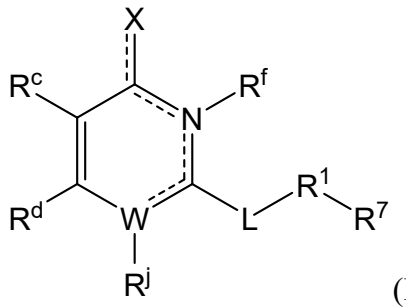
Claims:

1. A compound represented by Formula (II):



(II)

or a pharmaceutically acceptable salt or tautomer thereof, wherein:

X is O or OR^h;

W is N;

L is $-SCH_2$;

R^1 is absent, C_6-C_{10} arylene, heteroarylene, wherein the heteroarylene comprises one or two 5- to 7-membered rings and 1-4 heteroatoms selected from N, O and S, and wherein the C_6-C_{10} arylene and heteroarylene are optionally substituted with one to two R^e;

each R^6 is independently at each occurrence H or C_1-C_4 alkyl;

R^7 is A;

A is $-(C(R^6)_2)_r$tetrazole, $-(C(R^6)_2)_r$oxadiazolone, $-(C(R^6)_2)_r$tetrazolone, $-(C(R^6)_2)_r$thiadiazolol, or $-(C(R^6)_2)_r$ isoxazol-3-ol;

R^c is H, halogen, or –CN;

R^d is CF_3, CR^fF_2, $-CH_2$-C_6-C_{10} aryl, $-(C(R^6)_2)_tC_6$-C_{10} aryl, $-(C(R^6)_2)_t$-5- or 6-membered heteroaryl;

each R^e is independently at each occurrence C_1-C_6 alkyl, chloro, bromo, C_1-C_6 haloalkyl, $-NHR^z$, -OH, or -CN;

R^f is H;

R^h is H;

R^j is absent;

R^z is independently H, C_1-C_6 alkyl, or C_1-C_6 haloalkyl;

each r is independently 0, 1 or 2;

each t is independently 1 or 2;

$\equiv$ represents a single bond or a double bond.

2. The compound of claim 1, wherein R^c is –CN.

3. The compound of claim 1, wherein R^c is H.

4. The compound of any one of claims 1-3, wherein R^d is $–CF_3$.

5. The compound of any one of claims 1-3, wherein R^d is CR^fF_2.

6. The compound of any one of claims 1-3, wherein R^d is $-(C(R^6)_2)_tC_6$-C_{10} aryl or $-(C(R^6)_2)_t$-5- or 6-membered heteroaryl.

7. The compound of any one of claims 1-3, wherein R^d is $-(C(R^6)_2)_tC_6$-C_{10} aryl.

8. The compound of any one of claims 1-7, wherein R^1 is C_6-C_{10} arylene.

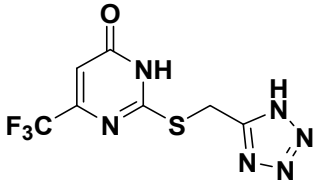
9. The compound of any one of claims 1-7, wherein R^1 is heteroarylene.

10. The compound of any one of claims 1-7, wherein R^1 is absent.

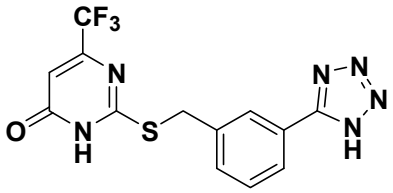
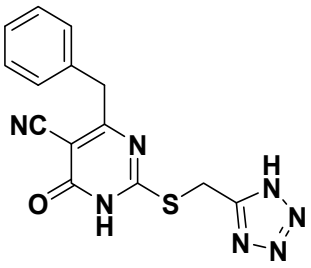
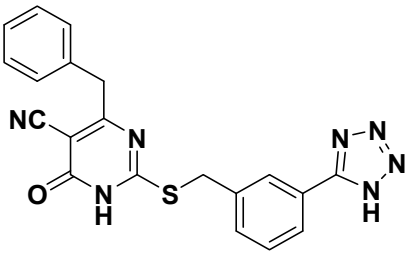
11. The compound of any one of claims 1-10, wherein A is $-(CH_2)_r$tetrazole.

12. The compound of claim 1, wherein R^1 is C_6-C_{10} arylene; R^7 is A; and A is $–(CH_2)_r$tetrazole.

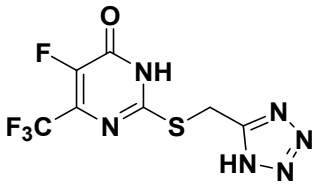
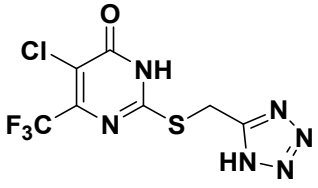
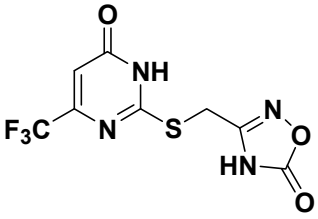
13. A compound, or a pharmaceutically acceptable salt or tautomer thereof, selected from the group consisting of:

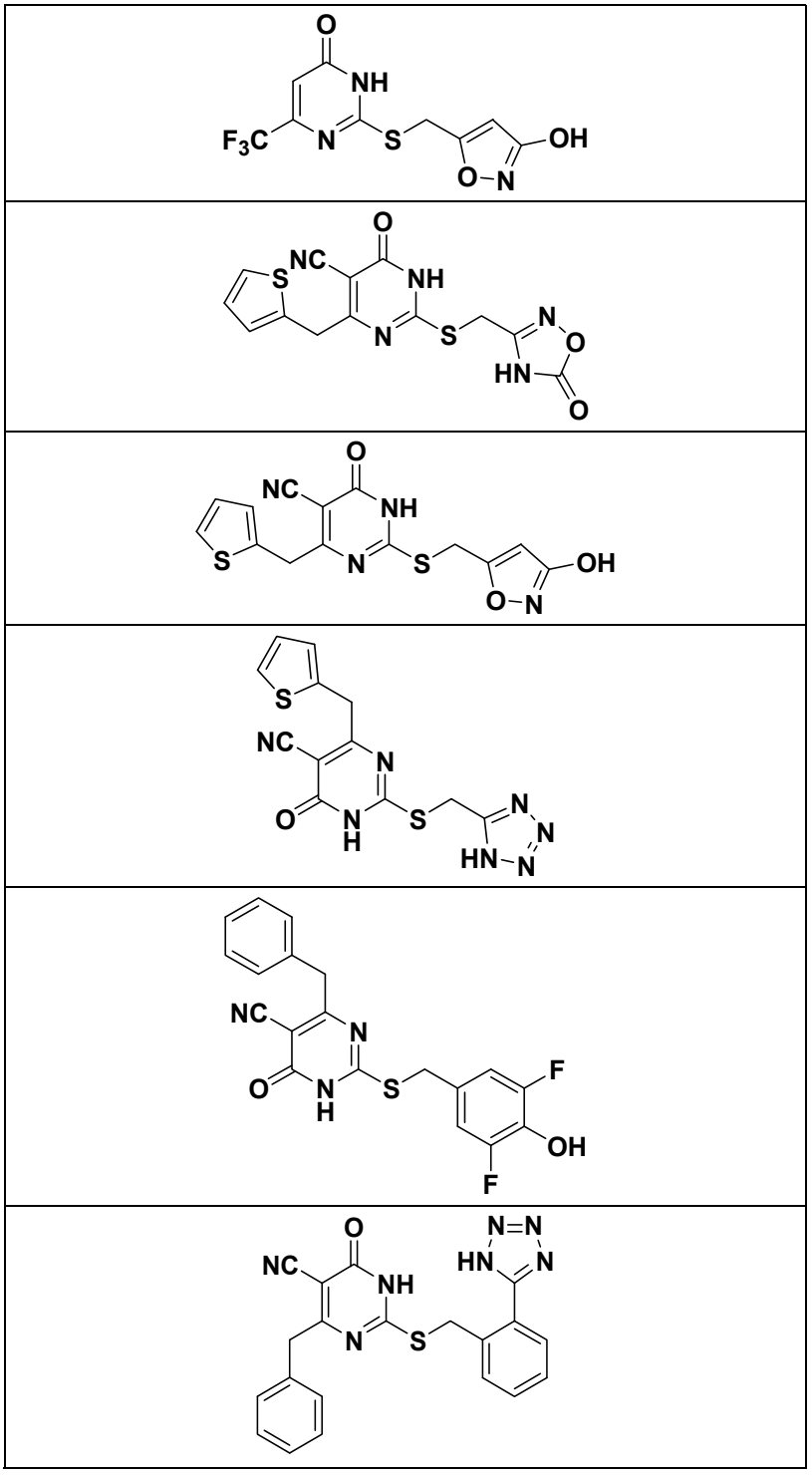
Cpd No.	**Structure**
I-26	

,

Cpd No.	Structure
I-29	
I-32	
I-34	

14. A compound, or a pharmaceutically acceptable salt or tautomer thereof, selected from the group consisting of:



15. A pharmaceutical composition comprising a compound of any one of claims 1-14, or a pharmaceutically acceptable salt thereof, and at least one of a pharmaceutically acceptable carrier, diluent, or excipient.

16. The pharmaceutical composition according to claim 15, which comprises one or more further therapeutic agents.

17. A compound of any of claims 1-14, or a pharmaceutically acceptable salt thereof, for use as a medicament.

18. A compound of any of claims 1-14, or a pharmaceutically acceptable salt thereof, for use in treating, preventing, or reducing the risk of a disease or disorder associated with reduced nicotinamide adenine dinucleotide (NAD^+) levels, wherein the disease is chronic liver disease selected from primary biliary cirrhosis (PBC), cerebrotendinous xanthomatosis (CTX), primary sclerosing cholangitis (PSC), drug induced cholestasis, intrahepatic cholestasis of pregnancy, parenteral nutrition associated cholestasis (PNAC), bacterial overgrowth or sepsis associated cholestasis, autoimmune hepatitis, chronic viral hepatitis, alcoholic liver disease, nonalcoholic fatty liver disease (NAFLD), nonalcoholic steatohepatitis (NASH), liver transplant associated graft versus host disease, living donor transplant liver regeneration, congenital hepatic fibrosis, choledocholithiasis, granulomatous liver disease, intra- or extrahepatic malignancy, Sjogren's syndrome, Sarcoidosis, Wilson's disease, Gaucher's disease, hemochromatosis, and alpha 1-antitrypsin deficiency.

19. A compound of any of claims 1-14, or a pharmaceutically acceptable salt thereof, for use in for treating, preventing, or reducing the risk of a disorder associated with mitochondrial dysfunction, wherein said disorder associated with mitochondrial dysfunction is an inherited mitochondrial disease, a common metabolic disorder, a neurodegenerative disease, an aging related disorder, a kidney disorder, or a chronic inflammatory disease.

20. Use of a compound of any of claims 1-14, or a pharmaceutically acceptable salt thereof, in the manufacture of a medicament for treating, preventing, or reducing the risk of a disease or disorder by inhibition of α-amino-β-carboxymuconate-ε-semialdehyde decarboxylase (ACMSD) dysfunction, wherein the disease is chronic liver disease selected from primary biliary cirrhosis (PBC), cerebrotendinous xanthomatosis (CTX), primary sclerosing cholangitis (PSC), drug induced cholestasis, intrahepatic cholestasis of pregnancy, parenteral nutrition associated cholestasis (PNAC), bacterial overgrowth or sepsis associated cholestasis, autoimmune hepatitis, chronic viral hepatitis, alcoholic liver disease, nonalcoholic fatty liver disease (NAFLD), nonalcoholic steatohepatitis (NASH), liver transplant associated graft versus host disease, living donor transplant liver regeneration, congenital hepatic fibrosis, choledocholithiasis, granulomatous liver disease, intra- or extrahepatic malignancy, Sjogren's syndrome, Sarcoidosis, Wilson's disease, Gaucher's disease, hemochromatosis, and alpha 1-antitrypsin deficiency.

21. Use of a compound of any of claims 1-14, or a pharmaceutically acceptable salt thereof, in the manufacture of a medicament for treating, preventing, or reducing the risk of a disease or disorder associated with reduced nicotinamide adenine dinucleotide (NAD^+) levels, wherein the disease is chronic liver disease selected from primary biliary cirrhosis (PBC), cerebrotendinous xanthomatosis (CTX), primary sclerosing cholangitis (PSC), drug induced cholestasis, intrahepatic cholestasis of pregnancy, parenteral nutrition associated cholestasis (PNAC), bacterial overgrowth or sepsis associated cholestasis, autoimmune hepatitis, chronic viral hepatitis, alcoholic liver disease, nonalcoholic fatty liver disease (NAFLD), nonalcoholic steatohepatitis (NASH), liver transplant associated graft versus host disease, living donor transplant liver regeneration, congenital hepatic fibrosis, choledocholithiasis, granulomatous liver disease, intra- or extrahepatic malignancy, Sjogren's syndrome, Sarcoidosis, Wilson's disease, Gaucher's disease, hemochromatosis, and alpha 1-antitrypsin deficiency.

22. Use of a compound of any of claims 1-14, or a pharmaceutically acceptable salt thereof, in the manufacture of a medicament for treating, preventing, or reducing the risk of a disorder associated with mitochondrial dysfunction, wherein said disorder associated with mitochondrial dysfunction is an inherited mitochondrial disease, a common metabolic disorder, a neurodegenerative disease, an aging related disorder, a kidney disorder, or a chronic inflammatory disease.

23. A pharmaceutical composition of claim 15 for use as a medicament.

24. A pharmaceutical composition of claim 15 for use in treating, preventing, or reducing the risk of a disease or disorder associated with reduced nicotinamide adenine dinucleotide (NAD^+) levels, wherein the disease is chronic liver disease selected from primary biliary cirrhosis (PBC), cerebrotendinous xanthomatosis (CTX), primary sclerosing cholangitis (PSC), drug induced cholestasis, intrahepatic cholestasis of pregnancy, parenteral nutrition associated cholestasis (PNAC), bacterial overgrowth or sepsis associated cholestasis, autoimmune hepatitis, chronic viral hepatitis, alcoholic liver disease, nonalcoholic fatty liver disease (NAFLD), nonalcoholic steatohepatitis (NASH), liver transplant associated graft versus host disease, living donor transplant liver regeneration, congenital hepatic fibrosis, choledocholithiasis, granulomatous liver disease, intra- or extrahepatic malignancy, Sjogren's syndrome, Sarcoidosis, Wilson's disease, Gaucher's disease, hemochromatosis, and alpha 1-antitrypsin deficiency.

25. A pharmaceutical composition of claim 15 for use in for treating, preventing, or reducing the risk of a disorder associated with mitochondrial dysfunction, wherein said disorder associated with mitochondrial dysfunction is an inherited mitochondrial disease, a common metabolic disorder, a neurodegenerative disease, an aging related disorder, a kidney disorder, or a chronic inflammatory disease.

26. Use of pharmaceutical composition of claim 15 in the manufacture of a medicament for treating, preventing, or reducing the risk of a disease or disorder by inhibition of α-amino-β-carboxymuconate-ε-semialdehyde decarboxylase (ACMSD), wherein the disease is chronic liver disease selected from primary biliary cirrhosis (PBC), cerebrotendinous xanthomatosis (CTX), primary sclerosing cholangitis (PSC), drug induced cholestasis, intrahepatic cholestasis of pregnancy, parenteral nutrition associated cholestasis (PNAC), bacterial overgrowth or sepsis associated cholestasis, autoimmune hepatitis, chronic viral hepatitis, alcoholic liver disease, nonalcoholic fatty liver disease (NAFLD), nonalcoholic steatohepatitis (NASH), liver transplant associated graft versus host disease, living donor transplant liver regeneration, congenital hepatic fibrosis, choledocholithiasis, granulomatous liver disease, intra- or extrahepatic malignancy, Sjogren's syndrome, Sarcoidosis, Wilson's disease, Gaucher's disease, hemochromatosis, and alpha 1-antitrypsin deficiency.

27. Use of pharmaceutical composition of claim 15 in the manufacture of a medicament for treating, preventing, or reducing the risk of a disease or disorder associated with reduced nicotinamide adenine dinucleotide (NAD^+) levels, wherein the disease is chronic liver disease selected from primary biliary cirrhosis (PBC), cerebrotendinous xanthomatosis (CTX), primary sclerosing cholangitis (PSC), drug induced cholestasis, intrahepatic cholestasis of pregnancy, parenteral nutrition associated cholestasis (PNAC), bacterial overgrowth or sepsis associated cholestasis, autoimmune hepatitis, chronic viral hepatitis, alcoholic liver disease, nonalcoholic fatty liver disease (NAFLD), nonalcoholic steatohepatitis (NASH), liver transplant associated graft versus host disease, living donor transplant liver regeneration, congenital hepatic fibrosis, choledocholithiasis, granulomatous liver disease, intra- or extrahepatic malignancy, Sjogren's syndrome, Sarcoidosis, Wilson's disease, Gaucher's disease, hemochromatosis, and alpha 1-antitrypsin deficiency.

28. Use of pharmaceutical composition of claim 15 in the manufacture of a medicament for treating, preventing, or reducing the risk of a disorder associated with mitochondrial dysfunction, wherein said disorder associated with mitochondrial dysfunction

is an inherited mitochondrial disease, a common metabolic disorder, a neurodegenerative disease, an aging related disorder, a kidney disorder, or a chronic inflammatory disease.

29. The use of any one of claims 20-21 or 26-27, wherein the disease is chronic liver disease selected from primary biliary cirrhosis (PBC), cerebrotendinous xanthomatosis (CTX), primary sclerosing cholangitis (PSC), drug induced cholestasis, intrahepatic cholestasis of pregnancy, parenteral nutrition associated cholestasis (PNAC), bacterial overgrowth or sepsis associated cholestasis, autoimmune hepatitis, chronic viral hepatitis, alcoholic liver disease, nonalcoholic fatty liver disease (NAFLD), nonalcoholic steatohepatitis (NASH), liver transplant associated graft versus host disease, living donor transplant liver regeneration, congenital hepatic fibrosis, choledocholithiasis, granulomatous liver disease, intra- or extrahepatic malignancy, Sjogren's syndrome, Sarcoidosis, Wilson's disease, Gaucher's disease, hemochromatosis, and alpha 1-antitrypsin deficiency.

30. The compound for use of claim 19 or 22, or the use of claim 25 or 28, wherein the common metabolic disorder is obesity or type II diabetes.