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Review Article

Quinazoline Marketed drugs – A Review

Theivendren Panneer Selvam*[1], Palanirajan Vijayaraj Kumar[2]

*[1]Department of Biotechnology, Acharya Nagarjuna University, Guntur-522510, India
[2]Faculty of Pharmaceutical Sciences, UCSI (University College Sadaya International) University, Jalan Menara Gading 56000 Cheras, Kuala Lumpur, Malaysia

Quinazoline is the main six-membered heterocyclic ring system reported for their biological activities, compounds with multiple pharmacophores, which bring together knowledge of a target with understanding of the molecule types that might interact with the target family. Robust, versatile and scalable chemistry must be employed to accomplish the task. This characteristic feature of quinazoline would make a good template for a lead generation library. The current review article focuses on biological actions done for various targets along with the brief description of the targets.

Medicinal chemistry is concerned with discovery, development, synthesis in laboratory and identification of physical and chemical methods. Here most of activity is directed to new natural or synthetic organic compounds. Inorganic compounds continue to be important in therapy that is trace elements in nutritional therapy, antacids & radiopharmaceuticals. Development of organic compounds has now new synthetic methods that includes exciting new field of biotechnology using cell's biochemistry to synthesize new compounds. Techniques ranging from recombinant DNA and site directed mutagenesis to fusion of cell lines have greatly broadened possibilities for new entities that treat the disease. By help of medicinal chemistry now pharmacist dispenses modified human insulin that provide more convenient dosing schedules, cell stimulating factors that have changed the dosing regimens for chemotherapy, humanized monoclonal antibodies that target specific tissues and fused receptors that intercept immune cell generated cytokines. For understanding principles of medicinal chemistry, it is necessary to consider physiochemical properties, used to develop new pharmacologically active constituents and their mechanism of action. Hundreds of thousands of new organic chemicals are prepared annually throughout world; many of them are entered to pharmacological screening for determining their biological activity. This random screening process has been inefficient, but it has resulted in identification of new lead compounds whose structures have been optimized to produce clinical agents. The main aim of medicinal chemist is to know the mode of action of drugs at molecular levels.

Heterocyclic chemistry is a chemistry involving the heterocyclic compounds, which has atoms of at least two different elements as number of ring. The heterocyclic atoms may be inorganic, though the compound contains carbon atoms in the ring. The word hetero means "different from carbon and hydrogen". Many heterocyclic compounds are biosynthesized by plants & animals are biologically active. Some heterocyclic compounds are fundamentals of life,

like haeme derivatives in blood & chlorophyll essential for photosynthesis in plants. Also the DNA & RNA are containing heterocycles. Dyestuffs of plant origins include indigo blue used to dye jeans. Several heterocycles are the basic structure nucleus for nicotine, pyridoxine, cocaine, morphine etc.

Quinazoline **Fig 1** is a compound made up of two fused six member simple aromatic rings- benzene & pyrimidine ring. It is a yellow colored compound, found usually in crystalline form. Medicinally it is used as antimalarial agent. It was first prepared by Gabriel in 1903 and first isolated from the Chinese plant aseru. The development of research on biological activity of quinazoline compounds started when the compound 2-methyl-1,3-aryl-4-quinazoline derivative was synthesized. This compound has soporific & sedative action. In last 10 to 15 years of research for medicinal has been characterized by significant advances. In 1968 only two derivatives were used, soporific & anticonvulsant- methaqualone and diuretic quinathazone. By 1980, about 50 kinds of derivatives of this class includes medicinal with different biological actions like 'soporific, sedative, tranquilizing, analgesic, anticonvulsant, antitussive, myorelexant, antirheumatic, hypotensive, antiallergic, bronchodilating, antidiabetic, cholagogue, diuretic, cystatic, antimalarial, spermicidal etc. The search for substances of cardiovascular agents begun in quinazoline derivatives after pharmacological screening of hypotensive activity of quinazoline that have a glycine amide or β-alanine amide residue in 3rd position. But unfortunately due to volume & density of general material on quinazoline derivatives, more specific problem of investigation of cardiovascular agents not has been successfully reflected in some reviews.

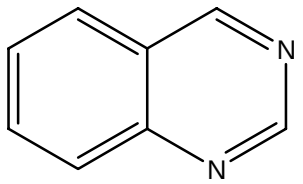

Fig 1 Quinazoline

Prazosin

Prazosin (Shen, 2008) is chemically 2-[4-(2-furoyl)piperazin-1-yl]-6,7-dimethoxyquinazolin-4-amine **Fig 2**. It is a sympatholytic drug used to treat high blood pressure. It belongs to the class of alpha-adrenergic blockers, which lower blood pressure by relaxing blood vessels. Specifically, prazosin is selective for the alpha-1 receptors on vascular smooth muscle. These receptors are responsible for the vasoconstrictive action of norepinephrine, which would normally raise blood pressure. By blocking these receptors, prazosin reduces blood pressure. It is also known as Minipress, Vasoflex , Pressin and Hypovase.

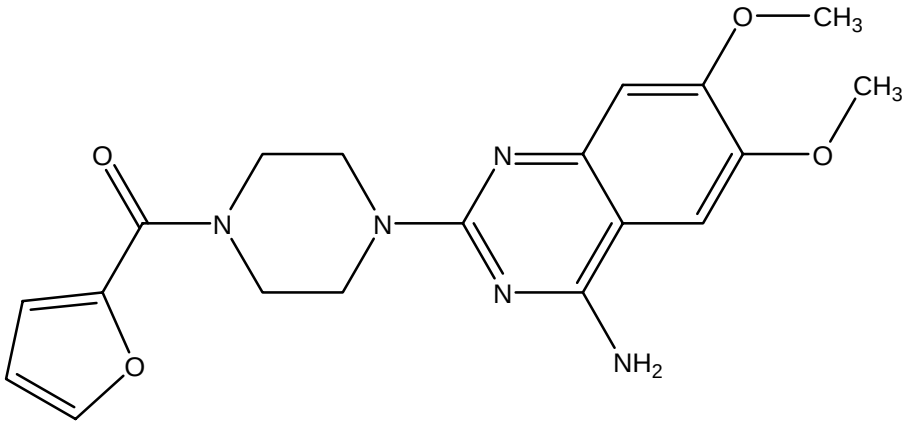

Fig 2 Prazosin

Gefitinib

Gefitinib **Fig 3** also known as Iressa marketed by AstraZeneca and Teva. It is a drug used in the treatment of certain types of cancer. Gefitinib is an EGFR inhibitor (epidermal growth factor receptor) which interrupts signaling through the epidermal growth factor receptor in target cells. Gefitinib has yet to be proven to be effective in other cancers, there is potential for its use in the treatment of other cancers where EGFR over expression is involved. Applications to expand its label as a first line treatment in patients harbouring EGFR mutations is currently in process based on the latest scientific evidence. Chemically it is N-(3-chloro-4-fluoro-phenyl)-7-methoxy-6-(3-morpholin-4-ylpropoxy) quinazolin-4-amine (Pao *et al*., 2004)

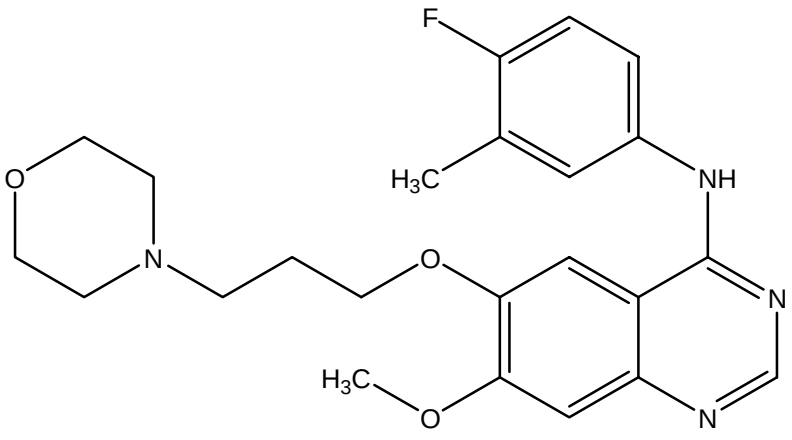

Fig 3 Gefitinib

Erlotinib

The trade name of Erlotinib **Fig 4** is Tarceva and its chemically known as N-(3-ethynylphenyl)-6,7-bis(2-methoxyethoxy)quinazolin-4-amine (Raymond *et.al*., 2000). It is a drug used to treat non-small cell lung cancer, pancreatic cancer and several other types of cancer. It is a tyrosine kinase inhibitor, which acts on the epidermal growth factor receptor (EGFR). Erlotinib is an EGFR inhibitor. The drug follows Iressa gefitinib, which was the first drug of this type. Erlotinib specifically targets the epidermal growth factor receptor (EGFR) tyrosine kinase, which is highly expressed and occasionally mutated in various forms of cancer. It binds in a reversible fashion to the adenosine triphosphate (ATP) binding site of the receptor. It is an inhibitor of epidermal growth factor receptor tyrosine kinase

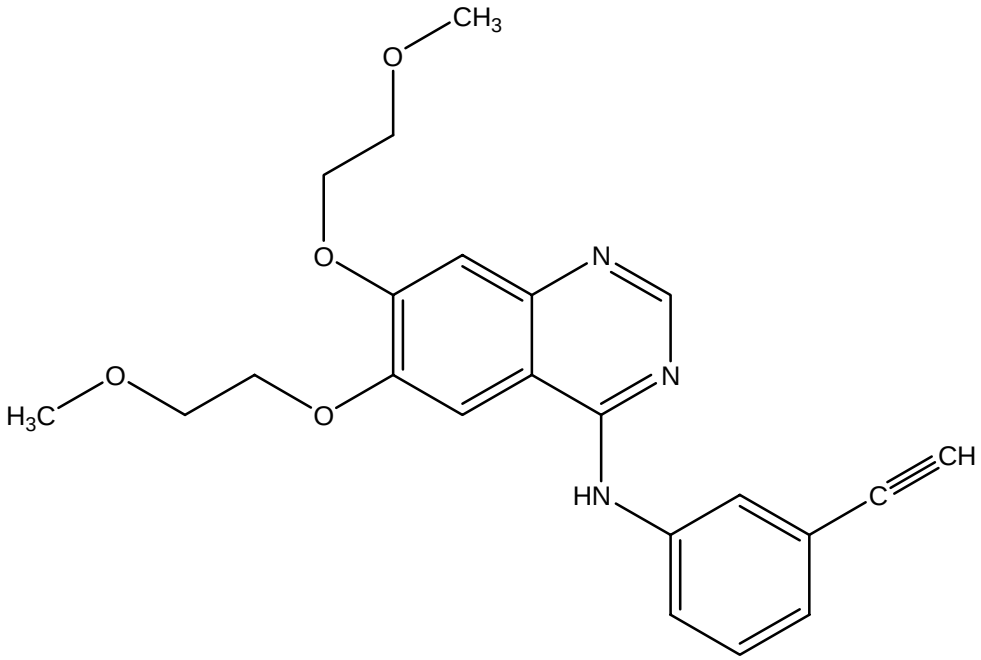

Fig 4 Erlotinib

Tetrodotoxin

Tetrodotoxin **Fig 5** (also known as "tetrodox" and frequently abbreviated as TTX, sometimes colloquially referred to as "zombie powder" by those who practice Vodou or are of Haitian descent) chemically known as (4R,4aR,5R,6S,7S,8S,8aR,10S,12S)-2-azaniumylidene-4,6,8,12-tetrahydroxy-6-(hydroximethyl)-2,3,4,4a,5,6,7,8-octahydro-1H-8a,10-methano-5,7-epoxymethanoxy) quinazolin-10-olate (Rivera *et al*., 1995). It is a potent neurotoxin with no known antidote. There have been successful tests of a possible antidote in mice, but further tests must be carried out to determine efficacy in humans. Tetrodotoxin blocks action potentials in nerves by binding to the voltage-gated, fast sodium channels in nerve cell membranes, essentially preventing any affected nerve cells from firing by blocking the channels used in the process.

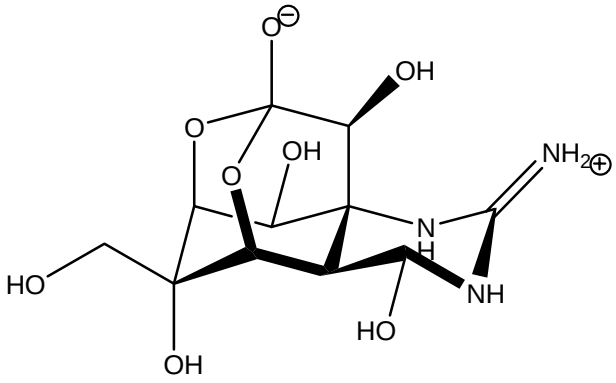

Fig 5 Tetrodotoxin

Alfuzosin

The trade name of alfuzosin **Fig 6** are UroXatral; Urion; Xatral; Alfetim, chemically known as N-[3-[(4-amino-6,7-dimethoxy-quinazolin-2-yl)-methyl-amino]propyl] tetra- hydrofuran -2-carboxamide (Hwang *et al*., 2007). It is a α_1 receptor antagonist used to treat benign prostatic hyperplasia (BPH). It works by relaxing the muscles in the prostate and bladder neck, making it easier to urinate. Alfuzosin should be used with caution in patients with severe renal insufficiency, and should not be prescribed to patients with a known history of QT prolongation who are taking medications known to prolong the QT interval.

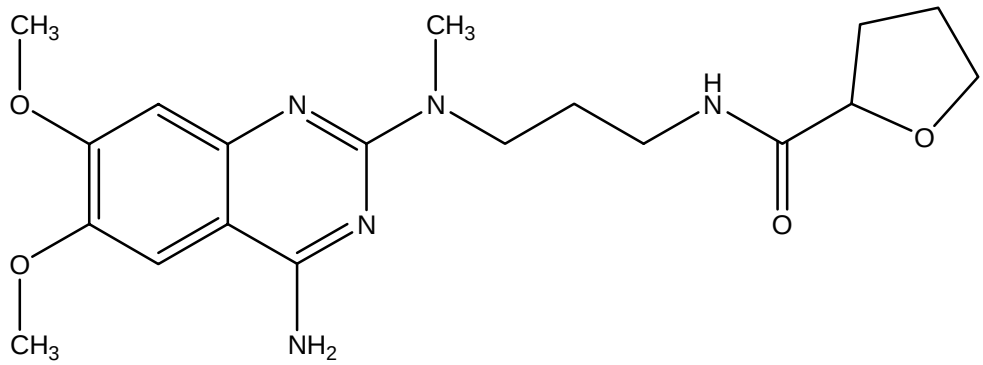

Fig 6 Alfuzosin

Trimetrexate

Trimetrexate **Fig 7** chemically known as 5-methyl-6-[(3,4,5-trimethoxyphenyl) aminomethyl] quinazoline-2,4-diamine (Wong *et al*., 1990, Smith *et al*., 2002), is a nonclassical folic acid inhibitor through its inhibition of the enzyme dihydrofolate reductase. It is being tested for efficacy as an antineoplastic agent and as an antiparasitic agent against pneumocystis pneumonia in AIDS patients. Myelosuppression is its dose-limiting toxic effect. It has been used with leucovorin in treating pneumocystis pneumonia. It has been investigated for use in treating leiomyosarcoma.It is a methotrexate (MTX) analog that is active against transport-deficient MTX-resistant tumor cells that overcome the acquired and natural resistance to methotrexate. Other uses include skin lymphoma.

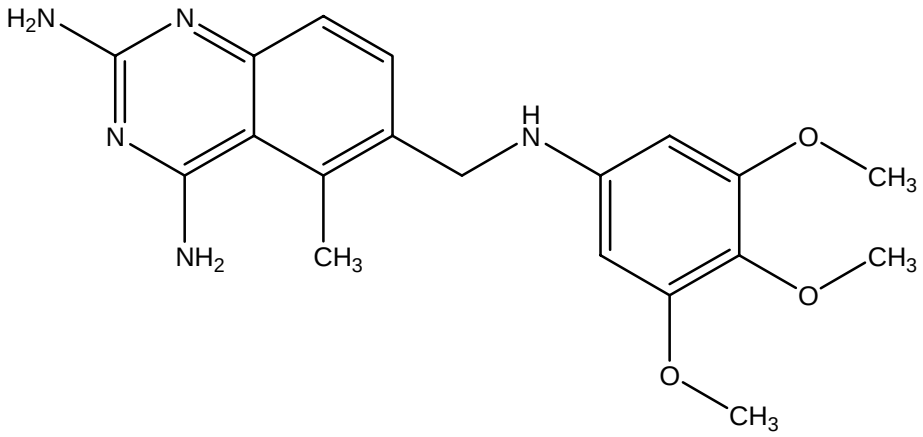

Fig 7 Trimetrexate

Bunazosin

Bunazosin **Fig 8,** trade name is andante, chemically known as 1-(4-(4-amino-6,7-dimethoxyquinazolin-2-yl)-1,4-diazepan-1-yl)butan-1-one, is an alpha-1 antagonist. Bunazosin was initially developed to treat benign prostatic hyperplasia (BPH). It has been approved in Japan in a topical form to treat glaucoma. The mechanism of action is a reduction of aqueous outflow through the uveoscleral pathway resulting in lowering the intraocular pressure. It also may act to improve blood flow to the ocular nerve. Systemic Alpha-1 adrenergic receptor antagonists have been implicated in Intraoperative Floppy Iris Syndrome (IFIS). Bunazosin potentially could have the same effect but there has been no research to substantiate this as a risk for cataract surgery.

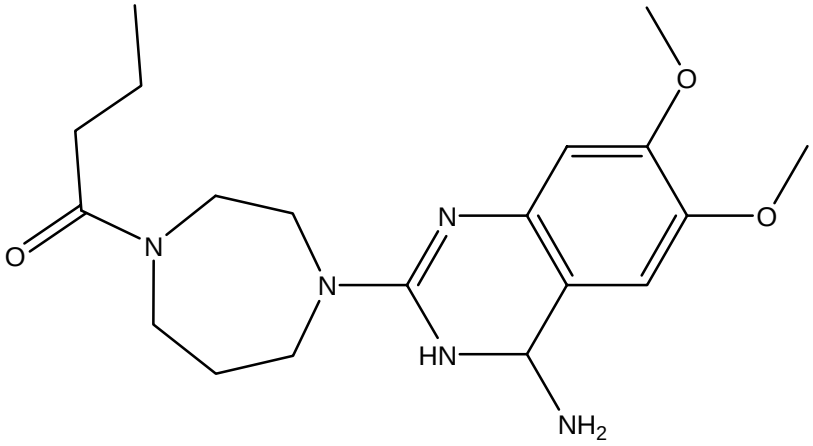

Fig 8 Bunazosin

Vandetanib

The trade name of Vandetanib is zactima, **Fig 9** also known as ZD6474, has chemical name N-(4-bromo-2-fluorophenyl)-6-methoxy-7-[(1-methylpiperidin-4-yl)methoxy]quinazolin-4-amine, it is an antagonist of the vascular endothelial growth factor receptor (VEGFR) and the epidermal growth factor receptor (EGFR). It is a tyrosine kinase inhibitor. Drug has a third target: inhibits RET-tyrosine kinase activity, an important growth driver in certain types of thyroid cancer.

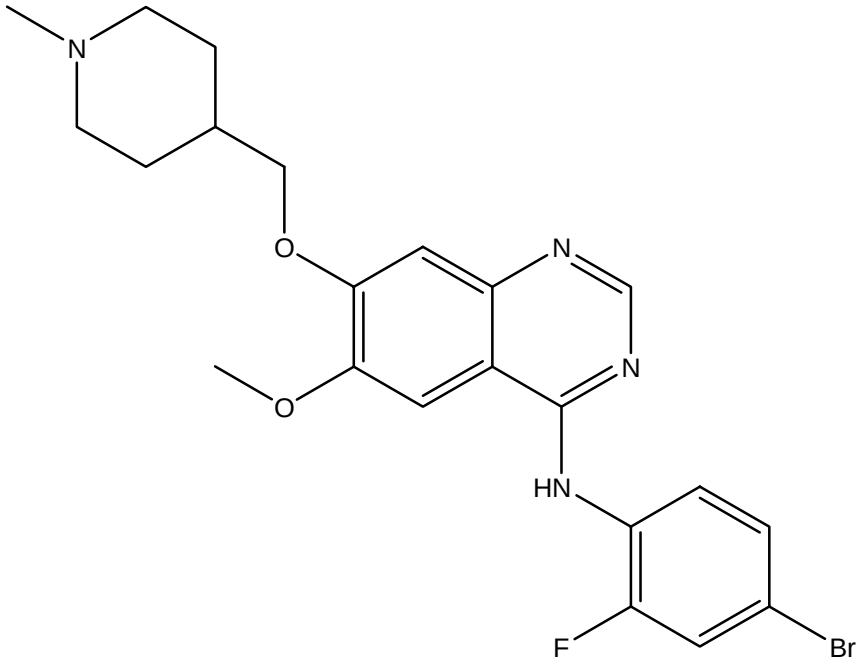

Fig 9 Vandetanib

Anagrelide

Its trade name are Agrylin/Xagrid, Shire, anagrelide **Fig 10,** and chemical name is 6,7-dichloro-1,5-dihydroimidazo(2,1-b)quinazolin-2(3H)-one (Voglová *et al*., 2006, Petrides, 2006), is a drug used for the treatment of essential thrombocytosis (ET), or overproduction of blood platelets. It also has been used in the treatment of chronic myeloid leukemia. Anagrelide works by inhibiting the maturation of platelets from megakaryocytes. The exact mechanism of action is unclear, although it is known to be a phosphodiesterase inhibitor. It is a potent (IC_{50} = 36nM) inhibitor of phosphodiesterase-II. It inhibits PDE-3 and phospholipase A2. According to a 2005 Medical Research Council randomized trial, the combination of hydroxyurea with aspirin is superior to the combination of anagrelide and aspirin for the initial management of ET. The hydroxyurea arm had a lower likelihood of myelofibrosis, arterial thrombosis, and bleeding, but it had a slightly higher rate of venous thrombosis.

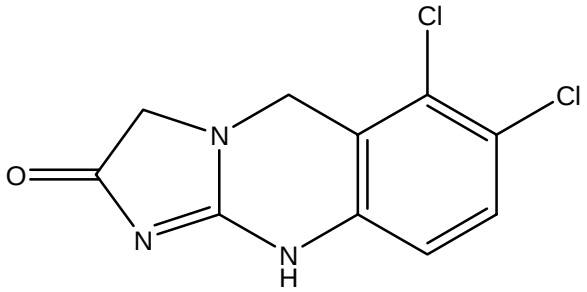

Fig 10 Anagrelide

Evodiamine

Evodiamine **Fig 11** is chemically known as 21-methyl-3,13,21-triazapentacyclo [11.8.0.$0^{2,10}$.$0^{4,9}$.$0^{15,20}$] henicosa-2(10),4,6,8,15,17,19-heptaen-14-one (Kobayashi, 2001, Wang, 2008). It is extracted from the Evodia spp family of plants which has been shown to reduce fat uptake in mouse studies. Its method is believed to be similar to capsaicin, but retains none of the "hot" taste. This chemical has been known to appear in some bodybuilding over the counter supplements, while neither its fat-burning benefits, nor its potential risks and side effects, have ever been established scientifically or empirically. Evodiamine raises your body's temperature and can inhibit the growth of certain cancer cells. It also manipulates your metabolism when combined with certain drugs and influences the secretion of catecholamines from your adrenal glands.

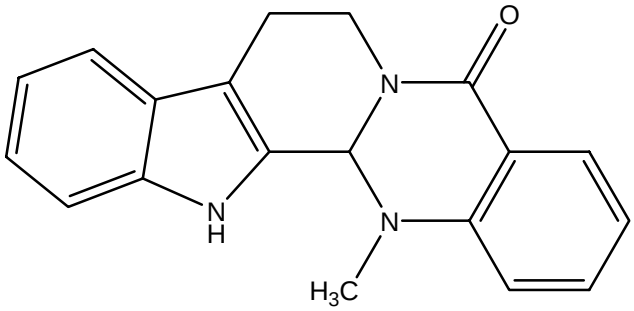

Fig 11 Evodiamine

Proquazone

Its trade name is Biarison **Fig 12** is chemically known as 1-isopropyl-7-methyl-4-phenylquinazolin-2(1H)-one. Proquazone is a non-steroidal anti-inflammatory drug.

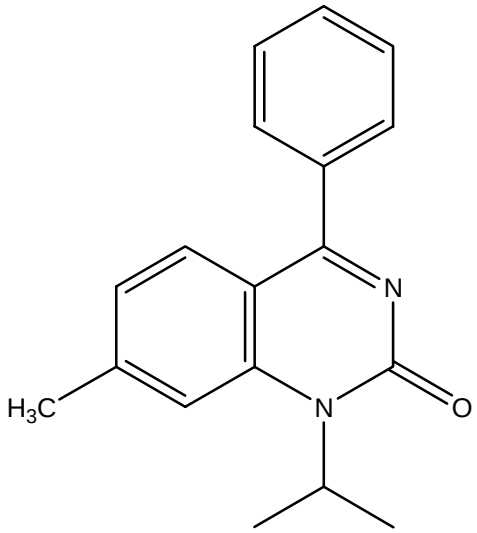

Fig 12 Proquazone

Nolatrexed

Nolatrexed **Fig 13** has chemical name 2-Amino-6-methyl-5-(4-pyridylthio)-1H-quinazolin-4-one (Hughes, *et al*., 1999). Nolatrexed is a thymidylate synthase inhibitor.

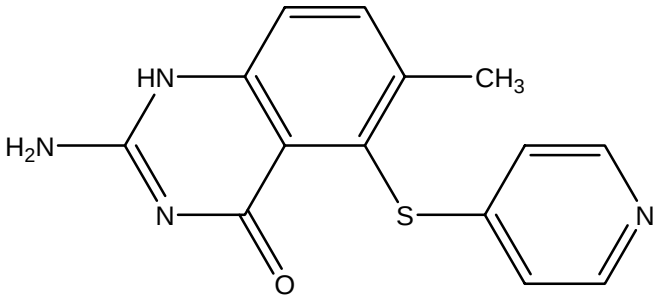

Fig 13 Nolatrexed

Quinethazone

Its brand name is Hydromox **Fig 14** chemically known as 7-chloro-2-ethyl-4-oxo-1,2,3,4-tetrahydroquinazoline-6-sulfonamide (Cohen, *et al*., 1960). Quinethazone is a thiazide diuretic used to treat hypertension. Common side effects include dizziness, dry mouth, nausea, and low potassium levels.

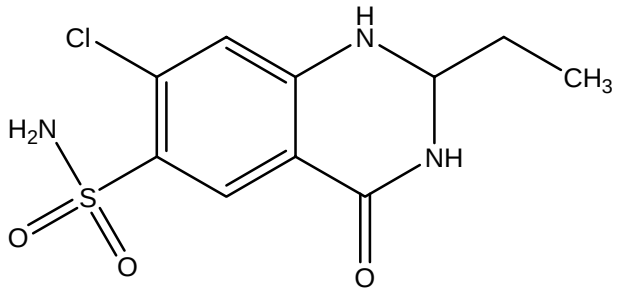

Fig 14 Quinethazone

Albaconazole

Albaconazole (UR-9825) **Fig 15** chemically known as 7-chloro-3-[(2R,3R)-3-(2,4-difluoro phenyl) -3-hydroxy-4-(1,2,4-triazol-1-yl)butan-2-yl]quinazolin-4-one, is a triazole antifungal. It has potential broad-spectrum antibacterial activity.

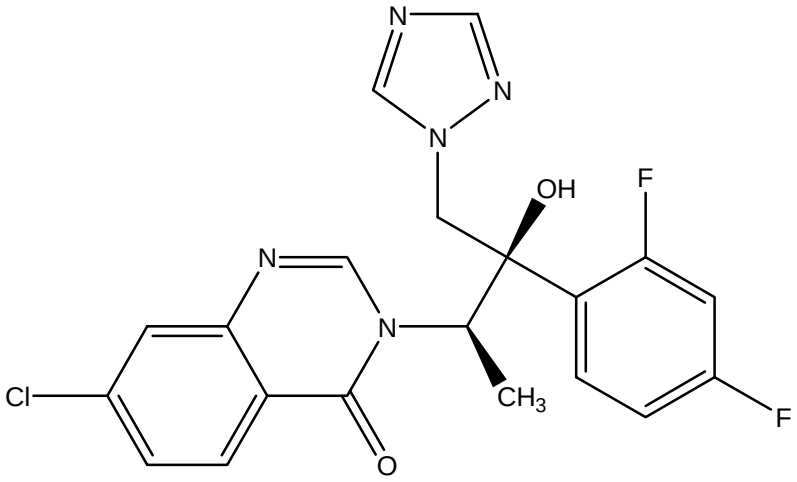

Fig 15 Albaconazole

Febrifugine

Febrifugine **Fig 16** chemically known as 3-{3-[(2S,3R)-3-Hydroxypiperidin-2-yl]-2-oxo propyl} quinazolin-4(3H)-one (McLaughlin, *et al*., 2010) is a quinazolinone alkaloid first isolated from Chinese herb Dichroa febrifuga, but also found in the garden plant Hydrangea. Febrifugine has antimalarial properties and the halogenated derivative halofuginone is used in veterinary medicine as a coccidiostat.

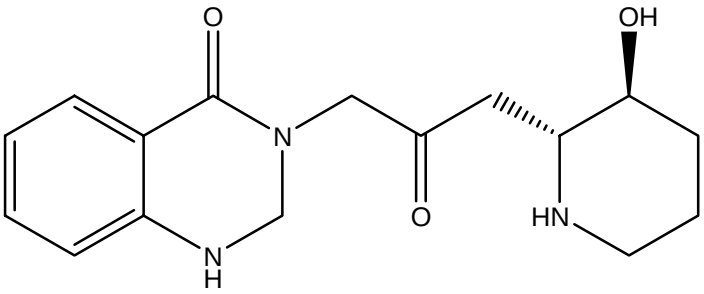

Fig 16 Febrifugine

Afloqualone

Its brand name is Arofuto,**Fig 17** chemically known as 6-amino- 2-(fluoromethyl)- 3-(2-methyl phenyl) quinazolin- 4-one (Ochiai, *et al*., 1982, Ishikawa, *et al*., 1994). It is an analogue of methaqualone developed in the 1980s in Japan. It has sedative and muscle relaxant effects, and has had some clinical use, although it causes photosensitization as a side effect which can cause skin problems such as dermatitis.

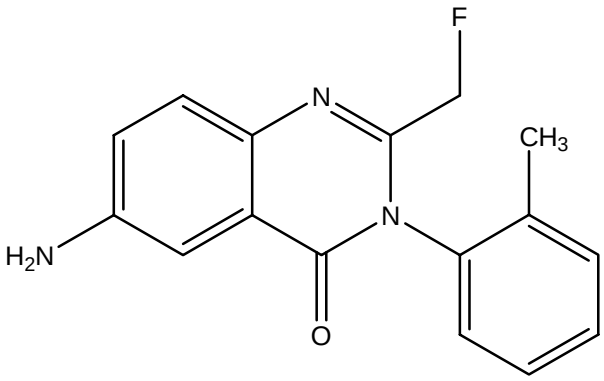

Fig 17 Afloqualone

Fenquizone

Its brand name is Idrolone, **Fig 18** chemically known as 7-chloro-4-oxo-2-phenyl-1,2,3,4-tetrahydroquinazoline-6-sulfonamide, is a diuretic, part of the class of low-ceiling sulfonamide diuretics. Fenquizone is used primarily in the treatment of treatment of oedema and hypertension.

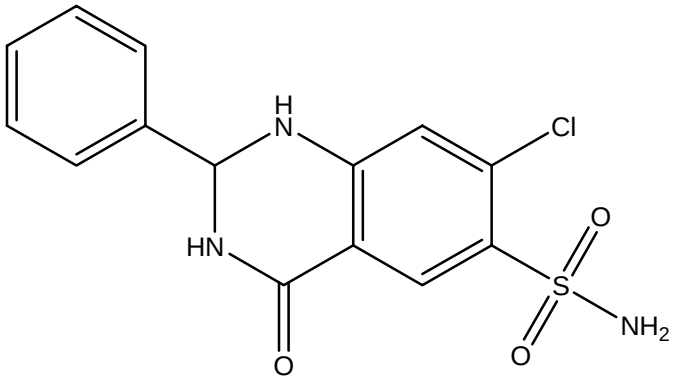

Fig 18 Fenquizone

Linagliptin

Its trade name is Ondero, **Fig 19** chemically known as 8-[(3R)-3-aminopiperidin-1-yl]-7-(but-2-yn-1-yl)-3-methyl-1-[(4-methylquinazolin-2-yl)methyl]-3,7-dihydro-1H-purine-2,6-dione (Wang, *et al*., 2008). It is a DPP-4 inhibitor developed by Boehringer Ingelheim undergoing research for type II diabetes. Results from a Phase III clinical trial of linagliptin showed that the drug can effectively reduce blood sugar.

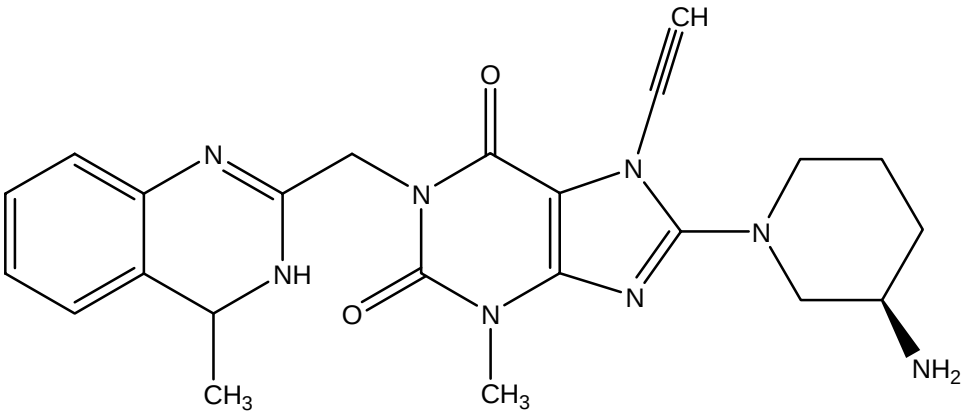

Fig 19 Linagliptin

Quinazolinone

It is also called as quinazolindiones, **Fig 20** chemically known as Quinazolin-4(3H)-one (Chen, *et al*., 2006). Chemicals with two conjoined aromatic rings incorporating two nitrogen atoms and one of the carbons oxidized with keto oxygen. Quinazolinone is a heterocyclic chemical compound. There are two structural isomers, 2-quinazolinone and 4-quinazolinone, with the 4-isomer being the more common. Quinazolinones are also a class of drugs which function as hypnotic/sedatives that contain a 4-quiazolinone core. Their use has also been proposed in the treatment of cancer. Examples include afloqualone, cloroqualone, and diproqualone. Alkaloids containing the quinzolinone core include febrifugine and halofuginone.

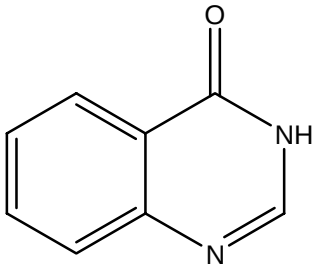

Fig 20 Quinazolinone

Quazinone

Its brand name are dozonone, posicor **Fig 21** chemically known as (3R)-6-chloro-3-methyl-5,10-dihydroimidazo[2,1-b]quinazolin-2(3H)-one (Eigenmann, *et al*., 1984, Holck , *et al*., 1984, Belz, *et al*., 1985, Daly, *et al*., 1985, Osinski, *et al*., 2000, Denis *et al*., 1999), it is a cardiotonic and vasodilator drug which was developed and marketed in the 1980s for the treatment of heart disease. It acts as a selective PDE3 inhibitor.

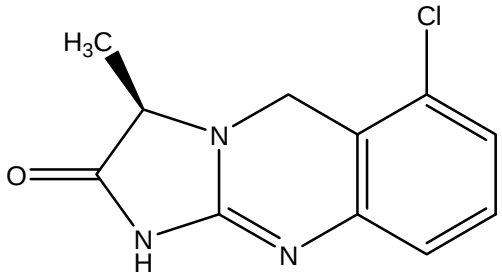

Fig 21 Quazinone

Quazodine

Its brand name are quazodinum, quazodina **Fig 22** chemically known as 4-ethyl-6,7-dimethoxy-quinazoline (Amer, *et al*., 1971). The effects of quazodine and theophylline have been studied on the rat hemidiaphragm and chick biventer cervicis preparations in vitro. Theophylline and quazodine enhanced maximal twitches and contractural responses to acetylcholine and carbachol. These actions on contractility were exerted directly upon the muscle fibres and were dependent upon the concentration of calcium ions in the bathing solution. In addition, quazodine enhanced the neuromuscular blocking activity of tubocurarine, probably by a prejunctional action.

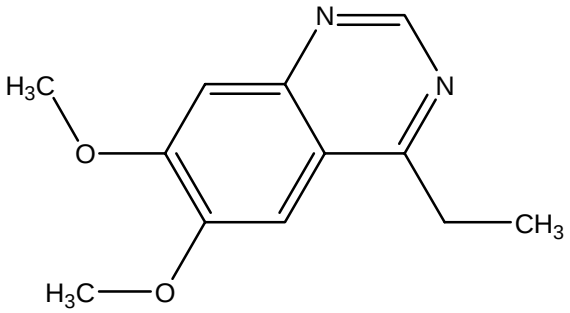

Fig 22 Quazodine

Raltitrexed

Its brand name is Tomudex, **Fig 23** chemically known as N-[(5-{methyl[(2-methyl-4-oxo-1,4-dihydroquinazolin-6-yl)methyl]amino}-2-thienyl)carbonyl]-L-glutamic acid, is an antimetabolite drug used in cancer chemotherapy. It is an inhibitor of thymidylate synthase, and is manufactured by AstraZeneca. Raltitrexed used in treatment of colorectal cancer since 1998. Raltitrexed is chemically similar to folic acid and is in the class of chemotherapy drugs called folate antimetabolites. It works by inhibiting Dihydrofolate reductase, an enzyme used in the synthesis of tetrahydrofolate, thereby preventing the synthesis of thymidylate. Raltitrexed is fully active after polyglutamylation. By inhibiting the formation of precursor pyrimidine nucleotides, raltitrexed prevents the formation of DNA and RNA, which are required for the growth and survival of both normal cells and cancer cells.

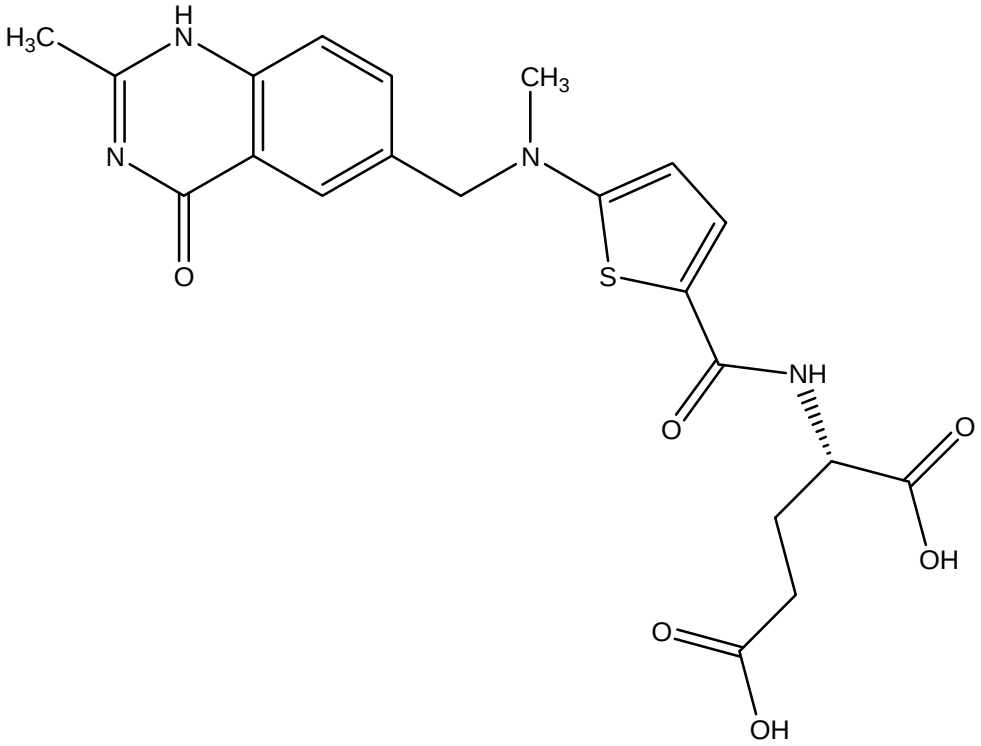

Fig 23 Raltitrexed

Ketanserin

It is **Fig 24** chemically known as 3-[2-[4-(4-fluorobenzoyl) piperidin-1-yl]ethyl]-1H-quinazoline-2,4-dione. It is a selective serotonin receptor antagonist with weak adrenergic receptor blocking properties. It inhibits platelet aggregation. It is well tolerated and is particularly effective in older patients. Drug is used in the treatment of acute or chronic vascular hypertension regardless of pharmacological mechanism. Drug binds to but do not activate serotonin receptors, thereby blocking the actions of serotonin, thus known as seretonin receptor antagonists.

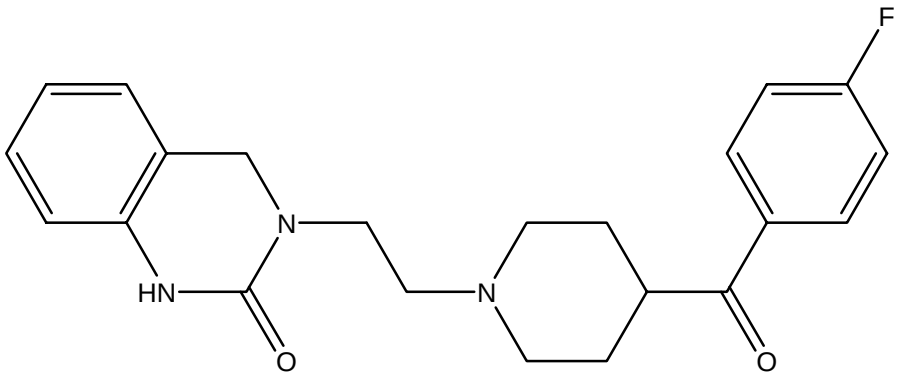

Fig 24 Ketanserin

Benzouracil

Benzouracil **Fig 25** is chemically known as 2,4(1H,3H)-quinazolinedione. The substituted Benzouracil used in treating or preventing an infection due to a virus from the Flaviridae family by administering to a patient in need there of an effective amount of a quinazoline derivative according to the structural formula.

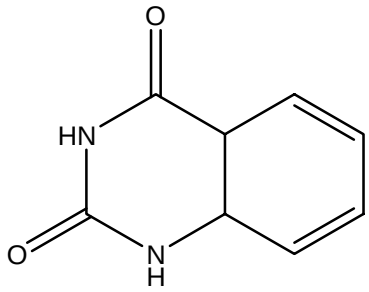

Fig 25 Benzouracil

CB 3717

CB 3717 **Fig 26** chemically known as (2S)-2-[[4-[(2-amino-4-oxo-1H-quinazolin-6-yl)methyl-prop-2-ynylamino] benzoyl]amino]pentanedioic acid. It is used as antineoplastic agent, folic acid antagonist of enzyme tetrahydrofolate dehydrogenase & used in cancer chemotherapy.

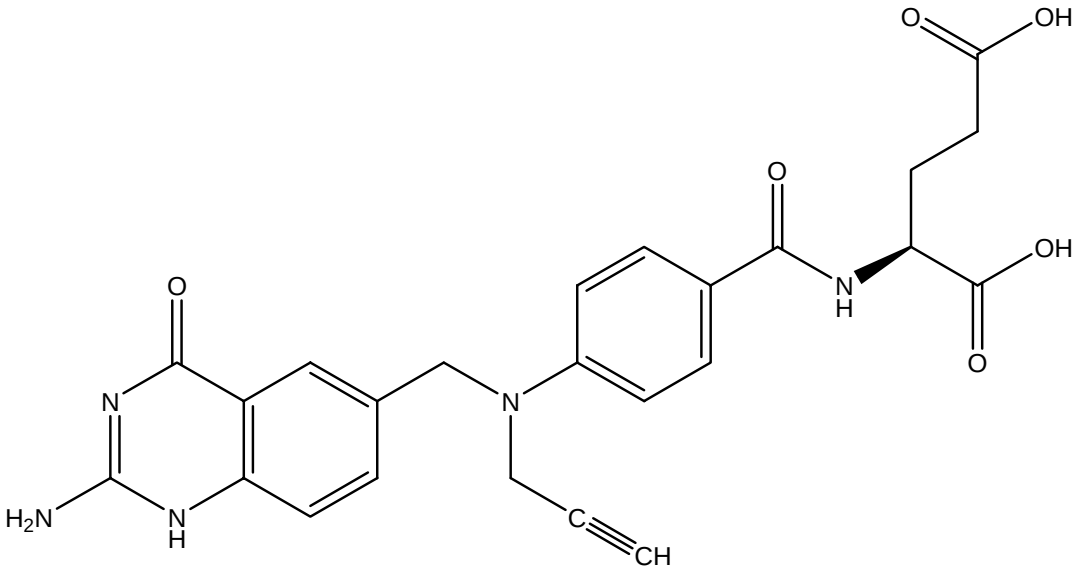

Fig 26 CB 3717

EBE-A22

It is also known as PD 153035; PD-153035; PD153035; **Fig 27** chemically known as N-(3-bromophenyl)-6,7-dimethoxyquinazolin-4-amine (Cheng, *et al.*, 2011). It is used as antineoplastic agent & intercalating agent (capable to insert themselves between bases of DNA). They are used in the study of DNA.

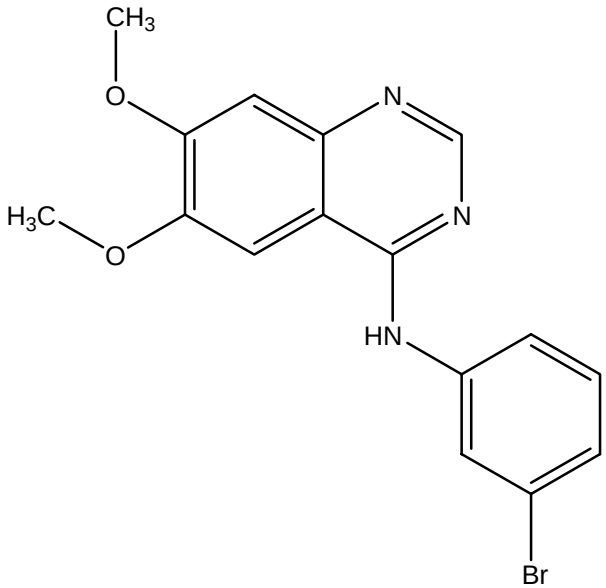

Fig 27 EBE-A22

NSC127213

NSC127213 **Fig 28** is chemically known as tetrazolo [1,5-c]quinazoline. NSC127213 is useful as inhibitors of H1R and/or H4R for the treatment or prevention of inflammatory, autoimmune, allergic, and ocular diseases.

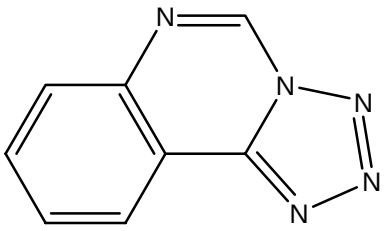

Fig 28 NSC127213

NSC137192

NSC137192 **Fig 29** is chemically known as 8-methylbenzo[f]quinazoline-1,3-diamine. The drug invention provides compositions and methods for the treatment of B-cell proliferative disorders that employ an A2A receptor agonist or one or more PDE inhibitors. The methods and compositions may further include an antiproliferative compound.

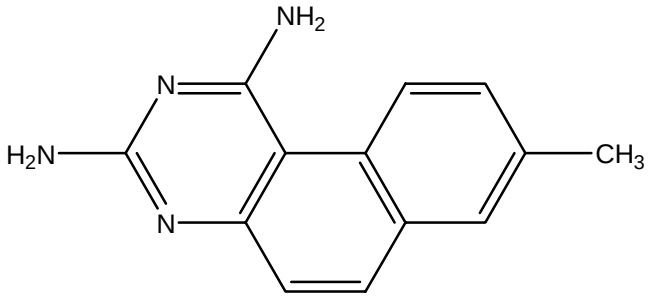

Fig 29 NSC137192

BIBN4096BS

BIBN4096BS **Fig 30** is chemically known as (R-(R*,S*))-N-(2-((5-amino-1-((4-(4-pyridinyl)-1-piperazinyl)carbonyl)pentyl)amino)-1-((3,5-dibromo-4-hydroxyphenyl)methyl)-2-oxoethyl)-4-(1,4-dihydro-2-oxo-3(2H)quinazolinyl)-1-piperidinecarboxamide (Mallee, *et al*., 2002, Doods, *et al*., 2000). It is a potent competitive antagonist of the relaxant effects of alpha-CGRP on human temporal artery. Calcitonin gene-related peptide (CGRP) is one of the most potent endogenous vasodilators known. This peptide is increased during migraine attacks and has been implicated in the pathogenesis of migraine headache. Here we report on the first small molecule selective CGRP antagonist: BIBN4096BS. *In vitro*, this compound is extremely potent at primate CGRP receptors exhibiting an affinity (K_i) for human CGRP receptors of 14.4±6.3 (n=4) pM. In an *in vivo* model, BIBN4096BS in doses between 1 and 30μgkg^{-1} (*i.v.*) inhibited the effects of CGRP,

released by stimulation of the trigeminal ganglion, on facial blood flow in marmoset monkeys. It is concluded that BIBN4096BS is a potent and selective CGRP antagonist.

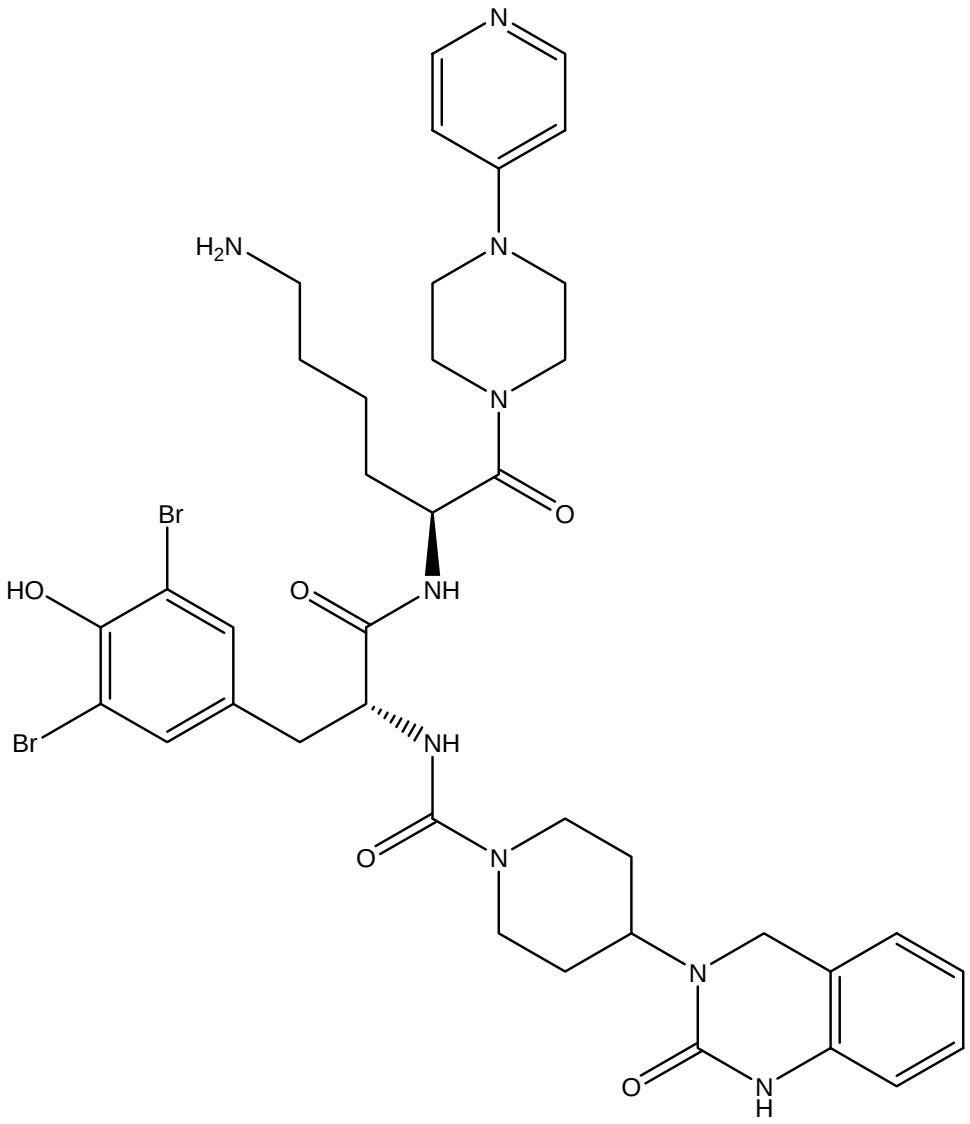

Fig 30 BIBN4096BS

ZD 9331

It is also known as BGC9331, **Fig 31** is chemically known as (2S)-2-[[4-[(2,7-dimethyl-4-oxo-1H-quinazolin-6-yl)methyl-prop-2-ynylamino]-2-fluorobenzoyl]amino]-4-(2H-tetrazol-5-yl) butanoic acid[34]. AstraZeneca (formerly Zeneca) is developing ZD-9331, a non-polyglutamatable thymidylate synthase inhibitor, as a potential treatment for solid tumors and other neoplasia, including colorectal tumors [216476,179954,179955]. ZD-9331 is being developed as both an oral and an *i.v.* formulation, both of which are in phase II trials as of December 1999 [349551,352095]. As of June 1998, ZD-9331 was in phase II trials for advanced colorectal and other solid tumors

[315489], with drug filings not expected until 2002 [349551]. A clinical study presented at the 36th Annual Meeting of the American Society of Clinical Oncology (ASCO) demonstrated that treatment with ZD-9331 resulted in a period of intracellular 2'-deoxyuridine (dUrd) elevation, a surrogate marker of thymidylate synthase inhibition, with observed myelosuppression being no greater than that seen with raltitrexed and less than with bolus 5-FU [369475]. Results from a 56-patient phase I study were presented at the 1999 ASCO meeting. Dose escalation followed a two-stage procedure. As in previous studies myelosuppression was the dose-limiting toxicity, occurring at 4.8 and 7.5 mg/m2/day, with one patient at each of these two doses experiencing a DLT. The MTD was not achieved until 12 to 16 mg/m2/day, based on which a fixed dose of 25 mg/day was being evaluated [326935]. A number of other studies are ongoing, comparing once to twice daily dosages as well as the pharmacokinetics of the compound. Encouraging phase I data have been seen in melanoma, ovarian, colon and breast cancer; myelosuppression is the dose limiting toxicity in the majority of these studies [326938, 326943, 326945, 327399]. A phase I dose-escalation trial was conducted to evaluate the feasibility of a once 3-weekly 30-min i.v. infusion of ZD-9331, with doses ranging from 4.8 to 370 mg/m2. The regimen was overall well tolerated up to 370 mg/m2, with grade IV myelosuppression and grade IV diarrhea being observed in a small number of patients [288959, 377842]. In June 2000, Deutsche Bank predicted sales of $12 million in 2002 [374500]. In January 1999, ABN Amro predicted sales of US $8 million in 2002 rising to $66 million in 2005 [316250, 328676]. In March 1999, Lehman Brothers predicted a 30% probability that the drug would reach the worldwide markets, and be launched in 2002 [336599].

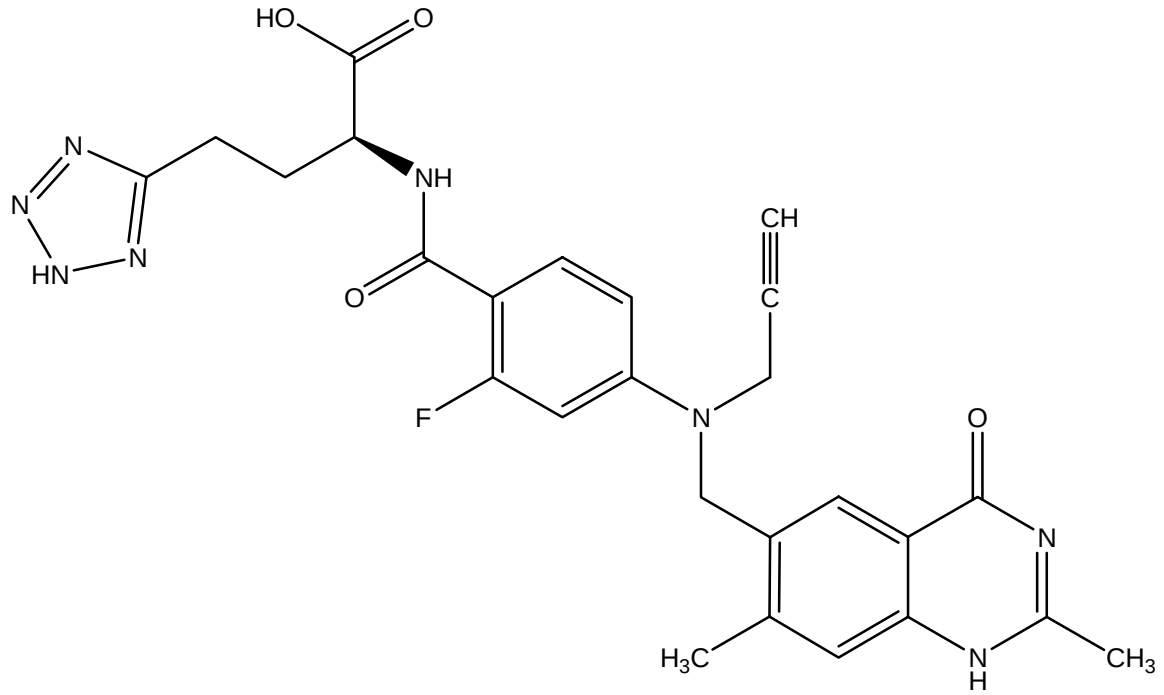

Fig 31 ZD 9331

Conclusions

The article has outlined the chemistry and biological activities of the quinazoline scaffold. The synthetic methodologies indicate the simplicity, maneuverability and versatility, which offer the medicinal chemist a complete range of novel derivatives. Given the advances in synthetic methodology and technology in recent years and the continued interest in the quinazoline skeleton in medicinal chemistry and drug development, the development of efficient and reliable methods for the construction of these molecules will ensure that this is an active and important area of research in heterocyclic chemistry.

The high degree of protection against seizures can be positive signs for further investigation of quinazoline derivatives as anticonvulsants. The activity of quinazoline as antitubercular compounds in multi-drug resistant tuberculosis and their potent anthelmintic activity are promising. The broad spectrum antibacterial and antifungal activity of these compounds could lead to a new series of antimicrobials. The quinazoline derivatives have demonstrated significant antiviral and anticancer activities. The enzymes and receptor agonist or antagonist action of these derivatives furthers their biological importance. Thus quinazoline scaffold is not only synthetically important but also possesses a wide range of promising biological activities. Future investigations of this scaffold could give some more encouraging results.

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