2. LITERATURE SURVEY

- Kadriye Benkli et al. \(^{31}\) synthesized 1-substituted 2-(imidazol-1-yl)-3-(4, 5-diarylimidazol- 2-yl)indoles (1), 1-substituted 2-(imidazol-1-yl)-3-(phenanthro[9, 10- d]imidazole-2yl) indoles (2) and 1-substituted 2-(imidazol-1-yl)-3-(benzimidazol-2-yl) indoles (3). Antimicrobial activities of the compounds were examined and notable antifungal activity was observed for some of the compounds.

- Sureyya Ölgün et al. \(^{32}\) reported the synthesis and biological evaluation of N-substituted indole esters (4) as inhibitors of cyclo-oxegenase-2 (cox-2). Following compound was found slightly active against cox-2.

- Mauro Mazzei et al. \(^{33}\) reported unsymmetrical methylene derivative of indole as antiproliferative agent. The synthesized molecules were tested invitro against the MCF7 and MDA-MB-231 breast cancer cell lines by MTT and cell count assay.
Among all, the 3-(7′-acetoxy-4-methylcoumarin-8′-yl)methyl-2-methylindole (5) resulted the most effective in both cell lines, compared to indole-3-carbinol.

Joseph L Kgokong et al. 34 have reported 1, 2, 4-triazino-[5, 6-b]indole derivatives (6): effects of the trifluoromethyl group on in vitro antimalarial activity. Derivatives with a trifluoromethyl group at position 6 exhibited increased in vitro activity as compared to unsubstituted analogues.

Elisa P et al. 35 have reported novel substituted 2-methyl-3-indolyl acetic acid derivatives (7). These compounds were evaluated for their activity in vitro and in vivo on COX-1 and COX-2 MD simulations indicated an induced fit for COX-1 but not for COX-2, probably because of a lower plasticity of the latter.
• Mingde Xia et al. synthesized dipiperidines of substituted indoles (8). And studied the structure-activity relationship and in vivo anti-inflammatory efficacy of synthesized compounds.

![Chemical structure of compound 8](image)

• Adel H Mandour et al. reported the synthesis of a series of 1, 8-dihydro-1-aryl pyrazolo (3,4-b) indoles (9) and tested these compounds for their anti-inflammatory and anticonvulsant activities.

![Chemical structure of compound 9](image)

\[ \text{R = H, CH}_3, -\text{CH}_2\text{Ph, -COPh etc} \quad \text{X = H} \]

• Soubhye J et al. designed and synthesized a series of 3-(aminoalkyl)-5-fluoroindole (10) analogues. These compounds possessed myeloperoxidase inhibitor activity.

![Chemical structure of compound 10](image)

\[ \text{n = 1 to 6} \quad \text{R}_1 \text{ & R}_2 = \text{H, aliphatic or alicyclic hydrocarbons} \]

• Krishna C. Joshi et al. synthesized 2-pentachlorophenyl-5/6-fluoroindoles. These compounds were subjected to formylation and nitration reactions under various conditions. 5-fluoro-2-pentafluorophenylindole was treated separately with acetic anhydride and oxalylchloride followed by morpholine to yield 3-
acetyl-5-fluoro-2-pentafluoro-phenylindole and 5-fluoro2-pentafluoro-phenylindole-3-morpholinoglyoxamide respectively.

- Kadry A M et al. synthesized various derivatives of indoles from 2-methylindole-3-acetyhydrazide and compounds showed anti-inflammatory activity.

- Hel-Diwani et al. synthesized N-substituted indole derivatives of 2,3-diphenyl-5-methoxyindole. Several of the compounds were tested for their effect on arterial blood pressure, anti-inflammatory and ulcerogenic activities.

- M. Verma et al. reported the synthesis of 1-[2-(indole-3yl)(acetyl or propionyl)]-3-arylidene-amino-2-thiobarbituric acids, which were finally converted into corresponding Mannich Bases. Then the synthesized compounds were evaluated for anti-inflammatory activity.

- Jose C et al. carried out reduction of 3,3-difluoro-2-oxindoles using a freshly prepared borane tetra hydro furan.

- S P Hiremath et al. synthesized 5-hydrazino-10-substituted-7H-indolo[2,3-c]isoquinolines and 1-(10-substituted- 7H-indolo[2,3-c] isoquinolin-5-yl)-3,5-disubstituted pyrazoles, -3-methylprazole-5-ones and -3,5-disubstituted pyrazolines. These compounds were screened for their antimicrobial, analgesic and anti-inflammatory activities.

- David R Adams et al. prepared 6-chloro-5-fluoroindole (11) via the use of palladium and copper-mediated heterocyclisations.
Shalabh Sharma et al.\textsuperscript{46} reported synthesis of some new 1-acetyl-5-substituted aryl-3-[5\textsuperscript{′} - (3\textsuperscript{′}′- indolylmethyl)-2\textsuperscript{′}-amino-1\textsuperscript{′}, 3\textsuperscript{′}, 4\textsuperscript{′} - thia diazole-2[N-yl]-2-pyrazolines (12) and 1-acetyl-5-substitutedaryl-3-[5\textsuperscript{′} - (3\textsuperscript{′}′- indolylmethyl)-2\textsuperscript{′}-amino-1\textsuperscript{′}, 3\textsuperscript{′}, 4\textsuperscript{′}-oxadiazole -2[N-yl]-2-pyrazolines (13). These compounds were screened for their anti-inflammatory activity.

![Chemical structures](image1)

S K Sahu et al.\textsuperscript{47} prepared 3-(2,3-epoxypropyloxyimino) indole- 2, 3- dione (14) by reacting 3-oximinoindole-2, 3- dione with epichlorhydrin. Further they synthesized 3-(3-hydroxy-2-ethoxy propyloximino) indole- 2, 3- dione (15) and mannich bases. These compounds have been screened for analgesic and anti-inflammatory activities.

![Chemical structures](image2)

Guru S Gadaginamath et al.\textsuperscript{48} reported the synthesis of 1-cyclohexyl-3-carbethoxy-2-methyl-5-oxadiazolyl/ triazolyl and pyrrolyl amino carbonyl methoxy indoles (16, 17, 18). The newly synthesized have been evaluated for their antimicrobial activity.
- Rani P et al. \(^{49}\) reported the synthesis of chalcones of indole and their corresponding products (pyrazolines and azo compounds). Synthesized compounds were evaluated for their anti-inflammatory activity against carrageenan induced edema in albino rats. All the compounds showed promising anti-inflammatory activity.

- Maddirala Shambabu Joseph et al. \(^{50}\) reported 7-mono- and 6, 7-disubstituted-2-(5-aryl-4, 5-dihydro-3-isoxazolyl)-3-phenyldiones (19) and substituted 2-(5-aryl-3-isoxazolyl)-3-phenyldiones (20).

- Ashok Kumar et al. \(^{51}\) reported the synthesis of 1-[[N-phenylsulphonyl-3-(2'-substituted-3'-sulphonyl-5'-methoxyindole-3'-yl)]-2-pyrazolines (21) and 1-[[N-benzoyl -3-(2'-substituted -3'-sulphonyl -5'-methoxyindole -3'-yl)] -2-pyrazolines
These compounds were screened for their anti-inflammatory, analgesic and COX-2 inhibitory activities.

- Shambabu Joseph Maddirala et al. synthesized 2-(4-formyl-3-pyrazolyl)-3-phenylindoles (23). These compounds were tested for antibacterial and antifungal activities.

- Mark Hamann and co-workers have reported the indole alkaloids are a class of marine natural products that show unique promise in the development of new drug leads. This report reviews the literatures on indole alkaloids of marine origin and also highlights their own research. Specific biological activities of indole alkaloids include: cytotoxicity, antiviral, antiparasitic, anti-inflammatory, serotonin antagonism, Ca-releasing, Calmodulin antagonism and other pharmacological activities.

- Jose Luis Falcoitor and co-workers have reported synthesis, pharmacology and molecular modeling of N-substituted-2-phenylindoles and benzimidazoles as
potent GABA\textsubscript{A} agonists. Among the known non-benzodiazepine hypnotic drugs, Zolpidem, Indiplon and Zaleplon have shown high affinity and selectivity for the \(\alpha_1\) subunit of the GABA\textsubscript{A} receptor.

- Manojit Pal and co workers \(^{55}\) have reported number of novel indomethacin glycolamide esters. These compounds were tested for their cyclooxygenase (COX-1 and COX-2) inhibition properties in vitro. Many of these compounds proved to be selective COX-2 inhibitors, and structural changes in the substituents on the glycolamide ester moiety altered the inhibitory properties as well as potencies significantly. Their in vitro data were rationalized through molecular modeling studies. Few of them displayed anti-inflammatory activity in vivo.

- Dubey and co workers \(^{56}\) have reported synthesis of potential COX-2 inhibitors by means of internal Micheal addition of o-toluenesulphonylaminophenylacrylic acid methyl ester followed by hydrolysis resulting in the formation of \([2-(3\text{-oxo-3, 4-dihydro-2H-benzo}[1, 4]\text{oxazin-6-carbonyl]}	ext{-1H-indol-3-yl}]\text{acetic acid}\) (24).

- Mohamed A A Radwan et al. \(^{57}\) synthesized and carried biological evaluation of new 3-substituted indole derivatives as potential anti-inflammatory and analgesic agents.
• Sham M Sondhi et al. 58 carried microwave assisted synthesis of indole derivatives (25) possessing good anti-inflammatory and analgesic activity.

\[
\text{\begin{align*}
\text{COOH} + R\text{-SO}_3\text{NHNNH}_2 & \xrightarrow{\text{MWI}} \text{CONHNHSO}_2R \\
\end{align*}}
\]

• S. S Panda and P.V.R Chowdary 59 synthesized number of chalcones by reacting indole-3-aldehyde. These chalcones were reacted with urea, thiourea and guanidine hydrochloride to obtain the corresponding hydroxyl, thio and aminopyrimidines. Synthesized compounds were tested for anti-inflammatory activity, antioxidant and antibacterial activities.

• Vijai Nath Pathak et al. 60 synthesized 4, 5-dihydro-3-(2-aryl-indole-3-yl)-5-(4-chlorophenyl)-N'-phenylpyrazoles (26). They evaluated the antibacterial and antifungal activities of all the synthesized compounds. Some of them showed promising results against E.coli, S.aureus, C.albicans and A.niger.

\[
\text{\begin{align*}
\text{X} & = \text{p-Br, p-Cl, p-F, m-Cl} \\
\end{align*}}
\]

• S. S. Panda et al. 61 synthesized 5-(indole-3-yl)-3-(substituted phenyl)isoxazoles (27). These compounds were tested for the acute anti-inflammatory activity using carrageenan induced rat paw edema method and antibacterial activity by cup-plate method.
Prakasham T et al. \textsuperscript{62} prepared 2-(1H-indole-3-yl)-6-methoxy-4-arylpypyridine-3, 5-dicarbonitrile through one-pot multicomponent reaction under reflux condition. These compounds showed a good anti-inflammatory activity.

K Anandrajgoapl et al. \textsuperscript{63} reported the synthesis of several novel manich bases of indoles. All the synthesized compounds were evaluated for their anti-nociceptive activity in mice. All the compounds showed highly significant anti-nociceptive activity.

Sunil Kumar P \textsuperscript{64} synthesized 1-acetyl-3-(2,3-epoxypropyloximino)indole-2,3-dione (28) and evaluated for its anti-inflammatory activity.

R. S Chavan et al. \textsuperscript{65} synthesized a series of 3-(4,5-dihydropyrazolyl)-indoles (29). All the compounds showed analgesic, anti-inflammatory activities.
• Dharmendra Kumar et al. \textsuperscript{66} synthesized a series of 2-phenyl sulpho substituted indoles (30) by the interaction of sulpho/ substituted anilines and phenacyl halide. The newly synthesized compounds were tested for antibacterial and anti-inflammatory activity.

\[
\begin{align*}
\text{NH} & \quad X = \text{Cl, F, NO}_2, \quad \text{SO}_2\text{NH}_2 \quad \text{&} \quad \text{SO}_2\text{N} \text{H}_2 \\
\end{align*}
\]

• Wei Bi et al. \textsuperscript{67} linked an anti-inflammatory moiety (1, 3-dioxane derivative) to the key pharmacophoric moiety of melatonin, hypothesizing that the resulting new indole derivatives might induce a synergistic protection against oxidative damage associated with Ischemia/ Reperfusion injury. Results revealed that one of these indole derivatives manifested potent anti-inflammatory, antioxidant effects and exerted a protective effect against skeletal muscle injury and associated lung injury following limb I/ R in rats.

• J Banurekha et al. \textsuperscript{68} synthesized a variety of 4\{[(phenyl substituted)(2-methyl-3-\text{a, 7a-dihydro-1H-indole-1-yl)benzyl]amino}benzoic acid (31). These compounds were having potent anti-inflammatory activity.

• Chavan Rajashree S et al. \textsuperscript{69} reported the synthesis of various derivatives of 2-(4, 5-dihydro-1H-pyrazol-3-yl)-3-phenyl-1H-indole (32). Synthesized compounds were evaluated for analgesic and anti-inflammatory activities.
Ozdemir et al. \textsuperscript{70} synthesized twelve 1-phenyl-, 1- thiocarbamoyl- and 1-N-substituted thiocarbamoyl-3-(2-furyl)-5-phenyl/ (2-furyl)-2-pyrazoline derivatives and studied their antiepileptic action by maximal electroshock seizure (MES) and subcutaneous pentylenetetrazole (metrazol) (scMet.) tests, neurotoxicities by rotarod toxicity test on albino mice. 1-Thiocarbamoyl-3, 5-di(2-furyl)-2-pyrazoline, 1-N-methylthiocarbamoyl-3, 5-di(2-furyl)-2-pyrazoline and 1-N-ethylthiocarbamoyl-3, 5-di(2-furyl)-2-pyrazoline were found protective against MES and scMet at 30-300 mg.kg\textsuperscript{-1} dose levels.

Kucukguzel et al. \textsuperscript{71} synthesized a new series of 4- Arylhydrazono-2-pyrazoline-5-one derivatives (33) and evaluated for their anticonvulsant activity. Compound showed 40\% protection against pentylenetetrazole (PTZ)- induced seizures in albino Swiss mice.

Singh et al. \textsuperscript{72} synthesized several 3-(3-Acetoamino) phenyl-1, 5-substituted phenyl-2-pyrazolines (34) and evaluated for their anticonvulsant activity. All the substituted pyrazolines exhibited anticonvulsant activity, which was reflected by 30- 80\% protection observed against PTZ-induced seizures. Most of these
substituted pyrazolines inhibited selectively the *in vitro* oxidation of substrates requiring nicotinamide adenine dinucleotide (NAD dependent) by rat brain homogenates.

- Kornet et al. 73 synthesized 1-Phenyl-2-(phenylcarbamoyl) pyrazolidines (35) as potential anticonvulsant agents. These adduct showed little anticonvulsant activity in the MES and PTZ seizure assays.

- Palaska et al. 74 synthesized ten new 3, 5-Diphenyl-2- pyrazoline derivatives and evaluated their antidepressant activities by the ‘Porsolt Behavioural Despair Test’ on Swiss- Webster mice. 3-(4-Methoxyphenyl)-5-(3, 4- dimethoxyphenyl)-2-pyrazoline, 3-(4-methoxyphenyl)-5- (2-chloro-3, 4-dimethoxyphenyl)-2-pyrazoline and 3-(4-chlorophenyl)-5-(2-chloro-3, 4-dimethoxyphenyl)-2-pyrazoline reduced 41.94-48.62% immobility times at100 mg.kg-1 dose level. In addition, it was found that 4- methoxy and 4-chloro substituents on the phenyl ring at position 3 of the pyrazoline ring increased the antidepressant activity; the replacement of these groups by bromo and methyl substituents decreased activity.

- Prasad et al. 75 synthesized five new 1, 3, 5-Triphenyl-2- pyrazolines (36, 37) and another five new 3-(2" Hydroxynaphthalen- 1"-yl)-1, 5-diphenyl-2-pyrazolines
and evaluated their antidepressant activity by the Porsolt behavioural despair test on Swiss-Webster mice. 1-Phenyl-3-(2''-hydroxyphenyl)-5- (4''-dimethylamino phenyl)- 2-pyrazoline, 5-(4'- Dimethylaminophenyl)-1,3-diphenyl-2-pyrazoline, 1-Phenyl- 3-(2''-hydroxynaphthalen-1''-yl)-5-(3',4',5'- trimethoxyphenyl)-2-pyrazoline, 1-Phenyl-3-(4''- methylphenyl)- 5-(4'-dimethylaminophenyl)-2-pyrazoline and 1-Phenyl-3-(4''-bromophenyl)-5-(4'-dimethyl amino phenyl)-2-pyrazoline reduced immobility times 25.63- 59.25% at 100 mg.kg-1 dose level. In addition, it was found that the compounds possessing electron-releasing groups such as dimethyl amino, methoxy and hydroxyl substituents, on both the aromatic rings at positions 3 and 5 of pyrazolines, considerably enhanced the antidepressant activity when compared to the pyrazolines having no substituents on the phenyl rings.

- Jayaprakash et al. 76 synthesized several 3, 5-Diaryl carbothioamide pyrazolines (38) designed as mycobactin analogs (mycobacterial siderophore) and evaluated their antidepressant and MAO inhibitory activity; because, they were in the search of designing antitubercular molecules with reduced MAO-inhibitory activity (since pyrazoline has antidepressant and MAO inhibitory activity). They found that antitubercular compound was also selective inhibitor of rat liver MAO-B.
Barsoum et al. 77 synthesized a variety of Bis(3-aryl- 4, 5- dihydro-1H-pyrazole-1-carboxamides) and screened for their anti-inflammatory properties and PGE2 inhibitory properties (at a dose level of 50 mg.kg-1) utilizing in vivo acute carrageenan-induced paw oedema standard method in rats. They exhibited that many of the tested compounds reveal considerable anti-inflammatory properties, especially which reveal remarkable activities relative to indomethacin (which was used as a reference standard at a dose of 10 mg.kg-1 of body weight). They exhibited lower ulcer index values than the used reference standard (indomethacin).

Amir et al. 78 synthesized a series of 3-(4-Biphenyl)-5- substituted phenyl-2-pyrazolines and 1-Benzoyl-3-(4-biphenyl)-5-substituted phenyl-2-pyrazolines (39) and screened for their anti-inflammatory and analgesic activity. Among the compounds studied, compound showed more potent anti-inflammatory and analgesic activity than the standard drug, along with minimum ulcerogenic index.

Rathish et al. 79 synthesized new 2-pyrazoline bearing benzene sulfonamide derivatives and screened for their anti-inflammatory activity at dose of 20 mg.kg-1 (in carrageenan induced rat paw edema model) and volume of paw edema was
measured at 0, 3 and 5 h. Two compounds were found to be more active than celecoxib throughout the study (at 3 and 5 h). They were devoid of ulcerogenic potential when administered orally at a dose of 60 mg.kg-1 of body weight.

- Kelekc et al. \(^{80}\) synthesized a novel series of 1-thiocarbamoyl-3-substituted phenyl-5-(2-pyrrolyl)-4, 5-dihydro-(IH)-pyrazole derivatives (40) and tested for their \textit{in vivo} anti-inflammatory activity by two different bio-assays namely, carrageenan-induced oedema and acetic acid-induced increase in capillary permeability in mice. In addition, analgesic and ulcerogenic activities were also determined. The combined anti-inflammatory data from \textit{in vivo} animal models showed that compound exhibited anti-inflammatory activity comparable to that of indomethacin with no ulcerogenic effects.

- Khode et al. \(^{81}\) synthesized a novel series of 5-(Substituted) aryl-3-(3-coumarinyl)-1-phenyl-2-pyrazolines and screened for \textit{in vivo} anti-inflammatory and analgesic activities at a dose of 200 mg.kg-1 of body weight. Among the 12 prepared compounds, Compounds exhibited significant anti-inflammatory activity in model of acute inflammation such as carrageenan-induced rat edema paw.

- Shoman et al. \(^{82}\) synthesized a group of NO-donating 2-pyrazoline derivatives (41) and evaluated for their anti-inflammatory activity using carrageenan induced rat paw edema and compared to a well-known NSAID, indomethacin as a reference drug. The ability of the prepared compounds to induce gastric toxicity
was also evaluated. Most of the prepared compounds showed significant anti-inflammatory activity at the injected dose of 100 mg.kg-1 of body weight, but they were safer than indomethacin in regard to gastric toxicity. The incorporation of the NO-donating group into the parent pyrazoline derivatives caused a non-significant reduction in the anti-inflammatory activity while a marked decrease in gastric ulcerations induced by their parent pyrazolines was observed.

Kaplancikli et al. synthesized 1-[(Benzoxazole/ Benzimidazole-2-yl) thioacetyl] pyrazoline derivatives (42) and evaluated for antinociceptive activities. All of the compounds (100 mg.kg-1 of body weight) exhibited significant antinociceptive activities in both hot plate and acetic acid-induced writhing tests. Naloxone (5 mg.kg-1 of body weight) pre-treatment reversed the antinociceptive activities suggesting the involvement of opioid system in the analgesic actions. None of the compounds impaired motorcoordination of animals when assessed in the Rotarod model.

Ozdemir et al. synthesized several 1-(4-Aryl-2-thiazolyl)- 3-(2-thienyl)-5-aryl-2-pyrazoline derivatives (43) and investigated their antimicrobial activities against
*Escherichia coli*, *Staphylococcus aureus*, *Salmonella typhimurium*, *Bacillus cereus*, *Streptococcus faecalis*, *Aeromonas hydrophila*, *Candida albicans* and *Candida glabrata*. A significant level of activity was observed.

Abdelwahab et al. synthesized 1-(Benzofuran-2-yl)-4- nitro-3-arylbutan-1-ones and 3-(Benzofuran-2-yl)-4,5- dihydro-5-aryl-1-[4-(aryl)-1,3-thiazol-2-yl]-1H-pyrazoles (44) and evaluated their antibacterial and antifungal activities at 100 µg concentration. Some of the compounds showed excellent antimicrobial activities than control drugs.

Stirrett et al. synthesized small molecules (45) with structural similarities to siderophores and evaluated as novel antimicrobials against *Mycobacterium tuberculosis* and *Yersinia pestis*.

Abunada et al. synthesized several 1,3-Diaryl-5-(cyano-, aminocarbonyl- and ethoxycarbonyl) -2-pyrazoline, pyrrolo[3, 4-c]pyrazole-4, 6-dione and 1, 3, 4, 5-
tetraaryl-2-pyrazoline derivatives and screened their antimicrobial activities against *E. coli*, *S. aureus*, *Asperagillus flavus* and *C. albicans*.

- Bhatt et al.\textsuperscript{88} synthesized different types of pyrazolines and cyanopyridines as potential antimicrobial agents. They found that these have remarkable activity against *B. mega*, *B. subtilis*, *E. coli* and *M. tuberculosis H37 Rv*.

- Udupi et al.\textsuperscript{89} synthesized certain pyrazoline derivatives of naproxen. Biological evaluation showed that some members of the series had significant antimicrobial and anti-inflammatory activities.

- Bharmal et al.\textsuperscript{90} synthesized some pyrazoline derivatives (46) as biologically active agents. All the compounds showed antimicrobial activity against *S. typhosa* and *A. niger*.

- Basawaraj et al.\textsuperscript{91} synthesized some 1H-pyrazolines bearing benzofuran as biologically active agents. They exhibited high antimicrobial activity against *S. aureus* and moderate activity against *E. coli*.

- Desai et al.\textsuperscript{92} synthesized some new pyrazolines, phenyl pyrazolines, flavanones, and related compounds and evaluated their antimicrobial activities. The products exhibited activity against Gram +ve bacteria.

- Jamode et al.\textsuperscript{93} synthesized some 1- Isonicotinoyl/Carboxamido-2-pyrazolines and evaluated their antimicrobial properties against *S. aureus*, *E. coli*, *Proteus*.
*mirabilis,* and *Pseudomonas aeruginosa.* Most of the compounds were found to be moderately active.

- Shenoy et al. synthesized 1, 3, 5-Trisubstituted-2-pyrazolines (47) and evaluated their antimicrobial activity. Some of the compounds exhibited antitubercular activity.

\[
\text{\includegraphics[width=0.5\textwidth]{image.png}}
\]

- Mamolo et al. synthesized 5-Aryl-1-isonicotinoyl-3- (pyridin-2-yl)-4, 5-dihydro-1H-pyrazole derivatives and tested for their *in vitro* antimycobacterial activity. The compounds showed an interesting activity against a strain of *M. tuberculosis* and a human strain of *M. tuberculosis* H4.

- Ozdemir et al. synthesized new 1-[(N, N-disubstituted thiocarbamoylthio)acetyl]-3-(2-thienyl)-5-aryl-2-pyrazoline derivatives and evaluated for *in vitro* antimycobacterial activity against *M. tuberculosis* H37Rv.

- Shaharyar et al. synthesized several phenoxy acetic acid derivatives and evaluated for their antimycobacterial activities against *M. tuberculosis* H37Rv.

- Zampieri et al. synthesized several 1-(3, 5-Diaryl-4, 5-dihydro-1H-pyrazol-4yl)-1H-imidazole derivatives (48) and tested for their *in vitro* antifungal and antimycobacterial activities. These imidazole derivatives showed an excellent antifungal activity against a clinical strain of *C. albicans* and an interesting antitubercular activity against *M. tuberculosis* H37R.
Havrylyuk et al. synthesized several novel thiazolone-based compounds containing 5-Aryl-3-phenyl-4, 5- ihydro-1Hpyrazol- 1-yl framework and tested for in vitro anticancer activity. Most of them displayed anticancer activity on leukemia, melanoma, lung, colon, CNS, ovarian, renal, and prostate and breast cancer cell lines. The most efficient anticancer compound was found to be active with selective influence on colon cancer cell lines, especially on HT 29 (log GI50 = -6.37).

Bhat et al. synthesized a series of substituted pyrazoles (49) and evaluated for in vitro cytotoxic activity against a panel of human cancer cell lines. Out of 93 compounds screened, 8 compounds showed marked activity.

Manna et al. synthesized a series of substituted pyrazolines (1-Acetyl-3,5-diphenyl-4,5-dihydro-(1H)-pyrazole) and evaluated for their anticancer activity and for their ability to inhibit P-glycoprotein-mediated multidrug resistance by direct binding to a purified protein domain containing an ATP-binding site and a modulator interacting region. Compounds have been found to bind to P-glycoprotein with greater affinity.
Kini et al. synthesized a novel series of heterocyclic o/m/p-substituted diphenyl ether derivatives and determined their activity against H37Rv strain of *Mycobacterium*. All 10 compounds inhibited the growth at concentrations as low as 1 µg.ml⁻¹. This level of activity was found comparable to the reference drugs rifampicin and isoniazid at the same concentration.

Ali et al. synthesized a series of 5-(-4-(Substituted) phenyl)-3-(4-hydroxy-3-methylphenyl)-4,5-dihydro-1H-1-pyrazolyl-2-toluidino methanethione and 5-(Substituted) phenyl-3-(4-hydroxy-3-methylphenyl)-4,5-dihydro-1H-1-pyrazolyl-2-methoxyanilino methanethione and tested for their *in vitro* antitubercular activity against *M. tuberculosis* H37Rv. Among the synthesized compounds, compound Anilino-3-(4-hydroxy-3-methylphenyl)-5-(2,6-dichlorophenyl)-4, 5-dihydro-1H-1-pyrazolylmethanethione was found to be more active agent against *M. tuberculosis* H37Rv with minimum inhibitory concentration of 0.0034 µM.
Babu et al. \textsuperscript{104} synthesized and evaluated biological activity of 1, 3, 5-Trisubstituted pyrazolines bearing benzofuran. They were found to be antitubercular, antimicrobial and anti-inflammatory in nature.

Chimenti et al. \textsuperscript{105} synthesized a series of N1-substituted 3, 5- diphenyl pyrazolines (52) and evaluated for their \textit{in vitro} antibacterial activity against \textit{H. pylori}. Among the prepared compounds those with an N1-acetyl group and a 4-methoxy substituent in the 5-phenyl ring showed the best activity against \textit{H. pylori} metronidazole resistant strains in the 1-4 µg.ml\textsuperscript{-1} MIC range.

Mogilaiah et al. \textsuperscript{106} synthesized and found antibacterial activities of 1, 3, 4-Oxadiazole and pyrazoline derivatives (53) containing 1, 8-Naphthyridine moiety. All the compounds were far less active than the standard drug (gentamycin) taken.

Vijayvergiya et al. \textsuperscript{107} synthesized some new 3, 5-Diaryl-1- phenyl/isonicotinoyl-2-pyrazolines (54) and evaluated its biological activity. All the synthesized compounds showed antibacterial activity against Gram +ve bacteria \textit{S. aureus}, \textit{S. albus}, \textit{S. pyogenes}, \textit{S. viridans} and Gram -ve bacteria \textit{E. coli}, \textit{S. typhosa}, etc.
Waheed et al. synthesized certain substituted 1, 2-Pyrazolines from nalidixic acid as antibacterial and analgesic agents. They were found to have significant antibacterial activity against Gram -ve bacteria and possessed appreciable analgesic activity.

Wang et al. synthesized 5-(9-Anthryl)-3-(4-nitrophenyl)-1-phenyl-2-pyrazoline (55) (ANPP) and screened its photoluminescence property. The absorption of anthryl moiety at about 325-400 nm superimposed on the broader absorption of 3-(4-Nitrophenyl)-1-phenyl-2-pyrazoline moiety peaked at 420 nm. Photo-induced intramolecular energy transfer from the anthryl to pyrazoline moiety exists simultaneously with the charge transfer from N1 to C3 in the pyrazoline moiety in the excited state and both compete with each other.

Jin et al. synthesized Triphenyl pyrazoline derivatives (TPPs) bearing electron withdrawing and pushing substituents and investigated their photoluminiscent property in the solution and doped in poly (N-vinylcarbazole) (PVK) thin films.
When TPPs were doped into PVK films the photoluminescence intensity was enhanced with increasing TPPs concentration. It indicated that the energy transfer from PVK to TPPs has happened. The pyrazoline derivative with both electrons withdrawing and pushing substituents was the optimistic candidate for electroluminescent emitter due to higher transfer efficiency from electric energy to light energy as well as larger luminance.

- Lu et al.\textsuperscript{111} synthesized a novel pyrazoline derivative 3-(4-Methoxyphenyl)-5-[4-(1, 1-dimethylethylphenyl)]-4, 5- dihydro-1-phenyl 1-\(H\)-Pyrazole (56) and investigated for its light emitter property in blue organic electroluminescent devices. It had hole-transporting ability, good film-formation, and excellent PL property. The device with a structure of ITO/PVK/P3/Al could emit blue light (451 nm) and the turn on voltage was 25 V.

- Svechkarev et al.\textsuperscript{112} synthesized two novel 1,3,5-Triphenyl-2- pyrazoline moiety containing derivatives of 3- hydroxychromone and discussed the prospects of practical application of these compounds exhibiting high solvatofluorochromism into analytical chemistry and biophysics as effective ratiometric polarity probes proceeding from the data on their fluorescent properties.

- Budakoti et al.\textsuperscript{113} synthesized a variety of 3-(3- Bromophenyl)-5-phenyl-1-(thiazolo[4,5-b] quinoxaline-2- yl)-2-pyrazoline derivatives and screened for their
antamoebic activity against *HM1:IMSS* strain of *E. histolytica* by microdilution method and compared the *IC50* values with the standard drug metronidazole. Some of the quinoxaline derivatives showed less *IC50* values than metronidazole. All the compounds were non-toxic.

- Budakoti et al. \(^{114}\) synthesized new Pd (II) complexes with 1- N-substituted thiocarbamoyl-3, 5-diphenyl-2-pyrazoline derivatives (57) and evaluated their antiamoebic activity by microdilution method against *HM1: IMSS* strain of *E. histolytica* and compared the results with the standard drug metronidazole. Generally palladium complexes showed better activity than their corresponding ligands. Compound showed better *IC50* = 0.05 µM as compared to metronidazole *IC50* = 1.82 µM.

- Abid et al. \(^{115}\) synthesized new 1-N-substituted thiocarbamoyl-3-phenyl-2-pyrazoline derivatives (58) and evaluated their *in vitro* antiamoebic activities against *E. histolytica* in comparison with metronidazole used as reference substance. Out of the 30 compounds screened for antiamoebic activity, 10 were found to be better inhibitors of *E. histolytica* since they showed lesser *IC50* values than metronidazole. The preliminary results indicated that the presence of 3-chloro or 3-bromo substituent on the phenyl ring at position 3 of the pyrazoline ring enhanced the antiamoebic activity as compared to unsubstituted phenyl ring.
Chimenti et al.\textsuperscript{116} synthesized a series of N1-propanoyl-3, 5- diphenyl-4, 5-dihydro-\((IH)\)-pyrazole derivatives (59) and assayed as inhibitors of MAO-A and MAO-B isoforms. These showed inhibitory activity with micromolar values and MAO-A selectivity and found to be useful as co-adjuvants in the treatment of Parkinson’s disease (PD) and Alzheimer’s disease.

Silver et al.\textsuperscript{117} synthesized pyrazoline-type insecticides and examined the mechanism of action of these compounds based on available electrophysiological, pharmacological and toxicological information and found to act at neuronal target sites.

Godoy et al.\textsuperscript{118} investigated whether spinal noradrenergic and serotonergic systems are involved in the antinociception induced by the novel pyrazolines MPCA and PPCA. The results suggested that spinal 5-HT receptors and α2-adrenoceptors are involved in the antinociception induced by MPCA and PPCA, but not in that elicited by dipyrone.

Turan-Zitouni et al.\textsuperscript{119} synthesized some 1-(4-Arylthiazol-2-yl)-3, 5-diaryl-2-pyrazoline derivatives (60) and investigated their hypotensive activity by the tail-
cuff method using clonidine as reference standard. All examined compounds showed appreciable hypotensive activities.

Jeong et al. \(^{120}\) synthesized a series of 3-(3, 5-Di-tert-butyl-4-hydroxyphenyl)-5-(multi-substituted 4-hydroxyphenyl)-2-pyrazolines (61) and evaluated their inhibitory action on acyl-CoA: cholesterol acyltransferase. They showed \textit{in vitro} inhibitory activity on hACAT-1 and -2.

Manna et al. \(^{121}\) synthesized a novel series of 1-Acetyl-3, 5-diphenyl-4,5-dihydro-(1H)-pyrazole derivatives and investigated for the ability to inhibit selectively MAOs, swine kidney oxidase, and bovine serum amine oxidase. 1-Acetyl-3-(2,4-dihydroxyphenyl)-5-(3-methylphenyl)-4, 5-dihydro- (1H) -pyrazole (62) showed to be a potent monoamine oxidase inhibitor with a \(K_i\) value of about 10^(-8) M.
Babu et al. synthesized a series of pyrazoline derivatives (63) and evaluated for antioxidant activity at 1000, 500, 250, 100, 50, 25 and 10 mg.ml-1 concentrations against standard drug ascorbic acid. Six compounds showed excellent antioxidant activity as compared with ascorbic acid.