverse as solid-phase catalyst immobilization, mass spectral analysis of reactive catalyst intermediates, and focused libraries of catalyst mixtures have all been utilized in this regard. Although 1, 10-phenanthroline is a venerable ligand in coordination chemistry, its use in catalytic reactions has only recently attracted significant attention. The disposition of the nitrogen atoms within the fused aromatic system makes phenanthroline a nearly universal ligand for d- and f-block metals. With these considerations in mind, it would be a significant achievement to find fast, flexible, and convenient methods to screen the catalytic properties of 1, 10-phenanthroline complexes. We therefore chose to pursue the solid-phase immobilization strategy. This report summarizes our work leading toward a semiautomatic method for the preparation of custom phenanthroline resins on polystyrene-divinylbenzene beads. Resins with immobilized 1, 10-phenanthroline or 2, 2'-bipyridyl ligands have been prepared previously. For instance, Neckers immobilized 2, 2-bipyridyl on polystyrene through a carbanion coupling procedure. This resin, presumably substituted at the 2-position, was inert to cleavage agents, and analysis could only be done indirectly with metal complexation and subsequent metal analysis. [67]

Scott D. Rychnovsky* et.al. shows that since Peterson’s work on the generation of R-aminoorganolithium reagents, the use of these intermediates in synthesis has been extensively explored. Particular focus has been given to the development of enantioselective processes that take advantage of the high configurational stability associated with these species. Frequently utilized methods
for the preparation of primary and secondary R-aminoorganolithiums include tin-lithium exchange and deprotonation aided by the proximity of a coordinating functional group. The utility of these methods for the preparation of tertiary R-aminoorganolithiums has not been well demonstrated. To the best of our knowledge, no examples of tin-lithium exchange to generate a tertiary R-aminoorganolithium have been reported and deprotonation does not appear to be a general strategy. An alternate approach to tertiary R-aminoorganolithium reagents involves reductive lithiation of an aryl sulfide using lithium di-tert-butylbiphenylide (LiDBB). In a similar manner, reductive decyanation of R-aminonitriles under traditional dissolving metal conditions (lithium or sodium in liquid ammonia) generates R-metalloamines, albeit as fleeting intermediates due to rapid protonation of the strongly basic tertiary organometallics.\textsuperscript{[68]}

Mallayan Palaniandavar* et.al. shows that there is considerable interest in the design of small molecules, which react at specific sites along the DNA strand, as reactive models for protein-nucleic acid interactions, as probes of DNA structure, as an aid to drug design, and as tools of molecular biology. The use of transition metal chelates is central in the effort to elucidate the mechanisms involved in the sitespecific recognition of DNA and to determine the principles governing the recognition. They can be uniquely useful in developing spectroscopic and reactive probes of nucleic acids. Understanding more details of the structure of DNA requires preparation of more structurally analogous complexes with different shape and electronic properties and investigation of their DNA binding behaviour. The interaction of transition metal polypyridyl and mixed ligand complexes with DNA has been extensively studied during the past several years, as their unusual binding properties, combined with their general photoactivity, make them suitable candidates as probes for DNA secondary structure, photocleavers and antitumor drugs.\textsuperscript{[69]}

Mehmet Sonmez* et.al. explains that the amino heterocycles containing two or more potential donor centers play an important role in the study of competitive reactivity of ambidentate ligand systems. Heterocyclic diazines, such as pyridazine and pyrimidine, are known to act as bidentate or tridentate ligands when coordinated to metal ions. Diazine ligands such as pyrimidine can form mononuclear and binuclear complexes. Transition metal complexes containing a pyrimidine ligand are commonly found in biological media and play important roles in processes such as catalysis of drug interaction with biomolecules. N-Aminopyrimidine Schiff base
chemistry is less extensive and our laboratory has been exploring this chemistry. This paper describes the synthesis of the binuclear Cu (II) complexes of some heterocyclic Schiff base ligands (Figure 1.) containing a ring of the pyrimidine. Spectral and magnetic studies have been used to characterize the structure of the complexes.\textsuperscript{[70]}

Behrouz Shaabani* et.al. The calix arenes can be easily functionalized both at the phenolic OH groups (lower rim) and, after (partial) removal of tert-butyl groups, at the para positions of the phenol rings (upper rim). The vast majority of this modified calixarenes exist in the cone conformation in which there is a cavity suitable for receiving of different ionic and neutral species. Furthermore, the most significant feature of the chemistry of these molecules is their ability to bind selectively alkali and alkaline earth cations. Compared to the number of reports on the binding of alkali metal ions with calixarenes, reports on the binding of transition metal ions are still limited. Monofunctionalized calixarenes are potentially excellent starting materials for the selective designing of new materials. Reinhudt et.al.reported the ipsonitration of p-tertbutylcalix arene for the preparation of nitrocalix arene. In the present work the preparation of monoamine functionalized \textit{p-}
tert-butylcalix arene at the upper rim and conversion of it to the salicylaldehyde Schiff base and finally complexation with Cu (II) is reported. The attempts for the preparation of complexes with other transition metals such as Co (II) and Ni (II) failed may be because of the steric hindrances. In the case of cobalt and nickel, they often prefer square planar and octahedral complexes but the copper four coordinated tetrahedral complexes are most common.\textsuperscript{[71]}

K. Siddappa* et.al. he explains that the among a wide variety of nitrogen heterocycles that have been explored for developing pharmaceutically important molecules, the quinazoline have played an important role in medicinal chemistry and subsequently have emerged as a pharmacophore. Recently, nitraquazone, a quinazoline derivative has been found to possess potent phosphodiesterase inhibitory activity which is potentially useful in the treatment of asthma. A few of the activities associated with quinazoline nucleus are hypotensive activity, anticonvulsant, anticoagulant, anti-fibrillatory, cardiac stimulant, diuretic, antibacterial and antiviral. Because of their biological relevance interesting to spectral and magnetic properties of ligand and its metal complexes are being used generally synthetic building blocks due to their chemical and biological relevance. The literature survey reveals that the
reaction of quinazoline hydrazide (PQH) and quinolinaldehyde (HQA) Schiff base have not been reported so far. Hence it was thought to undertake such study. Therefore, it was thought worthwhile to synthesize novel quinazoline ligand (HQMAPQ) and its metal (II) complexes are characterized.\(^{[72]}\)

Gabriel Fenteany* et.al. explains that the complexes of metals and organic ligands are becoming recognized as useful probes for biological research and as potential therapeutic agents. Certain metal–ligand complexes can form structures that resemble traditional drug-like organic molecules. In these complexes, the metal serves to coordinate the organic ligand, thus potentially generating an organic pharmacophore whose structure is determined by the structure imposed upon the ligand through chelation of the metal. A number of biologically active metal–ligand complexes of this kind have been identified. Cell migration is a basic biological process involved in a range of normal and pathological events, including wound healing, embryonic and tissue development, immune function and inflammation, angiogenesis and tumor metastasis. We screened the National Cancer Institute (NCI) Diversity Set collection of compounds in a cell migration assay based on the closure of scratch wounds by Madin–Darby canine kidney (MDCK) epithelial cell sheets in culture, a system we have previously used to identify new agents with antimigratory activity. Here we report that a Cu (II) complex of the Schiff base product of condensation of S-benzyl dithiocarbazate and 2-acetylpyridine is a potent inhibitor of cell motility with an IC50 of 93 nM. This compound has also been reported to weakly inhibit the dual specificity phosphatase Cdc. Other complexes of the same ligand have antifungal and antiamoebic activities.\(^{[73]}\)

Rudolf Pietschnig*, et.al. shows that the alkynylchalcogenolates (I) can be described as chalcenogeno ketene anions (II) and are capable of showing unique ambident reactivity. This ambident behavior has been mainly explored towards organic or main group based electrophiles in the case of alkynylthiolates, mostly aiming at thietoketenes. In contrast, much less information is available about the reactivity and coordination chemistry of alkynylthiolates towards transition metals, which started to develop only recently. Even less information is available for their selenium analogues, i.e. the alkynylselenolates, despite the favorable nmr properties of the 77Se nucleus. The first examples exploring the coordination behavior of these unusual ligands have been described by Tatsumi and coworkers. Recently we reported some alkynylselenolates carrying substituents with different electronic and
The growing interest into the chemistry and coordination behavior of alkynylselenolates stems from their structural flexibility, unique electronic situation and the antioxidative activity of biomimetic models based on structurally related organoselenium compounds. \(^{[74]}\)

D. G. Brewerp et.al. shows that the previous papers, the substituent effects upon the metal-nitrogen (ligand) and metal chlorine stretching frequencies in the far infrared region, as well as the coordination bond strength of a series of complexes of the form \([\text{ML}, \text{Cl}],\) where \(L\) is 4-methylpyridine, 4-carboxylpyridine, pyridine, 4-acetylpyridine, 4-pyridinecarboxamide, 4-carbomethoxypyridine, or 4-cyanopyridine, were studied. A new parameter, \(R,\) was introduced to measure the substituent effect upon the relative magnitude of \(n\)-bonding in this same series of complexes. In the present paper, a similar investigation has been carried out on the metal complexes of 4-methylpyridine with some divalent ions \(\text{Mn} \ (\text{II}), \ \text{Co} \ (\text{II}), \ \text{Ni} \ (\text{II}), \ \text{Cu} \ (\text{II}), \ \text{and} \ \text{Zn} \ (\text{II}).\) The coordination bond strength of these complexes has been compared by means of their metal-ligand stretching frequencies, and the stretching force constants obtained by a normal coordinate calculation. In order to compare the relative \(n\)-contribution of the divalent metal ions to the coordination bond in their 4-methylpyridine complexes, the \(R,\) values of these complexes have also been determined. It was indicated in the previous paper that this \(R,\) parameter could only be used to compare the effects of different metal ions on the relative \(n\)-contribution to the coordination bond of the substituted pyridine complexes when the substituent is an electron-releasing group, although it was derived in order to measure any substituent effect on the \(n\)-contribution. This previous study showed that for an electron- \(^{[75]}\) Present address: Division of Applied Chemistry, National Research Council of Canada, and Ottawa, Canada. Ions gave almost the same value for \(R,\) in their complexes with this particular ligand, due to the delocalized nature of the \(n\)-system in these complexes under the influence of such a substituent. Therefore it seems unlikely that the \(n\)-bonding capability of metal ions in coordination with pyridines having electron-attracting substituents can be estimated from these \(R,\) values. Since the methyl group is an electron-releasing group, 4-methylpyridine has been chosen as a starting point for this study.

Nizam M. El-Ashgar* et.al. explains that the recently, inorganic supports of silica based matrix bearing reactive organic sites have been the subject of
considerable interest. These types are known as functionalized polysiloxanes which have been prepared either by the low temperature sol-gel process or by modification of pre-prepared polysiloxane. The sol-gel process involves hydrolysis and polycondensation of Si (OEt) and the appropriate silane coupling agent (RO): SiX$_3$ where X represents a ligand containing functional group. Modification methods were used to introduce the organic ligand containing functional groups when appropriate chelating silane agents are difficult to prepare. These immobilized ligand systems have advantages, over organic polymers such as their high thermal, hydrolytic and mechanical stability in addition to lack of swelling in solvents. These properties make important applications like; extraction, recovery and separation of metal cations from organic solvents and aqueous solutions. They were also used as stationary phases in chromatography and as supported ligands for catalysis. Many spectroscopic techniques such as solid state nuclear magnetic resonance (NMR), thermal analysis and photoelectron spectroscopy (XPS) have been employed to study the ligand-modified polysiloxane systems. In this work a new immobilized polysiloxane ligand system with a di-nitrogen chelating ligand was prepared and characterized. The immobilized ligand system was used for extraction of the metal ions (Co$^{2+}$, Cu$^{2+}$, Zn$^{2+}$ and Pb$^{2+}$) from aqueous solutions, and results show much promise for extraction, separation and preconcentration of metal ions.$^{[76]}$

Z. H. Abdel-wahab* et al. shows that the antipyrine derivatives are reported to exhibit analgesic and anti-inflammatory effects, antiviral, antibacterial activities and have also been used as hair colour additives and to potentiate the localaesthetic effect of lidocaine. These compounds have been widely used in spectrophotometric determination of metal ions. Many of these reagents give intense colours with transition metal ions, providing sensitive probes and some of them can also coordinate to rare earth ions to form metal complexes with interesting structures. Antipyrine Schiff base derivatives can serve as antiparasitic agents and their complexes with platinum (II) and cobalt (II) ions have been shown to act as antitumour substances. The condensation between 4-aminoantipyrine and salicylaldehyde yields 2,3-dimethyl-1-phenyl-4-salicylidene-3-pyrazolin-5-one (HL) which reacts alone or mixed with 2-aminopyridine (2-Ampy), 8-hydroxyquinoline (8-OHqu), and oxalic acid (Ox) with the metal ions Co$^{2+}$, Ce$^{3+}$, and UO$_6^{2+}$ to give different structures of complexes. The binary complexes were tested for antifungal and antibacterial activities.$^{[77]}$
L. V. Gavali* et.al. explains that the transition metal complexes with Schiff bases as ligands have been amongst the widely studied coordination compounds in the past few years, since they are found to be important as biochemical, analytical and antimicrobial reagents. The complexes of azo compounds also exhibit bacteriostatic and other biochemical activities. Heterocyclic azo Schiff base and their complexes with transition metal ions are also of importance due to their complexing, catalytic biological properties. Heterocyclic ring containing sulphur, nitrogen and oxygen impart special biological activity to these Schiff bases and their metal complexes. In view of the interesting ligation behavior of such system, we considered it worthwhile to prepare Co (II), Ni (II), Cu (II), Zn (II) and Cd (II) complexes of tridentate ligand derived from 5-(2'-thiazolylazo) salicylaldehyde and p-chloroaniline. The complexes have been characterized by various physicochemical methods.

Abdul hakim. A. Ahmed et.al. shows that in the recent years, metal complexes with salen ligands derived from the condensation of salicylaldehyde with a diamine have been widely studied. Dinucleating metal complexes have been a fascinating area of research, in view of their significance as biomimetic catalysts in the process of oxygenation (Konsler, Karl, & Jacobsen 1988; Wei, & Atwood 1997; Kolb, Vannieuwenhze, & Sharpless 1994). Discoveries of dinuclear cores at the active sites of some metalloproteins have aroused interest in the investigation of multimetallic systems (Than, Feldmann, & Krebs 1999) Schiff bases have been widely used as ligands because of high stability of the coordination compounds and their good solubility in common solvents. The system in a Schiff base often imposes a geometrical constriction and affects the electronic structure as well. Thermochemical properties of Schiff bases have attracted much researcher attention in view of their ability to coordinate metal ions, acting as bidentate or tetrade dentate ligands in metal chelates involving a NO or N₂O₂-Schiff-base donor atom sets. These Schiff base metal derivatives have considerable interest due to their role as model complexes to biological systems, contributing to the knowledge of their structure and behavior (Costamagna, Vargas, Latorre, Alvarado, & Mena 1992; Marchetti, Pettinari, Pettinari, Cingolani, Leonesi, & Lorenzotti, 1999). Catalytic studies reveal that the metal complexes of N₂O₂-Schiff-base donor types of chiral metal complexes are active catalysts for stereoselective organic transformations including hydroxylation of styrene, aldol reactions, alkene epoxidation,
trimethylsilylcyanation of aldehydes, and desymmetrization of meso-N-sulfonylaziridine (Che, & Huang 2003). We have previously reported results for the structural study of some Schiff bases derived from β-diketones and diamines and their complexes (Ahmed, BenGuzzi, & El-Hadi 2007). We are now involved in the synthesis and structural investigation of another set of related tetradeutate Schiff base ligand, obtained as condensation products of benzidine with acetylacetone, and its complexes with Cr (III), Fe (III), Co (II), Ni (II), Cu (II) ions.\[79\]

N. Turan et al. shows that the diamines have been widely used as ligands in asymmetric synthesis. Also, several biologically active entities are known to contain diamine moieties. The diamine derivatives are reported to have analgesics activity. Further, they are used in the determination of mercury in natural waters, production of colored thermoplastic resins and cross-linked epoxy resins, determination of selenium by instrumental methods, prevention of corrosion, pressure-sensitive color imagin technologies, powdered hair dyes, cation-exchange copolymerizations and some antiallergenes of medical use. Complexes formed by the reactions of diamines with transition metals have a wide range of applications. It is important to use amines containing at least two nitrogens since they produce quite stable complexes with transition metals. Amines and their derivatives (monodental, bidental, etc.) have been known to produce stable complexes with transition metals. A lot of amine complex compounds have been synthesized and their properties (carcinogenic, optical and biological activities) established.\[80\]

Mohamed Mohamed Omar et al. shows that the large number of Schiff bases and their complexes have been studied for their interesting and important properties, e.g., their ability to reversibly bind oxygen, catalytic activity in hydrogenation of olefins and transfer of an amino group, photochromic properties, and complexing ability towards some toxic metals. The high affinity for the chelation of the Schiff bases towards the transition metal ions is utilized in preparing their solid complexes. Schiff base derived from the reaction of 2, 5-thiophenedicarboxaldehyde and o-amino-benzenethiol gives 2, 5-bis (benzothiazolidin-2-yl) thiophene (I). Schiff base reacted as a neutral ligand with Pb (II) and a dianion with Cu (II), Ag (I), Cd (II), Pb (II), and Zn (II). The behavior of (I) with Hg (II), Ru (II), Pt (II), Rh (III), and Ni (II) involved the opening of the thiazoline rings of the ligand. The condensation of o-aminothiophenol with 2-thiophenecarboxaldehyde yields 2-thiazolin-2-ylthiophene, rather than the expected Schiff base. However, upon reaction with metal ions, the
thiazoline rearranged to the expected thiolate Schiff base. Complexes of Schiff base with Ni (II), Cu (II), Zn (II), Cd (II), Pb (II), Ag (I), and Pd (II) were isolated and characterized. MLL$^1$ (M = Cu(II), Ni(II); HL = salicylideneamine; HL$_1^1$ = 1-(2-hydroxyphenyl)ethyliden-amine), ML$_1$L$_2$(HL$_2$) = 2-hydroxy-1-naphthylmethyleneamine), and MLL$_2$ reacted with 2-amino-benzenethiol to give Cu$_2$L$_3$ (H$_2$L$_3$ = N-(2-mercaptophenyl) salicylaldimine (SMAH), N-(2-mercaptophenyl)-2-hydroxy-1-naphthylmethyleneamine (NMAH), NiL$_3$(AMA) (AMA = N-(2-mercaptophenyl)-1-(2-hydroxyphenyl)ethylidenamine) and Ni(SMA)(NMA). The complexes were characterized by IR, reflectance spectra, and TGA. Schiff base derived from the reaction of the aldehydes, 3-hydroxybenzaldehyde and 5-nitrosalicylaldehyde, with the amines, aniline and o-aminothiophenol, and their complexes with VO (II), Co (II), and Ni (II), were prepared and characterized by elemental analyses, magnetic measurement, and electronic absorption data. Complexes of Ni(II), Co(II), Cu(II), Zn(II), Pd(II), and Pb(II) with Schiff base derived from isatin with 2-aminothiophenol (HIATP) were synthesized and characterized by elemental analyses, molar conductance, magnetic moments, $^1$H NMR, IR, and electronic spectra studies. Spectroscopic investigation of some thio-Schiff bases of 2-aminothiophenol with benzaldehyde derivatives has been described. Chemical shifts of the different types of protons in the NMR spectra of the prepared Schiff bases were also reported. Schiff bases derived from 5-nitrosalicylaldehyde and the amines, o- and p-aminophenols, o-aminothiophenol, and sulfanilic acid were prepared and their complexes were characterized by IR, electronic absorption, ESR spectra, and magnetic and conductance measurements. The complexes were tested for antibacterial activity against common pathogenic organisms and showed mild to moderate activity. Schiff bases derived from ethylene-2,2'-dioxydibenzenaldehyde and 2-aminothiophenol and its complexes with Ni(II), Cu(II), and Cd(II) were synthesized and characterized by elemental analyses, IR, UV/VIS spectra, and conductance measurements. Synthesis, spectroscopic characterization, redox, and biological screening studies.

Hamdi Temel, et al. shows that in the recent years, the complexes of oxovanadium (IV) have received considerable attention. Oxovanadium (IV) chelates containing tetra dentate Schiff base ligands derived from 1, 2-diamines have been the subject of several recent reports. These square-pyramidal complexes exhibit a strong tendency to remain five-coordinate in both donor and non-donor solvents. In
this paper, we report the synthesis of a new oxovanadium complex of a Schiff base derived from the condensation of 1, 2-bis (p-aminophenoxy) ethane with salicylaldehyde (Fig. 1). The resulting complex was studied by elemental analyses, magnetic measurements, and UV-VIS and IR spectra. Furthermore, we report the stability constants and thermodynamic values for the complexation of Cu (II), Zn (II), and VO (IV) in 80% dioxane–water and pure methanol as solvent with this ligand containing nitrogen and oxygen donor atoms. \[82\]

Pier Giorgio Cozzi* et.al. explains that the Hugo Schiff described the condensation between an aldehyde and an amine leading to a Schiff base in 1864. Schiff base ligands are able to coordinate metals through imine nitrogen and another group, usually linked to the aldehyde. Modern chemists still prepare Schiff bases, and nowadays active and well-designed Schiff base ligands are considered ‘privileged ligands’. In fact, Schiff bases are able to stabilize many different metals in various oxidation states, controlling the performance of metals in a large variety of useful catalytic transformations. In this article we show that Schiff bases are also able to transmit chiral information to produce nonracemic products through a catalytic process; chiral aldehydes or chiral amines can be used. From a practical point of view, the aspects involved in the preparation of Schiff base metal complexes are spread out in the literature. We wish to summarize and introduce some practical guidelines for the preparation and use of Schiff base metal complexes in catalysis. The present review will focus on the different ways of preparing metal complexes and their use in catalytic processes. Generally, active catalytic Schiff base metal complexes are obtained are not well characterized. However, the appropriate choice of metal precursor and the reaction conditions are crucial for catalytic properties. Finally, a particular class of Schiff bases will also be discussed. When two equivalents of salicylaldehyde are combined with a diamine, a particular chelating Schiff base is produced. The so-called Salen ligands, with four coordinating sites and two axial sites open to ancillary ligands, are very much like porphyrins, but more easily prepared. Although the term Salen was used originally only to describe the tetradeutate Schiff bases derived from ethylenediamine. \[83\]

Giray Topal et.al. shows that in the ion-pair extractive separation of metal cations using a neutral chelation reagent and a counter anion, selection of the chelation reagent is one of most important factors to realize preferable separation. Especially, investigation of effect of steric structure around electron donor atoms in
the reagent on the separation ability is very important for the development of novel reagents having high separation performance. Schiff bases derived from the reaction of salicylaldehyde with primary amines (salen type Schiff base) represent a versatile series of ligand. In attention to importance of these compounds many literatures have been published in this field. Symmetric and asymmetric transition metal complexes of these bases have been developed and used as ligands/catalysts in many reactions such as epoxidation, asymmetric synthesis, asymmetric sulfoxidation, asymmetric silylcyanation and many other applications. Schiff bases and the relevant transition metal complexes are still found to be of great interest in inorganic chemistry, although this subject has been studies extensively. Schiff bases play a central role as chelating ligands in main group and transition metal coordination chemistry. The determination of ion-pair formation constants of organic ligands-metal ion complexes in water can be examined with different methods by following the extraction of metals to the varied organic solvents with organic ligands. The solvent extraction of metal cations which contains dye ligands is preferred to use for its easy determination by spectrophotometric methods. This paper describes extractive-spectrophotometric determination of sodium and potassium ions as ion-pairs and describes extractive-spectroscopic determination of Ca$^{2+}$, Mg$^{2+}$, Cr$^{2+}$, Fe$^{2+}$, Zn$^{2+}$, Cd$^{2+}$, Ni$^{2+}$, Mn$^{2+}$, Co$^{2+}$ ions using some chiral Schiff bases as complexing agents.\[84\]

Suning Wang* et.al. shows that we have been interested in the coordination chemistry of bifunctional ligands with metal ions involved in ceramic superconductors such as copper, lanthanides, and bismuth. The bifunctional ligands employed by our group typically contain a neutral nitrogen coordination site and a negatively charged oxygen coordination site such as the 1, 3-bis (dimethylamino) - 2-propanolato ligand (bdmap) and deprotonated hydroxypyridines. We have demonstrated earlier that these bifunctional ligands are capable of bringing two different metal centers such as lanthanide (III) and copper (II) ions together. We also demonstrated that polynuclear copper (II) complexes formed by these ligands display versatile structural features and interesting magnetic properties. The lack of fully characterized Cu-Bi complexes with these ligands prompted us to explore the coordination chemistry of other bifunctional ligands such as the di-2-pyridylmethanediol ligand (dpmdH$_2$). In comparison with the bdmapH ligand, the dpmdH$_2$ ligand is more rigid with an extra coordinating site, the OH group. We have
observed that the dpmdH\textsubscript{2} ligand forms complexes readily with copper (II) and bismuth (III) ions through several different bonding modes. More importantly, the singly deprotonated ligand dpmdH\textsuperscript{-} has been found to promote ferromagnetic couplings between copper (II) centers, thus, opening a new avenue for the synthesis of molecular magnets. Several examples of coordination compounds involving simple diolato ligands were reported previously. The coordination chemistry of diolato ligands containing additional coordinating atoms such as the dpmdH\textsubscript{2} ligand has, however, hardly been explored until recently. We therefore report herein the syntheses and crystal structures of a dinuclear bismuth(III) complex, a mononuclear copper(II) complex, and a tetranuclear copper(II) complex containing the dpmdH\textsuperscript{-} ligand, and the utility of the dpmdH\textsuperscript{-} ligand in promoting the ferromagnetism and the three dimensional extended structure of the tetranuclear copper (II) complex.\textsuperscript{[85]}

A. A. Ahmed et.al. shows that the complexes of transition metals have been used in solution as biomimetic catalysts for oxygen atom transfer, and as catalysts for enantioselective epoxidation, aziridinations, mediating organic redox reactions and other oxidative processes. Vanadium is a physiologically important trace element that is found in both anionic and cationic forms with oxidation states ranging from \(-1\) to \(+5\). Vanadyl (IV) complexes are very interesting as model compounds for the clarification of several biochemical processes. The physico-chemical properties of vanadyl (IV) complexes have been used to treat both insulin-dependent type-1 and non-insulin-dependent type, the vanadyl (IV) complexes proposed on the basis of the results of diabetic model animals by using a concept of equivalent transformation, which proven to be effective in changing the chemical property of a complex. The Vanadyl and the micro mineral derived from Vanadium, has been shown effective in helping to increase Insulin sensitivity. The main advantages of increased Insulin sensitivity are that it could promote less fat storage as well as that it may act as an Amino Acid magnet to cells. Several pharmaceutical agents have been used in diabetes treatment but many problems occurred such as side effect, hypoglycemia and weight gain, therefore new drug are needed, the vanadyl complexes have been proposed to function as potent insulin-mimetic and antidiabetic agents.\textsuperscript{[86]}

Yüksel Altun\textsuperscript{,a} et.al. shows that the ligands used in this work have three different and important functionalities: Schiff base character, thiazole and cyclobutane. It has been shown that Schiff base complexes derived from 4-
hydroxysalicylaldehyde and amines have strong anticancer activity, e.g. in Ehrlich ascites carcinoma (EAC). The chemistry of thiazoles and their derivatives has attracted the attention of chemists, since they are of importance in biological systems as anti-inflammatory or analgesic agents and as inhibitors of lipoxygenase activities. Furthermore, thiazole is found in vitamin B1 and in the coenzyme A carboxylase coenzyme. The penicillin molecule also contains a thiazolidine ring. It is also well known that 3-substituted cyclobutane carboxylic acid derivatives exhibit anti-inflammatory and antidepressant activities, as well as liquid crystal properties. The extensive synthetic possibilities of these Schiff bases, due to the presence of several reaction sites, hold promise for the preparation of new thiazole derivatives and determination of their acidity (or basicity) and the stability of their metal complexes. In the field of industrial pharmacy, perhaps the most important physicochemical characteristics of substances containing important functional groups. [87]

Mahendra Devidas Shelar* et.al. explains that according to previous literature survey there is large number of research papers appeared in last few decades regarding complexes of transition and non transition metals, amino heterocycles containing two or more potential donor centers play an important role in the study of competitive reactivity of ambidentate ligands system. Transition metal complexes containing pyrimidine ligands are commonly found in biological media and play important roles in processes such as catalysis of drug interaction with biomolecules. N-Amino pyridine Schiff base chemistry is less extensive and our laboratory has been exploring this chemistry. Schiff base complexes derived from 4-hydroxy salicylaldehyde have strong anticancer activity e.g., against Ehrlich as cites carcinoma (EAC). The Schiff bases derived from 3-amino-5 methyl isoxazole and methoxy salicylaldehyde and naphthaldehyde were reported earlier and it was found that antimicrobial activity of metal complexes show increased activity compared to corresponding Schiff bases. Highly potential synthesis and characterization of new Schiff’s bases derived from different Diamine and aromatic aldehyde compounds by using dichloromethane as a solvent at reflux condition. Catalytic study of P₂O₅/SiO₂ with Schiff base compounds. Co, Ni and Cu complexes have been prepared by reacting metalchloride with 4-chlorobenzaldehyde oxime, 4-methylbenzaldehyde oxime, 4-nitrobenzaldehyde oxime, 4- chlorobenzaldehyde semicarbazone, 4-methylbenzaldehyde semicarbazone, 4-nitrobenzaldehyde semicarbazone, 4-chlorobenzaldehyde phenylhydrazone, 4-methylbenzaldehyde
phenyl hydrazone and 4-nitrobenzaldehyde phenylhydrazone and their antibacterial activity have been studied and compared with their ligands against *E. coli* which gave significant results of activity. Synthesis of various oximes, semicarbazones, phenyl hydrazones and their complexes with different transition metals are reported in the literature and found to be active as antibacterial, antitubercular activity.\[88\]

Shelar Mahendra Devidas* et.al. shows that the Schiff's base compounds and their complexes have significant importance in chemistry. Every year number of reports is published on preparation of these compounds and their application in chemical reactions. Such type of ligands represents vast utilized classes of new series of compounds in metal coordination chemistry. The Schiff's base compounds and their complexes are widely applied in enantioselective cyclopropanation of styrene.s. Asymmetric addition of cyanide to aldehydes. Schiff base compounds containing imines group (-RC=N-) are usually formed by the condensation of primary amine and diamine with an active carbonyl compound in a methanol solvent. Some synthesis methods have not been entirely satisfactory owing to a number of drawbacks such as low yields and tedious workup procedures. According to the tremendous scope of Schiff bases possesses an inherent imidazopyridine, with a high class of compounds of medicinal importance and oblige. Over the past few decades, significant research has been directed towards the development of new technologies for environmentally benign processes (green chemistry). The dipyridyl can attach two molecules of an alkyl-halide thus forming a bi-quaternary base. The method of preparation consisted in preparing first a quaternary base of pyridine and condensing two molecules of it to a dipyridyl compound by treatment with sodium amalgam and successive oxidation. The deep Studies on a new kind of chemotherapeutic Schiff bases are now attracting the attention of biochemists\[89\].

Birinchi Kumar Das* et.al. explains that the transition metal coordination compounds have numerous applications among which an important one is in the catalysis of various reactions. Catalytic use of these compounds is particularly pre-eminent in reactions involving the oxidation of organic compounds via C–H activation. Along with other important metals such as copper, iron, vanadium, osmium, etc., cobalt is active as a catalyst in the oxidation of substrates including alkylaromatics, alkenes and alcohols. Several industrial reactions make use of cobalt-based catalysts. Use of cobalt (II) salts and complexes is common in the published literature. The resultant processes utilize the +3 oxidation state of the
metal in completing the catalytic cycle, but instances of either cobalt (III) salts or complexes being used in organic oxidation are rather rare. Ratnasamy et al. have reported the selective oxidation of $p$-xylene to terephthalic acid by trinuclear oxo-bridged cluster complexes of cobalt (II/III) and manganese (II/III) including mixed-Co/Mn species in presence of dioxygen. Oxo-bridged cluster complexes +For correspondence of transition metals have also been the subject of studies because these complexes may help in understanding the redox and ligand substitution reactions in metal catalysed autoxidation processes. Clearly, metal cluster complexes of cobalt are of particular interest because of their catalytic activity towards autoxidation of various aromatic hydrocarbons. Trinuclear cobalt clusters, [(py)$_3$Co$_3$O$_{15}$OAc$_5$OR][PF$_6$] have been used as catalyst precursors for the autoxidation of toluene in acetic acid containing LiBr with O$_2$ as the oxidant to produce benzoic acid. Since cobalt-oxo clusters of different nuclearities may form under a given oxidative synthetic condition, it appeared important for us to identify the complex species that may play an active role in oxidation catalysis. Presence of the oxide ion as a ligand in these systems favours the formation of cobalt (III) complexes, but existence of the metal in the +4 oxidation state also cannot be ruled out. Presence of nitrogen bases as probable ligands in the oxidizing preparative condition favours the formation of cobalt (III) complexes of reversible redox stability. Oxo-bridged transition metal complexes with ancillary N-and O-donor ligands are of considerable interest to synthetic inorganic chemists because of their interesting structure. [90]

Christoph Janiak" et al. shows that the poly (pyrazolyl) borato anions are versatile chelating ligands in the coordination chemistry of transition-metal and main-group elements."They are especially popular as auxiliary ligands in bioinorganic model complexes. The appropriate substitution of the pyrazolyl hydrogen atoms by alkyl or aryl groups to give sterically demanding or so-called "second generation Trofimenko ligands" proved to be crucial in the exploitation of this ligand class for unique chemical transformations and stabilizations and contributed to a resurgence of interest in poly (pyrazolyl) borate chemistry.” In contrast to steric effects from (C-) H + (C-) R substitution, the control and the adjustment of electronic effects in poly (pyrazolyl) borato ligands has hardly been used. [91]

Trimbak K. Chondhekar" et al. shows that the Schiff bases are most widely used as chelating ligands in coordination chemistry. They are also useful in
catalysis and in medicine as antibiotics, antiallergic and antitumor agents. The metal complexes of Schiff bases derived from heterocyclic compounds have been the centre of attraction for many workers in recent years. Tetradeutate Schiff bases are well known for their coordination with various metal ions, forming stable compounds. Many symmetrical bis’ tetradeutate Schiff bases of 1, 2-diamines with o-hydroxyaldehydes/ketones have been prepared and studied intensively. However, much less attention has been focused on unsymmetrical tetradeutate Schiff bases derived from 1, 2-diamines and different aldehydes/ketones. In particular those derived from aromatic 1, 2-diamines have been under-investigated. It is worthwhile to mention that asymmetrical Schiff bases of this type are difficult to obtain and not easy to isolate. One of the oxygen heterocyclic compounds 3-acetyl-6-methyl-2H-pyran-2, 4(3H)-Dione (dehydroacetic acid or DHA) was reported to be an excellent chelating agent and to possess promising fungicidal, bactericidal, herbicidal and insecticidal activities. It is also a versatile starting material for the synthesis of a wide variety of heterocyclic ring systems. A search of the literature revealed that no work has been done on transition metal complexes of the asymmetrical Schiff bases derived from aromatic 1, 2-diamine, dehydroacetic acid and salicylic aldehyde. The synthesis of an asymmetrical tetradentate Schiff base formed by the condensation of 4-methyl-o-phenylenediamine, dehydroacetic acid and salicylic aldehyde is reported. The complexes of Cu (II), Ni (II), Co (II), Mn (II) and Fe (III) with this ligand were also prepared in the solid state and characterized by different physico-chemical methods. [92]

Shiuh-Tzung Liu* et.al. explains that the construction of carbon-carbon or carbon-heteroatom bonds involving copper complexes as catalysts is an important research area in organic synthesis. Thus study of coordination of copper ions toward various ligands has received much attention. In this context, there is a considerable interest in the design and synthesis of phosphine-copper complexes owing to their associated catalytic activity in organic transformations. Compared with the extensive information on four-coordinate copper-phosphine complexes, two- or three-coordinate species have been less reported. It is known that both the halides and phosphine ligands influence the coordination sphere of metal centers and the bulky tertiary phosphines generally direct the formation of two- or three-coordinate copper complexes. In our recent work, we have synthesized the bulky phosphine-pyridinyl (P–N) ligand and studied its coordination chemistry toward palladium (II) ions. Here
the preparation of copper (I) complex containing this bulky P–N ligand and its catalytic activity on C–C bond formation will be presented.\textsuperscript{[93]}

Om Prakash\textsuperscript{*} et.al. shows that the fused heterocyclic 1,2,4-triazoles have acquired much importance because of their CNS depressant, antiallergy, antimicrobial and anti-inflammatory properties. Most methods for the preparation of fused 1, 2, 4-triazole derivatives are based on the oxidation of heterocyclic hydrazones or hydrazides with phosphorus oxychloride, lead tetraacetate, bromine, etc., which are associated with toxic properties. Therefore, alternative approach avoiding these reagents is always preferred. Organohypervalent iodine reagents have emerged as reagents of choice for various synthetically useful transformations due to their low toxicity, ready availability and ease of handling. We have recently reported the usefulness of iodobenzene diacetate (IBD) to effect oxidative cyclization of benzalhydrazones to 1, 2, 4-triazoles. Pyrazoles form an integral part of many natural products of therapeutic importance and possess potentially reactive sites for a variety of chemical reactions to generate molecular diversity. (S)-3-Pyrazolylalanine, lonazolac, difenamizole, mepirizole, metamizol and 4,5-dihydro-3-phenyl-6H-pyrrolo[1,2-b] pyrazole are some of the biologically active compounds endowed with antimicrobial, hypoglycaemic and non-nucleoside HIV-1 reverse transcriptase inhibitor properties.\textsuperscript{[94]}

Koichiro Oshima\textsuperscript{‡} et.al. shows that the palladium and nickel catalysts play a key role in modern organic synthesis. Cross-coupling and Mizoroki–Heck reactions are among the most important carbon–carbon bond-formation reactions. Normally, aryl and vinyl halides are the choice of the substrates, since the use of alkyl halides having hydrogen at the β-position to the halide atom suffers from β-hydride elimination unless intensive screening of reaction conditions was performed. During the course of our study on transition-metal-catalyzed reaction, readily available cobalt complexes were found to act as catalysts complementary to palladium and nickel in cross-coupling and Mizoroki–Heck reactions. The cobalt-catalyzed reactions probably proceed via carbon-centered radicals as key intermediates that are generated by single electron transfer from electron-rich cobalt complexes to alkyl halides. The radicals enable fascinating transformations that conventional palladium and nickel cannot catalyze.\textsuperscript{[95]}

Hemant S. Patel\textsuperscript{*} et.al. explains that the great attention has recently been paid to synthesize the high-performance polymers with increased thermal stability
and heat resistance, and good mechanical properties, as these are required in the modern technological applications. Aromatic polyesters and copolyesters are thermally stable polymers with a favorable balance of physical and chemical properties. They form one of the most important classes of the polymers. They can compete with almost all the known conventional materials in their characteristic applications. They are commercially available as high performance engineering plastic materials. However, these polymers generally lack the properties essential for successful fabricating into useful forms. Many researchers have tackled these inherent problems over the last few decades. As an approach to improve the solubility and processibility of heterocyclic polymers, while maintaining the thermal stability, numbers of published reports have described the synthesis and properties of polyesters and their copolyesters containing an s-triazine ring. The polymers containing s-triazine rings in their backbone are unique in the sense that they exhibit an unusual combination of properties such as high softening temperature and thermal stability together with solubility. Many of the problems arising while processing and fabricating homopolymers, for example, decomposition at processing temperature, melt stiffness etc., can be reduced or almost solved by using copolyesters of the mixture of diols and diacid chlorides. The present work describes synthesis and characterization of some aromatic Co-polyester by condensation of EAPCCT with various mixtures of aromatic diols.\[96\]

Peter J. Steel* et.al. explains that the chiral heterocyclic ligands have found many applications in chemistry, most notably in the area of asymmetric catalysis. Such compounds are usually synthesised from readily available, naturally occurring compounds from the chiral pool. Monoterpenes serve as a useful source of inexpensive synthons for such studies. For example, von Zelewsky and co-workers have prepared a vast library of chelating and bridging heterocyclic ligands which contain a fused pinane subunit within their structures. Similarly, we have synthesised many chiral ligands, using camphor as a source of the chirality. Accordingly, by fusing a pyrazole ring to the bornane skeleton we have prepared many bidentate and tridentate chelating ligands, as well as a number of bridging ligands containing this subunit. More recently, we have turned our attention to fusing the bornane skeleton to azine rings and have reported the synthesis of the first chiral 2, 2'-bipyrimidine. We have also fused bornane units to a pyrazine ring and have described the preparation of some chiral coordination polymers, using the C₂-
symmetric ligand as a bridging ligand. In contrast, the C1-symmetric ligand proved less useful for the construction of chiral coordination polymers, because of the difficulty for this ligand to faithfully assemble in a single orientation, due to the similar, but subtly different, nature of the two nitrogen donors. However, this ligand can successfully be used as a monodentate ligand for the construction of discrete, rather than polymeric, coordination compounds. In this context, we have studied the coordination chemistry of and the related quinoxaline with various transition metals and now report the synthesis and X-ray crystal structures of copper and zinc mononuclear complexes and a tetranuclear copper complex in which ligand acts as a monodentate donor. We believe that ligands such as these offer considerable potential as auxiliaries in the topical context of asymmetric synthesis.

Alexander D. Garnovskii* et.al. shows that the formulation of the basic principles of phase transfer catalysis advanced by Mieczyslaw Makosza dates back to the middle of sixties, and the method continues to be one of the powerful tools of the synthetic organic chemistry. In recent years phase transfer catalysis has assumed a new importance in organometallic and coordination metal chemistry, in particular as a useful approach to the preparation of ligands. While being employed mostly in the reactions of nucleophiles, the method may be applied also to the transformations occurring with the participance of electrophilic reactants in two- and triphase catalytic systems. An amply studied example of such type transformation is azo coupling reactions affording diverse less accessible aromatic and heterocyclic azo compounds in high (80-85%) yields. Many of these compounds serve as useful ligands in the synthesis of metal coordination compounds. This paper presents a concise review of the structural and preparative aspects of metal coordination compounds with azo-group containing aromatic and heterocyclic ligands.

James P. Stambuli* et.al. shows that over the last thirty years, significant strides have been made in organometallic processes that form carbon-sulfur bonds. Substantial growth in the transition metal-catalyzed formation of carbonheteroatom bonds has been observed, however, the development of effective C-S bond formation reactions is underdeveloped with respect to the corresponding C-N and C-O coupling reactions. The necessity for the advancement of carbon-sulfur bond forming reactions is warranted by the prevalence of biarylsulfides in natural and unnatural products that exhibit activities against cancer, HIV, Alzheimer’s disease, inflammation, and asthma. Represents some biologically active sulfide-containing
compounds. Methods to synthesize aryl sulfides without the use of transition metals are generally inefficient, require impractical reaction conditions, and have limited functional group tolerance. Some of these methods include nucleophilic attack on disulfides, aromatic substitution reactions, and metal-mediated disulfide reductions. The development of practical and efficient methods to create aryl sulfides has been realized through transition metal catalysis. Transition metal-thiolate interactions are strong and numerous stable complexes have been reported in the literature. This strong coordinating ability often leads to the belief that sulfur will hinder transition metal catalytic activity. Despite this notion, thioethers can be excellent ligands for metal-catalyzed processes and metal-thiolate complexes can undergo facile reductive elimination to form C-S bonds. Reviews discussing metal-catalyzed carbon-heteroatom bond forming reactions have been reported, including a recent excellent review on organometallic approaches to C-S bond formation. This review is meant to serve as an account to discuss the proposed mechanistic aspects that allow aryl sulfide formation through transition metal catalysis. The significant advances in the field will be described and when possible, mechanistic rationale will be discussed for each C-S bond forming process presented. 

Sarika Verma* et.al. suggested that the metal ions affect the well being of human in various ways. Several of these elements are in dispensable for life and nature governs their uptake metabolism and excreting consequently their concentrations in a human body are compartmentalized and well defined. The inner transition metal ions are known to have the small radii and variable coordination number ranging from 3 to 12, which make them excellent spacers in assembling fascinating metal organic frameworks. Inner transition metal complexes are of continuing interest mainly due to their structural and catalytic properties and their application in diagnostic pharmaceutical and laser technology. They have been found to exhibit anticancer and fungicidal properties also. Investigations are going on the formation of metal complexes with benzimidazole ring containing ligands because benzimidazole and its derivatives play an important role in analysis and in several biological reactions. Considering the importance of drugs and their complexes it has been desired to synthesize and characterize some ternary complexes of Inner transition metals [Th (II), Ce (II), Gd (II), Nd (II)] with a benzimidazole derivative, omeprazole and cytosine. Omeprazole is used for the treatment in acid induced inflammation conditions and ulcers of the stomach and
duodenum, gastro esophageal reflux disease which are all caused by stomach acid. By blocking the enzyme, the production of acid is decreased and this allows the stomach and esophagus to heal. Its chemical name is \((5\text{-methoxy-2-\{}{(4\text{-methoxy-3, 5-dimethy-1-pyridiny}) methyl}\text{ sulfinyl}\}\text{-IH-benzimidazole})\). As the interaction of metal ions with nucleobases is of great interest because of their relevance to the essential, medical or toxic bioactivity of metal, where nucleobase molecule can coordinate as exogenous ligands in metalloproteins, function as cofactors in the enzymatic systems. Thus, cytosine is selected as the secondary ligand for the formation of ternary complexes. Its chemical name is \(4\text{-amino-1H-pyrimidine-2 one}\). [100]

Rajeev Johari et al. explains that the macrocyclic and compounds have attracted increasing interest owing to their role in the understanding of molecular processes occurring in biochemistry, material science, catalysis. It is well known that N and S atoms play a key role in the coordination of metal at the active sides of numerous metallobiomolecules. Metall-organic chemistry is becoming an emerging area of research due to the demand of new metalbased antibacterial and antifungal compounds. The aliphatic or aromatic amines can form strong five of six membered chelates rings which are able to produce the metal containing crosslinking agents with required properties. There are a number of important molecules shows biological activities including antibacterial, antifungal, antidiabetic, antitumor, antiproliferative, anticancer, herbicidal, anticorrosion and anti-inflammatory activities. Schiff bases represent an important class of compounds because they are utilized as starting materials in the synthesis of industrial products. Moreover, Schiff bases are regarded as privileged ligands. Due to their capability to form complexes with different transition metals can act as catalysts for many different reactions. The discovery and development of effective antibacterial and antifungal drugs with novel mechanism of action have because an urgent Rajeev Johari task for infectious diseases research program. Many investigations have proved that binding of a drug to a metalloelements enhances its activity and in some cases, the complex possesses even more healing properties that the parent drug. In the present article, we report the synthesis and characterization of Schiff base derived from acetylacetone and thio-carbohydrazide, and its metal complexes to gain more information about related structural and spectral properties as well as their antimicrobial activities. [101]
H. N. Aliyu* et.al. explains that the Schiff’s base is a compound formed from the condensation of either an aldehyde or a ketone (Holm *et al.*, 1966; Hobday and Smith, 1972; Pierre, 1987). The carbonyl group of the aldehyde gives aldmines while that of ketone gives ketoimines. It has been known that different metal ions on interaction with Schiff bases yield chelates, for example; Tsumaki, (1983) reported [Co (sal$_2$-en) Complex which received a great attention owing to its ability to undergo reversible adduct formation with molecular oxygen. The oxygenation ability of the complex was first recognized by Hassan *et al.*, (1998), however, the mechanism for the oxygenation process was not well understood until recently with the advent of modern physical techniques reported the synthesis and characterization of a novel Schiff base ligand formed from the condensation of 2, 2-bis (P-methoxyphenylamine) and Salicylaldehyde and its Mn (II), Co (II) and Cu (II) complexes. The Ben Saber *et al.*, (2005) reported the synthesis and characterization of Cr (III), Fe (III), Co (II) and Ni (II) complexes with a Schiff base derived from 4-dimethylamino benzaldehyde and primary amines.  

K. N. Shivananda,* et.al. shows that the Hydrazones are a special group of compounds in the Schiff base family. They are characterized by the presence of >C=N-N=C<. The presence of two inter linked nitrogen atoms separates this from imines, oximes, etc. Compound to simple hydrazone Schiff bases, acyl, aroyl and heteroacroyl Schiff bases have an additional donor sites >C=O. The additional donor sites make them more flexible and versatile. It is this versatility that has made hydrazones good polydentate chelating agents that can form a variety of complexes with various transition and inner transition metals and has attracted the attention of many researchers. Hydrazones are used as plasticizers and stabilizers for polymers, polymerization initiators, antioxidants, etc., they act as intermediates in preparative chemistry. In analytical chemistry, hydrazones find application in detection, determination and isolation of compounds containing the carbonyl group. More recently, they have been extensively used in detection and determination of several metals. They also find applications as indicators and spot test reagents. One of the major synthetic efforts in the field of epoxy resin to improve to words the heat, chemical and moisture resistant of epoxy polymers. The need for such polymers is their potential use as materials for air-craft, spacecraft, automotive and electronic components. Incorporation of transition metals into polymer chains offers a possibility to access new useful heat-resistant polymers. The methods to prepare
metal-containing epoxy polymers are the use of metal chelates as the curing agent’s use of organotransition-metal complexes as additives and synthesis of epoxy resins containing transition metal ions. It has been found that the metal-containing epoxy polymers possess higher strength and thermal stability, and which can be used for industrial production of one-plate glass-reinforced plastic springs for large-loaded motor vehicles. On the other hand, epoxy resins modified with maleimide compounds also received attractive attentions, due to the similar curing conditions and processing properties of the epoxy resins and maleimides. Maleimide-epoxy resins usually showed appropriate properties between epoxy and maleimide resins. Thus, both the intercrossed and the interpenetrating systems (IPN) based on bis-maleimides and epoxy resins were prepared and which exhibited good thermal and mechanical properties additionally, since imide groups could provide char formation in the condensed phase to improve polymers flame retardant properties, epoxy resins modified with imide compounds through chemical reactions or physical blending have been reported to show good flame retardant properties.\textsuperscript{[103]}

R. T. Vashi et.al. shows that the 8-hydroxyquinolinyl or 8-quinolol is well known as an analytical reagent. It various derivatives are also useful in pharmaceuticals. Several azo dyes based on 8-quinolinol are also reported for dying of textiles as well as their chelating properties. One of the derivatives, viz 5-amino-8-hydroxy quinoline can be synthesis facilely and studied extensively for number of derivatives. The chemistry of heterocyclic compounds continuously to be an explore field in the organic chemistry. Infectious diseases caused by micro and micro organisms; viz. bacteria, fungi, viruses and parasites are still a major threat to human health, despite tremendous inventions in drug chemistry. The emergence of wide spread drug resistance, particularly multi-drug resistance against gram-positive bacteria is a major concern. The heterocyclic nitrogen compounds especially quinazolinone derivatives play a vital role in many biological processes and as synthetic drugs. A Quinazolin-4-one derivative possesses biological activities such as antifungal. The formation of 8-hydroxyquinoline and quinazolin-4-one molecules into one molecule has not received any attention in spite of well-defined applications of both the molecules. Hence the initial work in this direction has been carried out. Thus in the extension of this work present communication comprises the synthesis, characterization and chelating properties of novel qunazolin-4-one-8 hydroxyquinoline derivatives.\textsuperscript{[104]}
J. Sreeramulu* et. al. explains that there is currently a growing interest in dithiocarbamate complexes of dithiolates. Dithiocarbamates, in particular, are versatile chelating agents with diverse applications in industry, agriculture and medicine. Although complexes of dithiocarbamates with monodentate and polydentate ligands have been prepared and characterized. The dithiocarbamate ligands reported in only the dithiocarboxy group as the ligator group, so they behave like bidentate ligands in complexes. Dithiocarbamates have been found to act almost as uninegative bidentate ligands, coordinating through both Sulphur atoms, and both tetra and hexa-coordinated complexes of many transition metal ions have been isolated. In this article we report the synthesis, characterization and antimicrobial activity of Copper (II) and Mn (II) Complexes of dithiocarbamates.

A. S. Rajbhoj* et.al. explains that the Vitamin C (Ascorbic Acid) is a water soluble antioxidant. It was first isolated in 1928 by the Hungarian biochemist and Noble prize winner Szent Gyorgyi. It is an unstable easily oxidized acid and can be destroyed by oxygen, alkali and at high temperature. Unlike animals humans cannot synthesize vitamin C, rendering its ingestion from oxygenous supplement or diet necessary of human inability to synthesize ascorbic acid is the absence of the active enzyme. 1–gulonolactone oxidase from the liver (Burns, 1959). Body requires vitamin C for normal physiological functions. It helps in the metabolisms of tyrosin, folic acid and tryptophan. It helps to lower blood cholesterol and contributes to the synthesis of the amino acid carnitine and catecholamine that regulate nervous system. It is needed for tissue growth and wound healing. It helps in the formation of neurotransmitters and increases the absorption of iron in the gut. Being an oxidant, it protects the body from the harmful effects of free radicals & pollutants. Deficiency of this vitamin causes defective formation of the collagen fibers of connective tissue due to which the process of healing wounds retards and also causes disease scurvy. Vitamin C is essential for the process from bone formation to scar tissue repair. In complexes of transition metals the formation of a coordination bond can be considered as a transfer of a lone electron pair from the coordinated group or ligand to the metal ion. These metal ligand chelates serves as suitable models for the valuable information in the elucidation of biological processes. The Literature survey reveals that no work has been reported on complex formation of vitamin C with transition metal ions in aqueous medium. Therefore in order to understand the...
complex formation behaviour of vitamin C at different ionic strength i.e. 0.1M, 0.3M and 0.6M NaClO₄ at constant temperature i.e. 298K is studied.\textsuperscript{[106]}

Ardeshir Shokrollahi* et.al. shows that the amino acids are organic molecules containing amino group, -NH₂ and carboxylic acid group, -COOH both attached to the same carbon atom called α–carbon. Such amino acids are also known as α–amino acids. Amino acids were earlier discovered as constituents of natural products even before they were recognized as components of proteins; asparagine was discovered in 1806 in juice of asparagus plant and cystine in 1810 in urinary stones. In deed their names are based on the sources from which they were isolated (Akpurieme, 1995). The first amino acid isolated from hydrolysis of protein was glycine, obtained in 1820 from gelatin by Braconnot as reported by Lehninger (1995). He also reported threonine as the most recently discovered amino acid isolated from hydrolyzates of fibrin by Rose in 1935 (Lehninger, 1995). Even though a large number of amino acids had already been discovered by the end of 19th Century it was not until 1902, with the publication of the works of Hofmeister and of the Fischer (1902) that an explanation was offered for the mode of combination of the amino acids in proteins (Akpurieme, 2001). Their development of the peptide hypothesis of protein structure is regarded as one of the most important events in the history of protein chemistry. Amino acids are the essential constituents of plants and animal tissues, they also occur in plants cells both as free acid or amides. Over 200 different amino acids have been found in higher plants and twenty (20) are known to be the building blocks of protein found in cytoplasm. Some of the isolated amino acids, which are not compounds of proteins, are found in plants as earlier mentioned and others are found in bacteria and animal tissues (Akpurieme, 2001).\textsuperscript{[107]}

Aminou Mohamadou\textsuperscript{a} et.al. shows that the continuing interest in the study of amide complexes derives from their ability to model active sites present in some metalloproteins and the search for a better understanding of the physicochemical properties of such complexes, especially the stereochemistry of the metallic center. In this case, linear ligand systems based upon 2-pyrazinecarboxamide are very useful to modulate the structural and electronic properties of first-row transition-metal centers. The ligand 2-(N, 2 pyridylmethyl) pyrazinecarboxamide (hereafter denoted Hpzpy) may adopt both chelating and bis (chelating) coordination modes, and thus has the ability to form mononuclear as well as polynuclear complexes
through spare nitrogen of pyrazyl group. A variety of structural motifs, including chain and framework structures are possible, making this ligand an attractive choice in attempts to prepare supramolecules based on the assembly of organic molecules and metal-ion building blocks. The Hpzpy ligand has been used recently in the construction of some interesting molecular weaving with octahedral metal ions. To the best of our knowledge no published data referring either to the acidity constants of Hpzpy ligand or to the stability constants of its metallic ion complexes have been reported. In solid state, only few X-ray crystal structures of cobalt and manganese complexes and the Hpzpy ligand have been reported: onemononuclear [CoIII(pzpy)2]BF4 compound, one dinuclear [MnII(Hpzpy)2(OH2)2Cl4] complex and one trinuclear octahedral cobalt compound [CoII(III)(pzpy)4 CoII(OH2)2(Cl2)2Cl2]; (pzpy is an amide-deprotonated ligand). In this paper, we describe the syntheses of the pzpy ligand and their copper (II) complexes as well as the thermodynamic constants of the metal chelates formed by this ligand. A variety of new crystal structures with different coordinating anions as coligand are reported together with their spectroscopic and magnetic properties.\[108]\n
Abdulbaset A. Zaida\[a\] et.al. shows that the transition metal ion chelate complexes are exploited by industry in the large-scale purification of amino acids and in the synthesis of wide range of drugs and drug precursors containing an amino carboxylic acid moiety. Chiral ligand exchange chromatography, which utilizes stereoselective binding to an immobilized chiral ligand (selector), is commonly used in industry for the separation of racemic mixtures of amino acids and their derivatives. Newer technologies for scalable continuous separation of chiral racemates present the selector either directly in solution or on the surfaces of stable micelles. These industrial applications are often best carried out at temperatures far from ambient or physiological conditions. Efficient design and optimization of these technologies therefore requires knowledge of chemical equilibria within the system and its dependence on temperature. Complexes as the term is usually used in inorganic chemistry, include compounds composed of a metal atom or ion and one or more ligands (atoms, ions, or molecules) that formally donate electrons to the metal. Complexes are the compounds containing coordinate bonds between electron pairs donors as the ligand and electron pairs acceptors as the metal atoms or ions. The number of electron pairs donated to the metal is known as its coordination number and thereby many complexes exist which exhibit coordination number of
two, four or six. In order for a pair of electrons to be donated from ligand to a metal ion. There must be an empty orbital on the metal ion to accept the pair of electrons. In a complex, a central atom or ion is coordinated by one or more molecules or ions (ligands) which act as Lewis bases, forming coordinate bonds with the central atom or ion; the latter acts as a Lewis acid. Atoms in the ligands that are directly bonded to the central atom or ions with donor atoms. In chemical language, it is known as acid base coordination complex or coordination compound or complexes. Any substance that can accept a pair of electron called as Lewis acids whereas any substance that can donate a pair of electrons commonly called as Lewis bases. When a ligand contains two or more donor atoms close to each other, the metal complex formed is said to be a chelate, and the process is referred as chelation. The chelating ring may be ionic or covalent depending on the nature of ligand. Thus, the formation of mixed-ligand complexes is also important in understanding the behavior of metal ligand complexes which are made up of a central metal ion and ligands in addition to the solvent molecules required to make up the coordination sphere of the metal ion. Such metal ion ligand complexes are quite common in biological and analytical systems. Thus an understanding of the significance of metal ions in biological systems may unravel the mysteries surrounding the protein substrate interactions and the control mechanisms that determine the coordination and coordination tendency of the metal ions bound at the active sites of many enzymes in enzyme-metal ion-substrate reactions, considering the high affinity of ion for donor atoms like oxygen and nitrogen etc. Motivated mainly by the desire of understanding metal ion-biomolecule interactions, in the past 25 years there has been an increased interest in the study of mixed-Chelate complexes in solution. Several effects have been established, as responsible for the stability enhancement of such complexes compared to statistical expectations. A great number of biologically relevant metal ion-ligand interactions involve the formation of hexacoordinated complexes for which tris-chelates represent a very important fraction. Mixed ligand complexes derived from transition metal ions and designed ligands having specific functional groups are useful in biomimetic studies for exploring the role of such metal ions in enzymatic processes. Biological metal ions play key roles in the structural organization and activation of certain enzymes, which are involved in the transfer of genetic information from DNA, leading to the synthesis of specific proteins. It is well known that ternary complexes play an important role in biological processes, as
exemplify by many instances in which enzymes are known to be activated by metal ions. Ternary complexes have also been implicated in the storage and transport of active substances through biological membranes. Much attention has been paid recently to the study of ternary complexes of transition metals with molecules of biological and pharmaceutical interest. Furthermore, it has been suggested that the presence of metal ions in biological fluids, could have a significant effect on the therapeutic action of drugs. Amino acids and their metal complexes are equally important compounds, since they have frequent utilization in both biological and chemical applications. Ternary complexes formed between metal ions and two different types of bioligands, namely heteroaromatic nitrogen bases and amino acids (or peptides) may be considered as models for substrate metal ion–enzyme interactions and other metal ion mediated biochemical interactions. Among these compounds, metal complexes are known to play a significant role either in naturally occurring biological systems or as pharmacological agents, such as antitumor, antifungal, antimycobacterial, antimicrobial activity, etc. In a number of biochemical processes metal ion is involved in mixed ligand complex formation and ligand catalyzed complex formation reactions. The history of complexes and the interpretation of complexes begin with Alfred Werner (1866-1919). Complexes were known much earlier; many complexes have been used as pigments but with the gradual development of analytical methods. The formulas of many of compounds became known late in 19th century and theories of structure and bonding became possible.  

H. N. Aliyu et.al. stated that the hydroxytriazanes are polydentate ligands, they served as effective chelating agents, having been widely used as spectrophotometric and complexometric reagents for transition metal determination. Their application as analytical reagents is quite established as shown by various review appearing in literature during the last many years. Hydroxytriazanes are widely used as ligands to coordinate different transition or inner transition metal ions due to their good solubility in common solvents and the high stability of their complexes. They coordinate with the metal ions in a bidentate manner through N-OH group (ionic linkage) and triazeno group (coordinate linkage) (Singh et.al., 2005). For example, Ali et.al. (2006) reported the synthesis and investigation of 3-hydroxy-3-phenyl-1-o trifluorophenyltriazene as a selective complexing ligand for the extraction and spectrophotometric determination of Ni (II) ion. Manu et.al.
(2007) also reported the synthesis of 1, 3-diphenyl-3-hydroxytriazene (DPHT) and its Cu (II) complex. Their spectral properties and electrochemical behavior have been investigated. An improved gravimetric method for the determination of titanium in the presence of niobium and tantalum, as well as other cations and anions, with a new reagent 1-(o-carbonylphenyl)-3-hydroxy-3-methyltriazene is suggested. The titanium (1-40mg) is quantitatively precipitated in the pH range 1.0-4.5 and can be weighed as TiO(C₈H₄O₃N₃)₂ after drying at 1200°C. The few serious interferences can be avoided by the use of masking agents (Majumdar et al., 2001).

Majumder and Saha,(2002) also reported a direct gravimetric method for the determination of titanium with a new reagent 1-(o-carbonylphenyl)-3-hydroxy-3-phenyltriazene. The titanium is precipitated at the pH range 2.0-5.0 and weighed as TiO(C₁₃H₁₀N₃O₃)₂ after drying at 115-1200°C in the presence of EDTA, only niobium and tantalum interfere. The reagent 1-(o-carboxyphenyl)-3-hydroxyphenyltriazene was found to be an excellent spectrophotometric reagent for the determination of nickel (II), palladium (II) and copper (II). At pH 6.8-8.3, 2.4-3.5 and 2.2-3.8, nickel, palladium and copper form greenish yellow, yellowish orange and light green complexes with maximum absorption at 410, 410, 400nm, respectively. The spectrum obeys Beer’s law with optimum ranges from 0.25 to 2.0ppm for Ni (II), 0.5-0.4 for Pd (II) and 0.5-0.3 for Cu (II); The elements form 1:1 complexes with the stability constants of 2.1x10⁻⁵, 1.5x10⁻⁵, 2.0x10⁻⁵ for Ni, Pd and Cu respectively (Majumdar et al., 1971, Pranab et al., 2001).

S. Arunachalam* et.al. shows that Schiff bases, named after Hugo Schiff’s, are formed when any primary amine reacts with an aldehyde or a ketone under specific conditions. Structurally, a Schiff base (also known as imine or azomethine) is a nitrogen analogue of an aldehyde or ketone in which the carbonyl group (>C=O) has been replaced by an imine or azomethine group. Schiff bases are some of the most widely used organic compounds. Schiff bases have also been shown to exhibit a broad range of biological activities, including antifungal, antibacterial, antimalarial, antiproliferative, anti-inflammatory, antiviral, and antipyretic properties. Imine or azomethine groups are present in various natural, natural-derived, and non-natural compounds. The imine group present in such compounds has been shown to be critical to their biological activities. The first preparation of imines was reported in the 19th century by Schiff (1864). Since then a variety of methods for the synthesis of imines have been described. The classical synthesis
reported by Schiff involves the condensation of a carbonyl compound with an amine under azeotropic distillation. Molecular sieves are then used to completely remove water formed in the system. In the 1990s an in situ method for water elimination was developed, using dehydrating solvents such as tetramethyl orthosilicate or trimethyl orthoformate. In 2004, Chakraborti et al. demonstrated that the efficiency of these methods is dependent on the use of highly electrophilic carbonyl compounds and strongly nucleophilic amines. They proposed as an alternative the use of substances that function as Bronsted-Lowry or Lewis acids to activate the carbonyl group of aldehydes, catalyze the nucleophilic attack by amines, and dehydrate the system, eliminating water as the final step. The main aim of the production and synthesis of any antimicrobial compound is to inhibit the causal microbe without any side effects on the patients. In addition, it is worthy to stress here on the basic idea of applying any chemotherapeutic agent which depends essentially on the specific control of only one biological function and not multiple ones. The chemotherapeutic agent affecting only one function has a highly sounding application in the field of treatment by anticancer, since most anticancers used in the present time affect both cancerous diseased cells and healthy ones which in turns affect the general health of the patients. Therefore, there is a real need for having a chemotherapeutic agent which controls only one function. In this paper, we discuss the synthesis, spectral characterization and biocidal efficiency of series Schiff base compounds. [111]

Ali Bayrı et al. shows that the scientists were studying the magnetic properties of the first transition metal complexes in different surroundings for many years. The magnetization and hence the magnetic susceptibility is one of the most important properties of matter, which is directly related to its electronic structure. In other words, the information about the electronic structure of molecules is contained in its magnetic moment $\mu$. The magnetic properties of Mn (II), Cr (II), and Cu (II) ions in 12- and 15-membered macrocyclic ligands are the main part of this study. Metal complexes with macrocyclic ligands have gained an accelerated research interest in recent years. Nature prefers macrocyclic derivatives for many fundamental biological functions such as photosynthesis and transport of oxygen in mammalian and other respiratory systems. Metal ion complexes with macrocyclic ligands are significant for the development of new methodologies in separation science also. These ligands are also of theoretical interest as they are capable of furnishing an environment with controlled geometry and ligand field strength. [112]
A. P. Mishra* et.al. explains that the formation of variety of metal complexes with such ligands, indicate the spectacular progress in coordination and bioinorganic chemistry. Schiff base complexes of transition metals containing ligand with N, S donors are known to exhibit interesting biological activity. Still, development of new Schiff bases long term administration for chelation of metal deposits. A large number of Schiff’s base compounds and their complexes have been studied for their interesting and important properties e.g. their ability to reversibly bind oxygen, transfer of an amino group and complexing ability towards some toxic metals. The high affinity for the chelation of the Schiff bases towards the transition metal ions is utilized in preparing their solid complexes. The real impetus towards developing their coordination chemistry is their physico-chemical properties and significant biological activities. Metal complexes of Schiff bases play a central role in the development of coordination chemistry. Schiff bases provide potential sites for chemical and biological activity of compounds. From the survey of existing literature, it appears that 2- thiophenecarboxaldehyde and their complexes have a variety of applications in biological, clinical and analytical fields. Keeping the above facts in the mind and in continuation of our research work on transition metal (II) complexes with Schiff bases, we report the synthesis and characterization of VO (II), Fe (II), Co (II), Cu (II) and Zn (II) metal complexes of Schiff bases derived from the condensation of thiophene-2-carboxaldehyde with 2,6-dichloro-4-nitroaniline and 4-anisidine as ligands. Antimicrobial and insecticidal activity of Schiff bases and their metal complexes have also been explored. Thus the aim of this study is to observe the impact of chelation on the therapeutic value of the organic compounds / drugs as biocidal or static agent by creating impact on morphological or physiological cycles.\[113\]

Yakubreddy Naini\[1\] et.al. suggested that the interest in coordination chemistry is increasing continuously with the preparation of organic ligands containing a variety of donor groups and it is multiplied many fold when the ligand have biological importance-. Benzoimidazoles are involved in a great variety of biological processes. Some of their poly functional derivatives have been proven to possess antibacterial, fungicide and anti-hermitic activity. Therefore substituted benzimidazoles have attracted the interest of various research groups, especially since it has been reported that the influence of the substitution at 1, 2 and 5-positions is very important for their pharmacological effect. Several groups have reported
cobalt (II) and Zn (II) coordination compounds showing a similar stoichiometry [M (bz) 2X2] (MII=Co, Zn, X=Cl, Br, I; bz=benzimidazole). In all cases, the geometry adopted by the metal ion is tetrahedral. The compound dichloro bis (1Hbenzimidazole) - cobalt (II) reported elsewhere is a type of the above complexes. Coordination compounds containing thiabendazole, 2-(4′-thiazolyl) benzimi-dazole form bis-chelate and tris-chelate compounds. In all cases the ligand coordinates to the metal (cobalt (II), nickel (II), copper (II) zinc (II), cadmium (II) and mercury (II) through the imidazolic and thia-zolic nitrogen atoms. The spi- racylic structure [Co(btz-SMe)2], Btz=N-benzo-thiazole-2-yl) dithiocarbamic methyl ester, the ligand is derivative of benzothiazole, is anionic and behaves as bidentate, nitrogen and sulfur atoms are bonded to the central metal ion giving planar tricyclie chelates, where Co(II) is part of the six-membered rings. The crystal structures of Co (II) and Ni (II) complexes of 4- (benzimidazole-2-yl)-3-thiabutanioc acid which provide a benzimidazole, a thioether and carboxyl donor group. The crystal structure of Cu (II) complex indicates that the two oxygen and two nitrogen donors for a square coordination around the copper ion, while the two sulfur are approximately axial to the copper center. In view of the reported interesting results and in continuation of our studies on transition metal complexes with sulphur, oxygen and nitrogen containing ligands, we are presenting here the preparation of new ligands 1,2 or 1,3 and 1,4-(benzimidazole-2-thio) ethane (L1), propane (L2) and butane (L3) Scheme-1 and their Co (II), Ni (II), Cu (II) and Zn(II) complexes. The N-alkylamino phenothiazine derivatives (NPTZs) including chlorpromaz ine (CP) are biologically active heterocyclic compounds. Structurally, CP is a phenothiazine substituted with chlorine and tert-alkyamine groups at 2 and 10 positions, respectively. The NPTZ derivatives find extensive applications in the field of medicine as antipsychotic, anxiolytic, antiemetic and inodilation drugs. Previously, some studies of transition metal-NPTZ complexes have been reported by several workers. Keshavan and co-workers have synthesized and characterized compounds of selected NPTZs with molybdenum(IV), tungsten(IV), ruthenium(II/III) and copper(II). Keshavan and Janardhan, and Gowda and Jayarama have reported mononuclear copper (II) and zinc (II) complexes of NPTZs. Kroener et.al. have studied the X-ray crystal structures of some cis- and trans-bis (2, 2′-bipyridine)-bis (phenothiazine-S) ruthenium (II) hexafluorophosphates. Made Gowda et.al. have previously studied the synthesis and characterization of some coordination compounds of NPTZs with
rhodium (II/III), rhenium (VII), iridium (III/IV), molybdenum (IV/V), zinc (II), palladium (II) and mercury (II). Chaitanya Lakshmi et al. have reported transition metal-pyridoxine complexes. We here report the synthesis and characterization of four transition metal complexes with CP.HCl as the main ligand. [114]

P.S. Desai* et al. suggested that the extended bridges actually appears as a very active area of molecular magnetism. Coordination chemistry of metal the aromatic carboxylic acid complexes provide carboxylato species is an attractive subject from the interesting coordination compounds because the phenoxy magneto-structural standpoint because the carboxylate carboxylate ions adopt various coordination modes, group mediates magnetic exchanges by bridging usually monodentate, bridging bidentate or chelating paramagnetic first-row transition metal cores. An absence of the inter-metal magnetic the organoborate chemistry has been extensively interaction (paramagnetism) and its presence explored in the past three decades. Interactions of (ferromagnetism, antiferromagnetism) are largely related KBH with pyrazole, indazole, imidazole and indol to the coordination mode of the compounds with focus have been shown to yield a variety of ligands which on the magnetic path between the adjacent metal ions have exploited mainly in the synthesis of transition metal. The magneto structural characterization of dinuclear complexes. Scorpionate-type poly (pyrazole) borate and metal (II) complexes has played a key role in the poly (pyrazole) alkane ligands have found wide development of magnetochemistry. The possibility applications in coordination, organometallic and of a achieving strong magnetic interactions between bioinorganic chemistry. The increasing robust nature magnetic centers which are linked through more and more and ease with which their steric and electronic properties. Compounds containing triazole have attracted much interest because of their biological applications and are used as dyes and photographic chemicals. Furthermore, triazole appears frequently in the structures of various natural products. Triazole containing compounds appear in many metabolic products of fungi and primitive marine animals. The coordination chemistry of triazole and benzotriazole derivatives was studied due to their importance in industry, agriculture and their biological activity. In view of the above facts and in continuation of our interest in studying the ligating behavior of such compounds, therefore the present paper comprise the synthesize and characterize the solid complexes of the newly ligand containing the triazole moieties, 2-(2-(5-benzoyl-1H-1,2,3-benzotriazole-1-
yl) 2-oxoethylamino) acetic acid with Zn$^{2+}$, Cu$^{2+}$, Ni$^{2+}$, Mn$^{2+}$, Co$^{2+}$ and investigate their antimicrobial effects towards some Gram-positive and Gram-negative bacteria.$^{[115]}$

Aliyu, H. N. et.al. shows that when an aldehyde or a ketone is condensed with a primary amine, a Schiff base is produced, which is a compound containing azomethine group, R – C = N – (Holm et.al., 1966; Hobday and Smith, 1972). It has been known that a variety of metal ions on interaction with Schiff bases yield chelates, for example; Holm et.al.(1966) reported the synthesis and magnetic studies on Schiff base complexes of copper (II). Recently, Xishi et.al.(2003) reported the synthesis and characterization of Mn (II), Co (II) and Cu (II) complexes with a novel Schiff base ligand derived from 2, 2′-bis (pmethoxyphenylamine) and salicylic aldehyde. Transition metal Schiff’s base complexes have been found to play a vital role in medicine, biological systems and industries. The field of medicine has witnessed an increase in the number of complexes with therapeutic value, for example, cobalt (III) Schiff base complexes are potential antiviral agents, cis dichlorodiamineplatinum (II) is an anti-cancer agent and copper (II) Schiff base complex is an antitubercular agent (Lippard, 1994; Bleomink and Reed, 1996). The use of atom transfer radical cyclization mediated by copper (II) Schiff base complexes to furnish nitrogen heterocycles most of which are biologically active molecules and also the use of copper Schiff base catalyst in carbon based radical cyclisation reactions were recently investigated (Clerk and Jones, 1989; Clerk et.al., 1998; Clerk et.al., 1999). The complex compound formed by Schiff base derived from benzoin and 2-amino benzoic acid with cobalt (II) salt has been reported (Mahaptra et.al., 1977). This paper reports the preparation and characterization of two new complex compounds formed by iron (II) and nickel (II) metal ions with the Schiff base.$^{[116]}$

S. Chanda$^{[116]}$ he suggested that to overcome the alarming problem of microbial resistance to antibiotics, the discovery of novel active compounds against new targets is a matter of urgency. Many of the crude drugs, which are sources of medicinal preparations, still originate from wild-growing material. However, plant-based drugs have shortened the life span of the source of material. There is a continuous search for more potent and cheaper raw material to feed the industry. Compounds, which on dissolution do not give ions of which they are made but instead give complex ions, are called co-ordination compounds. Co-ordination
compo- unds exhibit different characteristic properties which depend on the metal ion to which they are bound, the nature of the metal as well as the type of ligand, etc. These metal complexes have found extensive applications in various fields of human interest. The nature of a coordination compound depends on the metal ion and the donor atoms, as well as on the structure of the ligand and the metal–ligand interaction. With increasing knowledge of the properties of functional groups, as well as the nature of donor atoms and the central metal ion, ligands with more selective chelating groups, i.e., imines or azomethines which are more commonly known as Schiff bases are used for complex formation studies. Schiff bases have been studied extensively because of their high potential chemical permutation. Magnetic susceptibility, absorption spectra, elemental analysis, molecular weight determination, conductivity, thermal analysis of many Schiff bases and their complexes has been reported. Several workers also studied their biological properties, such as antibacterial, antifungal, etc., activities. It is reported that the rapidly developing field of bioinorganic chemistry is centered on the presence of coordination compounds in living systems. In the present work, complexes of Cu (II), Ni (II), Zn (II) and Fe (II) with two Schiff bases have been synthesized. Their structures were confirmed by IR and NMR spectral analysis. Further, their antibacterial activity towards some clinically important bacteria was evaluated.

Rajendra K. Jain* et al. shows that the metal complexes have been receiving considerable attention for many years, due to their interesting characteristics in the field of material science and biological systems. Optoelectronic, electrical and magnetic properties of the metals and metalloids can be tailored by reacting them with different ligands. A large number of Schiff bases and their complexes may exhibit the properties likeo reversibly bind oxygen, transfer of an amino group, as nanoprecursors and varied complexing/redox ability. The Schiff bases have high affinity to chelate with the transition metal ions, hence are attracting attention due to potential applications in areas viz. biology, catalysis, thermal, electrical, optical, magnetic etc. Metal complexes are suitable to molecular materials, on the basis of electronic properties associated with the metal center1-. Schiff base ligands containing O and N donor atoms play an important role in coordination chemistry related to catalysis and enzymatic reaction, magnetism and molecular architecture. Metal complexes with Schiff base ligands containing salicylaldehyde and its derivatives; have been extensively studied. Metal complexes with such ligands are
quite common and also reflect their facile synthesis, accessibility of diverse structural modifications and wide applications in different fields, such as catalysis, biological systems and material chemistry. Microwave reactions under solvent free and less solvent conditions are attractive offering reduced pollution, low cost and offer high yields together with simplicity in processing and handling. The salient features of microwave approach are shorter reaction times, simple reaction conditions and enhancements in yields. In this study, we report the synthesis, physicochemical characterization and biological significances of Co (II), Ni (II) and Cu (II) complexes with ligands derived from 5 bromosalicylaldehyde with 3, 4-dimethylaniline (BSMA) and 3, 4-dichloroaniline (BSCA). The reaction was carried out by both conventional and microwave methods. The metal complexes formed with these two new ligands may be used as precursors for the synthesis of new compounds. Some of them may exhibit interesting physical, chemical and biological properties.\[a\]

John Maria Xavier\[1\] et.al. explains that the Schiff bases form an important group of compounds in synthetic chemistry due to their useful physical and chemical properties and large number of reactions they undergo. Schiff bases are also used widely in pharmaceutical industry and have interesting pharmacological activities. The study of Schiff base has been fast developing because they possess excellent characteristics such as structural similarities with natural biological substances, relatively simple preparation procedures and the synthetic flexibility that enables design of suitable structural properties. Many biologically important Schiff bases have been reported in the literature possessing, antibacterial, antifungal, antimicrobial, and anticonvulsant, anti-HIV, and anti-inflammatory, antitumor, insecticidal, CNS depressant and catalytic activities. Studies on new classes of chemotherapeutic Schiff bases are now attracting the attention of biochemists. Schiff's bases have the potentials to be used in different areas such as electrochemistry, bioinorganic, catalysis, metallic deactivators, separation processes and environmental chemistry and they are becoming increasingly important in the pharmaceutical, dye and plastic industries as well as in the field of liquidcrystal technology. The aim of the work is to synthesize and characterize a Schiff base: 2,13-bis (4- aminophenyl)-3, 6, 9, 12-tetraaza tetradeca-2, 12-diene. It is expected that the presence of both keto & amino group will enhance the synthetic application of
the derivatives. In this study we also aim to study the electronic absorption spectra on the ascorbic acid-interacted Schiff base.\[^b\]

Usharani, E. Akila et al. suggested that the literature reveals that the Schiff base ligands are excellent coordinating ligands. It forms a stable complex with different transition metal ions. In particular, the transition metal complexes have been the subject for thorough investigation because of their extensive application in wide ranging areas from material science to biological sciences. The study of mixed ligand complexes formation were relevant in the field of analytical chemistry, where the use of mixed ligand complexes allows the development of methods with increased selectivity, sensitivity and has also great important in the field of biological and environment chemistry. The pharmacological activity have been found to be highly dependent on the nature of the metal ion and the donor sequence of the ligands, different ligand shows different biological properties, though they may vary only slightly in their molecular structure. The present investigation is to prepare some Schiff base mixed ligand complexes derived from $L_1$ (4-chloroaniline & salicylaldehyde), $L_2$ (benzaldehyde & 2-aminophenol) and $L_3$ (4-nitroaniline & 2-hydroxyacetopheneone), to elucidate their geometrical structures and to show their biological activity on some pathogenic bacteria.\[^c\]

P. Mishra et al. shows that the metal complexes have been receiving considerable attention for many years, due to their interesting characteristics in the field of material science and biological systems. Optoelectronic, electrical and magnetic properties of the metals and metalloids can be tailored by reacting them with different ligands. A large number of Schiff bases and their complexes may exhibit the properties like to reversibly bind oxygen, transfer of an amino group, as nanoprecursors and varied complexing/redox ability. The Schiff bases have high affinity to chelate with the transition metal ions, hence are attracting attention due to potential applications in areas viz. biology, catalysis, thermal, electrical, optical, magnetic etc. A Transition metal complexes which usually contain nitrogen, sulphur/or oxygen as ligand atoms are becoming increasingly important because these Schiff base can bind with different metal centers involving various coordination sites and allow successful synthesis of metallic complexes with interesting stereochemistry. Heterocyclic compounds are widely distributed in the nature and essential to many biochemicals, analytical and industrial processes. Compounds containing these heterocycles have important properties in the field of
material science and biological systems. Microwave-assisted synthesis is a branch of green chemistry. The application of microwave-assisted synthesis in organic, organometallic and coordination chemistry continues to develop at an astonishing pace. Microwave irradiated reactions under solvent free or less solvent conditions are attractive offering reduced pollution, low cost and offer high yields together with simplicity in processing and handling. The salient features of microwave approach are shorter reaction times, simple reaction conditions and enhancements in yields. Reports on the synthesis of metal complexes by microwave methods have been comparatively less. In this study we report the synthesis and physicochemical characterization of Co (II), Ni (II) and Cu (II) complexes with ligands derived from 2- thiophenecarboxylidene-3-chloro-4-fluoroaniline (TCC) and 2-thiophene-carboxylidene-4-fluoroaniline (TCF). Some of the findings relating to structural and biological studies as a part of this paper have been published elsewhere. The metal complexes formed with these two new ligands may be used as precursors for the synthesis of new compounds. Some of which them may exhibit interesting physical and chemical properties.

Mehmet G¨ulcan et.al. explains that the Schiff bases, products of the reaction of primary amines and carbonyl compounds, are involved in many metabolic processes. Numerous products of further fragmentation and crosslinking are responsible for the color, flavor, and Synthesis, characterization, and antimicrobial activity of M. G¨ulcan, et.al. taste of foods and drinks. Salicyliden- and 2-hydroxynaphthylideneamines have been the subject of particular interest because some of their complexes are found in nature and biological activities have been recorded for the synthesized ones. Pyrimidine is the parent heterocycle of a very important group of compounds that have been extensively studied due to their occurrence in living systems. Pyrimidines are reported to have a broad spectrum of biological activities. Some are endowed with antitumor, antiviral, antiinflammatory, antipyretic, antimicrobial, and antifungal properties. Considerable attention has been given to the metal (II) complexes of polydentate Schiff base ligands of the Naminopyrimidine type, due to their structural richness and electrochemical properties as well as their potential as a model for a number of important biological systems. This paper describes the synthesis of a new Schiff base ligand containing a ring of pyrimidine and its metal complexes. Spectral and magnetic studies were used to characterize the structure of the complexes. IR, $^1$H-NMR, $^{13}$C-NMR, and mass
spectra were obtained to determine the structure of the ligand (HL). All of the synthesized compounds were evaluated for their antimicrobial activities against gram-positive and gram-negative bacteria and fungi using the microdilution procedure. [6]

Kamini J. Donde*,2 et al. show that the Schiff bases are a significant class of ligand in coordination chemistry and find extensive purpose in different fields. Schiff bases derived from pyridoxal and amino acids are considered very important ligands from the biological point of view. Transition metal complexes of such ligands are important enzyme models. The rapid development of these ligands resulted in an enhanced research activity in the field of coordination chemistry leading to very interesting conclusions. Mixed ligand complexes have been found to act as an active catalyst in reactions of industrial importance including hydrogenation, hydroformation, and oxidative hydrolysis of olefins and carboxylation of methanol. These complexes have also shown catalytic activity in various oxidation reactions of environmental and biological importance. Mixed ligand complexes containing amino acids as a secondary ligand are of significance as they are potential models for enzyme-metal ion substrate complexes. The lot of attention is being given to the study of mixed ligand complexes of Schiff bases containing salicylaldehyde and amino acids separately. Main aim of this study was to establish research topics where these two areas could be combined in a novel way. To fulfill this Schiff base 2-amino-4-nitrophenol-N-salicylidene was selected as a starting point and the mixed ligand Co (II) complexes were prepared by introducing the various amino acids (viz. alanine, phenylalanine, valine, cysteine, leucine and glutamic acid) with Co (II) ions. [f]

N. P. Ndahi1,* et al. suggested that the Schiff bases are compounds containing a carbon-nitrogen double bond (azomethine group), (C=N-) with the nitrogen atom connected to an aryl or alkyl group but not hydrogen. Schiff bases are of the general formula R1R2C=N-R3, where R3 is an aryl or alkyl group that makes the Schiff base a stable imine. Schiff bases, named after Hugo Schiff (1834-1915), and their transition metal complexes continue to be of interest even after over a hundred years of study. Schiff bases have a chelating structure and are in demand because they are easy to prepare and are moderate electron donors. Schiff base metal complexes are still widely used in catalysis but increasingly with a slightly modified concept. The chemistry of the carbon-nitrogen double bond plays a vital role in the
progress of chemical sciences. Schiff-base compounds have been used as fine chemicals and medical substrates. Much attention has been devoted by bioinorganic as well as by medicinal chemists to the relationship between the metal ions and their complexes as antitumour and antibacterial agents. Interaction of various metal ions with antibiotics may enhance or suppress their antimicrobial activity but usually in many cases the pharmacological activity of antibiotics after complexation with metals is enhanced as compared to that of free ligands. Some novel transition metal [Co (II), Ni (II) and Zn (II)] complexes of substituted pyridine Schiff-bases have been prepared and characterized by physical, spectral and analytical data. The synthesized Schiff-bases act as deprotonated tridentate for the complexation reaction with Co (II), Ni (II) and Zn (II) ions. Various transition and inner-transition metal complexes with bi-, tri- and tetra-dentate Schiff bases containing nitrogen and oxygen donor atoms, play an important role in biological systems. There are certain metallo-elements without which the normal functioning of the living organism is inconceivable. Examples of such elements are: V, Cr, Mn, Fe, Co, Ni, Cu, and Zn. These elements are present in trace and ultra-trace quantities and play vital roles at the molecular level in a living system. These transition elements are known to form Schiff base complexes. In this work, we report the results of our studies on the synthesis, physicochemical and antimicrobial properties of Co(II), Ni(II) and Zn(II) complexes of benzenecarboxaldehyde with 2-aminophenol and 4- bromoaniline. 

R. Rajavel* et.al. explains that the chemistry of macrocyclic complexes has attracted the interest of both inorganic and bioinorganic chemists in recent years. The field of coordination chemistry of macrocyclic complexes has undergone remarkable growth during the past few decades and undergone remarkable growth during the past few decades and become a growing class of research. This enormous growth is due to synthesis of great number and variety of synthetic macrocycles which behave as coordinating agents for metal ions. Template reactions lie at the heart of macrocyclic chemistry and are the best aids for the preparation of macrocyclic complexes. Generally transition metal ions have been used as templates. The importance of macrocyclic complexes in coordination chemistry is because of its various applications in biological processes such as photosynthesis and dioxygen transport catalytic properties, potential applications as metal extractants and radio therapeutic agents. The importance of macrocyclic complexes is due to their resemblance with many natural systems like porphyrins and cobalamines.
Macrocyclic complexes have attracted attention because bacterial and fungal growth. Some macrocyclic complexes have been reported to have anti-inflammatory approach. Several macrocyclic complexes with tetraaza macrocyclic ligands, such as cyclam, cyclam or bicyclam have been reported to exhibit antitumour activity. Macrocyclic metal complexes of lanthanides, eg. Gd$^{3+}$ are used as MRI-contrast agents. The chemistry of macrocyclic complexes is also important due to their use as dyes and pigments as well as NMR shift reagents. In the present study the complexes was prepared by the template condensation of 3,3'-Diaminobenzidine with benzil and O-phenylenediamine and the transition metals like Cu (II), Ni (II) and VO (II) to afford the corresponding binuclear macrocyclic Schiff base complexes.\[h\]

H. N. Aliyu et.al. shows that the condensation of either an aldehyde or a ketone with primary amine yields Schiff base (Pierre, 1987). The carbonyl group of the aldehyde gives aldimes while that of ketone gives ketoimines. It has been known that different metal ions on interaction with Schiff bases yield chelates, for example; Tsumaki, (1983) reported [Co (sal-2-en)] Complex which received a great attention owing to its ability to undergo reversible adduct formation with molecular oxygen. The oxygenation ability of the complex was first recognized by Hassan \textit{et.al.}, (1998), however, the mechanism for the oxygenation process was not well understood until recently with the advent of modern physical techniques. Xishi \textit{et.al.}, (2003) reported the synthesis and characterization of a novel Schiff base ligand formed from the condensation of 2, 2-bis (p-methoxyphenylamine) and Salicylaldehyde and its Mn (II), Co (II) and Cu (II) complexes. The Ben Saber \textit{et.al.}, (2005) reported the synthesis and characterization of Cr (III), Fe (III), Co (II) and Ni (II) complexes with a Schiff base derived from 4-dimethylamino benzaldehyde and primary amines. The chemical analysis data showed the formation of (1:1) metal-ligand ratio and a square planar geometry was suggested for Co (II) and Ni(II) complex while an octahedral structure for Cr (III) and Fe (III) complexes. In another report, Cu (II), Co (II), Ni (II) and Zn (II) complexes of new hetrocyclic Schiff base derived from 1-amino – 5- benzoyl – 4- phenyl – 1H – pyrimidine – 2- on with salicylaldehyde have been synthesized and investigated by elemental analysis (Sonmez and Sekerel, 2002). An octahedral geometry was suggested for all the complexes. Ben Saber et.al., (2005), reported the synthesis of a Schiff base derived from salicylaldehyde, and histidine and its complex compounds with divalent
transition metal ions. The complexes were investigated by elemental analysis and were found to be of 1:1 metal to ligand ratio. Transition metal Schiff base complexes are used in various fields, such as medicine, agriculture, industries, etc. For example, [Co(acac2-en)] in dimethylformamide, pyridine and substituted pyridines proved to be involved in oxygen metabolism (Hanna and Mona, 2001). Transition metal complexes with 1,10-phenanthroline and 2,2-bipyridine are heavily used in petroleum refining (John et al., 1976). Schiff base formed by the condensation of 1-formyl-2-hydry-3-naphtholic arylamide with O-hydroxyl or O-methoxy aniline complexes of Co (II), Ni (II), Cu (II) and Zn (II) are useful as figments (Gupta et al., 2002). Oxovanadium complexes have been found strongly active against some type of Leukemia (Dong et al., 2002). Transition metal complexes derived from a number of amino acids have been reported to have biological activity (Zahid et al., 2007). Morad et al., (2007), reported the antibacterial activity of Ni (II) with salicyaldehyde.

Saeid Amani et al. suggested that the azo Schiff base complexes contain both azo and azomethine groups. The azo group possesses excellent donor properties and is important in coordination chemistry, and some azo compounds have been shown to possess good antibacterial activity. Schiff bases are common catalysts. Azo Schiff bases are commonly synthesized by coupling a diazonium reagent with an aromatic aldehyde to form an azo aldehyde. The azomethine group has good donor properties and can form stable complexes with transition metal ions. The azo and azomethine groups on azo Schiff base ligands are oriented in such a way that coordination of both groups to a metal ion is not possible, thus preferential coordination of the azomethine group while the azo group is left free and uncoordinated has been observed. Schiff bases derived from salicylaldehydes are known polydentate ligands, coordinating to metals in both their deprotonated and neutral forms. Some cobalt and copper complexes exhibit diverse biological properties. Salicylaldehyde-based ligands have found applications in preparation of metalmesogens, optical metal ion detection, and in coordination chemistry. Schiff bases derived from salicylaldehydes are known polydentate ligands, coordinating to metals in both their deprotonated and neutral forms. Many Schiff base complexes show excellent catalytic activity for various reactions at high temperatures (>100 °C) and in the presence of water. Over the past few years, there have been many reports on their applications in homogeneous and heterogeneous catalysis. A wide variety of cobalt (II) and copper (II) complexes are known to bind with transition metal ions. The complexes were investigated by elemental analysis and were found to be of 1:1 metal to ligand ratio. Transition metal Schiff base complexes are used in various fields, such as medicine, agriculture, industries, etc.
dioxygen more or less reversibly and are therefore are frequently studied as model compounds for natural oxygen carriers and for O₂ storage. Some thermochemical work on a limited series of cobalt (II) and copper (II) complexes has been reported by various researchers. Based on the aforementioned properties of Schiff bases and azo compounds, we reported herein the synthesis and spectroscopic studies as well as thermal investigation of novel salicylaldimine-based ligands 1-{3-[3-hydroxypropyl-imino]methyl}-4-hydroxyphenylazo}-4-nitrobenzene (2a), 1-{3-[3-hydroxypropyl-imino)methyl]-4 hydroxyphenyl-azo}2-chloro-4-nitrobenzene (2b) and 1-{3-[3-hydroxypropyl-imino)methyl]-4-hydroxyphenylazo}4-chloro-3-nitro-benzene (2c). 

13C- and ¹H-NMR spectra were obtained to determine the structure of the ligands 2a–c. The copper (II) and cobalt (II) complexes derived from azo-linked salicylaldimine were also prepared and their structures were confirmed by elemental analysis, FTIR spectroscopy, UV-Vis spectroscopy, thermogravimetric analysis and magnetic moment measurements.

Zahraa Salim M et.al. suggested that the Schiff bases are the compounds containing azomethin group (-HC=N-). They are condensation products of ketones or aldehydes with primary amines. Formation of Schiff base generally takes place under acid or base catalysis or with heat. Schiff-bases are considered as a very important class of organic compounds and have a wide application in many biological aspects, proteins, visual pigments, enzymatic aldolization and decarboxylation reactions. Moreover, some Schiff-bases were exhibits antibiotic, antiviral and antitumor agents because of their specific structure. Acid phosphatase (ACP) is a type of enzyme manufactured by the body. It is classified as a hydrolase enzyme. Specifically, acid phosphatase targets and breaks the molecular bonds of phosphate groups. Generally speaking, ACP can be found in certain organs and tissues, including blood cells, bone marrow, spleen, pancreas, liver, and kidneys. However, this substance is found in the greatest concentration in the prostate and up to 1,000 times greater in seminal fluid than any other bodily fluids. Prostatic acid phosphatase (PAP) is an enzyme Synthesis and Characterization of New Amino Acid-Schiff Bases Produced by the prostate. It’s evaluated in prostate cancer. The highest levels of acid phosphatase are found in metastasized prostate cancer, while diseases of the bone, such as Paget's disease or hyperparathyroidism, diseases of blood cells, such as sickle-cell disease or multiple myeloma or lysosomal storage diseases, such as Gaucher's disease, will show moderately increased levels. Schiff
bases appear to be an important intermediate in a number of enzymatic reactions involving interaction of an enzyme with an amino or a carbonyl group of the substrate. One of the most important types of catalytic mechanism is the biochemical process which involves the condensation of a primary amine in an enzyme usually that of a lysine residue, with a carbonyl group of the substrate to form an imine, or Schiff base. There are many interesting studies on the Schiff bases compounds derived from amino acids. Matharasi et.al. found that the Schiff bases derived from amino acid and Aloin [the bio active molecule, 10-glucopyranosyl-1, 8-dihydroxy-3-(hydroxymethyl)-9, (10H) anthracenone] having good antibacterial activity in good range when comparison to control (Ampicilin). Also Deng et.al. synthesized a new derivative of amino acids azomethin and its complexes with tin that it used in biological activates. The 2-acetyl-benzimidazoledehyde-glycine Schiff base ligand and the corresponding Pr (III) complexes were synthesized and their fluorescent properties studied by Danghui et.al. Also, the Schiff bases compounds derived from amino acids were used as a ligands and their complexes were used in wide range in medicinal chemistry. The aim of the present work is to studying the effect of Schiff base compounds derived from L-glycine and L-tryptophan on the activity of acid phosphatase enzymes, where no similar researches found in the literature. These products might be potential compounds for biological activity tests on this enzyme.\[k\]

Yeshwant B Vibhute* et.al. shows the Schiff bases constitute one of the most active classes of the compounds possessing diversified biological applications. The Schiff bases have been reported to possess higher degree of antitubercular, anticancer, antibacterial, anti-inflammatory, and antifungal. Schiff bases belong to a widely used group of organic intermediates used for synthesis of pharmaceutical or rubber additives and amino protective group in organic synthesis. Various formazans occupy an important role in medicinal chemistry. Formazans have been reported to possess antiviral, antimicrobial and anti-inflammatory, anticancer, anti-HIV activities. An environmentally benign synthesis method has received considerable attention. Verma et.al. reported synthesis of Schiff bases using water as a solvent. Jarrahpour et.al. has prepared bis-Schiff bases of isatin by conventional method using ethanol. Tania et.al. reported synthesis of bis-imine Schiff bases under solvent free conditions and also in polypropylene glycol (PPG) as a recyclable reaction medium. Naqvi et.al. have synthesized Schiff bases using (A) water based synthesis,
Microwave synthesis and Grindstone synthesis. Laulloo et al. Synthesised bis-Schiff bases under solvent free conditions. Jarrahpour and khaili reported synthesis of bis-Schiff bases of isatin and 5-Fluoroisatin in a water suspension medium. All these reported synthetic protocols are simple and giving high yield of products. Considering wide range of biological activities in Schiff bases and formazans, in the present communication we have synthesized some new Schiff bases by conventional as well as by using grindstone technique further formazans were synthesized by conventional method. All the newly synthesized Schiff bases and formazans were evaluated for antimicrobial activities.\[1\]

Rajesh Kumar et.al. suggested that in the preparation of multi-component metal oxide material, some important factors should be concentrating on related to the structure, properties and performance of the final material. These aspects are essential to control the stoichiometry, homogeneity, phase and crystallinity, which are directly related to the structure and reactivity of the metal-organic precursors in homogeneous solutions. The performance of “advanced” mixed metal oxide materials such as optoelectronic ceramics is greatly affected by control of these properties. The stoichiometry and homogeneity depends on the structure and reactivity of the precursor solutions. Addition of two different metal-organic reagents, AC. (closed spheres) and BO, (open spheres), in equimolar ratios to a solvent can give different possible results (assuming they dissolve): (i) they may not react, (ii) they may react, especially with the addition of water, to give a single molecular species like ABCpOq (shaded spheres), or (iii) a mixture of molecular species with different metal atom stoichiometries may be formed. The molecular level homogeneity is same for (i) and (ii) but there is a possibility of regional in homogeneity for (iii), although the overall stoichiometry is correct. Whatever the result, it seems reasonable that the control over homogeneity and stoichiometry at molecular level would be useful. However, the preparation of a specific precursor resulting in a specific oxide is difficult, especially if bi- or multi-metallic ceramic oxides are targeted. The investigation and the use of heterometallic alkoxides as single-source molecules precursors for synthesis of oxides have seen a rapid growth during the last more than one and half decade. The control of particle size and the morphology of the oxide are of crucial importance nowadays both from the fundamental and industrial point of view. Heterometallic-\(\mu\) o xoalkoxides are often associated with more accessible precursors such as carboxylates, Schiff bases and _-
diketonates in chemical routes to intricate mixed metal oxides. The mixed metal oxides of the type $\text{MAI}_2\text{O}_4$ ($\text{M}=\text{Ca, Mg, Mn, Co, Fe, Ni, Zn}$) obtained from heterometallic-$\mu$-oxoalkoxides precursors have found use to new ceramics and medicinally important such as for absorbing harmful chemicals and gases such as $\text{SO}_2$, $\text{CCl}_4$ and decontaminating chemical warfare agents. Interestingly $\text{MgAl}_2\text{O}_4$ prepared from $[\text{MgO}_2\text{Al}_2(\text{OPri})_4]_2$ have been used to destructively adsorb paraxon [diethyl-4-nitrophenol phosphate (DNPP)]. Nanocrystalline metal oxides of magnesium, calcium, aluminium and transition metals have proven to be exceptional adsorbents and catalysts due to their smaller size and high surface area. Core/shell bimetallic mixtures, such as MgO coated with $\text{V}_2\text{O}_3$, possess their own unique sorption and catalytic properties. In view of the solubility of metal alkoxides and oxoalkoxides in organic solvents, these materials are strongly preferred as precursors in sol-gel processes. In heterometallic-$\mu$-oxoalkoxides $\text{M-O-M'}$ linkage is present, which makes the $\text{M-O-M'}$ bond strong and stable as compared to other precursors. Non-cleavage of the $\text{M-O-M'}$ bond even upon hydrolysis followed by dehydration, makes homogenous oxides of high surface area mixed metal oxides nanoparticles. Therefore, these compounds are considered as especially suitable precursors over other precursors such as metal nitrate, acetate, monodispersed metal hydrous oxides, mainly due to the ease of their purification, solubility in organic solvents, volatility and their extremely facile hydrolizability. The hydrolysis rates of metal alkoxides (especially in the case of heterometallic alkoxides) are very high due to electrophilic nature of metal and its ability to expand its coordination number which complicates the problem by causing phase segregation. Therefore, careful handling and controlled hydrolysis are required to avoid phase segregation problem during hydrolysis of such compounds. Many metal alkoxides thermally decompose in the range ~100-300 °C. Depending on process conditions, this thermolysis can afford nanosized powders of oxide or metallic phases. When certain specifications such as homogeneity, high purity, narrow particle-size distribution, fabrication of functional materials intended for aircraft, space, electronic fields, and chemical industry: individual oxides, their solid solutions, complex oxides, powders of metals and alloys active towards sintering, the sol-gel process is probably the best approach. Hence, hydrothermally assisted sol-gel method was used for the preparation of hydrolyzed product. This method is simple, low temperature process and cost effective route for the preparation of crystalline oxides; sol-gel is expensive route for
the preparation of ceramics. Due to high sensitivity of metal alkoxides to the moisture and inhomogeneous precipitation hydothermal assisted sol-gel method is preferred over conventional sol-gel processing. The aim of this work was to prepare suitable precursors for mixed metal oxide powders from their metal alkoxides by hydrothermally assisted sol-gel process.\[m\]

Kavita Rana et.al. explains that the Schiff bases, named after Hugo Schiff, are formed when any primary amine reacts with an aldehyde or a ketone under specific conditions. Structurally, a Schiff base (also known as imine or azomethine) is a nitrogen analogue of an aldehyde or ketone in which the carbonyl group (C=O) has been replaced by an imine or azomethine group. Schiff bases are some of the most widely used organic compounds. They are used as pigments and dyes, catalysts, intermediates in organic synthesis, and as polymer stabilizers. Schiff bases have also been shown to exhibit a broad range of biological activities, including antifungal, antibacterial, antimalarial, antiproliferative, anti-inflammatory, antiviral, and antipyretic properties. Imine or azomethine groups are present in various natural, natural-derived, and non-natural compounds. The imine group present in such compounds has been shown to be critical to their biological activities. In this review we present the general approaches to the synthesis of Schiff bases. We also highlight the most significant examples of compounds belonging to this class, which exhibit analgesic, anti-inflammatory, and non-ulcerogenic activities to have been reported in the literature. The relationship between Schiff bases and other pharmacological activities, such as antiproliferative activities, are not included in this review\[n\]

S. Arunachalam* et.al. shows that the Schiff bases, named after Hugo Schiff, are formed when any primary amine reacts with an aldehyde or a ketone under specific conditions. Structurally, a Schiff’s base (also known as imine or azomethine) is a nitrogen analogue of an aldehyde or ketone in which the carbonyl group (C=O) has been replaced by an imine or azomethine group. Schiff bases are some of the most widely used organic compounds. Schiff bases have also been shown to exhibit a broad range of biological activities, including antifungal, antibacterial, antimalarial, antiproliferative, anti-inflammatory, antiviral, and antipyretic properties. Imine or azomethine groups are present in various natural, natural-derived, and non-natural compounds. The imine group present in such compounds has been shown to be critical to their biological activities. The first
preparation of imines was reported in the 19th century by Schiff (1864). Since then a variety of methods for the synthesis of imines have been described. The classical synthesis reported by Schiff involves the condensation of a carbonyl compound with an amine under azeotropic distillation. Molecular sieves are then used to completely remove water formed in the system. In the 1990s an in situ method for water elimination was developed, using dehydrating solvents such as tetramethyl orthosilicate or trimethyl orthoformate. In 2004, Chakraborti et al. demonstrated that the efficiency of these methods is dependent on the use of highly electrophilic carbonyl compounds and strongly nucleophilic amines. They proposed as an alternative the use of substances that function as Bronsted-Lowry or Lewis acids to activate the carbonyl group of aldehydes, catalyze the nucleophilic attack by amines, and dehydrate the system, eliminating water as the final step. The main aim of the production and synthesis of any antimicrobial compound is to inhibit the causal microbe without any side effects on the patients. In addition, it is worthy to stress here on the basic idea of applying any chemotherapeutic agent which depends essentially on the specific control of only one biological function and not multiple ones. The chemotherapeutic agent affecting only one function has a highly sounding application in the field of treatment by anticancer, since most anticancers used in the present time affect both cancerous diseased cells and healthy ones which in turns affect the general health of the patients. Therefore, there is a real need for having a chemotherapeutic agent which controls only one function. In this paper, we discuss the synthesis, spectral characterization and biocidal efficiency of series Schiff base compounds.

Matangi Sunitha* et al. shows that in the field of coordination chemistry, Schiff base metal complexes have a curious history. Metal ions play vital roles in the vast number of biological processes. Metal complexes with Schiff base ligands have been studied for their application in biological, clinical, analytical and pharmacological areas. Benzimidazoles are very useful intermediates for the development of Molecules of biological interest. Substituted benzimidazole derivatives have found applications in antifungals, anticancers and antiulcers etc. In this paper efforts were taken for the synthesis, characterization and antimicrobial studies of transition metal Complexes of bidentate nature Synthesis, Characterization and Antimicrobial activity of Transition of the ligand which
coordinates through the tertiary nitrogen of the imidazole ring, the exocyclic imine nitrogen of 2-(2-aminophenyl)1-\textit{H}-benzimidazole.\cite{9}

Basavaraj M. Kalshetty\cite{1} et al. shows that the metal complexes of Schiff bases show biological activities including antibacterial, antifungal, anticancer and herbicidal. The Schiff base complexes and derivatives of Coumarin, Thiazolidinone and Triazoles so far reported as anti-inflammatory, anti-oxidant, Vasorelant, cytotoxic, anti-HIV, anti-tubercular, and anti-microbial and develop effective therapies. The organometallic compounds generated due to their versatile applications in the pharmaceutical and chemical industries. The medical application in the treatment of wounds and tumors, where the metal complex compounds of triazole is to impart strength, elasticity and impermeability of water. These Schiff base complexes of selected metal ions in view of their potential applications in medicinal chemistry, biotechnology and their structural variety. These compounds are the active component in number of biocidal formulations, finding applications in such diverse areas as fungicides, surface disinfectants and wood preservatives. The metal complexes are still a major line of approach to develop new drugs, as reported earlier the Thiazolidine ring present in a large number of biologically active compounds, the development of penicillin which shows the Thiozolidine ring. Next, the development of Coumarin and derivatives of Coumarin like Amino-methyl Coumarin compounds with metal ions are most useful areas in medical chemistry. Keeping in view, the present developments of 4-Amino-3-ethyl-5-mercapto-Triazole compounds with metal ions are most fascinating. The continuation of work on the synthesis of Schiff base derived from 3-Aldehydosalicylic acid and its complex compounds with metal ions such as Cu (II), Zn (II), Ni (II), Co (II) and Cd (II) at different pH. The Schiff base compounds synthesized followed by standard procedures contains the acidic groups such as -COOH and –OH (phenolic), it is predicted that the coordination behavior of ligand would be developed on pH using different reaction conditions and are remarkably different from these reported by Nag et al.\cite{9}

B. R. Thorat et al. explains that the compounds containing azomethine (-C=\textit{N}-) group are known as Schiff bases, are formed by the condensation of a primary amines with a carbonyl compounds such as aldehydes or ketones. The Schiff bases of aliphatic aldehydes are relatively unstable and are radially undergoes polymerization while those of aromatic aldehydes having an effective conjugation
system are more stable. Schiff bases are plays very important role in many biological and chemical reactions; because of the imine linkage. Schiff bases are generally bi- or tri- dentate ligands capable of forming very stable complexes with transition metals. The word phosphor was invented in the early 17th century. There are some characteristics of typical phosphor as must survive hazardous chemical environment, cannot be water soluble, durable, easy to apply, not easily detected or noticed without specialized equipment, etc. Phosphors become technologically and industrially important with the introduction of fluorescent lamps in 1938. Thermometry was suggested in the German patent in 1938. First peer reviewed article, to our knowledge appeared in 1949 between 1950 to 1980, it was not widely used. Its most common use was aerodynamic applications. Advances in lasers, microelectronics, and other supporting technologies enable additional commercial as well as scientific use. The physics and chemistry of luminescence materials and their applications become and still is the core area covered by Luminescence symposia. In the small molecules organic light emitting diodes, the family of carbazoles could be extended to be suitably fit for red, green, and blue light triplet emitters and therefore, they can be used in full color displays. More recently studies of Thompson, Forrest and co-workers shows that the use of electron blocking layers (EBLs) consisting of Ir (III) complexes with picolinate ligands produced improved color purities in the case of blue light emitting device. Some of the organic molecules are used as EBLs as- fluorinated phenylenes, and oxadiazole as well as triazole containing molecules such as trimer of N-arylbenzimidazoles (TPBi), 2-tert-butylphenyl-5-biphenyl-1,3,4-oxadiazole (PBD), 3-phenyl-4-(1’-naphthyl)-5-phenyl-1,2,4- triazole (TAZ), 1,8- Naphthalimides, polyquinolines, or carbon nanotubes doped in PPV were also found to be useful as hole blocking layers (HBLs).\[s\]

Suraj B. Ade et.al. shows that the indole derivatives and their metal complexes have received much attention due to their wide application in physiology and pharmacology. They constitute an important class of compounds possessing antibacterial, anticonvulsant and antihypertensive activity. These observation led to the conception that Schiff bases of indole 3-aldehyde would possess potential antimicrobial properties. It was therefore, proposed to investigate the ligation properties of Schiff base derived from 2-amino, 4-methyl phenol with Indole 3-aldehyde and their Ti (IV), Zr (IV), Cd (II) and Hg (II) metal ion complexes.\[s\]
Adebomi A. Ikotun et.al. shows that the isatin is an endogenous indole with a variety of pharmacological actions, including anticonvulsant, anti-microbial and antiviral activities, inhibition of monoamine oxidase and behavioral effects. It has also found a wide application as a precursor in fine organic synthesis, leading to many different products, such as amine-, ether-, nitrile- and oxazole- derivatives, which were also proposed as therapeutic agents for coronary diseases such as ischemic heart disease, cardiac arrhythmia, hypertension and depression and even anticancer agents. The study of the metal complexes of the Schiff base ligands derived from isatin has also received much attention. Isatin-thiosemicarbazone Copper (II) complexes related to the antiviral drug, methiszone, was prepared and characterized using spectroscopic techniques. This type of complexes were found to cause significant inhibition of human leukemic cell proliferation presenting the copper atom in a square pyramidal coordination, as determined by crystallographic analysis. A novel non-nucleoside reverse transcriptase inhibitor (NNRTI) has also been designed. This aminopyridimino isatin lead compound was designed as a broad-spectrum chemotherapeutic agent active against HIV, HCV, Mycobacterium tuberculosis and various pathogenic bacteria. Metal complexes of the Schiff base of isatin and sulfanilamide have also been prepared and characterized using spectroscopic means. The ligand was discovered to have acted either in a bidentate manner or in a tridentate manner presenting the different metal atoms in various geometries. Also, some novel Schiff bases of 5-substituted isatin derivatives were synthesized with a comprehensive study of their antimicrobial activities. The study revealed that the Schiff base of 5-substituted isatin and “p”-nitroaniline was the most potent with antimicrobial activity (against four gram-negative and three gram-positive bacteria) and also antifungal activity. All these prompted our study, which was aimed at synthesizing metal complexes of the Schiff base of isatin and “p” nitroaniline, with the view to comprehensively study the antimicrobial activities of these compounds. These types of compounds are expected to also be of great biological importance, which is quite distinctive of such metal complexes of isatin derivatives. Our interest was to determine the effect of condensing isatin and aniline possessing an electron withdrawing specie (a deactivating nitro group) at the para position on antimicrobial activities. Perhaps the distinctively strong antimicrobial potency of isatin might be able to overcome this deactivating effect, thus producing another potent antimicrobial ligand and metal complexes.\cite{1}
M. Usharani et.al. explains that the literature reveals that the Schiff base ligands are excellent coordinating ligands. It forms a stable complex with different transition metal ions. In particular, the transition metal complexes have been the subject for thorough investigation because of their extensive application in wide ranging areas from material science to biological sciences. The study of mixed ligand complexes formation were relevant in the field of analytical chemistry, where the use of mixed ligand complexes allows the development of methods with increased selectivity, sensitivity and has also great important in the field of biological and environment chemistry. The pharmacological activity have been found to be highly dependent on the nature of the metal ion and the donor sequence of the ligands, different ligand shows different biological properties, though they may vary only slightly in their molecular structure. The present investigation is to prepare some Schiff base mixed ligand complexes derived from \( L_1 \) (4- chloroaniline & salicylaldehyde), \( L_2 \) (benzaldehyde & 2 aminophenol) and \( L_3 \) (4-nitroaniline & 2- hydroxyacetopheone), to elucidate their geometrical structures and to show their biological activity on some pathogenic bacteria.

Kamini J. Donde et.al. suggested that the Schiff bases are a significant class of ligand in coordination chemistry and find extensive purpose in different field. Schiff bases derived from pyridoxal and amino acids are considered very important ligands from the biological point of view. Transition metal complexes of such ligands are important enzyme models. The rapid development of these ligands resulted in an enhanced research activity in the field of coordination chemistry leading to very interesting conclusions. Mixed ligand complexes have been found to act as an active catalyst in reactions of industrial importance including hydrogenation, hydroformation, and oxidative hydrolysis of olefins and carboxylation of methanol. These complexes have also shown catalytic activity in various oxidation reactions of environmental and biological importance. Mixed ligand complexes containing amino acids as a secondary ligand are of significance as they are potential models for enzyme-metal ion substrate complexes. The lot of attention is being given to the study of mixed ligand complexes of Schiff bases containing salicylaldehyde and amino acids separately. Main aim of this study was to establish research topics where these two areas could be combined in a novel way. To fulfill this Schiff base 2-amino-4-nitrophenol-N-salicylidene was selected as a starting point and the mixed ligand Co (II) complexes were prepared by introducing
the various amino acids (viz. alanine, phenylalanine, valine, cysteine, leucine and glutamic acid) with Co (II) ions.\textsuperscript{[iv]}

Nura Suleiman Gwaram\textsuperscript{1,*} et.al. explains that the Schiff base ligands containing various donor atoms (like N, O, S, etc.) show broad biological activities and are of special interest due to variety of ways in which they can bond to metal ions. It is known that the existence of metal ions bonded to biologically active compounds may enhance their activities. Schiff base metal complexes show great diversity in their varied biological activities as anticonvulsant, antifungal, anti-HIV, antiviral and anticancer antimicrobial and antibacterial agents. Nosocomial infections caused by multidrug resistant bacteria are an increasing medical problem worldwide, particularly among immunocompromised patients and those hospitalized in intensive care units. Both Gram positive and Gram negative bacteria have developed high level resistance to multiple classes of antibacterial agents. These include methicillin resistant Staphylococcus aureus (MRSA), Pseudomonas aeruginosa, Acinetobacter baumannii, Escherichia coli and vancomycin resistant enterococci (VRE). Few available drugs such as linezolid and some newer glycopeptides, and tigecycline are active against MRSA and VRE, but their success rates are variable. As such, there is a need to explore other sources of effective antibacterial compounds to augment the limited choice of drugs for therapeutic treatment. In this study, transition metal complexes of some newly synthesized $N,N',N''$-donor Schiff base ligands obtained from the reaction of 4-(2-aminoethyl)morpholine, 4-(2-aminoethyl)piperazine or $N,N$-dimethylethylene diamine with 2-acetylpyridine in the presence of Cl$^-$, Br$^-$, and SCN$^-$ ions were examined for potential antimicrobial activities. Most of the synthesized compounds present a morpholine derivative which has been used as a building block for preparation of the antibiotic linezolid. The morpholine ring is important for antimicrobial activity as proved by quantitative structure activity relationship (QSAR). The objective of the study was to determine the anti-bacterial activities for the transition metals complexes against methicillin-resistant Staphylococcus aureus (MRSA), Acinetobacter baumannii (A. baumannii), Klebsiella Pneumonie (K. pneumonie) and Pseudomonas aeruginosa (P. aeruginosa) by using the disc diffusion and micro broth dilution assays.\textsuperscript{[w]}

Hanan Farouk Abd El Halima* et.al. shows that the preparation of a new ligand was perhaps the most important step in the development of metal complexes
which exhibit unique properties and novel reactivity. Since the electron donor and electron acceptor properties of the ligand, structural functional groups and the position of the ligand in the coordination sphere together with the reactivity of coordination compounds may be the factor for different studies. Schiff bases are an important class of ligands, such ligands and their metal complexes had a variety of applications including biological, clinical, analytical and industrial in addition to their important roles in catalysis and organic synthesis. In early work closely related to the system of interest here, Lions and Martin synthesized Schiff base ligands from 2, 6-pyridinedicarboxaldehyde (PDC) with aniline and benzylamine and noted that the free ligands were crystalline materials. Therefore, studies ensued in which this same pair of Schiff base linkages was incorporated in many different kinds of polydentate ligands, including various macrocyclic ligands. Pursuing the analogy to the Sauvage template, p-aminophenol was used as the amine in the straightforward Schiff base condensation reaction with PDC to give the diphenolic ligand. Previous studies on ligands and metal complexes derived from the Schiff bases of o- and p-aminophenol are few. In one case, the reaction between PDC and o-, m- and p-aminophenols in the presence of cadmium ions was used to differentiate aminophenol isomers and paminophenol had appeared in some recent publications as a Schiff base precursor. Two of these studies examined hydrogen-bonding interactions of the phenolic hydrogen while another involved esterification of the phenolic oxygen of the free Schiff base ligand to construct potential metallomesogen components. The X-ray crystal structure of \( L_1 \) and its Ni (II) and Zn (II) complexes had been reported by Vance et.al. Metal and mixed ligand complexes of \( L_1 \) and \( L_2 \) ligands have been reported. The structures of these ligands are shown in. Therefore, in continuation to our interest in Schiff base ligands and their metal chelates, this work deals with the synthesis and characterization of Schiff base ligands; \( H_2L_1 \) and \( H_2L_2 \), and their complexes.\(^{[x]}\)

Rangappan Rajavel et.al. shows that the metal complexes with Schiff bases as ligand have been playing an important role in the development of coordination chemistry as a whole. Schiff bases have therefore provided a foundation stone for the building of contemporary coordination chemistry and find extensive applications in different fields. Schiff bases are derived from aromatic carbonyl compounds and have been widely studied in connection with metalloprotein models and asymmetric
catalysis, due to versatility of their steric and electronic properties. Metal ions can enhance a reaction with Schiff base ligand by stabilization of a transition state or product by appropriate coordination. Schiff base and their biologically active complexes have been often used as chelating ligands in the coordination chemistry of transition metal, radiopharmaceuticals for cancer targeting, agrochemicals, models systems for biological macromolecules, catalysts and as dioxygen carrier. They also found useful in catalysis, in medicine as antibiotics and anti-inflammatory agents and in the industry as anticorrosion. In recent years much effort has been put in synthesis and characterization of mono and binuclear transition metal complexes. Schiff base ligands that are able to form binuclear transition metal complexes are useful to study the relation between structures and magnetic exchange interactions, and to mimics bimetallic biosites in various proteins and enzymes. Glyoxal and its related compounds have been extensively used as biologically active complexing agents and analytical reagents. It is employed as a selective diketones to obtain binuclear complexes of desired cavity size and significant reactivity. In this regard, there is much current interest in designing dinucleating ligands and their transition metal complexes.\[^5\]

Generally we know that Schiff’s base compounds are mainly synthesized by condensation of active carbonyl compound with primary amines.

\[
\begin{align*}
\text{R'} & \quad \text{H} \quad \text{R'} \\
\text{R'} & \quad \text{H} \quad \text{R'} \\
\text{Active Carbonyl} & \quad \text{Primary} & \quad \text{Schiff’s} \\
\text{Compound} & \quad \text{amine} & \quad \text{bases}
\end{align*}
\]

Also we know that Schiff’s base compounds are very much effective as chelating agent when they bear supporting and stabilizing group like –OH in the vicinity of >C=N group. They form five or six membered chelates. Such variables in Schiff’s bases are responsible to have a large flexibility in the structure with interesting magnetic and spectral properties. Hence a series of various Schiff’s base compounds with diverse structures has been synthesized,\[^118\].
Therefore we can easily conclude before that the chemistry of Schiff’s base compounds and their metal complexes giantly attracted many researcher and has been developed rapidly in recent years, \[119\].

According to previous year’s literature survey metal complexes Schiff’s bases compounds can be synthesized by various methods of preparation \[120\].

But they are mostly synthesized by the addition of alcoholic or aqueous metal ion solution to the alcoholic Schiff’s base solution in the presence of sodium acetate or alcoholic or aqueous ammonia. The addition may also be carried out in neutral medium. The imines are derived from aromatic aldehyde and ketones are relatively stable \[121\].

If we carefully observe, the donor atoms in tridentate Schiff’s base compounds are N-N-N, O-N-N, O-N-O and O-N-S, such systems have also contributed in the progress of chemistry of co ordination complexes of transition metal ions \[122\], \[123\] Tridentate as well as polydentate Schiff’s base metal complexes \[124\], have also great deal of contribution in chemistry of co-ordination complexes.

Simple methods for synthesis of Schiff’s base compounds were prepared from the reactions of aromatic aldehydes with 1, 2- dipyridyl ketones, by using \(K_3FeCN_6\) as a catalyst \[125\].

Many reactions of aldehydes with different amines were reported. In reactions of initial additions of ammonia to aldehyde to form an imine, followed by nucleophilic attack of the generated imine to carbonyl of the ketone by their mechanism. Simply these types of compounds approach will offer a new and direct route not only for the ligand synthesis but also for a potential pharmaceutical synthesis \[126\].

An attractive synthesis and antimicrobial activity of such ligands were reported by using 2-Acteyl pyridine with aromatic and antiaromatic aldehyde derivatives in dilute ethanolic potassium hydroxide solution at room temperature by using the reaction of claisen Schmidt condensation reaction, \[127\].

The carbonyl compound was treated with the primary amine in the presence of \(P_2O_5\) supported on \(SiO_2\) as a catalyst without a solvent by grinding with aromatic and aliphatic benzaldehyde. The reaction of different amines with benzaldehyde was obtained as the corresponding ligands in highly excellent yields in shorter time \[128\].
Determination of Stability Constant:

According to Calvin B-jerrum technique the formation of complex at equilibrium can be represented as follows, \[^{[29]}\].

\[
\text{M} + \text{L} \rightleftharpoons \text{ML} \quad \text{.........(1)}
\]

Where, M and L are metal and ligand respectively. Ligand L is a weak acid (HL), dissociated as,

\[
\text{HL} \rightleftharpoons \text{H}^+ + \text{L} \quad \text{.........(2)}
\]

The whole reaction of ligand with metal takes place as

\[
\text{HL} + \text{M} \rightleftharpoons \text{H}^+ + \text{ML} \quad \text{.........(3)}
\]

This is a measure of hydrogen ion concentration in a solution. For polyprotic acid H: L where is any positive integer in a solution.

The stepwise equilibrium constant is:

\[
\text{HL} + \text{H} \rightleftharpoons \text{H}_2\text{L} \quad \text{.........(4)}
\]

\[
\text{HL} + \text{H} \rightleftharpoons \text{H}_2\text{L} \quad \text{.........(5)}
\]

\[
\text{H}_{i-1} \text{L} + \text{H} \rightleftharpoons \text{H}_i \text{L} \quad \text{.........(6)}
\]

The \(i\)th thermodynamic proton – ligand stability constant \(K_{i^H}(T)\) is given as,

\[
K_{i^H}(T) = \frac{\text{a}^i \text{H}_{i-1} \text{L}}{\text{a}^{i-1} \text{H}_{i-1} \text{L} \cdot \text{a}^i \text{H}} \quad \text{.........(7)}
\]

\(\text{a}^i \text{H}_{i-1} \text{L}\) is the reciprocal of thermodynamic dissociation constant of acid \(\text{H}_{i-1} \text{L}\) dissociating as,

\[
\text{H}_{i-1} \text{L} \rightleftharpoons \text{H}_i \text{L} + \text{H} \quad \text{.........(8)}
\]

Where, ‘a’ is the activities of the respective species. According to equation number 1 the term ‘L’ reacts with the metal ions.

Now applying the law of mass action to above equation,

\[
K = \frac{[\text{M} \text{L}]}{[\text{M}] [\text{L}]} \quad \text{.........(9)}
\]

Where,

\([\text{M}]\) is the metal concentration.
[L] is the ligand concentration, and K is the equilibrium constant.

Many complexes with different ratios or metal to ligand ranging from ML to ML$_N$ are formed in solution.

Their stabilities could be described by the following set of equilibrium constant.

$$K_1 = \frac{[ML]}{[M][L]} \quad \text{(10)}$$

$$K_2 = \frac{[ML_2]}{[ML][L]} \quad \text{(11)}$$

$$K_N = \frac{[ML_N]}{[ML_{N-1}][L]} \quad \text{(12)}$$

Above mentioned quantities in the brackets are the concentration terms.

The thermodynamic metal – ligand stability constants are obtained by replacing the concentration terms by activity,

$$K_N(T) = \frac{^aM_L^N}{^aM_L^{N-1}^aL} \quad \text{(13)}$$

we can get total number of protons in the system. B-jerrum introduced a term called ligand number $\bar{n}$ in order to overcome this difficulty. He defined $\bar{n}$ as the average number of ligands bound per metal ion present in the same solution.

$$n = \frac{\sum_{i=0}^{N} i [ML_i]}{\sum_{i=0}^{N} [ML_i]} \quad \text{(14)}$$

for the proton ligand association similar $\bar{n}_A$ is given as follows,

$$n = \frac{\sum_{i=0}^{N} i \beta_i H [H^i]}{\sum_{i=0}^{N} \beta_i H [H^i]} \quad \text{(15)}$$

Where $\bar{n}_A$ is the mean number of protons bound per non-complex bound ligand molecule.
The total concentrations $T_M$ of the metal ion M is the sum of concentrations of the different species containing it as follows,

$$T_M = [M] + [ML] + \ldots + [ML_{i-1}] = \sum_{i=0}^{N} [ML_i] \quad \ldots \quad (16)$$

Similarly, the total concentration of the ligand is the weighted sum of the concentrations of the species containing it as

$$T_L = [L] + [2][ML_2] + \ldots + N[ML_N]$$

$$= [L] \sum_{i=0}^{N} i[ML_i] \quad \ldots \quad (17)$$

The total concentrations $T_M$ and $T_L$ are given by the expression:

$$T_M = \sum_{i=0}^{N} \beta_i [L]^i \quad \ldots \quad (18)$$

and

$$T_L = [L] + [M] \sum_{i=0}^{N} i \beta_i [L]^i \quad \ldots \quad (19)$$

The total extent of complex formation is characterized by the ligand number $\hat{n}$, given by,

$$\hat{n} = \frac{[ML] + 2[ML_2] + \ldots + N[ML_N]}{[M] + [ML] + \ldots + N[ML]}$$

$$= \frac{T_L - [L]}{T_M} \quad \ldots \quad (20)$$

From this equation we have,

$$\hat{n} = \frac{\sum_{i=0}^{N} i \beta_i [L]^i}{\sum_{i=0}^{N} \beta_i [L]^i} = \frac{\sum_{i=0}^{N} i \beta_i [L]^i}{1 + \sum_{i=0}^{N} \beta_i [L]^i} \quad \ldots \quad (21)$$

The measurement of the free ligand concentration permits the calculations of the complete set of stability constant.
Experimental Method for Determination of Stability Constant:

If we observe, there are certain steps to determine the stability constant of metal complexes.

1. The construction of formation curve of the system. This is expressed by plotting n against pL
2. The calculation of the values of K by solving the formation functions of the system.
3. The conversion of the stochiometric constants into the thermodynamic ones.

The experimental procedure involves following three titrations:

1. Free HClO₄ (A) → A
2. Free HClO₄ (A) + ligand (R) → A+R
3. Free HClO₄ (A) + ligand (R) + Metal ion (M) → A+R+M

Ionic strength of the solution with standard NaOH was maintained constant 0.1 M by the addition of NaClO₄ solution.

The temperature of titration solution was kept constant at 30°C. According to the same volume of alkali, the ligand curve will indicate lower values of the pH then the acid curve if it contains more titrable hydrogen ions as it would happen when the chelating agent is an acid. If the metal chelate is formed in the reaction, the proton attached to the ligand must be displaced so that the metal complex titration curve will indicate pH values lower than the ligand titration curve.

Calculation of \( \bar{n}_A \) values:

\( \bar{n}_A \) is the proton ligand formation number. The proton ligand formation number \( \bar{n}_A \) will be calculated from the volume of alkali required to obtain the same pH values in the acid and ligand titrations.

From the equation which is given below we can calculate the values of \( \bar{n}_A \) for various pH values.

\[
\bar{n}_A = \frac{(V_2-V_1) (N + \Box^0)}{(V_0^0 + V_1) T^O_L}
\]

Where \( \gamma \) is the number of replaceable hydrogen hydrogen ions in the ligand, \( V^0 \) is the initial volume of the solution, \( V_1 \) and \( V_2 \) are the volumes of alkali of a known normality \( N \) required during the acid (A) and acid + ligand (A+L) titrations respectively.
When we observe the pH at a particular pH, $\Delta^o$ and $T^o_L$ are the initial concentrations of the perchloric (HClO$_4$) acid and ligand respectively.

The horizontal difference ($V_2-V_1$) was taken from the graph accurately up to the second place of decimals.

**Calculation of pK values:-**

According to stability constants, the proton ligand stability constants pK$_1$ were calculated by the following method.

1] **Half Integral method:-**

Half integral method is one of the methods for calculations of approximate PK values were calculated from the formation curve. The values of pH at $\bar{n}_A$ =1.5 and $\bar{n}_A = 0.5$ corresponds to the values of pK$_1$ and pK$_2$ respectively.

**Calculation of $\bar{n}$ values:-**

According to calculation of $\bar{n}$ values the metal ligand formation number, is given by the expression as follows,

$$\bar{n} = \frac{(V_3-V_2) \ (N + \Delta^o)}{(V^0 + V_2) \ \bar{n}A \ T^o_M}$$

Where, $V_3$ is the volume of alkali required to obtain the same pH for (A+R+M) systems as per the acid and acid +ligand titrations, $T^o_M$ in the initial concentration of metal ions, $\bar{n}_A$ is the proton – ligand formation number at the pH value.

**Calculations of pL values:-**

For the calculations of P$_L$ values we can follows,

$$pL = \log \frac{1+H^+/K}{T^o_L - \bar{n} T^o_M} \ \times \ \frac{V^o + V_3}{V^o}$$

and if the ligand have two pK values.

$$pL = \log \frac{1+ \frac{H^+}{K_2} + \frac{(H^+)^2}{K_1 K_2}}{T^o_L - \bar{n} T^o_M} \ \times \ \frac{V^o + V_3}{V^o}$$

**Calculations of Log K values:-**
For the calculations of metal ligand stability constants the following methods were used.

1. **Half Integral Method:**

   The half integral method can be used as follows,

   The values of $\tilde{n}$ have been plotted against $pL$ to get the formation curve for the metal ligand complexes. The approximate $\log K_1$ and $\log K_2$ values were calculated from the formation curves by the known value of $pL$ at which $\tilde{n} = 0.5$ and $\tilde{n} = 1.5$ respectively.

   **Method of pointwise calculations:**

   Method of pointwise calculations is very important method for metal-ligand stability constant. The accurate $\log K$ values were calculated by this method. The metal ligand stability constant for 1:1 complex i.e. for calculations of $\log K_1$ the expressions,

   \[
   \log \frac{\tilde{n}}{1 - \tilde{n}} = \log K_1 - pL \quad \text{for } \tilde{n} = 0.2 \text{ to } 0.8
   \]

   and the ligand-metal stability constant for 1:2 complex i.e. for calculations of $\log K_2$, the expressions,

   \[
   \log \frac{\tilde{n} - 1}{1 - \tilde{n}} = \log K_2 - pL \quad \text{for } \tilde{n} = 1.2 \text{ to } 1.8
   \]

   Were solved for $\tilde{n}$ values between 1.2 to 1.8

   **Method of Least Squares:**

   According to calvin b-jerrum technique it is important and useful for stability constants; B-jerrum equates the half integral values to appropriate $\log K$ values, where $K$ is a formation constant, as the first step in a series of successive approximations. As we know that this method also have been certified by Irriving and Rossoti on the grounds that is uses only two points on the formation curve and it holds only when $(K_1/K_2 \geq 2.5)$, for system where only 1:1 and 1:2 complex are formed.

   When this calvin b-jerrum pH titration technique is used to obtain the formation curve data, the log $K$ values can not be more accurate than the observed pH values i.e. the accuracy can not by greater than above $\pm 0.02$ log unit, if we seen in such cases half integral method give reasonably accurate values for even much lower value of $\log (K_1/K_2)$, \[^{[130]}\].

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Table 1.1 shows the minimum passing (permissible) values of log (K₁/K₂) for certain desired accuracies of the log K₁ value for system involving 1:1 and 1:2 complexes.

<table>
<thead>
<tr>
<th>Allowable error values in Log K₁</th>
<th>Minimum permissible value of Log K₁/ Log K₂</th>
</tr>
</thead>
<tbody>
<tr>
<td>-0.002</td>
<td>3.10</td>
</tr>
<tr>
<td>-0.006</td>
<td>2.40</td>
</tr>
<tr>
<td>-0.02</td>
<td>2.11</td>
</tr>
<tr>
<td>-0.01</td>
<td>1.75</td>
</tr>
<tr>
<td>-0.09</td>
<td>0.92</td>
</tr>
</tbody>
</table>

The method of least squares was therefore, worked out for all those systems where log (K₁/K₂) was less than 2.09 because the accuracy of our pH meter is ± 0.01. Since most of the systems in present investigation fall into this criterion, the method of least squares was used. The mathematical expression for method of least squares when the complexes present are only 1.1 and 1.2 can be written as,

\[
\frac{\bar{n}}{(\bar{n} - 1)} = \frac{(2 - \bar{n})}{K_1 K_2 - K_1}
\]

**METAL CHELATES IN SOLUTION:**

As we known, Metal chelates have the tendency to coordinate Covalent bond to the same metal ions. There are several ligands (Schiff’s base compounds) with more than one donor atoms have geometries such that they can form more than one co-ordinate covalent bond to the same metal ion; these types of chelating natured ligands should be non-linear and property they must forms bonds with different reasonable angles at the metal atom. Such a type of bond angle needs the different varieties of donor atoms must be for enough in the ligand to form five or six membered rings. This type of Heterocyclic ring is known as chelate and the whole process is known as chelation process. [131]. If we discussed about five and six membered ring are more stable. Five membered ring with single bond is usually most stable [132], but the six membered ring with two double bonds in the ring have large stability.

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In aqueous solution all ionic and molecular species are highly solvated by water molecules because the formation of bond of positive metal ions to the negative ends of water dipoles and so there is a high solution of metal ions.

According to affinity of Schiff’s bases ligands which are weak acids, has higher affinity for the more electropositive metal ion than for the proton.

When ligands attaches to metal ion, it releases a proton and simultaneously, replaces a water molecule coordinated to the metal ion. The change in proton concentration is thus related to the extent of reaction taking place which can be followed by the pH measurements.

Brief Account of Transition Metal Complexes:-

Fe (III) Iron Complexes:-

Iron is biologically most important transition element in plants and animals functioning as electron carrier, oxygen carrier, oxygen storage and forms several unusual complexes\(^{[133]}\), Iron is fourth most abundant element in the earth’s crust. Iron can easily takes part or attaches towards ligands. Ligands have coordinate via oxygen octahedral complexes of Fe (III) like \([\text{Fe (CN)}_6]^{3-}\) are low spin with an unpaired electron having a magnetic moment of 1.9 B.M., While the complexes \([\text{Fe (H}_2\text{O)}_6]^{3+}\) \([\text{Fe (F)}_6]^{3-}\) etc. are high spin with five unpaired electrons having a magnetic moment of 5.9 MB.

There are many types of the ligands such as bipyridyl, phenanthroline have chelating nitrogen donor atoms and form stable complexes with Fe (III). According to substitution of metal ion, the substitution of metal ion is difficult in such low spin complexes yield by strong field ligands. According to bidentate, tridentate and polydentate Schiff’s base ligands with a several number of stable chelates of Fe (III) were reported in brief account.\(^{[134],[135]\text{ and }[136]}\), for iron (II) complexes ([Ar] 45\(^0\) 3d\(^5\)) a coordination number of six within octahedral ligand sphere is preferred. Iron (III) ([Ar] 45\(^0\) 3d\(^5\)) can co-ordinate three to eight ligands and often exhibits an octahedral coordination. Iron (III) is generally a harder lives acid.

If we observe the role of iron complexes in organic chemistry, iron play an important role in catalysis is an important field in both academic and industrial research. Iron has not played a dominant role in catalytic processes. Organo iron chemistry was started by the discovery of penta carbonyl iron in 1891, independently by Mond.\(^{[172]}\) more recently, the increasing number of reactions using
catalytic amounts of iron complexes indicates a renaissance of this metal catalysis.

Iron catalysis care into focus by the Reppe Synthesis [173], Iron in low oxidation states and in particular for iron-catalyzed reactions because they can form more reactive complexes than their iron (II) and iron (III) counter parts. Therefore, iron (O) and iron (-II) compounds are favoured for iron catalysis. Iron carbonyl complexes are of special interests due to their high stability with an iron centre capable of co-ordinating complex organic ligands, which represents, the basis for organ iron chemistry.

Iron forms three stable homoleptic complexes with carbon monoxide, penta carbonyliron (Fe(CO)₅), nonacarbonyldiiron (Fe₂(CO)₉) and dodecarbonyltriiiron (Fe(CO)₁₂) pentacarbonyliron is a stable 18-electron complex of trigonal bipyramidal geometry and represents the primary source of most organoiron complexes.

**Cobalt (II) Complexes:**

A cobalt complex plays an important role in oxygenation of cobalt (II) complexes. The mechanism and the thermodynamic and kinetic factors of the oxygenation of cobalt (II) complexes are discussed. It is shown that the essential features of the oxygenation of Cobalt (II) complexes are explicable with the mechanism to be proposed [174], Cobalt (III) complexes have been some of the most widely studied since they are kinetically inert and undergo ligand exchange reactions very slowly. In contrast cobalt (II) compounds are labile and undergo such reactions very rapidly. A very common synthetic procedure for the synthesis of cobalt (III) complexes involves oxidation of the corresponding cobalt (II) salt in the presence of the desired ligands.

If we seen the electronic configuration of cobalt, having odd atomic number with d⁷ configuration has low abundance of only 23 ppm by weight in the earth crust out of the common (+2) and (+3) oxidation states, (+2) state is more stable than (+3). However (+3) states is stable considerabely and is important in complexes. Co (II) forms tetrahedral or octahedral complexes. The Co (II) forms more tetrahedral complexes than any other metal ion. The colours of octahedral complexes are orange pink in colour, while tetrahedral complexes are having blue or violet in colour.

The cobalt chelates are derived from ligands of bromo salicyladehyde and suphamethoxy pyridizine; sulphamethazole, sulphafurazole have been reported as six coordinated. [138] The cobalt (II) complexes are also tridentate, the Schiff’s base
compounds can be prepared by various analytical techniques and reported to be a six coordinated chelates.\textsuperscript{[139]}

**Nickel (II) Complexes:**

Nickel (II) is one of the most important transition metal elements which is moderately abundant and is twenty second most abundant element in earth’s crust. It exists as Ni (II) in most of its complexes, having d\(^8\) configuration and has coordination number rarely exceeding to six. The octahedral and square planner complexes are commonly formed and a few tetrahedral, trigonal bipyramidal structures are also reported \textsuperscript{[140]}. According to octahedral and tetrahedral Ni (II) complexes, these are having green, intensively blue, or blue in colour, they are paramagnetic as the d\(^8\) ion has two unpaired electrons involving Sp\(^3\)d\(^2\) and Sp\(^3\) by hybridization respectively.

The square planar Ni (II) complexes are generally red brown or yellow in colour. They are diamagnetic under strong field forcing the electrons to pair up with dsp\(^2\) hybridisation.

In case of mixed ligand complexes of Ni (II) of MLL’ type prepared from Schiff’s bases of salicylaldehyde and 2 hydroxy acetophenone were synthesized and they are reported to have octahedral geometry. However, the mixed ligand chelate of Ni (II) commonly forms complexes with three different geometries octahedral, tetrahedral and square planar. Their some five coordinated complexes are known but are rare. Nickel (II) is a 3 d\(^8\) system so octahedral and tetrahedral complexes will have two unpaired electrons and square planar complexes will have none. Octahedral complexes can be prepared from both strong field and weak field ligands tend to be square planar and those with weak field ligands tend to be tetrahedral.

Square planar Ni (II) complexes usually have no unpaired electrons, are diamagnetic and thus have a magnetic moment of zero. Ni (II) with 2 unpaired electrons would have a calculated spin only magnetic moment of 2.83 \(\mu_\beta\). Octahedral Nickel (II) complexes have magnetic moments between 2.9 and 3.4 \(\mu_\beta\) which indicates a small but definite orbital contribution to the magnetic moment.

Different geometries of Ni (II) have quite different spectra in the visible and near IR portions of the spectrum. Octahedral Ni (II) has three absorptions: 900-1100 nm (9,000-11,000 cm\(^{-1}\)); 550-700 nm (14,000-18,000 cm\(^{-1}\)) and 325-400 nm.
Tetrahedral Nickel (II) typically has a similar spectrum but shifted to lower energies.

**Cr (II) Complexes:**

We know that chromium is an abundant element in the earth’s crust. The metal is used for plating and in chrome steels. The chromates [Cr (VI)] have many industrial uses as pigments; catalysts and fungicides. Cr (III) is a common and stable oxidation state that displays significant kinetic inertness.

The use of Cr (II) / amino acid complexes as reducing agents for some organic reactions as well as the use of Cr (II) is justified by its easy availability, excellent coordination behaviour as well as strong reducing power. The use of amino acid as ligands appears to be a necessary condition for the reactivity of Cr (II) ion is aqueous or strongly polar media. If the amino acid ligands are selected from a pool of natural amino acids the reductions by this complex produce enantiometric excess in products, if prochiral substrate was used.

The chromium Cr (II) complexes used as anticancer drugs. Cancer is a leading cause of death current therapies, includes surgery, radiotherapy and chemotherapy in short Cr (II) complexes are used in the treatment of cancer and chemotherapy.\[^{142}\].

According to stability constant of some Cr (II) complexes, the equilibria between the binuclear complexes Cr$_2$, Co$_2$, (Me)$_4$ and various chelating ligands have been studied spectrophotometrically in acetate buffer media with following ligands malonate, log $\beta_2$ = 6.0 ± 0.2 N- methyliminodiacetate, log $\beta_2$ = 12.3 ± 0.50; ethylenediamine, -N; N" – acetate log $K_1$ = 9.1 ± 0.2 at $T= 25^\circ C$ 1=1.0 M (1 m = mol dm$^{-3}$) (NaClO$_4$)\[^{143}\].

**Cd (II) Complexes:**

The stability constants for the Cd (II) –glycine binary complex system have been determined using polarographic measurements in DMF – water mixture ionic strength was maintained with KCl ($\mu = 1.0$ M). This type of study shows the tendency of glycine to form complex with Cd (II) ion is greater in DMF – water mixed as compared to that in only water.\[^{175}\], Cadmium plays an important role in biological and chemical process. Cadmium also forms useful amalgams with many metals, which finds various applications in diverse fields due to the numerous applications and the toxic nature of amalgams and cadmium compounds. Cadmium is one of the most toxic heavy metal on earth. The toxicity of Cadmium depends on
its occurring forms; the co-ordination chemistry of Cadmium Cd (II) differs from most other transition metals due to its large size and \(d^{10}\) configuration. Its interference in biological systems, and its potential as a toxin or as a medicine, has required a better understanding of its co-ordinative properties.\(^{[176-177-178]}\).

The cadmium Cd (II) complexes of thiourea and N-alkylthiourea as have been used as precursors for the preparation Topocupped Cds nano particles. The precursors are air stable, easy to prepare and in expensive. These compounds decompose cleanly to give good quality of crystaline materials.\(^{[144]}\).

Cadmium salts of organic acids are used as catalysis in the productions of a wide variety of organic materials, cadmium mercury telluride is an important semiconductor of IR imaging system.

**Cu – Copper (II) Complexes:**

According to investigation of complex ions of copper (II), transition metal ions such as Cu (II) ion in aqueous solutions generally exist as complex ions in which water molecules, acting as Lewis bases, \(\text{“co-ordinate”}\) or bond with the small cation (which acts as a Lewis acid) aqueous copper (II) ions are generally coordinated with four water molecules resulting in the species \([\text{CuCH}_2\text{O}_4]^{2+}\) (tetraaquacopper (II) ion).

**Aim and Short Description of Present Research Work:**

The aim of present work is to prepare some novel Schiff’s base compounds from transition metal complexes. We know that Schiff’s base; ligands are generally derived from aldehyde, ketonic and amine containing groups. Schiff’s base ligands can easily react with transition metal ions and gives high yield of products also Schiff’s bases are medicinally important compounds.

The Schiff’s base ligands \((H_2L^1 – H_2L^4)\) has been prepared by the reaction of acetoacetanilide with O-phenylenediamine and salicylaldehyde/ O-hydroxyacetophenone/O-Vanillin /2 hydroxy-1-napthaldehyde and a series of mononuclear ruthenium (II) complexes has been synthesized \(^{[179]}\). A number of aldehydes and ketones have been found to react with O-phenylenediamine leading to the formation of an azomethine linkage exhibiting a broad spectrum of biological activities \(^{[180]}\), Studies of Mn (II) and Ni (II) complexes with ligands prepared from 2-amino benzoic acid and salicylaldehyde compounds \(^{[181]}\). As can be observed metal complexes plays an essential role in agricultural, pharmaceutical and industrial chemistry. \(^{[182]}\), preparation, characterization and anti microbial activity of various
Schiff’s base complexes of Zinc (II) and Copper (II) ions, The latest and present availability of azomethine group in these compounds has been found to decrease toxicity considerably, According to Schiff’s base ligands of sulphonamide with salicyldehyde have been found to be good complexing agents and giving good yield of products, preparation of Schiff’s base ligands derived from 4-hydroxy-3-3 (1-C\textsubscript{2}2\textsubscript{-2}[2-hydroxy-benzylidine)-amino] phenyl imino) –ethyl-6 methyl-pyran-2 one etc. at reflux condition by adding 10% methanolic solution of amononia, According to complex formation of some lanthanides with Schiff’s base ligands derived from sulphanalaine and salicyldehyde compounds which are medicinally very much important.

A physiochemical study of stability constant of ternary complexation of some transition metals and their detailed discussion. Preparation and antimicrobial activity of some new chalcones of 2-Acetyl pyridine with substituted benzaldehyde compounds. The Schiff’s base compounds were prepared from the reaction of carbonyl compounds with primary amines with different substituted salicylaldehyde and benzaldehyde compounds, all these above mentioned and explained reference research work inspired us to study the complex characteristics, tendencies, varities of Schiff’s base ligands compounds of salicylaldehyde and 3, 5 tertiary -2-2 hydroxy benzaldehyde, 2-amino pyridine and diamines towards different type of metal ions.

The present work relates the synthesis of Schiff’s bases derived from given names of amines and aldehydes.

**Group –A-**

1] Salicylaldehyde
2] 3, 4 – tetrybutyl 2- hydroxyl benzaldehyde
3] 3, 5- tertery butyl 2- hydroxyl benzaldehyde
4] Benzaldehyde

**Group – B –**

1] Ethylene diamine
2] 1, 3- Diamino propane
3] 1, 2 -Diamino benzene
4] 2- Amino pyridine

The aim of present work can be given in following points:
i) The behaviour of Schiff’s base compounds towards the formation or metal complexes in solutions.

ii) To do the detailed study and the effect of different substituent at different positions on the stability of Schiff’s base ligands and their metal complexes.

iii) To study their effect of different temperatures.

iv) The solid study of transition metal complexes and Schiff’s base ligands.

v) To study the dependence of stability constants of the complexes on atomic number of metal ions.

vi) To explain the complexation equilibria of complexes with the help of various pH values.

vii) To study the detail magnetic behaviour of complexes.

**Factors affecting stability constant of metal complexes in solutions:**

In case of metal-ligand complexes, the stability constants under given experimental conditions were determined by the ratios of the central metal ions and Schiff’s base (ligands).

The correlations between the properties of the central ion and stability of complexes depend on the following factors:

i) Ionic Radius

ii) Ionization potential

iii) Electronic Configuration

iv) Charge on the central ion.

Similarly, the relation between the properties of ligands and the stability constants of metal complex depends on

a) Character of the donor atom.

b) Basicity of the ligand

c) Behavioural effect of chelate formation

d) Nature of central metal ion.

According to stability constant, stability constant is a measure to know the stability of metal-ligand complex in solution, the main basic need and purpose of stability constant is to know and measure the stability of metal-ligand complex in solution. Factors affecting the stability constant of a complex as follows:

**a] Character of donor atom:**
According to Sidgwick, nitrogen and oxygen atoms are found to be strongly chelating metal ions. This naturally occurring tendency was however found to be greatly influenced for both the elements with increasing substitution in the Schiff’s base compound structures. The great scientists Calvin and Wilson pointed out the correlation between basic strength of the Schiff’s base ligands and stability constant of the complexes with several enolic compounds. According to nature of the ligating atoms like N, O and F forms stable bonds with small metal ion like Li$^{+3}$, Co$^{+3}$, Ti$^{4+}$. Ligating atom like S and P form stable complexes with larger metal ions, Pb$^{2+}$, Hg$^{2+}$, and Cu$^{+}$ (HSAB concept).

**b) Basicity of the ligands:**

According to basicity of the ligands, electron donor tendency higher the electron donor tendency stabler is the complex basicity of organic ligand can be increased by Electron donor Substituents (+ 1 effect) for ex: NH$_3$, CH$_3$-NH$_2$ where, CH$_3$-NH$_2$ is more basic better electron donor from stable complexes.

**c) Behavioural effect of chelate formation:**

According to chelating ability of ligand, chelating ligand forms stabler complexes thus eg. (H$_2$N-CH$_2$-CH$_2$-NH$_2$) from stable complex the NH$_3$.

EX. [Cu (NH$_4$)$_2$]$^{2+}$ Stabler then [Cu (en) 2]$^{2+}$ therefore en is a chelating agent.

Chelate effect is thermodynamic effect can be explained using entropy factor during chelate formation. There is an increase in entropy i.e S is +ve. G is decreases i.e. Thermodynamic stability increases. [Co (H$_2$O)$_6$] $^{3+}$ + 3 en [Co (en) 3]$^{3+}$ + 6H$_2$O number of 1+2+1+6 particles 47 particles. There is a net increasess in the number of particles larger the number of particles higher is entropy there fore more the number of chelate ring higher is the stability.

**d) Nature of the central metal ion:**

As we know that transition metal ions are performing their complex activity with Schiff’s base ligands. One of the most important characteristic features of the central metal atom is that influence the stability of complexes are its degree of oxidation (charge on the central metal ion in the case of ionic complexes) radius and the electronic structure. If the basicity of the metal increases then stabilities of transition metal complexes increases, Mellor and Malley has shown that the stabilities of bivalent metal ion complexes follow the order: Cd$^{2+}$ > Cu$^{+2}$ > Ni$^{2+}$ > Pb$^{2+}$ > Co$^{2+}$ > Cd$^{2+}$ > Fe$^{2+}$ > Mn$^{2+}$ > Mg$^{2+}$ irrespective of the nature of the ligands.
Properties and characteristics of metal ions:

Properties of iron, cobalt, nickel, copper and zinc—all these metals are known as transition metal ions and are constituents of metallo enzymes, play an important role in oxygen transportation and redox catalysis process. These metals are also known as biometals, are always coordinated to bio-ligands such as amino acids and heteroatomic nitrogen bases. According to chemical properties of Iron, Cobalt, Nickel, Copper and zinc—Nickel compounds are most stable than P+ (II) compounds. The ionization energy of Nickel is less than that of platinum, Ni, Cu₂O, ZnO, FeSO₄ these metals are also used as catalysts in organic reactions. These transition metals are always used in the complex formation. There are many chemical properties and characteristics of transition metals ions these above are one of the properties. As we know that the correlations between the properties of the central ion and stability of complexes depend on the following factors can be explained in detail as following:

i] Ionic Radius:

In case of ionic radius, ionic radii are difficult to measure with any degree of certainty, and vary according to the environment of the ion for example, it matters about the co-ordination of the ions is (how many oppositely charged ions are touching it), and what those ions are.

ii] Ionisation potential and electronegativity:

Electron negativity is a chemical property that describes the tendency of an atom or functional group to attract electrons (electron density) towards itself. An atoms electronegativity is affected by both of its atomic number and the distance that is valence electrons reside from the changed nucleus. The higher associated electronegativity number, the more an element or compounds attracts electrons towards it. electronegativity can not be directly measured and must be calculated from other atomic or molecular properties.

According to ionization potential, the ionization energy or a chemical species, i.e. an atom or molecule, is the energy required to remove electrons from gases atoms or ions. The property is called ionization potential. Large atoms on molecules have low ionization energy, while small molecules tend to have higher ionization energies, elements with low ionization energy tend to be reducing agents and form salts. The ionization energy is different for electrons of different atomic or molecular orbitals.
iii) **Electronic Configuration:**

According to electronic configuration of metal ion metal ion with pseudo inert gas configuration forms stable complex than those having inert gas configuration. Pseudo inert gas configuration metal ion with (n-1) d\(^{10}\) ns\(^2\) np\(^6\) ex. K\(^+\) and Cu\(^+\). Where as the charge size nearly the same but Cu\(^+\) forms stabler complexes, the cations of transition metal elements have pseudo inert gas configurations (n-1) d\(^{10}\) ns\(^2\) np\(^6\) in the outermost shell, where d-orbitals are poor shielding and higher effective nuclear charge so ligands i.e. Schiff’s base attracts more. Hence Cu\(^+\) is stabler complex. So far the discussion has focused on the splitting of the d-orbitals in various fields, for the octahedral field; there are some electron configurations that are simple.

```
 eg  eg  eg  eg  eg
 t_2g  t_2g  t_2g  t_2g  t_2g
```

For d\(^4\) – d\(^7\), two different electron configurations are possible for first row transition elements.

iv) **Charge on the central ion:**

In case of charge on the central ion, the greater the charge and smaller size of an ion i.e., the larger the charge/radius ratio of an ion, the greater the stability of its complex for ex. The stabilities of high spin complexes of the ions between Mn\(^{2+}\) and Zn\(^{2+}\) with a given ligand vary in the order (with radius in Å):

\[
\begin{align*}
\text{Mn}^{2+} &< \text{Fe}^{2+} < \text{Co}^{2+} < \text{Ni}^{2+} < \text{Cu}^{2+} < \text{Zn}^{2+} \\
0.91 &< 0.83 < 0.82 < 0.78 < 0.69 < 0.74
\end{align*}
\]

This order is called as natural order or Iriving William order of stability.

According to Lewis acid concept higher the charge higher is Lewis acidity stabler the complex. Ex. [Fe (H\(_2\)O) \(_6\)]\(^2+\) less stable. [Fe (H\(_2\)O) \(_6\)]\(^3+\) - more stable because Fe\(^{3+}\) ion. Metal ion Cu\(^+\) forms stable complexes because the cations of non-transition elements have their inert gas configurations (n – 1) S\(^2\) P\(^6\) in the outer
most shell, where d-orbitals are poor shielding and higher effective nuclear change so ligand attracts more. Hence Cu+ is stabler complex.

**Stability of complexes:**

According to Calvin b-jerrum technique, the formation of complex [eg. MLₙ] proceeds by the stepwise addition of the ligands to the metal ion.

\[
\begin{align*}
M + L & \rightleftharpoons ML_1, K_1 = \frac{[ML_1]}{[M][L]} \\
ML + L & \rightleftharpoons ML_2, K_2 = \frac{[ML_2]}{[ML][L]} \\
ML_{n-1} + L & \rightleftharpoons ML_n, K_n = \frac{[ML_n]}{[ML_{n-1}][L]}
\end{align*}
\]

\[K_1 > K_2 > K_3 \ldots \ldots \ldots \ldots \ldots \ldots > K_{n-1} > K_n.\]

The higher the value of stability constant for a complex ion, the greater will be the stability. The overall formation constant K (or \(\beta_n\)) correspond to the process

\[M (H_2O)_n + n L \rightarrow ML_n + nH_2O\]

and is the product or stepwise formation constant.

\[K \text{ or } \beta_n = K_1, K_2, K_3 \ldots \ldots \ldots \ldots \ldots \ldots K_n\]

According to stability constant of complex the charge on metal ion, the greater change and smaller size or – an ion, i.e. the larger the change/radius ratio of an ion, the greater the stability of its complex.

**Introduction to magnetic susceptibility:**

According to magnetic susceptibilities of transition metal complexes, they can be determined by Faraday method an NMR and gouy balance method. Commonly we must know that the magnetic moments can be found out by magnetic susceptibilities. If we considered, then all the substances possess inherent magnetic properties and are affected in some way be the different applications of magnetic field. According to transition metals, we may find that chemistry of the transition (metal) elements provides the most interesting magnetic investigation; this
is because the fact that the influence of neighbouring groups on the ‘d’ electrons of metal ions are sufficiently strong to affect significantly their magnetic properties. Therefore the magnetochemistry is one of the most valuable techniques in the investigations of transition metal complexes.\[157],[158].

When a substance is subjected to magnetic field ‘H’ and a magnetization, I is the induced factor. The ratio I/H is called the volume susceptibility K can be measured by one of the techniques is known as Gouy balance method; Faraday method and Nonr method gram susceptibility is related to the volume susceptibility. The gram susceptibility is shown by the symbol $\chi$ and the molar susceptibility is shown by $\chi_m$.

\[
\chi = \frac{K}{d}, \quad \chi_m = \frac{KM}{d} \quad .................. (1)
\]

Where, d and m are the density and molecular weight of the substance respectively. In case of paramagnetic substance $K_1$, $\chi$ and $\chi_m$ are the positive quantities. The effective magnetic moment $\mu_{\text{eff}}$ is calculated from relation.

\[
\mu_{\text{eff}} = 2.83 \sqrt{\chi_m T} \quad .................. (2)
\]

Where,

$T = $ is the absolute temperature and the constant 2.83 is obtained from quantum mechanical calculations.

\[
\chi_{\text{para}} = \frac{N_A \mu_{\text{eff}}^2}{3 K T} \quad .................. (3)
\]

Magnetic susceptibility would depend on the temperature but it is independent of the strength of the external field applied. The magnetic susceptibility of paramagnetic substance, $\chi_{\text{para}}$ would, therefore, decrease with increase in temperature. The variation of $\chi_{\text{para}}$ with temperature is expressed in the form of curie law as,

\[
\chi_{\text{para}} = \frac{C}{T}
\]

Where ‘C’ is curie constant.

Curie low is always referred because its accuracy by some system such s [FeF$_6$]$^{3-}$. Many paramagnetic material deviate slightly from the ideal behaviour, and obey Curie – Weiss law.
\[ \chi_{\text{para}} = \frac{C}{T-\theta} \]

Where, \( \theta \) = Weiss constant.

Hence, this explains all about magnetic susceptibility.

**EXPERIMENTAL METHOD FOR DETERMINATION OF MAGNETIC SUSCEPTIBILITY:**

We know that electrons have a magnetic moment that can be aligned either with or in opposition to an applied magnetic field, depending on whether the spin magnetic quantum number, \( m_s \), is \( +\frac{1}{2} \) or \( -\frac{1}{2} \). For an atom or ion with only paired electrons, the individual electron contributions to the overall spin magnetic quantum number, \( M_s \), cancel one another, giving a zero net value of the overall spin quantum number; i.e., \( S = 0 \). Such a species is said to be diamagnetic. If a diamagnetic material is placed between the poles of a strong magnet it will experience repulsion for the applied field. The repulsion arises from circulation of the electrons caused by the applied field, resulting in an induced magnetic field in opposition. Suppose the sample is suspended between the poles of the magnet and is connected to the pan of an analytical balance. This is the experimental arrangement of a Gouy balance. As a result of the induced diamagnetic repulsion, the sample will appear to weigh less in the magnetic field, compared to its true weight outside the field. When removed from the applied field, the sample has no residual magnetic moment, and its apparent weight will be its true weight.

**Calvin-Bjerrum Titration Technique/Method**

The Calvin-Bjerrum method is widely used for the determination of metal chelate stability. This technique becomes applied for in the presence of very strong and very weak complexes. The concentration of the ligand required for the preparation of a complex is so less that the complex formation is complete even at every low pH values, irrespective of whether at very low pH values, irrespective of Schiff’s base is a free base or the anion of an acid under the conditions, the effect of released proton on the pH values of solution would be too small to be detected on any potentiometer. There are several systems have now studied by employing the method which uses the principles (i) (a) exchange of one liquid by another \(^{161}\), (b) exchange of one metal by another. According to association constants just recently have attempted to simplify the approach for calculating the many of parameters. It is
not necessary to know the definite concentrations of either of mineral acid mixed to the system of the alkali used as titrant. The expressions for $n_A$, $n_L$, $p_L$ for the irving rossoti equations can be obtained involving only the concentrations of the total metal ion, total ligand and hydrogen ion [$H^+$] as well as the volume of alkali: as titrant. If seen the protonation constants and the metal ligand association constants can then be calculated from these expressions. The main benefit of this technique is that the determination of the protonation constant of the protonated ligand is also not required for the evaluation of stepwise metal ligand formation constants. One of the most useful ways to characterize an organic chelating reagent is by the determination of the stabilities of the metallic chelates. The first quantitative evaluation of chelate stability was performed by Calvin and Wilson in 1945 by adaptation of the method used by B-jerrum [185], [186], in 1941 to study the formation constants of metal amines. The method, is applicable to reagents having acidic or basic properties, involves following the course of chelate formation by measuring the amount of hydrogen ion released in the reaction.

$$M^{2+} + 2\text{HR} \rightarrow \text{MR}_2 + 2H^+$$

Where, ‘M’ refers to a metal ion, ‘HR’ refers to the chelating agent and ‘MR$_2$’ refers to the metallic chelate.

The Calvin B-jerrum titration method appears to be the most reliable for the chelate stability evaluation in as much as it appears to be the only one of those mentioned which permits quantitative determination of formation constants. The Calvin B-jerrum technique for evaluation of chelate stability has been adapted to the study of chelating possessing more than one acidic or basic group. [187] several other methods have been employed to obtain information concerning relative stabilities of chelates. Shifts of the polarographic half wave potentials of related chelate compounds have been taken as indications of their relative stabilities by Calvin and Bailes. [188] who base their conclusion on the assumption that the more stable a metallic chelate the more difficult it would be reduce. In another instance, [189] the rate of exchange of radioactive metal ions with the same metal in chelate combination was assumed to be related to chelate stability. Chelates which experience almost instantaneous exchange were thought to contain an ionically
bound metal, while, a slow rate or metal exchange was considered an indication of the covalent character of the organometallic bond and hence, of its greater strength.

The overall explained theory given sufficient information about calvin b-jerrum method.