



AccuDiag™ Cardiolipin IgG ELISA Kit

REF 1491-2

IVD See External Label 2°C 8°C 96 Tests

Cardiolipin IgG ELISA	
Principle	Indirect ELISA
Detection	Semi-Quantitative
Sample	10 µL serum
Incubation Time	~ 65 min.
Sensitivity	91.7%
Specificity	75.9%
Shelf Life	12 Months from the manufacturing date

PRODUCT FEATURES

- Very easy to use with little training
- Highly specific and consistent assay
- Provides accurate results quickly
- Reading of results both visually and as absorbance data

INTENDED USE

The Diagnostic Automation, Inc. Cardiolipin Antibody Test System is an enzyme-linked immunosorbent assay (ELISA) designed for the semi-quantitative measurement of circulating IgG autoantibodies to cardiolipin. This test is for *in vitro* diagnostic use.

SIGNIFICANCE AND SUMMARY

Autoantibodies directed against phospholipids, and anti-cardiolipin (aCL) in particular, have been associated with recurrent thrombosis, thrombocytopenia, and spontaneous abortions (1,2,3). aCL is observed in patients with systemic lupus erythematosus, in patients with other connective tissue disease (4), in individuals undergoing chlorpromazine treatment (5), as well as in persons who do not have chronic illness.

ASSAY PRINCIPLE

The Diagnostic Automation, Inc. Cardiolipin IgG ELISA test system is designed to detect IgG class antibodies to cardiolipin in human sera. Sensitized wells of plastic microwell strips are created by passive adsorption with cardiolipin antigen. The test procedure involves three incubation steps:

1. Test sera (properly diluted) are incubated in antigen coated microwells. Any antigen specific antibody in the sample will bind to the immobilized antigen. The plate is washed to remove unbound antibody and other serum components.
2. Peroxidase Conjugated goat anti-human IgG is added to the wells and the plate is incubated. The Conjugate will react with IgG antibody immobilized on the solid phase in step 1. The wells are washed to remove unreacted Conjugate.
3. The microwells containing immobilized peroxidase Conjugate are incubated with peroxidase Substrate Solution. Hydrolysis of the Substrate by peroxidase produces a color change. After a period of time the reaction is stopped and the color intensity of the solution is measured photometrically. The color intensity of the solution depends upon the antibody concentration in the original test sample.

SPECIMEN COLLECTION & PREPARATION

1. It is recommended that specimen collection be carried out in accordance with CLSI document M29: Protection of Laboratory Workers from Infectious Disease.
2. No known test method can offer complete assurance that human blood samples will not transmit infection. Therefore, all blood derivatives should be considered potentially infectious.
3. Only freshly drawn and properly refrigerated sera obtained by approved aseptic venipuncture procedures should be used in this assay. No anticoagulants or preservatives should be added. Avoid using hemolyzed, lipemic, or bacterially contaminated sera.
4. Store sample at room temperature for no longer than 8 hours. If testing is not performed within 8 hours, sera may be stored between 2-8°C for no longer than 48 hours. If delay in testing is anticipated, store test sera at -20°C or lower. Avoid multiple freeze/thaw cycles that may cause loss of antibody activity and give erroneous results. It is the responsibility of the individual laboratory to use all available references and/or its own studies to determine stability criteria for its laboratory (9).

MATERIALS AND COMPONENTS

Materials provided with the test kits

Each Test System contains the following components in sufficient quantities to perform the number of tests indicated on the packaging label. **NOTE: The following components contain Sodium Azide as a preservative at a concentration of <0.1% (w/v): Controls, Calibrator, and Sample Diluent.**

1. **Plate:** 96 wells configured in twelve, 1x8- well, strips coated with Cardiolipin antigen from bovine heart. The strips are packaged in a strip holder and sealed in an envelope with desiccant.
2. **Conjugate:** Conjugated (horseradish peroxidase) goat anti-human IgG (Fc chain specific-yellow solution). Ready to use. One, 15 mL vial with a white cap.
3. **Positive Control (Human Serum):** One, 0.35 mL, red-capped.
4. **Calibrator (Human Serum):** One, 0.5mL, blue-capped.
5. **Negative Control (Human Serum):** One, 0.35mL, green-capped.
6. **Sample Diluent:** One, 30mL, green-capped, bottle containing Tween-20, bovine serum albumin and phosphate-buffered-saline. Green Solution, ready to use.
7. **TMB:** One, 15 mL, amber-capped, amber bottle containing 3, 3', 5, 5' - tetramethylbenzidine (TMB). Ready to use.



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I M M U N O D I A G N O S T I C S

- Stop Solution:** One, 15 mL, red-capped, bottle containing 1M H₂SO₄, 0.7M HCl. Ready to use.
- Wash Buffer Concentrate (10X):** Dilute 1 part concentrate + 9 parts deionized or distilled water. One, 100 mL bottle, (clear-capped) contains a 10X concentrated phosphate-buffered-saline and Tween-20 solution (Clear solution). **Note: 1X solution will have a pH of 7.2 ± 0.2.**

Kit also contains:

- Component list containing lot specific information is inside the kit box.
- Package insert providing instructions for use.

Materials required but not provided

- ELISA microwell reader capable of reading at a wavelength of 450nm. NOTE: Use of a single (450nm), or dual (450/620 - 650nm), wavelength reader is acceptable. Dual wavelength is preferred, as the additional reference filter has been determined to reduce potential interference from anomalies that may absorb light.
- Pipettes capable of accurately delivering 10 to 200µL.
- Multichannel pipette capable of accurately delivering (50-200µL)
- Reagent reservoirs for multichannel pipettes.
- Wash bottle or microwell washing system.
- Distilled or deionized water.
- One liter graduated cylinder.
- Serological pipettes.
- Disposable pipette tips.
- Paper towels.
- Laboratory timer to monitor incubation steps.
- Disposal basin and disinfectant. (Example: 10% household bleach – 0.5% sodium hypochlorite.)

PRECAUTIONS

- For In Vitro Diagnostic Use
- Follow normal precautions exercised in handling laboratory reagents. In case of contact with eyes, rinse immediately with plenty of water and seek medical advice. Wear suitable protective clothing, gloves, and eye/face protection. Do not breathe vapor. Dispose of waste observing all local, state, and federal laws.
- The wells of the Elisa plate do not contain viable organisms. However, consider the Slide potentially bio-hazardous materials and handle accordingly.
- The Controls are potentially bio-hazardous materials. Source materials from which these products were derived were found negative for HIV-1 antigen, HBsAg and for antibodies against HCV and HIV by approved test methods. However, since no test method can offer complete assurance that infectious agents are absent, these products should be handled at the Bio-safety Level 2 as recommended for any potentially infectious human serum or blood specimen in the Centers for Disease Control/National Institutes of Health manual "Biosafety in Microbiological and Biomedical Laboratories": current edition; and OSHA's Standard for Bloodborne Pathogens⁶
- Adherence to the specified time and temperature of incubations is essential for accurate results. **All reagents must be allowed to reach room temperature (20 - 25°C) before starting the assay.** Return unused reagents to refrigerated temperature immediately after use.
- Improper washing could cause false positive or false negative results. Be sure to minimize the amount of any residual wash solution; (e.g., by blotting or aspiration) before adding Conjugate or Substrate. Do not allow the wells to dry out between incubations.
- The Sample Diluent, Controls, Conjugate and Wash Buffer contain Sodium Azide at a concentration of < 0.1% (w/v). Sodium Azide has been reported to form lead or copper azides in laboratory plumbing which may cause

- explosions on hammering. To prevent, rinse sink thoroughly with water after disposing of solution containing Sodium Azide.
- The Stop Solution is TOXIC if inhaled, has contact with skin or if swallowed. It can cause burns. In case of accident or ill feelings, seek medical advice immediately.
 - The TMB Solution is HARMFUL. It is irritating to eyes, respiratory system and skin.
 - The Wash Buffer concentrate is an IRRITANT. It is irritating to eyes, respiratory system and skin.
 - Wipe the bottom of the plate free of residual liquid and/or fingerprints that can alter optical density (OD) readings.
 - Dilution or adulteration of these reagents may generate erroneous results.
 - Do not use reagents from other sources or manufacturers.
 - TMB Solution should be colorless, very pale yellow, very pale green, or very pale blue when used. Contamination of the TMB with conjugate or other oxidants will cause the solution to change color prematurely. Do not use the TMB if it is noticeably blue in color.
 - Never pipette by mouth. Avoid contact of reagents and patient specimens with skin and mucous membranes.
 - Avoid microbial contamination of reagents. Incorrect results may occur.
 - Cross contamination of reagents and/or samples could cause erroneous results
 - Reusable glassware must be washed and thoroughly rinsed free of all detergents.
 - Avoid splashing or generation of aerosols.
 - Do not expose reagents to strong light during storage or incubation.
 - Allowing the microwell strips and holder to equilibrate to room temperature prior to opening the protective envelope will protect the wells from condensation.
 - Collect the wash solution in a disposal basin. Treat the waste solution with disinfectant (i.e.: 10% household bleach - 0.5% Sodium Hypochlorite). Avoid exposure of reagents to bleach fumes.
 - Caution: Liquid waste at acid pH should be neutralized before adding to bleach solution.
 - Do not use ELISA plate if the indicator strip on the desiccant pouch has turned from blue to pink.
 - Do not allow the conjugate to come in contact with containers or instruments that may have previously contained a solution utilizing sodium azide as a preservative. Residual amounts of sodium azide may destroy the conjugate's enzymatic activity.
 - Do not expose any of the reactive reagents to bleach-containing solutions or to any strong odors from bleach-containing solutions. Trace amounts of bleach (sodium hypochlorite) may destroy the biological activity of many of the reactive reagents within this kit.

ASSAY PROCEDURE

- Remove the individual component from storage and allow them to warm to room temperature (20-25°C.)
- Determine the number of microwells needed. Allow six Control/Calibrator determinations (one Reagent Blank, one Negative Control, three Calibrators and one Positive Control) per run. Run. A Reagent Blank should be run on each assay. Check software and reader requirements for the correct Controls/Calibrator configurations. Return unused strips to the resealable pouch with desiccant, seal, and return to storage between 2° and 8°C.

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EXAMPLE PLATE SET-UP

	1	2
A	Blank	Patient 3
B	Neg. Control	Patient 4
C	Calibrator	Etc.
D	Calibrator	
E	Calibrator	
F	Pos. Control	
G	Patient 1	
H	Patient 2	

ABBREVIATED TEST PROCEDURE

1. Dilute Serum 1:21.
2. Add diluted sample to microwell - 100µL/well.
3. \longrightarrow Incubate 25 ± 5 minutes.
4. Wash.
5. Add Conjugate - 100µL/well.
6. \longrightarrow Incubate 25 ± 5 minutes.
7. Wash.
8. Add TMB - 100µL/well.
9. \longrightarrow Incubate 10 - 15 minutes.
10. Add Stop Solution - 50µL/well - Mix.
11. READ within 30 minutes.

RESULTS

3. Prepare a 1:21 dilution (e.g.: 10µL of serum + 200µL of Sample Diluent) of the Negative Control, Calibrator, Positive Control, and each patient serum.
4. To individual wells, add 100µL of each diluted control, calibrator and patient specimen. Ensure that the samples are properly mixed. Use a different pipette tip for each sample.
5. Add 100µL of Sample Diluent to well A1 as a reagent blank. Check software and reader requirements for the correct reagent blank well configuration.
6. Incubate the plate at room temperature (20-25°C) for 25 ± 5 minutes.
7. Wash the microwell strips 5 times.

A. Manual Wash Procedure:

- 1) Vigorously shake out the liquid from the wells.
- 2) Fill each microwell with Wash Buffer. Make sure no air bubbles are trapped in the wells.
- 3) Repeat steps 1) and 2) for a total of 5 washes.
- 4) Shake out the wash solution from all the wells. Invert the plate over a paper towel and tap firmly to remove any residual wash solution from the wells. Visually inspect the plate to ensure that no residual wash solution remains. Collect wash solution in a disposable basin and treat with disinfectant at the end of the day's run.

B. Automated Wash Procedure:

If using an automated microwell wash system, set the dispensing volume to 300-350µL/well. Set the wash cycle for 5 washes with no delay between washes. If necessary, the microwell plate may be removed from the washer, inverted over a paper towel and tapped firmly to remove any residual wash solution from the microwells.

8. Add 100µL of the Conjugate to each well, including the Reagent Blank well, at the same rate and in the same order as the specimens.
9. Incubate the plate at room temperature (20-25°C) for 25 ± 5 minutes
10. Wash the microwells by following the procedure as described in step 7.
11. Add 100µL of TMB to each well, including reagent blank well, at the same rate and in the same order as the specimens were added.
12. Incubate the plate at room temperature (20-25°C) for 10 to 15 minutes.
13. Stop the reaction by adding 50µL of Stop Solution to each well, including reagent blank well, at the same rate and in the same order as the TMB. Positive samples will turn from blue to yellow. After adding the Stop Solution, tap the plate several times to ensure that the samples are thoroughly mixed.
14. Set the microwell reader to read at a wavelength of 450nm and measure the optical density (OD) of each well against the reagent blank. The plate should be read within 30 minutes after the addition of the Stop Solution.

1. Calculations

A. Positive Calibrator

Based upon testing of normal and disease-state specimens, a maximum normal unit value has been determined by the manufacturer and correlated to the positive calibrator. The calibrator will allow you to determine the unit value of test samples, and to correct for slight day-to-day variations in test results. The calibrator unit value is determined for each lot of kit components and is printed on the Component List.

B. Interpretation of Results

Patient samples may be graded as normal, low positive, moderate, or high positive according to the following recommendations:

	GPL
Normal	<20
Low Positive	20 TO < 30
Moderate	30 TO < 80
High Positive	≥ 80

2. Conversion of Optical Density to GPL

The conversion of OD to unit value (GPL) can be represented by the following equation:

$$\text{Test Specimen APL} = (A \times B)/C$$

Where: GPL = Unknown unit value to be determined
 A = OD of test specimen in question.
 B = Unit value of calibrator (GPL).
 C = The mean OD of calibrator.

Example: Test specimen OD for Cardiolipin = 0.946
 Calibrator OD for Cardiolipin = 0.435
 Calibrator unit value for Cardiolipin = 155 GPL
Test Specimen GPL = (0.946 x 155)/0.435
Test Specimen = 337 GPL for anti-Cardiolipin

QUALITY CONTROL

1. Each time the assay is run, the positive calibrator must be run in triplicate. A positive control, negative control, and reagent blank must also be included in each assay.
2. Calculate the mean of the three positive calibrator determinations. If any of the three positive calibrator values differ by more than 15% from the mean, discard that value and calculate the mean of the remaining two values.
3. The mean OD value for the positive calibrator and the OD values for the positive and negative controls should fall within the following ranges:



	OD Range
Negative Control	≤0.250
Calibrator	≥0.300
Positive Calibrator	≥0.500

- The OD of the Negative Control divided by the mean OD of the Calibrator should be ≤ 0.9.
 - The OD of the Positive Control divided by the mean OD of the Calibrator should be ≥ 1.25.
 - If the above conditions are not met the test should be considered invalid and should be repeated.
- The positive control is intended to monitor for substantial reagent failure and will not ensure precision at the assay cut-off.
 - The positive and negative controls must meet the following additional criteria:
 - The negative control must be < 20 GPL
 - The positive control must be >20 GPL
 - Additional controls may be tested according to guidelines or requirements of local, state, and/or federal regulations or accrediting organizations.
 - Refer to CLSI Document C24: Statistical Quality Control for Quantitative Measurement Procedures for guidance on appropriate QC practices.

PERFORMANCE CHARACTERISTICS

A. Comparative Study

An in-house comparative study was performed to demonstrate the equivalence of the Diagnostic Automation, Inc. Cardiolipin IgG ELISA to another commercially available Cardiolipin IgG ELISA test system. Performance was evaluated using 260 specimens as described in Table 1 below. The results of the investigation have been summarized in Table 2 below.

Table 1. Summary of Clinical Specimens

No.	Comments
105	Disease state specimens obtained from rheumatology groups from two different university hospitals.
14	Specimens previously tested and found positive for anti-cardiolipin
28	Uncharacterized SLE Patient samples.
113	Normal donor samples collected in Northeastern United States.

Table 2: Calculation of Relative Sensitivity, Specificity, and Agreement

Commercial Cardiolipin IgG ELISA Result

		+	-	Totals
DAI	+	44	51	95
Cardiolipin	-	4	161	165
IgG ELISA	Totals	48	212	260

Relative Sensitivity = 44/48=91.7% 95% Confidence Interval **=83.8 to 99.4%
 Relative Specificity = 161/212 = 75.9% 95% Confidence Interval**=70.2 to 81.7%
 Relative Agreement = 205/260 = 78.8% 95% Confidence Interval **= 73.8 to 83.8%

** 95% confidence intervals calculated using the exact method.

B. Reproducibility

To evaluate both intra-assay and inter-assay reproducibility, six specimens were tested; eight replicates each, on each of three days. These results were then used to calculate mean unit values, standard deviations, and percent CV. Two of the

specimens were strong positives, two were clearly negative, and two were near the assay cut off. The results of the study have been summarized below.

Table 3: Diagnostic Automation, Inc. Cardiolipin IgG ELISA; Results of Precision Testing

Sample	Intra-Assay Reproducibility						Inter-Assay Reproducibility					
	Day 1		Day 2		Day 3		Mean (GPL)	StD	% CV			
	Mean (GPL)	StD	Mean (GPL)	StD	Mean (GPL)	StD						
1	84	2.05	2.4	75	4.25	5.7	87	2.83	3.3	82	5.91	7.2
2	73	2.11	2.9	66	5.88	8.9	74	3.16	4.2	71	5.28	7.4
3	34	2.01	6.0	30	3.48	11.6	33	1.58	4.8	32	2.91	9.0
4	28	1.60	5.7	26	3.47	13.5	25	1.76	7.2	26	2.73	10.5
5	2	1.24	56.4	2	0.13	8.0	2	0.31	15.0	2	0.75	37.7
6	0	0.04	54.1	0	0.06	15.4	0	0.22	82.8	0	0.18	77.5

C. Cross Reactivity

To investigate the potential for positive reactions due to cross reactive antibodies, 14 specimens which were reactive for various auto-antibodies were tested on the anti-cardiolipin test system. Eleven of the 14 (78.6%) were negative for anti-cardiolipin IgG activity, while three of the 14 (21.4%) were in the Low Positive area. The results of this study indicate that the potential for a high degree of cross reactivity with such autoantibodies is not likely.

LIMITATIONS OF THE ASSAY

- A diagnosis should not be made on the basis of anti-Cardiolipin ELISA results alone. Test results for anti-Cardiolipin should be interpreted in conjunction with the clinical evaluation and the results of other diagnostic procedures.
- The performance characteristics of this device have not been established for lipemic, hemolyzed and icteric specimens; therefore, these specimens should not be tested with this assay.
- Although aCL has been associated with certain SLE subsets (1-3), the clinical significance of aCL in SLE and other diseases remains under investigation.
- The range of "normal" aCL values may vary from population to population. The normal ranges shown above are those recommended by one group of investigators and are supported by studies of random blood donors from Northeastern United States. Testing laboratories, however, are encouraged to establish normal ranges for their regions.
- The clinical significance of any test result depends upon its relationship to other medical patient data. Disease diagnosis and management should be based on an evaluation of all relevant patient information.

EXPECTED RANGES OF VALUES

A study was conducted where 113 normal donor sera from Northeastern United States were evaluated for cardiolipin IgG autoantibodies. Of the 113 tested, five (4.4%) had results of 20 GPL or greater. In the same study a group of 28 uncharacterized SLE specimens were evaluated for cardiolipin IgG autoantibodies. Of these 28 specimens, 5 (17.9%) had results of 20 GPL or greater.

STORAGE CONDITIONS

- Store the unopened kit between 2° and 8°C.
- Coated microwell strips: Store between 2° and 8°C. Extra strips should be immediately resealed with desiccant and returned to proper storage. Strips are stable for 60 days after the envelope has been opened and properly resealed and the indicator strip on the desiccant pouch remains blue.
- Conjugate: Store between 2° and 8°C. **DO NOT FREEZE.**
- Calibrator, Positive Control and Negative Control: Store between 2° and 8°C.
- TMB: Store between 2° and 8°C.



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I M M U N O D I A G N O S T I C S



6. Wash Buffer concentrate (10X): Store between 2° and 25°C. Diluted wash buffer (1X) is stable at room temperature (20° to 25° C) for up to 7 days or for 30 days between 2° and 8°C.
7. Sample Diluent: Store between 2° and 8°C.
8. Stop Solution: Store between 2° and 25°C.

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MANUFACTURER AND BRAND DETAILS

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