USE

Oligo state on shipment
Standard Morpholino oligos and Vivo-Morpholinos are shipped as sterile lyophilized solids.

Making a Stock Solution of a Morpholino
A Morpholino is delivered as a prequantitated, sterile, salt-free, lyophilized solid in a glass vial. We recommend making a ≤1 mM Morpholino stock solution in distilled water. Like other oligos, Morpholinos can be damaged by diethyl pyrocarbonate (DEPC).

Vivo-Morpholinos, due to their lower solubilities, should be dissolved at lower concentration (≤0.5 mM). Water can be removed by lyophilization if needed. It is easiest to analyze Morpholinos by MALDI-TOF from a water solution. You can make a stock solution in a buffer (e.g. Danieau buffer or Ringer’s solution); however, some salts decrease solubility of Vivo-Morpholinos and lyophilization or mass spectrometry will be more difficult. Delivery dyes might inhibit Vivo-Morpholino activity. Do not autoclave Vivo-Morpholino solutions more than once.

GENE TOOLS suggests storing Morpholino stock solutions at room temperature in the original GENE TOOLS vial. It is best to keep stocks at 1 mM or less to avoid insolubility or aggregation and in tightly sealed vials to prevent evaporation, ideally in a humid environment. Activity lost due to solubility issues can often be restored by autoclaving Morpholino solutions. If your oligo does not readily dissolve during stock preparation, heat the vial to 65°C and vortex. If dissolution is incomplete, autoclave the stock solution.
### Stock solutions of Morpholino oligos

<table>
<thead>
<tr>
<th>Amount of Morpholino (Amount of Vivo-Morpholino)</th>
<th>Volume of sterile water</th>
<th>Resulting stock concentration</th>
</tr>
</thead>
<tbody>
<tr>
<td>100 nanomoles</td>
<td>0.10 mL</td>
<td>1.0 milliMolar (mM)</td>
</tr>
<tr>
<td>(100 nanomoles Vivo-MO)</td>
<td>0.20 mL</td>
<td>0.5 milliMolar (mM)</td>
</tr>
<tr>
<td>300 nanomoles</td>
<td>0.30 mL</td>
<td>1.0 milliMolar (mM)</td>
</tr>
<tr>
<td>(400 nanomoles Vivo-MO)</td>
<td>0.80 mL</td>
<td>0.5 milliMolar (mM)</td>
</tr>
<tr>
<td>1000 nanomoles</td>
<td>1.00 mL</td>
<td>1.0 milliMolar (mM)</td>
</tr>
<tr>
<td>(2000 nanomoles Vivo-MO)</td>
<td>4.00 mL</td>
<td>0.5 milliMolar (mM)</td>
</tr>
</tbody>
</table>

### Oligo Concentrations

Typical effective concentrations of standard Morpholino oligos in various systems:

<table>
<thead>
<tr>
<th>Test system</th>
<th>Oligo concentration</th>
</tr>
</thead>
<tbody>
<tr>
<td>Electroporation in cultures</td>
<td>1 µM to 10 µM (in delivery solution)</td>
</tr>
<tr>
<td>Endo-Porter(a) in cultures</td>
<td>1 µM to 10 µM (in medium)</td>
</tr>
<tr>
<td>Scrape-loading(b) in cultures</td>
<td>1 µM to 20 µM (in medium)</td>
</tr>
<tr>
<td>Microinjection into oocytes</td>
<td>Inject 1 to 10 nanoliters of 1 mM oligo into 1 µl oocyte to give 1 to 10 µM final concentration in oocyte</td>
</tr>
<tr>
<td>Cell-free translation system(c)</td>
<td>100 nM to 1000 nM (in lysate)</td>
</tr>
</tbody>
</table>

(a) Endo-Porter solution delivers Morpholino oligos into the cytosol of cells efficiently and uniformly by releasing oligos from endosomes.
(b) Morpholino oligos may be loaded into the cytosol/nuclear compartment of adherent cells by adding oligo to the medium and then scraping the cells from the plate (see: Antisense and Nucleic Acid Drug Dev. 6, 166 (1996)).
(c) See: Antisense and Nucleic Acid Drug Dev. 7, 63 (1997)

Typical effective concentrations of Vivo-Morpholino oligos in various systems:

<table>
<thead>
<tr>
<th>Test system</th>
<th>Oligo concentration and/or dose</th>
</tr>
</thead>
<tbody>
<tr>
<td>Cell bathing in cultures</td>
<td>1-10 µM in nutrient medium</td>
</tr>
<tr>
<td>Injection into mouse tail vein</td>
<td>12.5 (mg oligo)/(kg mouse) per day</td>
</tr>
<tr>
<td>Injection into mouse intraperitoneal</td>
<td>12.5 (mg oligo)/(kg mouse) per day</td>
</tr>
</tbody>
</table>

### Cell Delivery Protocols

Upon request GENE TOOLS will provide protocols for Endo-Porter or scrape delivery with cell scrapers. Copies of these protocols are normally shipped with orders which include these products.

### QUANTITY

**Standard Morpholino oligos**
- Typical package size for a classic Morpholino oligo is:
  - 300 nanomoles (about 2.5 mg or 75 OD units for 25-mer).
  - Larger amounts available (1000 nanomole, 6000 nanomole, 1g, etc.).

**Vivo-Morpholino oligos**
- Typical package size for a Vivo-Morpholino oligo is:
  - 400 nanomoles (about 4 mg or 100 OD units for 25-mer).
  - Larger amounts available (2000 nanomole, 10000 nanomole, 1g, etc.).

Note: The quantities above are the measured and delivered amounts of lyophilized, sterile Morpholino oligos.
<table>
<thead>
<tr>
<th>Gene Tools Prepared Controls</th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Standard Control</strong></td>
<td></td>
</tr>
<tr>
<td><strong>Sequence:</strong> 5’ CCTCTACCTCAGTTACAATTATA 3’</td>
<td></td>
</tr>
<tr>
<td><strong>Calculated Mass:</strong> 8328</td>
<td></td>
</tr>
<tr>
<td><strong>Molar Absorbance @265 nm in 0.1 N HCl:</strong> 259,160 1/(M*cm)</td>
<td></td>
</tr>
<tr>
<td><strong>Quantity Delivered:</strong> 100 nanomoles</td>
<td></td>
</tr>
<tr>
<td>25.9 OD 265, pH1 Units</td>
<td></td>
</tr>
<tr>
<td>0.833 mg</td>
<td></td>
</tr>
<tr>
<td><strong>Fluoresceinated Standard Control</strong></td>
<td></td>
</tr>
<tr>
<td><strong>Sequence:</strong> 5’ CCTCTACCTCAGTTACAATTTTATA 3’</td>
<td></td>
</tr>
<tr>
<td><strong>Calculated Mass:</strong> 8817</td>
<td></td>
</tr>
<tr>
<td><strong>Molar Absorbance @265 nm in 0.1 N HCl:</strong> 259,160 1/(M*cm)</td>
<td></td>
</tr>
<tr>
<td><strong>Quantity Delivered:</strong> 100 nanomoles</td>
<td></td>
</tr>
<tr>
<td>25.9 OD 265, pH1 Units</td>
<td></td>
</tr>
<tr>
<td>0.882 mg</td>
<td></td>
</tr>
<tr>
<td><strong>Lissaminated Standard Control</strong></td>
<td></td>
</tr>
<tr>
<td><strong>Sequence:</strong> 5’ CCTCTACCTCAGTTACAATTATA 3’</td>
<td></td>
</tr>
<tr>
<td><strong>Calculated Mass:</strong> 9112</td>
<td></td>
</tr>
<tr>
<td><strong>Molar Absorbance @265 nm in 0.1 N HCl:</strong> 259,160 1/(M*cm)</td>
<td></td>
</tr>
<tr>
<td><strong>Quantity Delivered:</strong> 100 nanomoles</td>
<td></td>
</tr>
<tr>
<td>25.9 OD 265, pH1 Units</td>
<td></td>
</tr>
<tr>
<td>0.911 mg</td>
<td></td>
</tr>
<tr>
<td><strong>Vivo Standard Control</strong></td>
<td></td>
</tr>
<tr>
<td><strong>Sequence:</strong> 5’ CCTCTACCTCAGTTACAATTTTATA 3’</td>
<td></td>
</tr>
<tr>
<td><strong>Calculated Mass:</strong> 10,138</td>
<td></td>
</tr>
<tr>
<td><strong>Molar Absorbance @265 nm in 0.1 N HCl:</strong> 259,160 1/(M/cm)</td>
<td></td>
</tr>
<tr>
<td><strong>Quantity Delivered:</strong> 100 nanomoles</td>
<td></td>
</tr>
<tr>
<td>25.9 OD 265, pH1 Units</td>
<td></td>
</tr>
<tr>
<td>1.01 mg</td>
<td></td>
</tr>
<tr>
<td><strong>Gene Tools Blue Standard Control</strong></td>
<td></td>
</tr>
<tr>
<td><strong>Sequence:</strong> 5’ CCTCTACCTCAGTTACAATTTTATA 3’</td>
<td></td>
</tr>
<tr>
<td><strong>Calculated Mass:</strong> 9078</td>
<td></td>
</tr>
<tr>
<td><strong>Molar Absorbance @265 nm in 0.1 N HCl:</strong> 259,160 1/(M*cm)</td>
<td></td>
</tr>
<tr>
<td><strong>Quantity Delivered:</strong> 100 nanomoles</td>
<td></td>
</tr>
<tr>
<td>25.9 OD 265, pH1 Units</td>
<td></td>
</tr>
<tr>
<td>0.908 mg</td>
<td></td>
</tr>
<tr>
<td><strong>Random Control 25-N</strong></td>
<td></td>
</tr>
<tr>
<td><strong>Sequence:</strong> 5’ NNNNNNNNNNNNNNNNNNNNNNNNNN 3’</td>
<td></td>
</tr>
<tr>
<td><strong>Calculated Mass:</strong> 8463 average mix of 25-mer</td>
<td></td>
</tr>
<tr>
<td><strong>Molar Absorbance @265 nm in 0.1 N HCl:</strong> 259,063 1/(M*cm)</td>
<td></td>
</tr>
<tr>
<td><strong>Quantity Delivered:</strong> 100 nanomoles</td>
<td></td>
</tr>
<tr>
<td>25.9 OD 265, pH1 Units</td>
<td></td>
</tr>
<tr>
<td>0.846 mg (average)</td>
<td></td>
</tr>
<tr>
<td><strong>Zebrafish p53</strong></td>
<td></td>
</tr>
<tr>
<td><strong>Sequence:</strong> 5’ GCGCCATTGCTTGGCAAGAATTG 3’</td>
<td></td>
</tr>
<tr>
<td><strong>Calculated Mass:</strong> 7805</td>
<td></td>
</tr>
<tr>
<td><strong>Molar Absorbance @265 nm in 0.1 N HCl:</strong> 236,990 1/(M*cm)</td>
<td></td>
</tr>
<tr>
<td><strong>Quantity Delivered:</strong> 100 nanomoles</td>
<td></td>
</tr>
<tr>
<td>23.7 OD 265, pH1 Units</td>
<td></td>
</tr>
<tr>
<td>0.780 mg</td>
<td></td>
</tr>
<tr>
<td><strong>Zebrafish Chordin (3’ Fluorescein)</strong></td>
<td></td>
</tr>
<tr>
<td><strong>Sequence:</strong> 5’ ATCCACAGCAGCCCTCCATCATCC 3’</td>
<td></td>
</tr>
<tr>
<td><strong>Calculated Mass:</strong> 8742</td>
<td></td>
</tr>
<tr>
<td><strong>Molar Absorbance @265 nm in 0.1 N HCl:</strong> 250,880 1/(M*cm)</td>
<td></td>
</tr>
<tr>
<td><strong>Quantity Delivered:</strong> 100 nanomoles</td>
<td></td>
</tr>
<tr>
<td>25.1 OD 265, pH1 Units</td>
<td></td>
</tr>
<tr>
<td>0.876 mg</td>
<td></td>
</tr>
</tbody>
</table>
Clawed Frog p53
Sequence: 5’ GCCGTTCTCAGAGGAAGGTTCCATT 3’
Calculated Mass: 8500
Molar Absorbance @265 nm in 0.1 N HCl: 256,200 1/(M*cm)
Quantity Delivered: 100 nanomoles
25.6 OD 265, pH1 Units
0.850 mg

Clawed Frog Beta-Catenin (3’Fluorescein)
Sequence: 5’ TTCAACCGTTTCAAAGAACCAGG 3’
Calculated Mass: 8901
Molar Absorbance @265 nm in 0.1 N HCl: 262,740 1/(M*cm)
Quantity Delivered: 100 nanomoles
24.3 OD 265, pH1 Units
0.890 mg

Green Fluorescent Protein Positive Ctrl
Sequence: 5’ ACAGCTCCTCGCCTTGCTCACCAT 3’
Calculated Mass: 8275
Molar Absorbance @265 nm in 0.1 N HCl: 246,420 1/(M*cm)
Quantity Delivered: 100 nanomoles
24.6 OD 265, pH1 Units
0.828 mg

Vivo GFP Positive Control
Sequence: 5’ ACAGCTCCTCGCCTTGCTCACCAT 3’
Calculated Mass: 10,085
Molar Absorbance @265 nm in 0.1 N HCl: 246,420 1/(M*cm)
Quantity Delivered: 100 nanomoles
24.6 OD 265, pH1 Units
1.01 mg

Photo GPF Postive Control
Sequence: 5’ ACAGCTCCTCaaPaaTGCTCACCAT 3’
Calculated Mass: 8237
Molar Absorbance @265 nm in 0.1 N HCl: 255,910 1/(M*cm)
Quantity Delivered: 100 nanomoles
25.6 OD 265, pH1 Units
0.824 mg

Gal4-UAS Photo Morpholino Antisense
Sequence: 5’ GTTCGATAGAtaPatGTAGCTTCAT 3’
Calculated Mass: 8393
Molar Absorbance @265 nm in 0.1 N HCl: 259,160 1/(M*cm)
Quantity Delivered: 100 nanomoles
25.9 OD 265, pH1 Units
0.839 mg

Gal4-UAS Photo Morpholino Sense
Sequence: 5’ ATGAAGCTACaaPaaTCTATCGAAC 3’
Calculated Mass: 8349
Molar Absorbance @265 nm in 0.1 N HCl: 268,450 1/(M*cm)
Quantity Delivered: 100 nanomoles
25.95 OD 265, pH1 Units
0.835 mg

Gal4-UAS
Sequence: 5’ GTTCGATAGAAGACAGTAGCTTCAT 3’
Calculated Mass: 8507
Molar Absorbance @265 nm in 0.1 N HCl: 266,090 1/(M*cm)
Quantity Delivered: 100 nanomoles
26.6 OD 265, pH1 Units
0.851 mg
Section I: Product Identification

Product Name: Morpholino Oligos
Chemical Name: Morpholino Phosphorodiamidate Oligomer
Chemical Formula: N/A
CASS #: None assigned

Section II: Hazardous Ingredients

Hazardous Components: None

Section III: Physical/Chemical Characteristics

Physical State: White Lyophilized Powder
Odor: None
Boiling Point: Does not boil
Vapor Pressure: Negligible
Vapor Density: N/A
Solubility: Soluble in water
Specific Gravity: Not determined
Melting Point: Does not melt
Evaporation Rate: Negligible

Section IV: Fire and Explosion Hazard Data

Flash Point: No information available
Unusual Fire or Explosion Hazards: None
Extinguishing Media: Fire-Fighting Instructions: Use water

Section V: Reactivity Data

Chemical Stability: Stable under normal temperatures and pressures
Incompatibility: Strong acids cause non-hazardous degradation of product
Conditions to Avoid: None reported
Hazardous Polymerization: Will not occur

Section VI: Health Hazard Data

Routes of Entry: May enter the body through ingestion, inhalation, skin and eye contact
Carcinogenicity: No information available
Toxicity: Intravenous injection of up to 800 mg/kg in mice causes no acute toxicity
Health Hazards: Preliminary studies suggest this product is not a health hazard
Signs and Symptoms of Exposure: Unknown, handle with care
Emergency and First Aid Procedures: None required

Section VII: Precautions for Safe Handling and Storage

Storage Precautions: Store at or below room temperature
Steps to be taken in case material is released or spilled: Wash area with soap and water
Waste Disposal Method: Observe all Federal, State and Local Environmental Regulations

Section VIII: Control Measures

Respiratory Protection: None required
Ventilation: General ventilation is sufficient
Personal Protective Equipment: None required
Work/Hygiene Practices: None required

The above information is correct to the best of our knowledge. This material is intended for research purposes only and must only be used under the supervision of a person experienced in handling hazardous materials. GENE TOOLS, LLC makes no guarantee of the accuracy or completeness of the information and shall not be held liable for any damage resulting from handling or from contact with the above material.

Morpholino Oligos are covered by European and United States Patents, including: 5,142,047 and 5,185,444.
Material Safety Data Sheet
Vivo-Morpholino Oligomer
Date Updated: 10 June 2016

Section I: Product Identification

Product Name: Vivo-Morpholino Oligo
Chemical Name: Morpholino Phosphorodiamidate Oligomer Conjugated with *in vivo* Delivery Moiety
Chemical Formula: N/A
CAS #: None assigned

Section II: Hazardous Ingredients

Emergency Overview
Caution: The chemical, physical, and toxicological properties of this product have not been thoroughly investigated. Exercise due care.

HMIS Rating
- Health: 3
- Flammability: 0
- Reactivity: 0

NFPA Rating
- Health: 3
- Flammability: 0
- Reactivity: 0

Section III: First Aid Measures

Oral Exposure: If swallowed, wash out mouth with water provided person is conscious. Call a physician.

Inhalation Exposure: If inhaled, remove to fresh air. If breathing becomes difficult, call a physician.

Dermal Exposure: In case of skin contact, flush with copious amounts of water for at least 15 minutes. Remove contaminated clothing and shoes. Call a physician.

Eye Exposure: In case of contact with eyes, flush with copious amounts of water for at least 15 minutes. Assure adequate flushing by separating the eyelids with fingers. Call a physician.

Section IV: Fire Fighting Measures

- Flash Point: Not available
- Autoignition Temp: Not available
- Flammability: Not available
- Extinguishing Media: Carbon dioxide, dry chemical powder, or appropriate foam. Water spray
- Fire Fighting: Wear self-contained breathing apparatus and protective clothing to prevent contact with skin and eyes.
- Protective Equipment: Specific Hazard(s): Emits toxic fumes under fire conditions.

Section V: Accidental Release Measures

Procedure to be Followed in Case of Leak or Spill: Evacuate area
Procedure(s) of Personal Precaution(s)

Wear respirator, chemical safety goggles, rubber boots, and heavy rubber gloves

Methods for Cleaning up

Sweep up, place in a bag and hold for waste disposal. Avoid raising dust. Ventilate area and wash spill site after material pickup is complete.

Section VI: Handling and Storage

Handling

User Exposure

Avoid inhalation. Avoid contact with eyes, skin, and clothing. Avoid prolonged or repeated exposure.

Storage

Suitable

Keep tightly closed

Storage at or below room temperature

Section VII: Exposure Controls/Personal Protection Equipment

Engineering Controls

Mechanical exhaust required

Personal Protective equipment

Respiratory

Respiratory protection is not required. Where protection from nuisance levels of dusts are desired, use type N95 (US) or type P1 (EN 143) respirator.

Other

Wear appropriate government approved respirator, chemical-resistant gloves, safety goggles, other protective clothing.

General Hygiene Measures

Wash thoroughly after handling

Section VIII: Physical/Chemical Characteristics

Physical State:

Lyophilized solid

Odor:

None

Boiling Point:

Not determined

Vapor Pressure:

Not determined

Vapor Density:

N/A

Solubility:

Soluble in water

Specific Gravity:

Not determined

Evaporation Rate:

Negligible

Section IX: Stability and Reactivity

Stability

Stable

Hazardous Decomposition Products

Carbon monoxide, carbon dioxide, nitrogen oxides

Hazardous Polymerization

Will not occur

Section X: Toxicological Information

Route of Exposure

Skin Contact

May cause skin irritation

Skin Absorption

May be harmful if absorbed through the skin

Inhalation

Material may be irritating to mucous membranes and upper respiratory tract, may be harmful if inhaled.
Ingestion
May be harmful if swallowed

Conditions Aggravated by Exposure
The toxicological properties have not been thoroughly investigated.

Section XI: Ecological Information
No data available.

Section XII: Disposal Considerations

Appropriate Method of Disposal of Substance or Preparation
Contact a licensed professional waste disposal service to dispose of this material. Dissolve or mix the material with a combustible solvent and burn in a chemical incinerator equipped with an afterburner and scrubber. Observe all federal, state, and local environmental regulations.

Section XIII: Transport Information

DOT
Proper Shipping Name
None
Non-Hazardous for Transport
This substance is considered to be non-hazardous for transport.

IATA
Non-Hazardous for Air Transport
Non-hazardous for air transport

Section XIV: Regulatory Information

US Classification and Label Text
US Statements
Caution: The chemical, physical, and toxicological properties of this product have not been thoroughly investigated. Exercise due care.

United States Regulatory information
SARA Listed
No

Canada Regulatory information
WHMIS Classification
This product has been classified in accordance with the hazard criteria of the CPR, and the MSDS contains all the information required by the CPR.

DSL
No
NDSL
No

Section XV: Other Information

The above information is correct to the best of our knowledge. This material is intended for research purposes only and must only be used under the supervision of a person experienced in handling hazardous materials. GENE TOOLS, LLC makes no guarantee of the accuracy or completeness of the information and shall not be held liable for any damage resulting from handling or from contact with the above material.