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UNLOCKING THE BIOLOGICAL POTENCY OF 2*H*-CHROMENE: A COMPREHENSIVE REVIEW

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Abstract:
2*H*-chromene, a versatile class of compounds, has garnered significant attention in recent years due to its diverse biological activities and potential therapeutic applications. This comprehensive review explores the multifaceted biological potency of 2H-chromene derivatives, highlighting their pharmacological significance in various areas such as anti-inflammatory, anticancer, antimicrobial, antioxidant, and antitumor activities. The information in the present article may be useful to many researchers, which leads to the exploration of new therapeutic species for society.

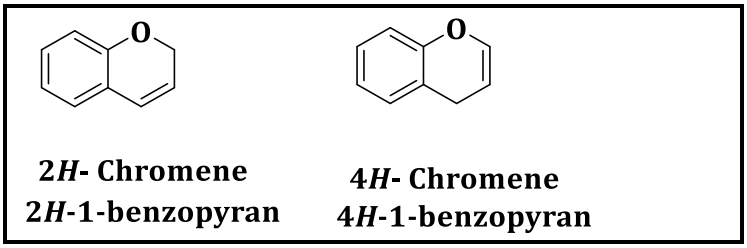
Introduction

2H-chromene, a bicyclic organic compound with a benzopyran structure, has emerged as a compelling area of research due to its diverse biological activities and potential therapeutic applications.[i] This class of compounds is characterized by a central oxygen atom fused to a benzene ring and a six-membered pyran ring, forming a unique structural scaffold.[ii] The designation "2*H*" indicates the presence of a double bond at the second position of the pyran ring, distinguishing it from related compounds like 4*H*-chromenes.[iii]

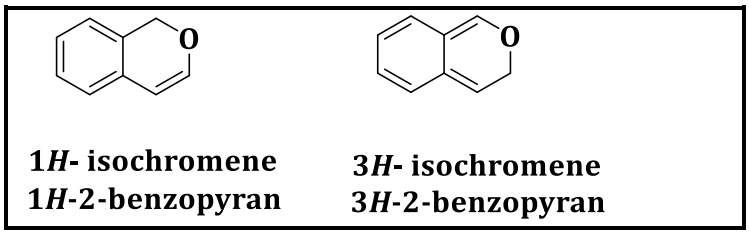
The 2H-chromene scaffold has attracted attention from the scientific community, pharmaceutical industry, and medicinal chemists due to its versatility and ability to modulate various biological processes.[iv] Researchers have synthesized numerous derivatives of 2H-chromene, each with distinct pharmacological properties, making it a promising candidate for drug discovery and development. [v]

Chemistry of 2*H*-chromenes

A polycyclic organic molecule called chromene, also referred to as the benzopyran, is created when a heterocyclic pyran ring and a benzene ring combine. It is known as chromene in IUPAC nomenclature. Benzopyran has two isomers: 1-benzopyran (chromene) and 2-benzopyran (isochromene), where the number designates where the oxygen atom is situated according to conventional naphthalene-like nomenclature. These isomers differ by the orientation of the fusion of the two rings with respect to the oxygen. The structural isomers of 2*H*-chromenes are



Structural isomers of Iso-chromene are



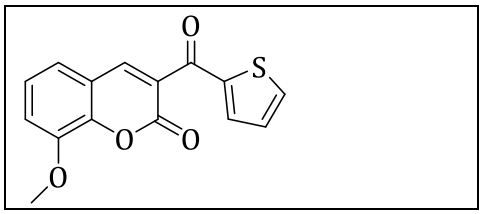
The chromene ring is a kind of oxygenated heterocycle found in a wide range of biologically active natural compounds. Chromene and its derivatives play an essential role in organic chemistry, both natural and synthetic.

The compounds of chromene have significant biological properties, such as antimalarial[vi], antimicrobial[vii], anticancer[viii], anticonvulsant[ix], anti-virus[x], anti-influenza[xi], antitubercular[xii-xiii], anti-inflammatory and analgesic[xiv], antidepressant[xv], antioxidant[xvi-xvii], anti-Alzheimer[xviii], antiproliferative[xix], mutagenicity[xx], central nervous system[xxi] etc.

Biological Activities:

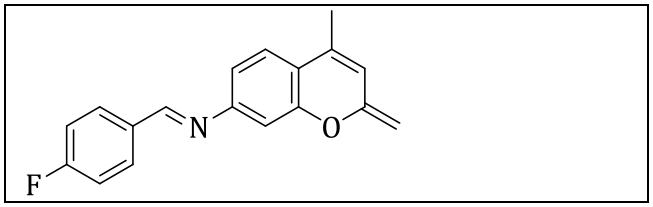
Antioxidant activity:

Okram, M. S., et al.,[xxii] created a number of novel 3-substituted-2*H*-chromene-2-thiones and it was discovered that (8-methoxy-2-thioxo-chromen-3-yl)-(2-thienyl) methanone had the best antioxidant activity.



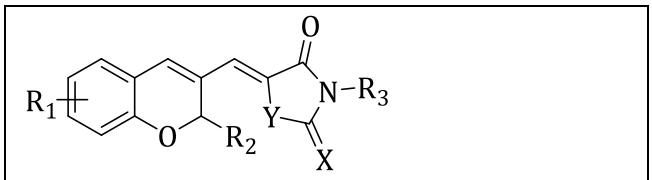
Anti-convulsant and anti-anxiety activity:

P. M. Ronald *et al*.,[xxiii] created coumarin derivatives and these derivatives were previously reported to have anti-convulsant and anti-anxiety properties. Some compounds of benzopyran-2-one have been reported to have anti-convulsant action by KOTI et al., PT2 caused mouse seizure model.



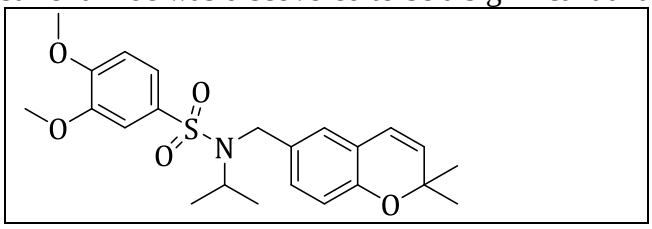
Anticancer activity:

Mohammd. A. *et al*.,[xxiv] reported a series of 2*H*- chromene derivatives bearing thiazolidine-2,4-dione, in which the following series of molecules are reported as potential anticancer agents.



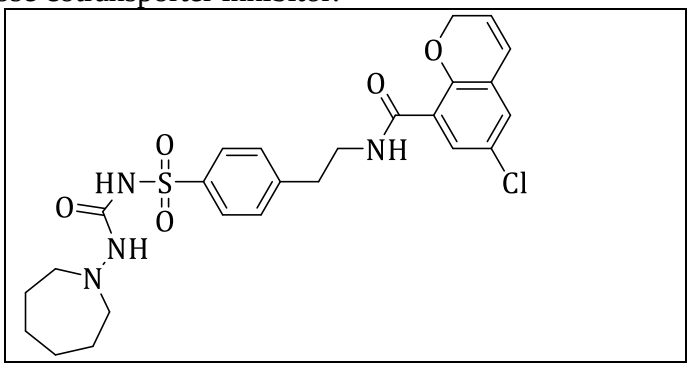
X=O,S; Y=S,NH,NMe
R_1=H,Br,OMe; R_2=H,Me
R_3=H,Me,Et,CH_2COOH

Jiyoung M. *et al*.,[xxv] created a series of substituted N-[(2,2-dimethyl-2H-chromen-6-yl) methyl] N-[(2,2-dimethylchromen-6-yl) methyl] N-phenylbenzenesulfonamides N-isopropyl-3,4-dimethoxybenzenesulfonamide was discovered to be a significant anti-cancer agent.



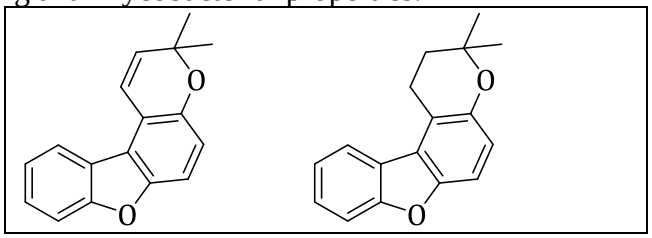
Anti-diabetic activity:

Mowakowska, Z. *et al*.[xxvi] described N-(4-(N-(azepan-1-ylcarbamoyl) sulfamoyl) phenethyl)-6-chloro-2*H*-chromene-8-carboxamide, which was investigated for its possible anti-diabetic effects as a Na^+- glucose cotransporter inhibitor.



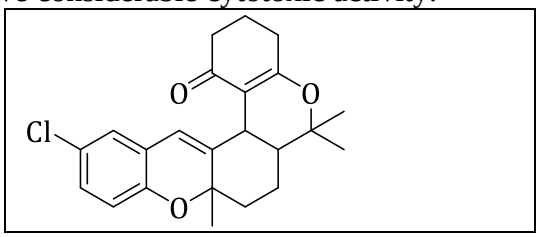
Antimycobacterial activity:

Prado. S. *et al*.,[xxvii] created a variety of compounds, including 3,3-dimethyl-1,2-dihydrobenzofuro [3,2-f] chromene and 3,3-dimethylbenzofuro [3,2-f] chromene and discovered a selective *invitro* inhibitor of mycobacterial growth. These substances were discovered to have strong anti-mycobacterial properties.



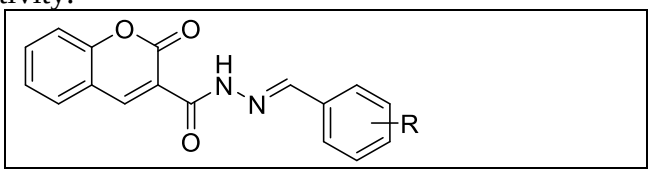
Cytotoxicity activity:

Subba Reddy, B. V. *et al*.[xxviii] developed the synthesis of novel polycyclic chromene derivatives and they were found to have considerable cytotoxic activity.

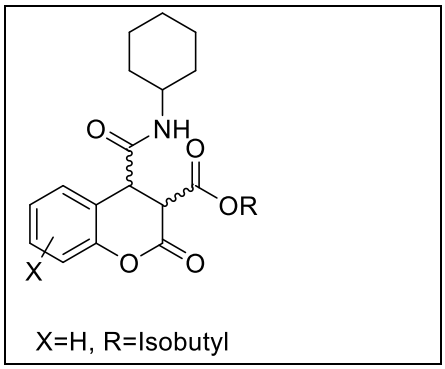


Anti-tubercular activity:

Silvia H. Cardoso, Milena B. Barreto and others[xxix] created the derivatives of compound 2-oxo-2Hchromene-3-carbohydrazide by refluxing compound coumarin-3-carboxylateethyl ester with 80% ethanolic solution of hydrazine. Finally, aldehyde in ethanol produces the needed compound. The synthetic substance was tested for anti-tubercular activity and found to have good anti-tubercular activity.

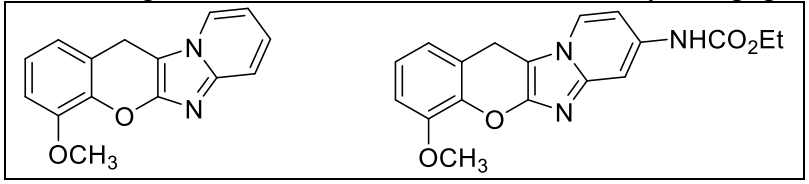


Rezayan and colleagues et al.[xxx] describe the synthesis of coumarin and its derivatives, and the antimycobacterial activity was assessed using the broth microtiter dilution method in vitro against the bacterium M. bovis. Ethambutol results and the activity results are contrasted. Several of the synthesised derivatives were discovered to be effective against M. bovis.



Antiproliferative activity:

Lima et al.[xxxi] synthesized a series of chromene containing fused imidazo[1,2-a] pyridine derivatives and tested their antiproliferative effects on HCT116 human cancer cell line18. The authors found that compound with carbamate group at 8th position of pyridine ring was observed to be most-effective among the series and showed the cell death by the apoptosis.



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