

# MitoCheck Complex II/III Activity Assay Kit

Item No. 700950



**Customer Service** 800.364.9897 \* **Technical Support** 888.526.5351  
[www.caymanchem.com](http://www.caymanchem.com)

## TABLE OF CONTENTS

<b>GENERAL INFORMATION</b>	3	Materials Supplied
	4	Precautions
	4	If You Have Problems
	4	Storage and Stability
	4	Materials Needed but Not Supplied
<b>INTRODUCTION</b>	5	Background
	6	About This Assay
<b>PRE-ASSAY PREPARATION</b>	7	Reagent Preparation
<b>ASSAY PROTOCOL</b>	9	Performing the Assay
<b>ANALYSIS</b>	10	Calculations
	11	Performance Characteristics
<b>RESOURCES</b>	12	Troubleshooting
	13	References
	13	Related Products
	14	Warranty and Limitation of Remedy
	15	Plate Template
	16	Notes

## GENERAL INFORMATION

### Materials Supplied

Kit will arrive packaged as a -80°C kit. For best results, remove components and store as stated below.

Item Number	Item	Quantity/Size	Storage
700951	Mitochondrial Complex III Activity Assay Buffer	2 vials/10 ml	-20°C
700952	Cytochrome <i>c</i> Assay Reagent	1 vial/3 mg	-80°C
700019	Bovine Heart Mitochondria Assay Reagent	1 vial/100 µl	-80°C
700021	Succinate Assay Reagent	1 vial/100 µl	-20°C
700020	Half Volume 96-Well Clear Plate	1 plate	Room temperature

If any of the items listed above are damaged or missing, please contact our Customer Service department at (800) 364-9897 or (734) 971-3335. We cannot accept any returns without prior authorization.



**WARNING:** This product is for laboratory research use only: not for administration to humans. Not for human or veterinary diagnostic or therapeutic use.

## Precautions

Please read these instructions carefully before beginning this assay.

For research use only. Not for human or diagnostic use.

**NOTE: It is recommended that gloves be worn at all time when working with isolated mitochondria and mitochondrial inhibitors.**

## If You Have Problems

### Technical Service Contact Information

**Phone:** 888-526-5351 (USA and Canada only) or 734-975-3888

**Fax:** 734-971-3641

**Email:** techserv@caymanchem.com

**Hours:** M-F 8:00 AM to 5:30 PM EST

In order for our staff to assist you quickly and efficiently, please be ready to supply the lot number of the kit (found on the outside of the box).

## Storage and Stability

This kit will perform as specified if stored as directed in the **Materials Supplied** section on page 3 and used before the expiration date indicated on the outside of the box.

## Materials Needed But Not Supplied

1. A plate reader capable of measuring absorbance at 550 nm at 30 second intervals
2. Adjustable and multichannel pipettes
3. A source of pure water; glass distilled water or HPLC-grade water is acceptable
4. Mitochondrial Inhibitors - Rotenone, TTFA, Potassium Cyanide, or Antimycin A
5. 0.1 M NaOH

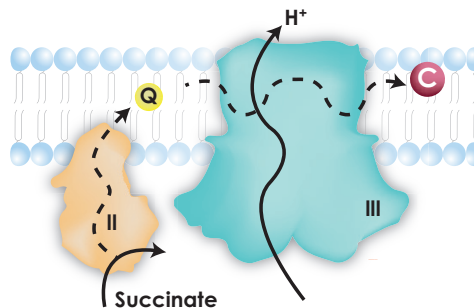
## INTRODUCTION

### Background

Complex III (CoQ cytochrome *c* oxidoreductase) is an essential protein for mitochondrial oxidative phosphorylation. Complex III functions as both a gatekeeper for mitochondrial respiration, and as a major source of reactive oxygen species III.<sup>1,2</sup> Complex III accepts electrons from complexes I and II in the form of QH<sub>2</sub>, the reduced form of the electron carrier ubiquinone. Once bound to complex III, QH<sub>2</sub> undergoes a series of redox reactions, known as the Q-cycle. During the Q-cycle, electrons are passed from QH<sub>2</sub> onto cytochrome *c* via the Reiske iron-sulfur protein and cytochrome *c*<sub>1</sub> resulting in the translocation of 4H<sup>+</sup> and the generation of O<sub>2</sub><sup>•-</sup>.<sup>3</sup> This assay is designed to measure the complex III-dependent reduction of cytochrome *c*. Because the mechanism is coupled to complex II, it is also sensitive to complex II inhibitors. It is therefore recommended that all potential complex III inhibitors be pre-screened against complex II. (See Cayman's MitoCheck Complex II Activity Assay Kit (Item No. 700940) for more details.)

## About This Assay

Cayman's MitoCheck Complex II/III Activity Assay measures the reduction of excess cytochrome *c* (550 nm absorbance) as catalyzed by complex III. This assay is coupled to succinate co-enzyme Q oxidoreductase (complex II) for the generation of  $\text{QH}_2$ . Due to the dependence on complex II activity, a counterscreen for complex II activity (Item No. 700940) should be performed in order to truly measure complex III activity. Cayman's Mitochondrial Complex II/III Activity Assay allows for the activity of complexes II/III to be determined without the need to isolate mitochondria or pre-incubate with antibodies. Since electrons can flow backwards through complex I and cytochrome *c* is readily reduced by complex IV, it is recommended that rotenone and potassium cyanide (not supplied) are present throughout the assay.<sup>2,4,5</sup> (Rotenone and potassium cyanide are not supplied.)



**Figure 1.** The coupled reaction of complex II and III as measured by this assay kit.

## PRE-ASSAY PREPARATION

### Reagent Preparation

All assay reagents, unless listed below, are ready to use as supplied.

#### 1. Mitochondrial Complex III Activity Assay Buffer - (Item No. 700951)

This buffer is ready to use as supplied. It is important that the buffer is warmed to room temperature prior to use. Additionally, vortex well to be sure that any crystals that may have precipitated have dissolved.

#### 2. Mitochondrial Inhibitors - (Not Supplied)

1. **Potassium Cyanide (KCN)** - KCN should be present to inhibit the ETC (complex IV) and prevent the oxidation of Q. It is important that extreme care is taken when preparing and using KCN. Protocol: In a ventilated hood, weigh out 6.5 mg of KCN and dissolve in 1 ml of 0.1 M NaOH to yield a 100 mM stock solution of KCN. **Do not use water or any acidic solvents to make up KCN.** Store stock solution on ice and make fresh less than three hours prior to running this assay. Use appropriate personal protective equipment (PPE).
2. **Rotenone (Item No. 13995)** - to ensure inhibition of complex I, use concentrations  $\geq 1 \mu\text{M}$ . Can be made up in DMSO or ethanol. If making up in DMSO, avoid freeze/thaws. Use appropriate PPE.
3. **Antimycin A** - to ensure inhibition of complex III, use concentrations  $\geq 10 \mu\text{M}$ . Can be made up in DMSO or ethanol. Use appropriate PPE.
4. **2-Thenoyltrifluoroacetone (TTFA)** - to ensure inhibition of complex II, use concentrations  $\geq 1 \text{ mM}$ . Can be made up in DMSO or ethanol. Use appropriate PPE.

## ASSAY PROTOCOL

### Pipetting Hints

- Use different tips to pipette each reagent.
- Avoid introducing bubbles into the well.
- Do not expose the pipette tip to the reagent(s) already in the well.

### General Information

- The final volume of the assay is 100  $\mu$ l in all wells.
- It is not necessary to use all the wells on the plate at one time.
- It is recommended that the samples be assayed at least in duplicate (triplicates preferred).
- The assay is performed in the kinetic read mode at 25°C.
- Monitor the absorbance at 550 nm every 30 seconds for 15 minutes.

## Performing the Assay

Label two polystyrene tubes as A and B and add the following reagents. *Isolated mitochondria can settle over time, so make sure contents of each tube are well mixed. Store tubes on ice until ready to use. Volumes indicated below are suitable for 20 reactions (or wells). Customer may scale volumes as needed.*

Tube A (1 ml)	Tube B (675 $\mu$ l)
958 $\mu$ l of Complex III Activity Assay Buffer	607 $\mu$ l of Complex III Activity Assay Buffer
20 $\mu$ l Bovine Heart Mitochondria Assay Reagent	8 $\mu$ l of Succinate Assay Reagent
2 $\mu$ l of 1 mM Rotenone *not supplied*	60 $\mu$ l Cytochrome c Assay Reagent
20 $\mu$ l of 100 mM KCN (1 mM) *not supplied*	

**Table 1. Assay preparation**

All assays are carried out at 25°C.

1. Add 50  $\mu$ l of the contents of tube A to each well.
2. Add 20  $\mu$ l of compound, positive control, or vehicle to each well. Allow for pre-incubation if required.
3. Add 30  $\mu$ l of the contents of tube B to each well. This should be done quickly as the reaction will start immediately.
4. Immediately place plate in plate reader and measure absorbance at 550 nm (30 second intervals for 15 minutes at 25°C).

## ANALYSIS

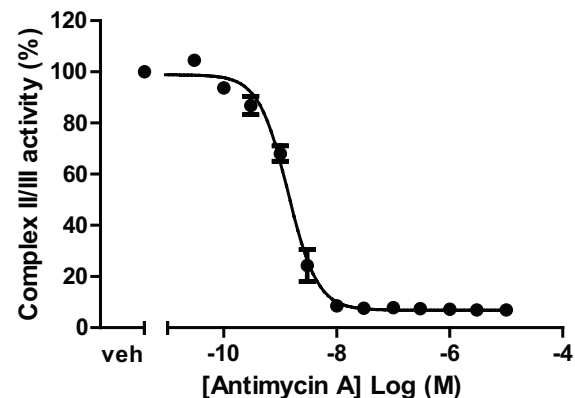
### Calculations

1. Plot data as absorbance (y-axis) *versus* time (x-axis).
2. To determine the reaction rate, calculate the slope for the linear portion of the curve.
3. Determine % activity relative to the vehicle control using the equation indicated below.
4. To determine an IC<sub>50</sub> value for each compound, plot the slope as a function of test compound concentration.

$$\text{Complex II/III Activity (\%)} = \left[ \frac{\text{Rate of Sample wells}}{\text{Rate of Vehicle Control}} \right] \times 100$$

### Performance Characteristics

The data shown below are an example of data obtained with this kit. Your results will not be identical to these. Do not use these data to directly compare your samples as your results may vary substantially.



**Figure 3.** A typical concentration response curve for inhibition of complex III activity by antimycin A (IC<sub>50</sub> = 136 nM). "Veh." represents compound vehicle control.

## Troubleshooting

Problem	Possible Causes	Recommended Solutions
Erratic values; dispersion of duplicates/triplicates	A. Poor pipetting/technique B. Bubble in the well(s) C. Poor test compound solubility	A. Be careful not to splash the contents of the wells B. Carefully tap the side of the plate with your finger to remove bubbles C. Test solubility with assay buffer
No activity was detected in test compound wells	Test compound is a potent inhibitor	Check vehicle controls to be sure complex III is active
Test compound absorbance is above saturating positive control ( <i>i.e.</i> , antimycin A) absorbance	Test compound absorbs at 550 nM	Determine absorbance of compounds in the absence of Cytochrome <i>c</i> ; subtract this value from all wells containing test compound
Positive control doesn't inhibit	A. Inhibitor has gone off B. Excess superoxide generated at Complex I	Make sure positive controls and rotenone are fresh; avoid freeze thaw cycles

## References

- Muller, F., Crofts, A.R., and Kramer, D.M. Multiple Q-cycle bypass reactions at the Qo site of the cytochrome bc1 complex. *Biochemistry* **41(25)**, 7866-7874 (2002).
- Hoffman, D.L. and Brookes, P.S. Oxygen sensitivity of mitochondrial reactive oxygen species generation depends on metabolic conditions. *J. Biol. Chem.* **284(24)**, 16236-16245 (2009).
- Crofts, A.R., Holland, J.T., Victoria, D., *et al.* The Q-cycle reviewed: How well does a monomeric mechanism of the bc1 complex account for the function of a dimeric complex. *Biochim. Biophys. Acta* **1777(7-8)**, 1001-1019 (2008).
- St-Pierre, J., Buckingham, J.A., Roebuck, S.J., *et al.* Topology of superoxide production from different sites in the mitochondrial electron transport chain. *J. Biol. Chem.* **277(47)**, 44784-44790 (2002).
- Lambert, A.J. and Brand, M.D. Inhibitors of the quinone-binding site allow rapid superoxide production from mitochondrial NADH:ubiquinone oxidoreductase (complex I). *J. Biol. Chem.* **279(38)**, 39414-39420 (2004).

## Related Products

10-Acetyl-3,7-dihydroxyphenoxazine - Item No. 10010469  
 Aconitase Assay Kit - Item No. 705502  
 Aconitase Fluorometric Assay Kit - Item No. 700600  
 FCCP - Item No. 15218  
 HQNO - Item No. 15159  
 JC-1 - Item No. 15003  
 JC-1 Mitochondrial Membrane Potential Assay Kit - Item No. 10009172  
 MitoCheck Complex I Activity Assay Kit - Item No. 700930  
 MitoCheck Complex II Activity Assay Kit - Item No. 700940  
 MitoCheck Complex IV Activity Assay Kit - Item No. 700990  
 MitoCheck Mitochondrial (Tissue) Isolation Kit - Item No. 701010  
 Oxygen Consumption Rate Assay Kit (MitoXpress®-Xtra HS Method) - Item No. 600800





## NOTES

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