510(k) SUBSTANTIAL EQUIVALENCE DETERMINATION
DECISION SUMMARY
ASSAY ONLY

I Background Information:

A 510(k) Number

K242802

B Applicant

Hangzhou Clongene Biotech Co., Ltd.

C Proprietary and Established Names

CLUNGENE Fentanyl Home Test Cassette; CLUNGENE Fentanyl Test Cassette

D Regulatory Information

Product Code(s)	Classification	Regulation Section	Panel
NGL	Class II	21 CFR 862.3650 - Opiate Test System	TX - Clinical Toxicology

II Submission/Device Overview:

A Purpose for Submission:

New device

B Measurand:

Fentanyl

C Type of Test:

Qualitative competitive binding lateral flow immunochromatographic assay

III Intended Use/Indications for Use:

A Intended Use(s):

See Indications for Use below.

B Indication(s) for Use:

The CLUNGENE Fentanyl Home Test Cassette is competitive binding, lateral flow immunochromatographic assay for the qualitative detection of Fentanyl in human urine at the cut off concentration of 1.0 ng/mL. This test provides only a preliminary result. A more specific alternative chemical method must be used to obtain a confirmed analytical result. Gas Chromatography-Mass Spectrometry (GC/MS) or Liquid Chromatography-Mass Spectrometry (LC/MS) is the preferred confirmatory method. Evaluate preliminary positive results carefully.

The CLUNGENE Fentanyl Test Cassette is competitive binding, lateral flow immunochromatographic assay for the qualitative detection of Fentanyl in human urine at the cut off concentration of 1.0 ng/mL. This test provides only a preliminary result. A more specific alternative chemical method must be used to obtain a confirmed presumptive positive result. Gas Chromatography-Mass Spectrometry (GC-MS), Liquid Chromatography-Mass Spectrometry (LC-MS), and their tandem mass-spectrometer versions are the preferred confirmatory methods. Careful consideration and judgment should be applied to any drugs of abuse screen test result, particularly when evaluating preliminary positive results.

C Special Conditions for Use Statement(s):

OTC - Over The Counter

D Special Instrument Requirements:

Not applicable

IV Device/System Characteristics:

A Device Description:

The CLUNGENE Fentanyl Tests are immunoassays intended for the qualitative detection of fentanyl in human urine. Each CLUNGENE Fentanyl Test device consists of a Test Cassette, a Dropper and a package insert. Each Test Cassette is sealed with sachets of desiccant in an aluminum pouch.

B Principle of Operation:

The CLUNGENE Fentanyl Test Cassette detects Fentanyl through visual interpretation of color development on the device. Drug conjugates are immobilized on the test region of the membrane. During testing, the specimen reacts with antibodies conjugated to colored particles and precoated on the sample pad. The mixture then migrates through the membrane by capillary action, and interacts with reagents on the membrane. If there are insufficient drug molecules in the specimen, the antibody- colored particle conjugate will bind to the drug conjugates, forming a colored band at the test region of the membrane. Therefore, a colored band appears in the test region when the urine is negative for the drug. If drug molecules are present in the urine above the cut-off concentration of the test, they compete with the immobilized drug conjugate on the test region for limited antibody binding sites. This will prevent attachment of the antibody-colored particle conjugate to the test region. Therefore, the absence of a colored band at the test region indicates a positive result. The appearance of a colored band at the control region serves

as a procedural control, indicating that the proper volume of specimen has been added and membrane wicking has occurred.

V Substantial Equivalence Information:

A Predicate Device Name(s):
AllTest Fentanyl Urine Test Cassette

B Predicate 510(k) Number(s):
K233417

C Comparison with Predicate(s):

Device & Predicate Device(s):	K242802	K233417
Device Trade Name	CLUNGENE Fentanyl Test Cassette	AllTest Fentanyl Urine Test Cassette
General Device Characteristic Similarities		
Indications for Use	For the qualitative determination of fentanyl in human urine	Same
Calibrator and Cut-Off Values	Fentanyl (FTY) 1 ng/ml	Same
Methodology	Competitive binding, lateral flow immunochromatographic assays based on the principle of antigen antibody immunochemistry	Same
Type of Test	Qualitative	Same
Specimen Type	Human Urine	Same
Configurations	Cassette	Same
Storage	4-30℃	Same
General Device Characteristic Differences		
Cross Reactivity	Percent Cross Reactivity (Carfentanil 2%)	Percent Cross Reactivity (Carfentanil 50%)

VI Standards/Guidance Documents Referenced:

Not applicable

VII Performance Characteristics (if/when applicable):

A Analytical Performance:

1. Precision/Reproducibility:

A precision study was carried out at one site for samples with concentrations of -100% cut off, -75% cut off, -50% cut off, -25% cut off, cut off, +25% cut off, +50% cut off, +75% cut off and +100% cut off, where the fentanyl cut-off concentration was 1 ng/mL. Samples with concentration of -100% cut-off were drug-free urine samples. Other samples were prepared by spiking fentanyl in negative samples, and the study was randomized and blinded. Each fentanyl concentration was confirmed by LC/MS. All sample aliquots were blindly labeled by the person who prepared the samples and didn't take part in the sample testing. Samples were tested by three operators using three different lots at two runs per day per operator for 10 days in a randomized order. Eighteen tests per day per concentration (3 operators x 3 lots x 2 runs) were tested for a total of 162 tests per day. There is a total of 60 tests per lot per concentration.

Lot Number	-100% cut off	-75% cut off	-50% cut off	-25% cut off	cut off	+25% cut off	+50% cut off	+75% cut off	+100% cut off
Lot 1	60-/0+	60-/0+	60-/0+	58-/2+	33-/27+	60+/0-	60+/0-	60+/0-	60+/0-
Lot 2	60-/0+	60-/0+	60-/0+	60-/0+	26-/34+	60+/0-	60+/0-	60+/0-	60+/0-
Lot 3	60-/0+	60-/0+	60-/0+	58-/2+	32-/28+	60+/0-	60+/0-	60+/0-	60+/0-

2. Linearity:

Not applicable, this device is intended for qualitative use only.

3. Analytical Specificity/Interference:

Cross-Reactivity:
To test specificity, similarly structured drug metabolites and other components that are likely to interfere in urine samples were added to the drug-free urine samples at different concentrations and tested using three lots of the device by three different operators. Results are expressed as a minimum concentration of metabolite or compound required to produce positive response (ng/mL). The percent cross reactivity of those compounds (calculated by dividing the cutoff concentration by the minimum concentration required to obtain a positive result and then multiplying by 100%) and lowest concentration that caused a positive result for each compound are listed below.

Fentanyl (Cutoff = 1 ng/mL)	Minimum concentration required to obtain a positive result (ng/mL)	% Cross-Reactivity
Acetyl fentanyl	1	100%
Acrylfentanyl	1	100%
Isobutyryl fentanyl	2.5	40%

Ocfentanil	5	20%
Butyryl fentanyl	5	20%
Furanyl fentanyl	10	10%
Valeryl fentanyl	5	20%
(±)β-hydroxythiofentanyl	2.5	40%
4-Fluoro-isobutyrylfentanyl	10	10%
Para-fluorobutyryl fentanyl	5	20%
Para-fluoro fentanyl	2.5	40%
Carfentanil	50	2%
Sufentanil	25	4%
Alfentanil	7,500	0.01%
Ω-1-Hydroxy fentanyl	2,500	0.04%
(±)-3-cis-methyl fentanyl	75	1.33%
Despropionyl fentanyl (4-ANPP)	2,000	0.05%
β-hydroxyfentanyl	100	1%
Thiofentanyl	50	2%
Cyclopropyl Fentanyl	10	10%
Trazodone	1,000	0.1%
Remifentanil	>100,000	<0.001%
Norcarfentanil	>100,000	<0.001%
Norfentanyl	>100,000	<0.001%
Acetyl norfentanyl	>100,000	<0.001%

The following structurally unrelated opioid compounds were tested at a concentration of 100 µg/mL. Three device lots were used to test each sample, and each operator used one lot. Negative results were obtained for all these compounds.

6-Acetyl morphine	Naloxone
Amphetamine	Naltrexone
Buprenorphine	Norbuprenorphine
Buprenorphineglucuronide	Norcodeine
Codeine	Norketamine
Dextromethorphan	Normeperidine
Dihydrocodeine	Normorphine
EDDP	Noroxycodone
EMDP	Oxycodone
Fluoxetine	Oxymorphone
Heroin	Pentazocine (Talwin)
Hydrocodone	Pipamperone
Hydromorphone	Risperidone
Ketamine	Tapentadol
Levorphanol	Thioridazine
Meperidine	Tilidine
Methadone	Tramadol
Morphine	Tramadol-O- Desmethyl
Morphine-3-glucuronide	Tramadol-N- Desmethyl

Interference:
Potential endogenous and exogenous interfering substances commonly found in human urine were added to drug-free urine and target drug fentanyl urine with concentrations at 50% below and 50% above cut-off levels. These urine samples were tested using three lots of each device, with tests performed for compounds at a concentration of 100 ug/mL or other specified concentration. No compounds showed any interference. Refer to the table below for the compounds tested at a concentration of 100µg/mL or other specified concentration.

Acetaminophen	Erythromycin	Octopamine
Acetone (1000 mg/dL)	Ethanol (1%)	O-Hydroxyhippuric acid
Acetophenetidin	Fenofibrate	Olanzapine
Acetylsalicylic acid	Fenoprofen	Omeprazole
Acyclovir	Fluphenazine	Oxalic acid (100 mg/dL)
Albumin (100mg/dL)	Furosemide	Oxazepam
Albuterol	Galactose (10 mg/dL)	Oxolinic acid
Aminopyrine	Gamma globulin (500 mg/dL)	Oxymetazoline
Amitriptyline	Gatifloxacin	Papaverine
Amobarbital	Gentisic acid	Penicillin G
Amoxicillin	Glibenclamide	Perphenazine
Ampicillin	Gliclazide	Phencyclidine
Apomorphine	Glucose (3000 mg/dL)	Phenelzine
Ascorbic acid	Hemoglobin	Phenobarbital
Aspartame	Hydralazine	Prednisone
Atropine	Hydrochlorothiazide	Procaine
Benzilic acid	Hydrocortisone	Promethazine
Benzoic acid	Hydroxytyramine	Propoxyphene (50 mg/dL)
Benzoylecgonine	Ibuprofen	Propranolol
Bilirubin	Imipramine	Propylthiouracil
Boric acid (1%)	Isoproterenol	Pseudoephedrine
Bupropion	Isoxsuprine	Quinine
Caffeine	Ketamine	Ranitidine
Captopril	Ketoprofen	Ribavirin
Carbamazepine	Labetalol	Riboflavin (10 mg/dL)
Chloral hydrate	Levonorgestrel	Rifampicin
Chloramphenicol	Lidocaine	Salicylic acid
Chlorothiazide	Loperamide	Secobarbital
Chlorpheniramine	Maprotiline	Serotonin (5-Hydroxytyramine)
Chlorpromazine	MDMA	Simvastatin
Cholesterol	Meperidine	Sulfamethazine
Clarithromycin	Meprobamate	Sulindac
Clomipramine	Methamphetamine	Tetrahydrocortisone 3-(β-Dglucuronide)
Clonidine	Methapyrilene	Tetrahydrocortisone 3-acetate
Cortisone	Methaqualone	Tetrahydrozoline
Cotinine	Methoxyphenamine	Theophylline
Creatinine	Metoprolol tartrate	Thiamine

Cyclobenzaprine	Metronidazole (300 µg/mL)	Thioridazine
Deoxycorticosterone	Mifepristone	Triamterene
Desipramine	Montelukast sodium	Trifluoperazine
Dextromethorphan	N-Acetylprocainamide	Trimethoprim
Diazepam	NaCl (4000 mg/dL)	Tyramine
Diclofenac	Nalidixic acid	Urea (2000 mg/dL)
Diflunisal	Naloxone	Uric acid
Digoxin	Naltrexone	Valproic acid (250 µg/mL)
Diphenhydramine	Naproxen	Venlafaxine
DL-Tryptophan	Niacinamide	Verapamil
DL-Tyrosine	Nicotine	Zomepirac
Doxepin	Nifedipine	β-Estradiol
Ecgonine methyl ester	Norethindrone	Δ9-THC
Ephedrine	Nortriptyline	/
Epinephrine hydrochloride	Noscapine	/

Effect of Urine Density and pH Value:
To evaluate the effect of urine density and urine pH value on the accuracy of test measurements, urine samples with 1.000, 1.003, 1.008, 1.014, 1.018, 1.020, 1.022, 1.025, 1.028, 1.030, 1.032, and 1.035 specific gravity and urine samples with pH of 4.0, 5.0, 6.0, 7.0, 8.0, and 9.0 were spiked with target fentanyl at 50% below and 50% above cut-off levels. These samples were tested using three lots of the device and one operator per lot. Results were all positive for samples at and above +50% cut-off and all negative for samples at and below -50% cut-off.

4. Assay Reportable Range:

   Not applicable

5. Traceability, Stability, Expected Values (Controls, Calibrators, or Methods):

Traceability:
The assay is traceable to a commercially available standard from Cerilliant Corp.

6. Detection Limit:

   Characterization of how the device performs at low concentrations appears in the precision section VII.A.1. above.

7. Assay Cut-Off:

   Characterization of how the device performs at low concentrations appears in the precision section VII.A.1. above.

B Comparison Studies:

1. Method Comparison with LC-MS/MS method:

A randomized and blinded method comparison study was conducted at one testing site by three operators between the CLUNGENE Fentanyl Test Cassette and LC-MS/MS method using only one device lot. Clinical samples tested included a total of 80 urine samples (40 negative and 40 positive) obtained from a hospital laboratory. The samples were blinded and compared to LC/MS results. Sample concentrations of fentanyl were confirmed by LC-MS/MS and ranged from drug-free, < -50% Cut-off (low positive), between -50% Cutoff and the cutoff (near cut-off negative), between cutoff and +50% (near cut-off positive), and > +50% Cut-off (high positive), with fentanyl cut-off of 1 ng/mL. The results are summarized in the tables below.

		Negative	Low Negative by LC/MS (less than -50%)	Near Cutoff Negative by LC/MS (Between -50% and cutoff)	Near Cutoff Positive by LC/MS (Between the cutoff and +50%)	High Positive by LC/MS (greater than +50%)
Operator 1	Positive	0	0	1	21	18
	Negative	10	16	13	1	0
Operator 2	Positive	0	0	1	20	18
	Negative	10	16	13	2	0
Operator 3	Positive	0	0	1	20	18
	Negative	10	16	13	2	0

Discordant Results

Operator	Sample ID	LC/MS Result (ng/mL)	Rapid Test Result
Operator 1	FYL57	0.953	Positive
Operator 2	FYL66	0.987	Positive
Operator 3	FYL66	0.987	Positive
Operator 1	FYL38	1.073	Negative
Operator 2	FYL19	1.083	Negative
Operator 2	FYL55	1.004	Negative
Operator 3	FYL24	1.073	Negative
Operator 3	FYL55	1.004	Negative

2. Matrix Comparison:

Not applicable. These devices are for use with urine samples only.

C Clinical Studies:

1. Clinical Sensitivity:

Not applicable

2. Clinical Specificity:

Not applicable

3. Other Clinical Supportive Data (When 1. and 2. Are Not Applicable):

Lay User Study:
A lay user study was performed at three sites representative of intended use settings with 140 lay persons and three device lots. The lay users had diverse educational and professional backgrounds and ranged in age from 19 to >50 years. Urine samples were prepared at -100%, +/-75%, +/-50%, and +/-25% of the fentanyl cut-off by spiking fentanyl into 6 drug free-pooled urine sample pools. Drug-free urine samples were also used in the study. The drug concentrations of the samples were confirmed by LC/MS. Each sample was further aliquoted into 20 individual containers (total 140 aliquots), blind-labeled and randomized. All 140 aliquots were distributed to the three testing sites, where each participant was provided with the package insert, 1 blind labeled sample and a device. Each participant tested the sample with the device, and the results are summarized below.

% of Cutoff by LC/MS	Number of samples	Drug Concentration by LC/MS (ng/mL)	Lay person results		The percentage of correct results (%)
			No. of Positive	No. of Negative	
-100% Cutoff	20	0	0	20	100.0%
-75% Cutoff	20	0.23	0	20	100.0%
-50% Cutoff	20	0.53	0	20	100.0%
-25% Cutoff	20	0.75	1	19	95%
+25% Cutoff	20	1.20	20	0	100.0%
+50% Cutoff	20	1.46	20	0	100.0%
+75% Cutoff	20	1.77	20	0	100.0%

Each participant was given a questionnaire to evaluate ease of understanding the instructions for use and device use. The questionnaire focused on personal information, product information, test procedures, and test results by the lay user. A Flesch-Kincaid Grade reading analysis was also performed on the package insert and resulted in a reading score of Grade 7 Level.

D Clinical Cut-Off:

Not applicable

E Expected Values/Reference Range:

Not applicable

VIII Proposed Labeling:

The labeling supports the finding of substantial equivalence for this device.

IX Conclusion:

The submitted information in this premarket notification is complete and supports a substantial equivalence decision.